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INDEX TO VOLUME XXX.

A

Accident claim department:
——Adjustment of claims, 382
——Agent and his work [Bennett], 707; [Carpenter], 709
——Effectiveness, Increasing [Hardin], 714
——Instruction of employees [Johnson], 711
——Management of bad cases [Vories], 713
——Policy of, toward the injured employee [Schoenen], 710
Accident claims of New York State and Great Britain, Comparison, 138
Accident fakirs, Baltimore, 127
Accident report, Little Rock, Ark., 96
Accidents:
——Birmingham, England, 931
——Car burned by broken trolley wire, *509
——Halifax, England, 931
——Investigation of, Indiana, 973
——Mattoon City Railway, Illinois, 376, 408, 1012
——New York City records, 899, 1187
Accountants' Association, Convention:
——Papers, 700
——President's address, 804
——Proceedings, 804
——Review of, 839
——Standard classification. (See Accounting.)
Accounting:
——Depreciation accounting [Neal], 700
——Electric lighting accounts, Criticism of proposed classification, 85
——Employees' records, Little Rock, 94
——Freight and express, 463
——Park accounts [Pryor, Jr.], 701
——Printing department, Milwaukee, 99
——Standard classification of operating accounts:
Accountants' association, 1000
Comments, 839
Interstate Commerce commission, 1032
Conference of various interests, 1062, 1175
Joint Committee, Report, 1176
Comments, 1191
National Association of Railway Commissioners, 914
New York State Public Service Commission, Hearings, 999
Adding Machine (See Calculating machines)
Advertising for traffic:
——Circulars, Importance of, 337
——List of articles in Street Railway Journal, 865
——Minneapolis, 109 *288, 870
——Newspaper, in Boston, 1179
——Steam railroad stations, Publicity work at, 119
Air brakes (See Brakes, Air).
Akron & Youngstown Air Line Ry., 1121
Alameda, Cal., Boiler test, 475
Albany, N. Y., United Traction Co., Report, 833
Albany & Hudson Ry., Cars, *231
Allis-Chalmers Co., Annual meeting, 894
Alternating-current vs. direct-current. (See Direct-current).
Alternators:
——Dick-Kerr turbo-alternator, *39
——Protection of, from overloads, 49
——Test of turbo-alternator at Kokomo, Ind., *362
——Two periodicities used in New Orleans, 1083
——(See also Turbines, Steam).
American Institute of Electrical Engineers:
——Cleveland section, 831, 1023
——Ithaca branch, 1186
——June meeting, 33
——Library open evenings, 974
——November meeting, 956
American Light & Traction Co., Annual report, 200
American Museum of Safety Devices and Industrial Hygiene, 974, 1187
American Railway Association, October meeting, 930
American Railway Master Mechanics' Association, 1908 convention, 932
American Railways Co., Annual report, 531
American Society of Mechanical Engineers:
——November meeting, 815
——October meeting, 510
American Street and Interurban Railway Association:
——Atlantic City as a permanent meeting place, 811, 853
——Convention at Atlantic City:
Entertainments and other information, 523
Exhibits, 767, 895
Papers and reports, 768, 863
President Beggs' address, 798
Proceedings, 798, 849
Railroad rates, 524
Track exhibits, 767
——Data sheet on municipal ownership, 334
——Election of officers, 797, *856
——Report on rules, 150
——Standard classification. (See Accounting)
American Street and Interurban Railway Accountants' Association. (See Accountants' Association)
American Street and Interurban Railway Claim Agents' Association. (See Claim Agents' Association)
American Street and Interurban Railway Engineering Association:
——Convention:
Beggs' address, 777
Entertainments, 767, 828
Papers and reports, 723
Photograph of members, *780
President's address, 779
Proceedings, 777
Question box, 325, 747
Reports of Committees, 729, 733, 737, 742, 757
——Standardization committee:
July meeting, Cleveland, 188, 205, 225
Members, 80
Report at Convention, 737, 789
September meeting, New York, 301, 424
American Trade Press Association, Financial meeting, 1074
Appraisals of electric railway systems, 905
——Right of way, Evaluating, 1017
Apprenticeship course. (See New York Central R. R., Apprentices; Technically trained men)
Armature banding machines:
——(American), *813
——(Columbia), *1006
Armature banding and winding machines (D. I. Co.) *363, *477, *526, *689
Armature-bearing boring machine (Black Diamond), *1181
Armature cradles:
——(D. I. Co.), *434
——Portland, Me., *285
Armature rack, Knoxville, Tenn., *498
Armature truck (D. I. Co.), *399
Armatures:
——Repair of, 744
——Testing method, Knoxville, Tenn., *497
Arresters. (See Lightning arresters).
Ash bin, Steel and concrete, *773, *774
Ash car, Motor-operated, Peoria, Ill., *91
Ash pits, Suspended concrete, *774
Astoria, Ore., Semi-convertible cars, *1118
Atlanta, Ga., Wage increase, 301
Atlantic City:
——Brief description, *537
——Proposition to erect permanent Exhibition Hall, 811, 853
Atlantic Shore Line, 188, 348, *1130
Austin, Tex., Shop notes, 15
Australia, Thermit joints, 1067
Austria:
——Alberg tunnel, Electricity in, 1006
——Single-phase road from Vienna to Baden, 165
Autobuses:
——Economies of, 904
——Gasoline, in New York City, 190, 276, *292
——London conditions, 931
Axles:
——Central Electric Railway Association, Report, *517
——Engineering Association, Discussion and report, 225, 424, *737
——German report, 353
——Radial, London, *361

B

Baggage, Carrying, Legal decision, 1208
Baltimore, Md.:
——Accident fakirs, 127
——Car houses, *255
——Coal car, *265
——Handling traffic during Old Home celebration, 958
——Instruction of motormen and shopmen, *289
——Multiple unit surface cars, *221
——Terminal at Bay Shore Park, *132
Baltimore & Annapolis Short Line, Progress, 449
Band saw sharpener (Rotary), *1150
Banding machines. (See Armature banding machines).
Bearings:
——Boring armature, *264 *497,
——Life of motor and armature, Germany, 356
——Roller, Tests on Syracuse car, *680
Berlin, Germany, Electrification of the Ringbahn and the Stadtbahn, estimated cost, 187, 643
Bibliography: References to Street Railway Journal, and Electric Railway Review, 865
Birmingham, Ala.:
——Bond issue, 44
——Strike, 81
Black, C. N., *442
Block signal system:
——Philadelphia & Western R.R., *920
——San Francisco, Oakland & San Jose R.R., *57
Boiler room reports, Daily, 547, 548, 592, 611
Boilers:
——Designs, Advantages of new [Booth], 1169
——Efficiency [Booth], 15
——Efficiency test of return tubular, using crude oil, Alameda, Cal., 475
——Ratio of heating surface to grate surface as a factor in power plant design [Finlay], 1173
Bombay, Annual report, 288
Bonding. (See Rail bonding)
Boring machine for armature bearings (Black Diamond), *1181
Boston:
——Corrugated rails tested, 506
——Eight-car trains on the "L," 321
——Elevated plans for Cambridge, 1014
——Express activity in vicinity of Boston, 913
——Forest Hills station, 857, *1204
——Gas engine experience [Winsor], 725
Comment, 837
——Generators for Lincoln Wharf station, 1149
——Grates, Reagan, Use of, *1068
——Interurban decisions, 486, 492
——Laboratory of A. D. Little, 677
——Massachusetts Electric Co's. annual report, 1153
——Operating agreement between Elevated and Boston & Northern, 935
——Power house, contract, 191
——Power station loads and temperature, Relation between [Corning], 1053
Comments, 1045
——Rheostat connections, changes in, to eliminate fuse and controller troubles, *916
——Semi-convertible cars, 1179
——Storage yard of elevated railway, *1028
——Subway:
Cambridge plans, 31
Embankment, 69
Washington Street, 487, 535, 681
——Tourist information bureau, 189
——Traffic, Handling, Old Home Week, 215
——Trip by trolley to Portland, Me., 348
Boston & Eastern Electric R.R., Plans of, *62
Boston & Northern Street Ry., Freight and express rights, 1075
Boston & Providence Interurban Electric R.R., 486, 492, 1043
Boston, Waltham & Western Electric Ry., Construction costs, 333
Boston & Worcester Street Ry.:
——Annual report, 1076
——Completing double track, 1075
——Funeral party, 1070
——Handling troops on, *189
Bradford, Pa., Extensions, 46
Brady, A. W., Portrait, *856
Brake hanger, adjustable, Milwaukee, *72
Brake rigging:
——[Heckler], *1058
——[Hutchins], 1057
——Slack adjuster, *498
Brake-shoes:
——Friction of, M.C.B. tests, 176
——German report, 356
——Necessity for practical tests, 154
——Standard:
Central Electric Railway Association, *518
Engineering Association, *226, *432, *739
——Wear of, on cast iron wheels, M.C.B. tests, 179, 181
Brakes, Air:
——A. C.-D. C. straight air brake apparatus (National), *230
——Emergency valves:
(Allis-Chalmers), 928
(N. B. & E. Co.), *1119
——New York Central motor cars, 569
——Pneumatic governor (Allis-Chalmers), 928
——Service tests, Columbus, 323
Brakes, Track:
——Combined magnetic and mechanical, Sheffield, England, *109
——Knoxville, Tenn., *498
——Leeds, England, 931
——Track and wheel brake practice in England and Germany, 348
Braking, Rules for, Quebec, 420
Brass foundry, Proper method of conducting, 205
Brazil, Extensions, 230
Bridge corrosion and steam locomotives, 1053
Brockton, Mass., Condenser trouble, 214

(Abbreviations: * Illustrated. c Correspondence.)

Brooklyn:
——Coney Island & Brooklyn R.R., Increase in number of cars, 298
——Livingston Street improvement for relieving traffic, *984
——Rapid Transit Co.:
Annual report, 693, 829
Hearings before Public Service Commission, 271, 299, 1043, 1073
Improvements proposed, 440
Winter schedule, 830
——Semi-convertible car, *917
——Truck, Two-bar equalizer, *957
Brooklyn Bridge, Manhattan terminal improvements, 151, 1013
Brooklyn Polytechnic Institute, Mechanical engineering courses, 974
Buenos-Ayres:
——Lacroze Railway, *1100
——Notes from, 32
——Subway proposed, 1031
Buffalo, International Railway Employes' Association, Annual report, 1042
Butler, Pa. (See Pittsburg & Butler Street Ry)

C

Calculating machines [Smith], 703
California:
——Peninsular R.R. to connect San Jose and San Francisco, 237
——Visalia Electric Railroad, 150, *1111
California Midland Ry., Projected, 59
Cambridge. (See Boston)
Canada:
——Historical Notes, 31
——Statistics of Eastern [Dubee], 29
——Statistics of Ontario [Clark], 30
——Street railway statistics, 352
Canadian Electrical Association, September meeting, 433, 492
Canadian Street Railway Association:
——June meeting, 27
——Secretary, Acton Burrows, 273
Car advertising conducted by company at Easton, Pa., 1198
Car cleaning, Sanitary spray, 398
Car design:
——London, Brighton & South Coast, 640
——Multiple Unit surface, Baltimore, *221
——Semi-convertible, Brooklyn, *918
——Semi-steel, Milwaukee, *218
Car elevator, Hudson River tunnels, *1206
Car houses:
——Baltimore, *255
——Boone, Iowa, *1049
——Concrete, Easton, Pa., *1196
——Concrete, Washington, D. C., *1160
——Construction requirements, Report of Committee [Adams], 880
——Dunton, L. I., Concrete, 601
——Fire protection:
Neglect of fire danger [McKeon], 187
Sprinkler requirements, 883
——Knoxville, Tenn., *494
——Long Island City, 332
——Mars, Pa., *263
——Nashville, Tenn., *384
——Open vs. closed terminals, Report of Committee, *733
Discussion, 793
——Reinforced-concrete requirements, 881
——Springfield, Mass., *909
——Sprinkler equipments, Rules and requirements for, 883
——Tacoma, Wash., *341
——Washington, D. C., Concrete, *1160
Car inspection, Mileage basis for, 339
Car inspection sheds:
——Erie R. R., *661
——Lighting inspecting shed, L. I. R. R., 601
Car pits:
——Design of, *775
——Lighting of, 601, *776, *1168
Car shops. (See Repair shops)
Car wheels. (See Wheels)
Car wiring:
——Diagrams of Public Service Corporation, *1140
——Germany, Single-phase railway, 638
——Report of Committee, 769
——Single-phase diagram, *262
Cars:
——Cost of, Boston & Eastern figures, 68
——Depreciation of, 240
——Statistics for U. S., Canada, and Cuba, 352
Cars, Closed:
——Albany & Hudson Ry., *231
——Buenos-Ayres, *1102
——Chattanooga, Tenn., *296
——Chicago, Pay-as-you-enter, *448
——Cincinnati, *1008
——Columbia, S. C., *1036
——Everett, Wash., *41
——Fort Dodge, Des Moines & Southern Ry., *1048 *1052
——Illinois Traction Co., *13
——London, Hammersmith & City Ry., *174
——Long Island R. R., 601
——Mexico, *434
——New York Central R. R., *565, 570,
——Northern Indiana Ry., *435
——Omaha, Neb., *958
——Peoria, Ill., *268
——Pittsburg & Butler Ry., *260
——Quebec, *982
——Rochester Division, Erie R. R., 659
——Scranton, Pa., *40
——Seattle-Everett line, *110
Cars, Closed: (Continued.)
——Spokane, Wash., *321
——Tacoma, Wash., *341
——Washington, Baltimore & Annapolis Ry., *686
——West Jersey & Seashore R.R., 618, 623
——West Shore R. R., 586
——Worcester, Mass., *1070
Cars, Coal, Baltimore, *265
Cars, Combination:
——Albany & Hudson Ry., *231
——Chicago, *363
——Pittsburg & Butler Ry., *261
——Scranton, Pa., *40
——Washington, Baltimore & Annapolis Ry., *686
Cars, Dump, Milwaukee, *161, 164
Cars, Emergency, *59, *497
Cars, Motor. (See Motor cars)
Cars, Non-combustible:
——Milwaukee, *218
——Montreal, *499
Cars, Observation:
——List of articles in Street Railway Journal and Electric Railway Review, 866
——Montreal, 320
Cars, Open:
——Columbus, Ga., *690
——Dayton, Covington & Piqua Ry., *189
——Gulfport, *813
——Mexico, *434
——Pittsfield, Mass., *73
——Portland, Ore., *400
——Worcester, Mass., *144
Cars, Parlor, Spokane, Wash., *321
Cars, Pay-as-you-enter:
——Chicago, *448
Operating results, 1034, 1072
——Montreal, *499
Operating results, 510
——New Jersey Public Service Corporation, 1149
——New York, 93, *845
Cars, Semi-convertible:
——Astoria, Oregon, *1118
——Baltimore, Md., *221
——Boston, 1179
——Brooklyn, *917
——Chicago, *363
——Delaware Water Gap, *75
——Easton, Pa., *1181
——Galesburg, *1069
——Galesburg & Kewanee Ry., *690
——Independence, Kan., *689
——La Crosse, Wis., *929
——Lake Charles, La., *1150
——Macon, Ga., *399
——Norfolk, Va., *108
——Peekskill, N. Y., *144
——Portland, Ore., *1007
——Sault Ste. Marie, Mich., *268
——Texarkana, Ark., *527
——Western New York, *479
Cars, Semi-steel, Milwaukee, Wis., *218
Cars, Sleeping, Illinois Traction Co., 191
Cars, Work, gravel spreader and snow plow, Milwaukee, *163
Cars, Wrecking, *59, *497
Carbon brushes (Speer), 528
Carbon dioxide recorders, Orsat and Westover [Mailloux], *1171
Catenary construction:
——Bridges, N. Y., N. H. & H. R. R., *243, *252
——Deflector wires, *252, *258, *657
——Hartford & Melrose branch, *1114
——Improvements in, General Electric, 858
——Materials for construction, 858
——Merits [Nicholl], 516
Discussion, 511
——Single-phase, 15-cycle road at Visalia, Cal., *1111
——Wooden bridges, Italy, *25
——(See also Overhead construction; Pantograph)
Cattleguard, Stewart expanded metal, *73
Cattleway, Concrete, *158
Central Electric Railway Association:
——Interurban operating rules, 955
——September meeting:
Announcement, 440
Brief account, 473
Comments, 491
Proceedings, 511
——November meeting, 1054
——Standardization Committee report *517
Chattanooga, Tenn.:
——Cars, *296
——Track construction, 1026
Chemical laboratory (Little), 677
Chicago:
——Chicago Electric Traction, Sale of, 237
——Chicago Railways Co., Reorganization plan, 113
——City Railway Co., Report, 533
——Detroit, Through service to, promised, 237
——Electrification on steam roads, 147
——Exhaust steam turbine plant [Wait], 1170
——"L" traffic statistics, 969, 1152
——Loop problem, 331, 377
——Northwestern Elevated Railroad, Annual report, 485
——Pay-as-you-enter cars:
Description, *448
First service, 1072, *1099
Instructions for handling, 1034
——Rails, Standard, *844
——Report on railway properties, 301
——St. Louis, Plans for through line to, 202, 376
——Semi-convertible cars, *363
——Space between tracks, 405
——Track reconstruction, *842
Chicago: (Continued.)
——Traction situation, 199, 272, 301, 331, 377, 405, 423, 534, 833, 900, 936, 971, 1010, 1043, 1073, 1219
——Transfers, 1069
——Union Traction earnings, 900
Chicago, Lake Shore & South Bend Ry., Progress, 271
Chicago & Milwaukee Electric Ry., Completion of extension, 333
Chicago, Milwaukee & St. Paul Ry., Electrification plans, 235, 331, 487
Chicago, South Bend & Northern Indiana Ry., Cars, *435
Cincinnati, Ohio:
——Cars, Closed, *1008
——Promotion of traffic, 810
Circuit breakers:
——(General Electric), 231
——New York Central sub-stations, *553
——Oil, N. Y., N. H. & H. bridges, *250
——Oil switches and circuit breakers (Westinghouse), *359
Claim Agents' Association, Convention:
——Papers, 707
——Proceedings, 803
——Question box, 715
Claim department. (See Accident claim department)
Cleveland:
——Extensions, 330
——Lake Shore improvements, 112
——Legal decision in the Isom injunction case, 116
——Mayor Johnson re-elected, 973
——Merchants tour electric lines, 925
——Municipal Traction Co., Balance sheet, 934
——Proposition of Cleveland Electric, 1127, 1147
——Railway ordinances, 1039
——Rerouting cars, 1077
——Seats in open cars, Vacant, Notifying passengers, 190
——Situation, 79, 149, 199, 236, 272, 300, 324, 406, 440, 487, 532, 692, 831, 898, 934, 1012, 1040, 1122, 1185, 1218
Cleveland, Alliance & Mahoning Valley Ry., Plans for building, 80
Cleveland & Sharon Railway:
——Plans, 440
——Receivership, 1150
Cleveland, Southwestern & Columbus Ry.:
——Changes in personnel, 1077
——Control of Mansfield Railway & Light Co., 46
Coal cars:
——Baltimore, *265
——Coal and ash car, *90
Coal handling:
——Cable conveyors, New Orleans, 1085
——Conveyors (McCaslin), Minneapolis, 122
——Cos Cob power station, 312
——Design of bunkers [Campion & McClellan], *773
——Montreal, 943
——Norfolk, Va., *53
——Park Royal power station, London, 167
——Peoria, Ill., power station, *87, *91
Coal trestle. Concrete, Easton, Pa., *1196
Coffin, E. R., 379
Coin counter (Dolt), *862
Collins, J. F., 238
Colorado Electric Light, Power & Railway Association, Convention, 488
Columbia, S. C., Cars, *1036
Columbia University, Evening courses, 767
Columbus, Ga., Open cars, *690
Columbus, Ohio:
——Fare increase, 328
——Rail controversy, *296, *491
——Scioto Valley Ry., Legal decision on fares, 151
——Service tests of train and single-car operation, 322
Commutator grooving device, *746
Commutator-turning device, San Antonio, *58
Commutators, Grooving, *1203
Concrete, Reinforced. (See Reinforced concrete)
Concrete, Tests for heat resistance, Connersville, Pa., 1201
Concrete mixer outfit for track construction, Chicago, *844
Concrete stubs for poles, *143
Concrete water tank, *315
Condenser: the laws of mixed vapors [Booth], 98
Condensers at Brockton, Overcoming troubles, 214
Conductor, Hints from a, 1067
Conduits, Electric, in New York, Difficulties with, 1019
Connecticut:
——Charters authorized, 302
——Children's half-fare tickets, 433
——Legislation in, 44, 237
Contact resistance in connection with rail bonding, Experiments, 389
Control apparatus for railway equipment, Improvements in [Case], 741
Discussion, 781
Controllers:
——Regulator (Durkin), *528
——Resistance connections, Proper, *916
——Wiring data of Public Service Corporation, 1143
Cooling tower and spray preventer, *814
Copper:
——Break in price of, 410
——Distribution copper, Operating economy of, 939
——Speculation in, 904
Corning, J. W., *902
Costs. (See Finance)
Couplers:
——(McConway & Torley), *679
——(Van Dorn) *74
——(Washburn), *682
——(Westinghouse), Car and air, *190

(Abbreviations: * Illustrated. c Correspondence.)

Cranes:
——Handling motors in cars, *1031
——Knoxville, Tenn., 8-ton, *496
——Magnetic (C. A. W.), *683
Cuba, Street railway statistics, 352
Curtain fixture, New (C. S. Co.), *815
Curves, Radii, on railways in Germany, 354

D

Dallas, Texas, New line to Sherman, 1010
Denver, Colo., Change in control, 46
Denver & South Platte Ry., Electric service, 520
Depreciation accounting [Neal], 700
Depreciation of rolling stock, 240
Derr, W. L., 47
Detroit:
——Fares, 151
——Sprinkling track difficulties, 267
——Through service to Chicago, 237
Detroit United Railways:
——Earnings, 332
——Passing of the dividend, 830, 897
Direct-current and single-phase equipment for Vienna-Baden Railway, *450
Direct-current vs. alternating-current systems [Davis], 357
Dispatching cars:
——Atlantic Shore Line, 1133
——Philadelphia elevated, 345
——Pittsburg & Butler Ry., 263
Doors, Vestibule, Drop sash for, c36
Dover, Del., Receiver for Delaware General Electric Railway Co., 1152
Draw-bars. (See Couplers)
Drills. (See Track drills)
Dump cars, Milwaukee, *161, 164
Dusinberre, G. B., 274

E

Eastman, Albert, 336
Easton, Pa., Semi-convertible cars, *1181
Easton, Pa., and Washington Traction Co., System of, *1194
Edinburg, Scotland, car order, 142
El Paso, Texas, Power station improvements, *1020
Electric lighting. (See Lighting)
Electrolysis controversy concluded in Richmond, Va., 1146
Elevator, Car, Hudson River tunnels, *1206
Ellicott, J. R., *1220
Empire State Gas and Electric Association:
——June meeting, 36
——October meeting with Railway Association, 482, 520
Employees:
——Clubhouse, San Antonio, *229
——Conductor, Hints from, 1067
——Conductors on open cars, Easton, Pa., 98
——Daily reports:
Little Rock, 94
San Antonio, 229
——Encouragement of, 1046
——Great Britain:
Municipal, 101, 102, 104
Wages, 913
Welfare work, 102
——Handling trainmen at San Antonio, *229
——Health of, in New York Subway [Soper], 185
——Inspector's report, San Antonio, 229
——Instruction in power stations, 83
——Instruction of trainmen:
Accident work [Johnson], 711
Baltimore, *289
Knoxville, Tenn., *387
Philadelphia, 20
——International Railway Employes' Association, Report, 1042
——Labor agreement, Pottsville, Pa., 78
——Montreal annual picnic, 327
——Municipal ownership, Effect of, 121
——Prussian railways, Statistics, 1070
——Reporting bad order cars at Nashville, 349
——Reporting offenses at Nashville, 98
——Rules, Report on, by American Street and Interurban Railway Association, 150
——Time card of shop employe, 343
——Tokio, 1097
——Traveling lecturer, 383, c916
——Wages of trainmen:
Atlanta, Ga., Increase, 301
Great Britain, 913
New Haven, Conn., 302
New York State and Gt. Britain, Comparison, 137
Pottsville, Pa., 78
Twenty-one cities of U. S., 138, 266
Vienna, 356
——(See also Strikes)
Engineers' Club, New York, Inaugural dinner, 1154
Erie R. R., Rochester division:
——Constructional features [Smith], 648, *650
——Operating features, 629
Europe, Electrical equipment of main line railways in [Dawson], *638
Evansville, Ind., Terminal station, *1202
Evansville & Eastern Electric Ry., System of, *446
Evansville & Southern Indiana Traction Co., Damage suit, 488
Everett, Wash., Cars, *41
Express. (See Freight and express)

F

Fall River, Mass., Freight rights of Old Colony Street Ry., 1186
Fare collection:
——Collection and registration on interurban railways [Frankel], 460
——Receipt on Buffalo interurban lines, *461
——Tokio, 1096
Fare register (Rooke), *70
Fares:
——Children's half-fare tickets, Connecticut, 433
——Columbus, Ohio, Increase, 328
——Comparison per mile, Great Britain and U. S., 140
——Density of travel, Influence on rates [Stebbins], 867
——Detroit, fare ordinance enjoined, 151
——Discrimination permissible under competition, 151
——Interurban fares [Stebbins], 866
——Massachusetts:
Half-fare law legal, 972
Scheme for equalization, 1169
——Memphis, Tenn., Reduction illegal, 533
——Minneapolis, 333
——Quebec, for commuters, 981
——Roanoke, Va., Compromise, 116
——Two-cent law in Indiana, 199
——(See also Tickets; Transfers)
Feed-water connections in Montreal power station, *947
Feeder maps and distribution-loss charts, Advantages of, 939
Fenders:
——Tests in Mass., 302
——Worcester, Mass., *401
Ferro-concrete. (See Reinforced concrete)
Financial:
——Berlin Ring and Stadtbahn, Estimated cost of electrifying, 187
——Canada, Earnings and operating expenses, 30
——Cost of new construction, Boston & Eastern, 63, 67
——Cost of new construction, Boston, Waltham & Western, 333
——Cost of Fort Wayne power station, 764
——Costs of direct-current and alternating-current systems for interurban railways [Davis,] 357
——Cost of service, Influence on rates [Stebbins], 867
——Costs of steel tie and concrete track construction [French], 665
——Depreciation of rolling stock, 240
——Electric railway situation to-day [Pierce], 521
——Great Britain, Tramway operation, 137
——Gross receipts for 1906, 21
——Maintenance costs [Herrick], 1054
——Operating expenses of various roads. Diagram, 1055
——Power costs in Harrisburg, 458
——Power plant design, Ratio of heating surface to grate surface as a factor in [Finlay], 1173
——Right of way, Evaluating, 1017
——Statistics for U. S., Canada and Cuba, 352
——Steam railroads in U. S. for 1906, 334
——Traffic estimates on Boston & Eastern, 62
——Valuations and rates, 307
——(See also Franchises)
Financial situation, 1074
Fire department of Montreal street railway, 525
Fire insurance:
——Data sheet on, 148
——Fire drills in shops, 1193
——Reports of Committee, 513, 890
Discussions, 512, 852
Fire protection of car houses:
——Neglect of fire danger [McKeon], 187
——Sprinkler requirements, 883
——Washington, D. C., *1160
Flue-gas analysis, Orsat and Westover recorders [Mailloux], *1171
Folds, G. R., 408, 489
Fort Dodge, Des Moines & Southern Ry., *1048
Fort Wayne, Ind.:
——Power station [Bibbins], *759
——Rails, *884
Fort Wayne & Wabash Valley Traction Co., Track construction, *1144
Fort Worth, Texas, Weed burner, *951
Franchises:
——Detroit, Mich., 151
——Milwaukee, Franchise a contract, 897
Franco-British Exposition of 1908, 1207
Frazer, Iowa, Power plant, *1051
Freight and express:
——Accounting, 463
——Atlantic Shore Line, Rates, 1135, 1136
——Boston, Express activity in vicinity of, 913
——Boston & Northern Street Ry., 1075
——Car-load freight on electric lines, 878
——Cost of electric freight service, 1158
——Earnings of electric and steam roads compared, 879
——Electric Express Co., Mass., 115
——Express rates and service [Walsh], [Armatage], 461, 462
——Great Barrington, Mass., 532
——Indianapolis, First express train, 448
——Light freight handling by electric lines [Crafts], 872
Discussion, 849
——List of articles in Street Railway Journal and Electric Railway Review, 865, 866
——Massachusetts, Developments, 409, 913, 971
——Montreal freight transportation, 1136
——N. Y., N. H. & H., Electric lines, 115
——Old Colony Street Ry., 1186
——Power consumption and cost of maintenance figures, 879
——Quebec, on Montmorency Division, 982
——Rates at Quebec, 983
Freight and express: (Continued.)
——Relations between electric and steam roads [Polk], 877
Discussion, 849
——Report on handling express business on interurban cars, 514
Discussion, 512
——Spokane & Inland Empire Ry., *664
Fuel-testing plant of U. S. Geological Survey near Norfolk, Va., 224, 797
Funeral cars, Boston & Worcester Street Ry., 1070
Fuses, Standardizing, in the power plant, 337

G

Galesburg, Ill., Semi-convertible cars, *1069
Galesburg & Kewanee Electric Ry., Semi-convertible cars, *690
Galvanizing line material, 49
——Opinions of Reesman and Frasse, 266
Galveston-Houston interurban line, Plans for, 201
Gas engines:
——(Allis-Chalmers), Recent installations, 974
——Boston, Year's experience [Winsor], 725
Comment, 837
——Distribution of heat in percentages at average load, 1169
——Milwaukee Northern Ry. power station, *1104
——Possibilities in improvement [Reeves], 1128
——Test, Service, of Westinghouse engine [Bibbins], 1129
——(Wisconsin Engine Co.), 1042
Gas producers, Milwaukee Northern Ry. Co., *1107
Gas works, Municipal, Reports on, 105, 133
Gasoline motor cars. (See Motor cars, Gasoline)
Gasoline autobus. (See Autobuses)
Gears:
——Discussion by Committee of Engineering Association, 425
——Graphite grease for, 1006
——Life of, German report on, 355
——Radial gear, London, *361
——Recommended standard, 738
Generators:
——Direct-current (Sprague), *926
——Lincoln Wharf station, Boston, 1149
——(See also Alternators)
German electric railway commission, Trip to the United States, 391, *670, 1200
German Street and Interurban Railway Association:
——Meeting, 352
——Rail corrugation, Report on, *948
——Rail sections, Report on standardization, 394
——Rolling stock, Report on standardization, 353
Germany:
——Eifel Bahn Railway, Electrical equipment [Dawson], *638
——Eifel region, Proposed railway, 129
——Track and wheel brake practice, 348
——Two thousand-volt d. c. railway at Moselle, 1031
Gilliam, H., 118
Glass cutter, Headlight, *58
Goodrich, C. G., Portrait, *856
Goshorn, H. R., Portrait, *804, *856
Grade crossings:
——Discussion, National Association of Railway Commissioners, 914
——Indiana, Elimination, 1041
Grading machine on Milwaukee interurban line, *163
Grand Rapids, Mich., Sprinkler, Double-truck centrifugal, *328
Grates, Reagan, Use in Boston, *1068
Grease, Graphited, in gear cases, 1006
Great Barrington, Mass., Freight rights, 532
Great Britain:
——Electrical equipment of main line railways [Dawson], 640
——Hours of labor and rates of pay [Clark], 913
——Municipal Tramways Association, Convention, 912
——Report on labor [Sullivan and Commons], 101
——Report on street railways [Maltbie], [Clark], 132, 134, 885
——Report on water and light plants [Edgar, Clark, Parsons, Bemis], 105
——Track and wheel brake practice, 348
Griffin, W. W., *1156

H

Hand-rail for open cars, Double-jointed, Knoxville, *498
Harrington, W. E., 408
Harrisburg, Pa., Power costs, 458
Hartford, Conn., Power station extension, 348
Harvie, W. J., 902
Havana, Cuba, Railway conditions, 146
Headlight glass cutter, *58
Headlight holder, adjustable (Gardner-Furber), *1037
Heater switch for cab, *73
Heaters:
——Electric panel heater (Consolidated), *267
——Hot water (Cooper), *75
Heavy electric traction:
——Corrosion of bridge due to steam locomotives, 1053
——Equipment of steam roads, 1199
——European railways [Dawson], *638

(Abbreviations: * Illustrated. c Correspondence.)

Heavy electric traction: (Continued.)
——Interpole motors, Possibilities of, 2
——List of electrified lines and notes on systems, 889
——Report of Committee [Townley], 889
Discussion, 854
——Sprague, F. J., on, 175
——(See also Erie R. R.; Europe; Long Island R. R.; New York Central R. R.; New York, New Haven & Hartford R. R., etc.)
Heel, Spring, for motormen, *296
Henry, F. R., Portrait, *856
High-tension lines, What constitutes? 1128
High-voltage direct-current railway at Moselle, 1031
High-voltage, direct-current and alternating-current systems for interurban railways [Davis], 357
Historical, Canada, Early roads in, 31
Holland, Railway statistics, 847
Hope Webbing Co., Completed plant, 685
Hot boxes, Preventing, 1201
Houston, Texas, Track construction, *1024
Houston-Galveston interurban line, Plans for, 201
Hydraulic rail bonder (E. S. S. Co.), *861

I

Illinois Traction Co.:
——Changes in personnel, 1099
——Chicago-St. Louis through line plans, 202, 376
——Power station at Peoria, *86
——Sleeping car service, 191
——System of [Hewitt], *4
Impostor, A plausible, 692
Incandescent lamp (Franklin), *526
Independence, Kan., Semi-convertible cars, *689
Indiana:
——Accidents, Prevention of, 973
——Crossing stops, 1121
——Extensions during year, 79
——Fare law, Constitutionality of, 199
——Fares on interurbans, 869
——Grade crossings, Elimination of, 1041
——"Railroad" applies to interurbans, 972
——Railroad Commission, Power of, contested, 932
——Railroad inspectors, Duties of, 56
——Relations with steam roads, 534, 831
——Safety appliance law, Test of, 1042
Indianapolis, Ind.:
——Express train, First, 448
——Interurban railways not an additional servitude, 114
Indianapolis & Cincinnati Traction Co., Improvements and extensions, *671
Indianapolis, New Castle & Toledo Electric Ry., Receiver, 1039
Indianapolis & Northwestern Traction Co., Steel tire removal, *1098
Inspection and maintenance of electrical equipment, Report of Committee, 742
——Comments, 696, 837
——Discussion, 782
Inspection car, Gasoline, Santa Fe R. R., *231
Inspection of cars, Mileage basis for, 339
Inspectors, Indiana, Duties of, 56
Instruction. (See Employees)
Insulators, High tension:
——[Delafield], 433, 492
——N. Y., N. H. & H. R. R., *247, *251
——Strain (Ohio), *814
——Underhung (Locke), *812
——Washington, Baltimore & Annapolis Ry. (O. B. Co.), *360, *361
——(See also Catenary construction; Overhead construction).
Insurance. (See Fire insurance)
International Street and Railway Association, Program for 1908 meeting, 1219
Interstate Commerce Commission, Classification of accounts, 1032, 1062, 1146, 1175
Interurban railways:
——Forms and blanks, 469
——Long distance travel, Does it pay? 1057
——Operation of trains on regular schedules only, 153
——Rules for, 459, 465, 849, 955
——(See also Direct-current; Fares; Heavy electric traction)
Inventors, Electric railway [Hobbs], 505
Iowa:
——Central Ry., Plans for new line, 1183
——Earnings of interurbans for 1906, 201
Italy:
——Brembana Valley single-phase railway, *25
——Electric railway traction in [Dawson], *639

J

Jacks, "High-pressure" (Roth), *110
Jamestown Exposition:
——Awards to exhibitors, 1074
——Jury of Exhibits and Awards, 435
Japan, Notes on [Brent], 1095
Johnson, T. L., re-elected Mayor of Cleveland, 973
Journal boxes, Standardizing:
——Central Electric Railway Association, *518
——Engineering Association, 225, 424, *737
——German Report, 354

K

Kansas City:
——Bond issue, 233
——Interurban center: a prophecy, 237
——Wheel practice, 216
Kansas City Railway & Light Co., Earnings, 235
Kelvin, Lord, Death of, *1190
Kentucky, consolidation of companies, 233
Kingston, N. Y.:
——Poster to accellerate car movement, *812
——Rails, *884
Knoxville, Tenn.:
——Car houses, *494
——Handling trainmen, *387
——Repair shops, *494
——Track brake, *498
Kokomo, Ind., Test of turbo-alternator, *362

L

Labor. (See Employees).
Laboratories:
——Chemical laboratory and the electric railway, 677
——Testing laboratory at Milwaukee, 291
La Crosse, Wis., Semi-convertible cars, *929
Laffin, R. T., 937
Lake Charles, La., Semi-convertible cars, *1150
Leffler electro-magnetic railway system, 222
Legal decisions:
——Abandonment of route permitted, 1216
——Carrying baggage, 1208
——Charters, franchises and ordinances, 195, 364, 959
——Cleveland Electric Ry., 1161
(See also Cleveland, Situation)
——Employees as passengers, 364,
——Fares:
Discrimination permissible under competition, 151
Interurban, 151
Tenn., 533
——Franchise a contract, 897
——Health appliances on street cars, 192
——Interurban cars not an additional burden on highway, Indiana, 114
——Interurbans not common carriers in Minnesota, 1041
——Intoxicated passengers, 959
——Joint use of tracks in California, 898
——Minnesota, Not common carriers in, 1041
——Negligence, Liability for, 192, 961, 1208
——Ohio decision on street railway consents, 690
——Paving decision in Trenton, N. J., 439
——Pole removals in Montreal, 434
——"Railroad" applies to interurbans, in Indiana, 972
——Safety appliance law in Indiana, 1042
——Street railways of New York State, Power of Public Service Commission, 1183
——Vestibules on street cars for protection of motormen, 192
Lewiston, Me., Merger, 482
Lexington, Ky., Changes in personnel, 1112
Lighting, Electric:
——Car pits, 601, *775, *776
——Cars, Public Service Corporation, *1140
——Municipal plants, Reports on, 105, 133
——Power station, Continuous lighting in, 239
——Voltage regulation for car lights, 381
Lightning arresters:
——Cos Cob power station, *315
——Operation, Partial check on [Hobbs], *349
——Transmission lines, 2, 34
Lima & Toledo Traction Co., Rights in Toledo, 482
Little, A. D., Chemical laboratory, 677
Little Rock, Ark., Accounting system, 94
Locomotives, Electric:
——Brembana Valley Ry., Italy, *26
——German 2000-volt d.-c. railway (Siemens-Schuckert), 1031
——Great Northern Ry., Three-phase, 1199
——High speed of, on grades [Armstrong], 1027
——London, Metropolitan Ry., *350
——Long Island R. R., D. C., 601
——New York Central R. R., *566, 571
——N. Y., N. H. & H. R. R., *246, *278, 604
——Penn. R. R., Single-phase, *92, *848
——Portland, Oregon, *1180
——Simplon tunnel, 639
——Single-phase, Illinois Traction Co., *14
——Steam vs. electric locomotives:
Comparative performances [Armstrong], *987, c. 1027
Comment, 978
Discussion, 996
Economies of steam locomotives [Toltz], 453
Comment, 444
——Swedish railways, *639
London:
——Charing Cross, Euston & Hampstead Ry., Opening of, *18
——County Council tramways, Report of, 932
——Franco-British Exposition of 1908, 1207
——Great Western Ry., Electrification of Hammersmith & City branch, *166
——Locomotives, Electric, *350
——Radial or steering axle, *361
London letters, 42, 197, 375, 529, 931, 1120
Long Island R. R.:
——Car houses, 332
——Electrification, 198
——Maintenance of rolling stock, 601
——Power station, Operating features, 587
——Sub-station and power transmission practice 595
——Third rail, *954
Los Angeles, Cal.:
——Extensions, 32
——Franchise taxes, 32
Los Angeles, Cal.: (Continued.)
——Los Angeles-Pacific Co., Bond issue, 405
——Pacific Electric Co., Four-track system, 986
——Transfers, Order concerning, 328
Lost article tag, Nashville, Tenn., 317
Louisville, Ky., Shop kinks, *264
Lubrication:
——Car lubrication, Blanks used, Phila., 342
——Effect of temperature on, 1053, 1045
——German practice, 356
——Graphited grease in gear cases, Economy of, 1006
——Long Island City power station, 589
——Specifications for power station lubricants, 76

M

McCarter, T. N., Portrait, *856
McNamara, J. W., 1220
Macon, Ga., Semi-convertible cars, *399
Mahoning & Shenango Ry., Overcoming motor lead troubles, 958
Mail and express rates on Atlantic Shore Line, 1135
Maintenance and inspection of electrical equipment, Report of Committee, 742
——Comments, 696, 837
——Discussion, 782
Managers:
——Problems of the small road [Cooper], 876
——Provision for future requirements, 1034
Manufacturers' Association, Convention, 776
——Exhibits, 332, 816
——New President, *1220
Maps:
——Atlantic Shore Line, 1130
——Boston & Eastern Electric R. R., 62
——Brooklyn, 985
——Easton, Pa., and Washington Traction Co., 1194
——Eifel Bahn Railway, Germany, 638, Pl. 49
——Fort Wayne & Wabash Valley Traction Co., 759
——Great Western Ry., England, 166
——Hartford & Melrose branch of N. Y., N. H. & H. R. R., 1113
——Illinois Traction Co., 4
——Middletown-Berlin, Conn., branch, 412
——Milwaukee interurban lines, 157
——Milwaukee Northern Ry., 1103
——Tacoma Pacific Traction Co., 340
——Tokio, 1095
Massachusetts:
——Fares:
Probability of higher, 972
Scheme for equalization, 1169
——Freight developments in, 404, 913, 971
——Half-fare law legal, 972
——Interurban decisions by Railroad Commission, 486, 492, 1154
——Railway law, Compilation of, 1036
——Street railway legislation, 223
——Wheel-guard tests, 302
Massachusetts Electric Co's. earnings, 975
Massachusetts Street Railway Association, Meeting at Boston, 1034
Master Car Builders' Association:
——Brake-shoe tests, 176
——Convention of 1908, 932
Mattoon, Ill., Railway accident, 376, 408, 1012
Mechanical stoker (Sarco), 361
Melbourne, Australia, Electrification 1123
Memphis, Tenn., Legal decision on fare reduction 533
Mexico:
——Cars between Lerdo and Torreon, *434
——Purchase in Puebla, 448
——Notes from, 228
Michigan:
——Fares on interurbans, 869
——Freight interchange with steam roads, 69
Middletown-Berlin, Conn., electrification, *412
Mileage basis of inspecting cars, 339
Mileage statistics for U. S., Canada and Cuba, 352
Milwaukee. Wis.:
——Adjustable brake hanger, *72
——Decision of Wisconsin Railroad Commission, 115
——Fire in car barns, 1152
——Franchise a contract, 897
——Interurban railway development, *156
——Interurbans on city lines, 1072
——Printing department, 99
——Semi-steel car, *218
——Testing laboratory, 291
——Track construction, *317
Milwaukee Northern Ry., Power plant, *1103
Minneapolis, Minn.:
——Advertising for traffic, 109, *288, 870
——Earnings of Rapid Transit Co., 975
——Exhibit at Atlantic City, *810
——Fare decision, 333
——Finances, Interview with Mr. Lowry, 452
——Handling traffic at State Fair, *908
——Lease of track, 1154
——Power station, *122
——Repair shops, *318
Minneapolis, Kansas City and Gulf Railway Co., Organization, 273
Minnesota, Interurbans not common carriers, 1041
Mobile, Ala.:
——Track construction, 1025
——Transfer table, Home-made, *316
Montreal:
——Fire department of railway, 525
——Free excursions for children, 285, 326

(Abbreviations: * Illustrated. c Correspondence.)

Montreal: (Continued.)
——Freight transportation, 1136
——Hochelaga power station, *942
——Observation car results, 320
——Pay-as-you-enter cars, *499
Operation results, 510'
——Picnic for Benefit Association, 327
——Pole removals, 434
——Repair shop practice, *1137
——Sub-stations, *1115
——Track reconstruction with steel ties, *345
——Truck and wheel practice, *393
Montreal Street Railway, Annual report, 970
Mortiser, Car (Fay & Egan), *1037
Motor brushes, Diagrams for setting, Public Service Corporation, *1138
Motor 'bus (See Autobuses).
Motor cars, Gasoline:
——Santa Fe R. R., *231
——Union Pacific R. R., 947
Motormen. (See Employees).
Motors, Electric:
——Combined direct-current and single-phase, Vienna-Baden Ry., *450
——Connection diagrams of Public Service Corporation, *1141
——Interpole, Possibilities of, 2
——Lead troubles on double truck cars, Overcoming, 958
——Maintenance of, Report on, 745
——Single-phase:
Alternating-current railway motors [Steinmetz], *1117
Regeneration with, 35
(See also Single-phase railways).
——Standards, Desirable, for parts of motors, 28
Multiple-unit control:
——Baltimore surface cars, 221
——Direct and alternating current (G. E.), *11
——Tests with train and with single car, 322
Municipal ownership:
——British tramways, 101
——Gas and electric lighting, Reports on, 133
——Labor under municipal ownership, 121
——Report of Committee [Wyman], 893
Discussion, 853
——Reports by National Civic Federation, 101, 121, 133, 134, 153, 182
——Street railways in Great Britain and United States [Clark], 134, 885
——Water and lighting plants, Report on, 105
Municipal Tramways Association of Great Britain, Convention, 912
Muralt, C. L., 976

N

Nashville, Tenn.:
——Car houses, *384
——Interurban to enter city, 332
——Lost article tag, 317
——Repair shops, *384
——Reporting bad order cars, 349
——Reporting offenses, 98
——Train schedule blanks, 229
National Amusement Park Association:
——Formation, 377, 832, 897
——Meeting in New York, 1041
National Association of Railroad Commissioners:
——Standard classification (See Accounting).
——Washington convention, 202, 914
National Civic Federation:
——Committee on Public Ownership, 182
——Discussion on street railways, 1174
——Reports on municipal ownership, 101, 121, 133, 134, 153, 182
National Electric Light Manufacturers' Association, 1217
National Fire Protection Association [Sweetland], 770
Nelson, A. B., 238
New England Street Railway Club:
——November meeting, 1041
——October meeting, 898
——Outing, 403
New Haven, Conn., Wage increase, 302
New Jersey Public Service Corporation:
——Changes in personnel, 1077, 1123, 1155
——Organization chart, 128
——Pay-as-you-enter cars, 1149
——Public Service Street Railway Co., Organization, 298
——Repair shop practice, *1138
——Shop men organization, 932
New Mexico, Railway developments, 488
New Orleans Railway & Light Co.:
——Dividend reduction, 438
——Income accounts, 936
——Reconstruction of power system, *1082
New publications, 81, 407, 535, 900, 955, 975, 1076, 1155
New York Central R. R., Apprentices, 1200
New York Central R. R., Electrification:
——Accident at Woodlawn, trial of A. H. Smith, 1187
——Cars:
Maintenance, 571
Operation questions, *565
——First electric trains, 570
——General features, 540
——Locomotives, *566
——Maintenance of rolling stock, Forms, 571
——Operating questions to assist motormen, 566, 568
——Organization of electrical department, Charts, 540
New York Central R. R., Electrification: (Continued.)
——Organization of maintenance department, 576
——Power distribution system, *552
——Power station practice, *544
——Rules for electric power department, 555
——Substation practice, 555, 560, 898
——Terminal operation, Effect of electrification on, 579
——Third rail, Under contact, *954
——Through service established, 37
New York City:
——Accidents on railways, 899, 1187
——Belmont tunnel, First official trip, *476
——Cars, Pay-as-you-enter, *845
——East River bridges, Progress on, 150
——Extensions, 147
——Fifth Ave. Transportation Co., Gasoline buses, 190, 276, *292
——Hudson Companies, Car elevator. *1206
——Interborough Rapid Transit Co.:
Earnings, 897, 1026
Elevated Division, Earnings, 1026
Exempt from taxes on subway, 334
Operating features of power station, 632
Organization chart, 636
Subway:
Health of employees [Soper], 185
Report by Arnold, 1117
Comment, 1079
Turbine test, 129
——New York City Ry.:
Car cleaning spray, 398
Outing of officers, 146
Receivership, 483, 533, 899, 1184
Vreeland resigns as manager for receivers, 693
——Omnibuses, Gasoline, 190, 276, *292
——Public Service Commission:
Battery tunnel, Report on, 438
Brooklyn Rapid Transit hearings, 271, 299, 1043, 1073
Comments, 51
Coney Island & Brooklyn hearings, 298
Hedley testimony, 234, 271
Personnel of Commission, 45
Recommendations for improving railways, 377
Shonts, testimony, 234
Tunnel under rivers, Investigation, 202
Tunnel investigation, New York rivers, 202, 438
Work of the Commission, 1011
——Third Avenue lines:
Finances, 971
Report of receivers, 1184
——Traffic congestion and the conduit system, 1019
——Transit conditions, City Club report, 147
——Transit investigation by Public Service Commission, 148, 200, 334, 377, 404, 533, 693, 833, 975, 1011, 1043
New York Edison Co., Steam turbine tests, 675
New York, New Haven & Hartford R. R.:
——Annual report, 520
——Electric railway practice, 608
——Electric service begun, 147
——Electric system and reasons for its adoption [McHenry], *242
Comments, 241, 275
——Hartford & Melrose branch, *1113
——Lightning arresters, *315
——Locomotives, Electric, *246, *278, 604
——Middletown-Berlin electrification, *412
——Overhead construction, 241, *245
——Power station at Cos Cob, 306, *308
——Press comments, Method of handling, 1037
——Purchase of proposed lines out of New York, 933
——Trolley and feeder distribution system, 613
——Trolley lines:
Earnings, 830
Express service in Mass., 115
Extensions rumored, 273
Orders for cars and equipment, 146, 201
——Trolley signboards, New, 973
New York Railroad Club, September meeting, 378, 444, 453
New York State Public Service Commission:
——Accounting, Hearings on, 999
——Circular to railroad corporations, 999
——Comments, 51
——Empire State Gas discusses, 36, 520
——Personnel of Commission, 45
——Street railways, Revocation of certificates, 1183
New York State Street Railway Association:
——October meeting, with Empire State Gas, 482, 520
——September meeting, 191
Papers, 443, 459
Newark, N. J., Public Service Corporation, Organization chart, 128
——(See also New Jersey).
Norfolk, Va.:
——Cars, Semi-convertible, *108
——Fuel-testing plant of U. S. Geological Survey, 224
——Power station, *52
North American Company's control in St. Louis, 1186
Northern Ohio Traction & Light Co., Issue of stock, 403

O

Oakland, Cal.:
——Electrification of Southern Pacific lines, 392, 833
——Key Route extensions, 236
Ohio:
——Abandonment of route permitted 1216
——Central Electric Railway Association, 440, 473
——Fares on interurbans, 869
——Legal decision on street railway consents, 690
——Merchants tour electric lines, 925
——Railway valuations, 533
——Report on interurban railways, 679
Ohio Electric Ry.:
——Official announcements, 378, 407
——Organization of, 970
Oil as fuel, Efficiency test, Alameda, Cal., 475
Oil burner for removing steel tires in Indianapolis, *1098
Oil for lubrication. (See Lubrication)
Oil sprinkling, Practice of various roads, 724
Oil switches and circuit breakers (Westinghouse), *359
Omaha, Neb., Closed cars, *958
Omnibuses. (See Autobuses).
Ontario, Statistics, 30
Ottawa, Ont., Sale of system, 302
Overhead construction:
——Atlantic Shore Line, *1131
——Brembana Valley Ry., Italy, *25
——Galvanizing line material, 49
——General Electric designs, *860
——Illinois Traction Co., *8
——Indianapolis & Cincinnati Traction Co., *671
——Middletown-Berlin line, *412
——Milwaukee interburan lines, *159
——N. Y., N. H. & H. R. R., 241, *242
——Pittsburg & Butler Street Ry., *257
——Rochester Division of Erie R. R., *654
——Steel towers, effect on lightning protection, 3, 34
——Stringing trolley wire, Milwaukee, *161, 165
——Tower cars. (See Tower cars).
——Visalia single-phase railway, *1111
——Washington, Baltimore & Annapolis Ry., *360
——(See also Catenary construction).
Overload in the power station, 940

P

Pantograph collector for high speed electric railways [Mayer], *951
Paris, Moving platform for, 999
Park accounts [Pryor, Jr.], 701
Park managers. (See National Amusement Park Association).
Parks and pleasure resorts:
——Baltimore, Terminal, *132
——Baseball park agreement, 864
——Highland Park, York, Pa., *346
——Lake Pontchartrain, La., 423
——List of articles in Street Railway Journal and Electric Railway Review, 865, 866
——Montmorency Falls, *980
——Pottsville, Pa., Baseball, 864
——Report of Committee [Harrington,] 863
——Riverton Park, Portland, Me., *503
——(See also Advertising for traffic; Theatres, etc)
Paving:
——Expense of, Case in Trenton, N. J., 439
——Standards for [King], 28
——T-rails for paved streets, 1143
——(See also Track construction).
Pay-As-You-Enter Car Co., 1118
Pay-as-you-enter-cars (See Cars, Pay-as-you-enter).
Peekskill, N. Y., Semi-convertible cars, *144
Pennsylvania R. R.:
——New York plans, 970
——Single-phase demonstration locomotive, *92 *848
——Testing track construction, New Jersey, 1027
——(See also West Jersey & Seashore R. R.).
Pennsylvania Street Railway Association, Organization, 1216
Peoria, Ill.:
——Cars, *268
——Franchises, 681
——Power station, *86
Philadelphia:
——Delaware Ave. power station, Condition of, *60
——Elevated railway, report blanks and forms, 342
——Instruction for motormen and shop men, 20
——Proposed line out of city, 862
——Rapid Transit Co., Annual report, 437
——Subway, Proposed, 690
——Subway-elevated lines, Progress on, *56
——Traction ordinance signed, 46, 150
——Transfer regulations, 900
Philadelphia & Eastern Ry., Reorganization, 273
Philadelphia & Western R. R., Block signal system, *920
Pile-driver, Electric, Milwaukee, *162'
Pinions, Device for taking off and pushing on, *264
Piping:
——Intake valve (Newman), *143
——Montreal power station, *942
Pittsburg, Car with side rods, *1145
Pittsburg & Butler Street Ry.:
——Power plant [Blakemore], *208
——Sub-stations, transmission and trolley lines [Blakemore], *256
Pittsfield, Mass., Open cars, *73
Platform clock for cars (Reeves), *688

(Abbreviations: * Illustrated. c Correspondence.)

Poles:
——Atlantic Shore Line, *1132
——Concrete and coal tar base, *159
——Concrete stubs for, *143
——Cypress for, 144
——Preservation. (See Timber preservation).
——Reinforced concrete, Richmond, *479
Polyphase railways:
——Alberg tunnel, Austria, 1006
——Great Northern equipment, 1199
Population:
——Average, per mile of track in different cities, 136
——Relation between earnings and population, Boston & Eastern figures, 66
Portland, Me.:
——Armature cradle, *285
——Open cars, *400
——Riverton Park, *503
Portland, Ore.:
——Improvements, 400
——Locomotive, Electric, *1180
——Semi-convertible cars, *1007
Post, Steel whistling (Hillman), *1070
Pottsville, Pa.:
——Baseball park argeement, 864
——Labor agreement, 78
Power consumption of car with connecting rods, in Pittsburg, *1145
Power consumption in relation to temperature [Corning], 1053
——Comments, 1045
Power station practice:
——Auxiliaries, Motor-driven, 50
——Combined railway and lighting service [Bibbins], 759
——Comparative data of 23 stations, 766
——Cost of installation, Boston & Eastern figures, 68
——Cost of installation and operation, various systems, 358
——Design, Influence of, on economy of operation [Campion and McClellan], *771
——Gas engine generating units, Milwaukee Northern Ry., *1104
——Gar engines at Boston [Winsor], 725
Comment, 837
——Instruction of employees, 83
——Lighting of station, 239
——Oil for. (See Lubrication).
——Operating shifts, Even, Advantages of, 649
——Overload, Questions of, 941
——Schedules, load factor and the cost of power, 978
——Steam turbines. (See Turbines, Steam).
——Storage batteries on single-phase system, 476
——Temperature and power station loads, Relation between [Corning], 1053
Comments, 1045
——Turbine economies [Bibbins], 675, 1148
——Voltage of auxiliary motors, 154
——(See also Sub-stations).
Power station records:
——Coal consumption and costs, Harrisburg, Pa., 458
——Operating expenses of various roads. Diagram, 1055
——Waltham, Mass., 508
Power stations:
——Atlantic Shore Line, *1132
——Buenos-Ayres, *1101
——El Paso, Texas, *1020
——Fort Wayne, Ind. [Bibbins], *759
——Hochelaga, Montreal, Direct-current, *942
——Indianapolis & Cincinnati Ry., *673
——London, at Park Royal, *166
——Long Island City, Operating features, 587
——Milwaukee Northern Ry., *1103
——Minneapolis, Minn., *122
——New Orleans, for combined railway and lighting load, *1082
——New York Central R. R., *544
——New York, Interborough Rapid Transit Co., Operation of, 632
——New York, New Haven & Hartford, 306, *308
——Norfolk & Portsmouth Traction Co., *52
——Peoria, Ill., *86
——Phila., Delaware Ave., *60
——Pittsburg & Butler Street Ry., Co. [Blakemore], *208
——West Jersey & Seashore R. R., 615, Pl. 37
——Yonkers, N. Y., New York Central R. R., *544
Power transmission:
——Canadian Association, Discussion at, 433
——Copper, Distribution, Operating economy of, 939
——Direct-current and alternating-current systems for interurban railways [Davis], 357
——Efficiency and reliability of different systems [Cunningham], *16
——Long Island, R. R., 595
——New York Central R. R., *552
——N. Y., N. H. & H., R. R., Overhead construction, 241, *245
——Pittsburg & Butler Ry., *256
——Rochester branch of Erie R. R. [Smith], *650
——West Jersey & Seashore R. R., *618
——West Shore R. R., 583
Printing department, Milwaukee, 99
Providence, R. I.:
——Fare registers (Rooke), *70
——Through service to Worcester, 295
Public relations, Report of Committee on [Ely], 891
Public Service Commission. (See New York City); New York State Public Service Commission)
Public Service Corporation of New Jersey. (See New Jersey).
Publicity departments of street railway corporations [White], 874
Publicity work. (See Advertising for traffic).
Puget Sound International Ry. organized, 833
Purchasing agent, Scope of the, 119

Q

Quebec:
——Braking, Rules relating to, 420
——Free excursions for children, 326
——Montmorency Division of Quebec Railway, Light & Power Co., *980
——Snow costs, 433

R

Rail bonding:
——Contact resistance in connection with, Experiments, *389
——Hydraulic tools for bonding, *861
——Testing bonds, New York Central R. R., 550
Rail drill, clamp (Bissell), *923
Rail joints:
——Report on, by Sub-Committee, 757
Discussion, 789
——Thermit, Australia, 1067
Rails:
——Chicago, standard section, *844
——Columbus, Ohio, *296, *401
——Composition, 1
——Corrugation:
Causes of [Mallock], 61, 120
Discussion, 130
Causes and remedies (Fell), 912
Elongation of upper surface of rail [Voynow], c956
Hardness of, Tests [Fowler], 506
Report of Commitee, 729
Discussion, 788
Report by German Street and Interurban Railway Association, *948
——Tests of corrugated rails, Milwaukee, 506
——Device for cleaning grooves, *58
——Dudley T-section, *884
——Effects of steam and electric locomotives on, Tests by Penn. R. R. 1027
——Ft. Wayne, Ind., *884
——Hunt T-section, *885
——Kingston, N. Y., *884
——Making by Bessemer process [Abbott], 1026
——Report on, by Sub-Committee, 757
Discussion, 789
——Specifications, Standard, 1
——Standard:
Central Electric Railway Association, *518
German report, *394
New standard discussed, 2
——T-rail in cities, Use of [Reel], 883, *1143
Discussion, 855
Proposed designs, 28, *165
——Wear, Sheffield, England, *93
"Railroad" applies to interurbans in Indiana, 972
Recorders, Carbon dioxide, Orsat and Westover [Mailloux], *1171
Reel stand and brake, Peerless, *328
Registers (Rooke), *70
Reinforced concrete, Use of, 1045
——(See also Concrete).
Relay, Portable (American), *480
Repair shop practice:
——Armature cradle, Portland, Me., *285
——Boring bearings, *264
——Car, General utility, *58
——Connections used in testing, New Jersey P. S. C., *1138.
——Defective parts of car equipment, Care of, 799
——Electric drive for, 84
——Grooving commutators, *1203
——Hot boxes, Preventing, 1201
——Making special apparatus or purchasing it, 1018
——Maintenance of railways [Herrick], 1054
——Mileage basis of inspecting cars, 339
——Montreal, *1137
——Motors in overhead positions, 977
——Pinions, Pulling and putting on, *264
——Report blanks, Philadelphia, 342
——Report on condition of cars, 97
——Size and capacity of shops, 207
——Soldering commutators, *264
——Steel tire removal, *1098
——System and organization, Need of, 940
——Time card, Philadelphia, 343
——Tool adjustments by compressed air, 1201
——Utilizing records of delays to equipment to check shop work, 493
Repair shops:
——Design of, for small roads, 83
——Fire drills in, 1193
——Knoxville, Tenn., *494
——Louisville, Ky., shop kinks, *264
——Mars, Pa., *263
——Minneapolis, *318
——Nashville, Tenn., *384
——New Jersey Public Service Corporation, *1138
——Springfield, Mass., *909
Research work by the Government suggested, 445
Rheostat connections:
——Changes in, to eliminate fuse and controller troubles, *916
——Diagrams, Public Service Corporation, 1139
Richmond, Va.:
——Electrolysis controversy concluded, 1146
——Fredericksburg and Southern R. R., Organization, 1218
——Poles, Reinforced concrete, *479
——Tourist guide, 68
Rides in miles, Possible length of, in Great Britain and U. S., 140
Rides per capita, in Great Britain and U. S., 135
Right of way, Evaluating, 1017
Roanoke, Va., Decision on fares, 116
Rochester, N. Y.:
——Arrest of employees for false statements, 376
——Report on railways by Public Service Commission, 333
Rochester Division of Erie R. R.:
——Constructional features [Smith], 648, *650
——Operating features, 629
Rochester & Sodus Bay Ry., Portable sub-station [Amesbury], *906
Roller bearings, Tests on Syracuse cars, *680
Roof construction, Reinforced concrete, "Trussit," *327
Root, Oren, 336
Rules for employees. (See Employees).
Rules for interurban railways:
——Central Association, 955
——National Association, 849
——New York State, 459, 465
Rutland Railway, Light & Power Co., Annual report, 270

S

Sacramento, Cal., Connection with Marysville, 301
St. Louis, Mo.:
——Club house opened, 975
——Control of lighting and power companies by North American Co., 1186
——Earnings, 200, 1039
——Financing of United Railways Co., 80
——Through line to Chicago proposed, 202, 376
St. Paul, Minn.:
——Selby Hill tunnel, *421
——Twin City Rapid Transit Co. (See Minneapolis).
San Antonio, Texas:
——Excursion and chartered cars, 217
——Handling trainmen, *229
——Shop notes, 58
——Track construction, *1024
San Francisco, Cal.:
——Connection with San Jose, 237
——Feed wires placed underground, 357
——Geary Street road, 331
——Increasing service, 1013
——Joint use of tracks, 898
——Overhead wires in business district, 331
——Reconstruction work, 1205
——Strike, Discussion of, and general labor conditions [Brent], 416
——Strike situation, 44, 78, 112, 331, 409, 485
——(See also Oakland, Cal.).
San Francisco, Oakland & San Jose R. R., Interlocking signal system, *57
Sand box, Worcester, Mass., *815
Sand driers:
——San Antonio home-made, *58
——Steam (Howe), *37
Sanding apparatus, New York Central R. R., 567
Santa Fe R. R., Gasoline inspection car, *231
Saulte Ste. Marie, Mich., Semi-convertible cars, *268
Saw, Portable, motor-driven circular, *164
Saw sharpener, Band (Rotary), *1150
Schedules:
——Blanks for Nashville, 229
——Graphic studies of competitive, 1158
——Indicator for cars (Reeves), *688
Schenectady, N. Y., Through line to Saratoga, 69
Scranton, Pa., Cars, *40
Seaman, H. S., 937
Seattle, Freight business [Dimmock], 851
Seattle-Everett Interurban Ry., Extensions, 110
Seattle, Puget Sound International Railway & Power Co., incorporated, 43
Seibert, William, 203
Shaw, J. F., Portrait, *856
Sheffield, England:
——Brake, Track magnetic, *109
——Rail wear, *93
Shops. (See Repair shops).
Shovels:
——Electric, Milwaukee, *162, *165
——Electric ballast (Chautauqua), *1007
Signal Appliance Association, Convention, Program, 530
Signal bridge, N. Y. Central R. R., 554
Signals, in power plants, 546, 590, 1018
Signals, Railway:
——Automatic, on electric railways, 411
(Bevan), *924
——Block system, Philadelphia & Western R. R., *920
——Interlocking system, San Francisco, Oakland & San Jose R. R.
——Steam railroads, Relation to electrification [Smith], 1199
——Telephone block signal system (T. S. Co.), *1035
Simmons, F. G., Portrait, *856
Simplon tunnel railway, 639
Single-phase car wiring diagram, *262
Single-phase railways:
——Brembana Valley Ry., Italy, *25
——Erie R. R., Rochester Division, *629, 648, *650
——European railroads [Dawson], *638
——15-cycle road, Visalia, Cal., *1111
——Illinois Traction Co., *4
——List of several, 357
——N. Y., N. H. & H. R. R. [McHenry], *242, *245, *278

(Abbreviations: * Illustrated. c Correspondence.)

Single-phase railways; (Continued.)
——Pittsburg & Butler Street Ry. Co., [Blakemore], *208
——Storage batteries, Spokane & Inland Ry., 476
——Three-phase generators for, 306
——Vienna-Baden Ry., 165, *450
——Visalia, Cal., 150
Single-phase system:
——Comparison with other systems [Young], 33
——Pantograph collector [Mayer], *951
——(See also Direct-current; Heavy electric traction).
Smith, Alfred H., Trial of, 1187
Smith, D. S., *82
Smoke in Boston suburbs, 305
Snohomish, Wash., Loss of records [Barron], c266
Snow costs in Quebec, 433
Snow plows:
——Rotary, Long Island R. R., 601
——(Russell), 815
——Snow plow, work car and gravel spreader combined, *163
Soldering armature with gas lamp, *264
Southern Pacific Ry., Electrification plans, 236, 325, 392, 833, 972, 1154
Spain, Three-phase system, 265
Spokane, Wash.:
——Parlor car service, *321
——Storage batteries on single-phase systems, 476
Spokane & Inland Empire R. R.:
——Annual report, 933
——Freight service, *664
Sprague, F. J., on electric trunk line operation, 175
Spray, Car cleaning, 398
Springfield, Mass., Car house and repair shop, *909
Sprinkler Road, Double-truck centrifugal, Grand Rapids, *328
Sprinklers, Fire:
——Requirements, 883
——System in Washington, D. C., Car house, *1166
Sprinkling track difficulties in Detroit, 267
Standardization of equipment:
——American Street & Interurban Railway Engineering Association, Report, 188, 205, 225, 301, 424, 737, 789
——Central Electric Railway Association, Report, 517
——German reports, 353, *394
——Standards for railway equipment [King], 27
——(See also Brake-shoes; Rails, etc.)
Stanley, George, 379
Statistics:
——Accidents on railways in New York City, 899, 1187.
——British and American roads compared, 135, 885
——Holland railways, 847
——Ohio electric interurban railways, 679
——Prussian employees, 1070
——Single-phase lines, 357
——Steam railroads of U. S. for 1906, 334, 439
——Street and elevated railways in Canada, Cuba, U. S. and insular possessions, 352
——Street car industry, Census of, 487
——Vienna municipal railways, 356
Steam in cylinder, Action of, 1047
Steam trubines. (See Turbines, Steam)
Stebbins, Theodore, *1016
Stoker, Mechanical (Sarco), 361
Stone & Webster:
——New building, 175
——Public service journal, 117
Storage batteries:
——Design of battery houses, 1157
——Montreal sub-station, *1115
——Single-phase system of Spokane & Inland Ry., 476
——Sub-station practice of New York Central, 560, 898
Stout, F. J., 442
Street cleaning and sprinkling, Responsibility for [Wilson], 723
Street Railway Journal:
——Chicago office, Changes, 1218
——Convention number, October 12th. 537, 539, 647
——Increase in size of, 1
——New home of, 381, *397
——Retrospect and prospect, 903
Strikes:
——Birmingham, Ala., 81
——San Francisco, 44, 78, 112, 331, 409, 485 Discussion (Brent), 416
——Yonkers, N. Y., 900, 933
Stroudsburg, Pa., Delaware Gap line, *75
Sub-stations:
——Atlantic Shore Line, *1133
——Avon, N. Y., Erie R. R., *651
——Bronx Park, N. Y. Central R. R., 554, 555, 560
——Butler, Pa., *256
——Combined with waiting station, *1109
——Cost of installation and operation, with various systems, 358
——Glasboro, N. J., 618
——Glenwood, Ind., *672
——Great Western Ry., London, 170, *172
——Illinois Traction Co., *6
——Kingsbridge, N. Y. Central R. R., 554, 555, 560
——Long Island R. R., 595
——Mars, Pa., *256
——Milwaukee Northern Ry., *1108
——Montreal, *1115
——New Orleans Railway & Light Co., *1092, *1093
Sub-stations: (Continued.)
——Newfield, N. J., 618
——Portable:
Kennebunk, Maine, *1134
Rochester & Sodus Bay Ry. [Amesbury], *906
——Storage batteries, Montreal, *1115
——West Jersey & Seashore R. R., *618
——West Shore, R. R., 583, *584
Superheaters, Regulating [Foster], c36
Superheating steam [Booth], 338, 392
Superintendent of motive power, Incorrect use of title, 977
Surface contact system, Electro-magnetic [Leffler], 222
Sweden, Electric traction in [Dawson], 639
Swenson, B. V., Portrait, *856
Switchboard, New Orleans, 1086
Switchboard instrument cases (American), *927
Switzerland, Heavy electric traction in [Dawson], 639
Sydney, N. S. W.:
——Notes on, 254
——Steam turbines (Williams), *38

T

Tacoma, Wash.:
——Line to American Lake, *340
——Pacific Traction Co.:
Construction details, *340
Track-laying machine, *398
Tank, Water, Ferro-concrete, *315
Taxes in the U. S., 1906, 137
Technically-trained man and the electric railway profession [Norris], 768
——Comment, 838
——Discussion, 801
Telegraph relay, Applegate "static pickup," *663
Telephone block signal system, *1035
Telephone testing set, *527
Temperature and power station loads, Relation between [Corning], 1053
——Comments, 1045
Terminal stations:
——Bay Shore Park, Baltimore, *132
——Evansville, Ind., *1204
——Forest Hills, Boston, *1202
——Minnesota State Fair, *908
——(See also Waiting station)
Terminals for car houses, Open vs. closed, Report of Committee, *733
——Discussion, 793
Terminals, Railroad, Trolley service to, 1159
Terre Haute, Indianapolis & Eastern Traction Ry., Cars, 435
Tests and testing:
——Contact resistance in connection with rail bonding, *389
——Corrugated rails, Hardness of [Fowler], 506
——Laboratory at Milwaukee, 291
——Lubricants, Testing, 76
——Service tests of train and single-car operation, 322
——Steam turbine, Curtis, 452
——Train testing apparatus [Ashe], *286, 398
——Turbo generator, Kokomo, Ind., *362
——Waltham, Mass., power plant, 508
Texarkana, Ark., Semi-convertible cars, *527
Texas railway projects, 1034
Texas Traction Co., New line, 1010
Theaters:
——Highland Park, York, Pa., *347
——Riverton Park, Portland, Me., *504
Third rail, Location, Standard, Report of American Railway Association, 930, *954
Third rail, Maintenance:
——Long Island R. R., *597, *954
——New York Central, *954
——West Jersey & Seashore R. R., 619, *955
Ticket punch (Bonney-Vehslage), *923
Tickets:
——Children's half-fare, Connecticut, 433
——Interurban railways [Stebbins], 868
——(See also Fares; Transfers)
Tie plates, Anchor bottom (Sellers), 927
Ties:
——Cypress for, 144
——Preservation (See Timber preservation)
——Steel:
(Benjamin), *685
Brooklyn, *986
Chicago, *843
Montreal, *345
——Steel and concrete, on Utica & Mohawk Valley Ry. [French], *665
Timber, Strength of structural, 957
Timber preservation:
——Cheaper timbers available, 669
——Government experiments, 277
——Open tank method, Circular, 363
——Practical wood preservation [Hartmann], 915
——Railway treating plants, 915
——Structure of wood and preservative treatment [Weihe], 668
Comment, 841
——Tree planting by railways, 915
Tokio Electric Railway Co. [Brent], *1095
Toledo, Ohio, Field day and outing, 264
Toledo, Ann Arbor & Detroit R. R., Sale of, 330
Toledo Railways & Light Co., Earnings, 830
Toledo, Urban & Interurban Ry., Traffic arrangements, 149
Tool adjustments by compressed air, 1201
Tools, Motor-driven, in track construction, 410
Tourist information bureau in Washington, 189
Tower cars for overhead construction work, *412 *414
Towers, Steel, Effect on lightning protection, 3. 34
——(See also Poles)
Track brakes. (See Brakes, Track)
Track construction:
——Asphalt paving, Milwaukee, *317
——Atlantic Shore Line, *1131
——Brick paving, Milwaukee, *317
——Brooklyn, on Livingston Street, *986
——Care of electric railway track [Wilson], 723
Comment, 698
Discussion, 784
——Chattanooga, Tenn., 1026
——Chicago, Reconstruction, *842
——Cost of, Boston & Eastern figures, 67
——Cost of repair and renewals, Sheffield, England, 93
——Effects of steam and electric locomotives on, Tests by Penn. R. R., 1027
——Fort Wayne & Wabash Valley, *1144
——Granite paving, Phila., *345
——Gt. Western Ry., Hammersmith & City branch, *173
——Handling traffic during construction, 338
——Houston, Texas, *1024
——Mobile, Ala., 1025
——Montreal, Reconstruction with steel ties, *345
——Motor-driven tools in, 410
——San Antonio, Texas, *1024
——Scoria paving, Phila., *345
——Space between tracks, New York and Chicago, 405
——T-rail, in Milwaukee, *317
——Tacoma, Wash., *341
——(See also Paving; Rails; Ties, etc.)
Track drills (Van Dorn), *267
Track-laying machine, Tacoma, *398
Traffic, Handling:
——Baltimore, Old Home celebration, 958
——Boston, Old Home Week, 215
——Interchange of, by steam and electric roads in Indiana, 534
——Minnesota State Fair, *908
——While double tracking, 338
Traffic, promotion of:
——Baseball as a promoter of, 864
——Ice skating of, 865
——Report of Committee [Harrington], 863
——(See also Advertising for traffic)
Transfer tables:
——Home-made, *316:
——Trucks, Table for, *775
Transfer table, Washington, D. C., *1163, 1164
Transfers:
——Chicago, 1069
——Honolulu, *857
——Los Angeles, 328
——New Orleans, 528
——Philadelphia regulation, 900
——Starting point designated in Chicago, 1069
——(See also Fares, Tickets)
Transformers:
——Delta and star connections, 206
——Improvements in, 941
——Oil for, 76
——Protection of, discussed at American Institute Electrical Engineers, 33, 34
Transmission. (See Power transmission).
Tree planting by railways, 915
Trees, Protecting, from wire injuries, 1046
Trenton, N. J., Paving suit decision against company, 439
Troney base, Parallel bearing, used in Montreal, *1137
Trolley harps:
——Divided fork, *1137
——Liberty, with flexible head, *687
Trolley pantograph collector [Mayer], *951
Trolley wheel with oil chamber (Recording), *1069
Trolley wire, Stringing, Milwaukee, *161, 165
Trucks, Car:
——Brooklyn, *919
——Connecting rods on truck, Pittsburg, *1145
——Hudson Valley Ry., M. C. B. type, *683
——Long wheel base trucks in European practice, 913
——Milwaukee, *220
——Montreal, 393
——(New York C. & T. Co.), 678
——Schenectady Ry., (American), *684, 813
——Standardizing, German report on, 354
——Two-bar equalizer, Brooklyn, *957
Tunnels:
——Alberg, Austria, Electrical equipment, 1006
——Battery, New York, Opening, 1072
——Belmont, New York, First official trip, *476
——Boston, Washington Street, 487, 535, 681
——St. Paul, Minn., Selby Hill, *421
Turbines, Steam:
——Construction of Allis-Chalmers [Chilton], *726
——Curtis turbine, Tests, 452, 848
[Kruesi], 754
Discussion, 794
——Developments in power station work [Bibbins], *758
——Exhaust steam (Willaus & Robinson), 929
——Exhaust steam turbine plant of Wisconsin Steel Co. [Wait], 1170
——Governing mechanisms of the Curtis turbine, *478
—Minneapolis, Minn., 125

Turbines, Steam: (Continued.)
——Peoria, Ill., 90
——Pittsburg & Butler Street Ry., Co. 213
——Reports on operation, N. Y. Central R. R., 547, 548
——Tests:
Interborough Rapid Transit, 129
New York Edison Co., 675, 1148
Waltham, Mass., 508
——Willans-Parsons, for Sydney, *38
——(See also Alternators)
Typewriters [Smith], 703

U

Union Pacific R. R., Gasoline motor cars, 947
Utica & Mohawk Valley Ry., Steel tie and concrete construction [French], *665

V

Valuations of steam and street railway property, 307
Valves, Air:
——Applying brakes and dropping fender (consolidated), 690
——Combined automatic and straight air-brake system, *1119
——Straight air-brake equipments (Allis-Chalmers), 928
Valves, Steam:
——Automatic cut-off (Lagonda), 862
Vestibule, New (Sjoberg), 812
Victoria, Suburban steam railway statistics 37
Vienna:
——Excursion trips by trolley, 930
——Report for 1906, 356
Vienna-Baden Ry., Combination d.-c. and a.-c., *450
Visalia Electric Railroad, California, 150, *1111
Vises, Double and single swivel, *108
Voltage regulation for car lights, 381
Vreeland, H. H., Resignation of, as manager for receivers, 693

W

Wages. (See Employees.)
Waiting station guards, Value of, 1079
Waiting stations:
——Combined with sub-station, *1109
——Pittsburg & Butler Ry., *260
——(See also Terminal stations)
Waltham, Mass., Power plant test, 50
Washington, D. C.:
——Car house, Concrete, *1160
——Crane for handling motors in cars, *1031
Washington, Baltimore & Annapolis Ry.:
——Cars, *686
——Catenary construction, *360
——Progress, 272
Water meter record, New York Central power station, 548
Water rheostat, Construction of, home-made, *130
Water tank, Ferro-concrete, *315
Wattmeter, Shunted type of graphic recording [MacGahan and Young], *294
Weed burner [Greer], *951
Weeks, B. J., 535
West Jersey & Seashore R. R.:
——Distribution and sub-station system, *618
——Maintenance of rolling stock, 623
——Power station practice, 615
——Third rail construction, *955
West Shore R. R.:
——Electrical operation, *581
——Operating organization, 581
——Sub-station operation, 583, 584
Westinghouse Manufacturing Co., Balance sheet, 1124
Westinghouse receivership, 899, 935, 1187, 1219
Wharton, William, Jr., 1125
Wheel-guard tests in Massachusetts, 302
Wheel records at Kansas City, 216
Wheels:
——Cast iron, Wear of brakeshoes on, 179, 181
——Chilled wheel practice at Kansas City, 216
——Deformation during use [Mallock], 61
Criticism, 120
Discussion, 130
——Kansas City wheel practice, 216
——Montreal practice, 393
——Sections:
Development of proper wheel flange, Angerer's diagram, *427
Different railway companies, *227, *228
Wheels: (Continued.)
——Standard:
Central Electric Railway Association, *518
Engineering Association, *227, *426, *740
Manufacturers' opinions, *426
——Tire removal, Indianapolis, *1098
Whistling post, Steel (Hillman), *1070
Wichita, Kan., New cars, 1207
Wilcoxen, E. J., 976
Wilgus, W. J., *118, 336
Winnebago Traction Co., Reorganization, 532
Williams, W. H., 902
Wisconsin Electric & Interurban Railway Association, Meeting, 1116
Wisconsin Engine Co., Manufacturers of gas engines, 1042
Wisconsin Railroad Commission, Reports on Milwaukee complaints, 115
Wisconsin Steel Co., Exhaust steam turbine plant [Wait], 1170
Wood. (See Timber)
Worcester, Mass.:
——Closed cars, *1070
——Fender, *401
——Open cars, *144
——Through service to Providence, 295
Worcester Consolidated Street Railway Co., Bond issue, 438
Work car, gravel spreader and snow plow combined, *163
Wrecking car, San Antonio, *59
Wright, Carroll D., Decoration to, 1014
Wyman, C. D., *1016

Y

Yards:
——Grand Central, *558
——Mott Haven, *557
——Storage yard of Boston elevated railway, *1028
Yonkers, N. Y.:
——Power station practice, *544
——Strike, 900, 933
York, Pa., Highland Park, *346
York Railways Co., A consolidation, 1042
Yount, J. M., 203

AUTHOR INDEX

ADAMS, H. H. Address by, 779
Amesbury, B. C. Portable sub-station for Rochester & Sodus Bay Ry., *906
Armstrong, A. H. Comparative performance of steam and electric locomotives, 987
——High speed of electric locomotives on grades, c1027
Ashe, S. W. Improved interurban train testing apparatus, *286

BARRON, C. A. Loss of records at Snohomish, Wash, c266
Beggs, John I. Addresses by, 777, 798, 806
Bemis, E. W. Report on municipal ownership, 107
Bennett, H. K. The claim agent of to-day and his work, 707
Bibbins, J. R. Developments in steam turbine power station work, *758
——Turbine economies, 1148
Blakemore, M. N. Pittsburg & Butler Street Railway Co., *208, *256
Booth, W. H. Advantage of new boiler designs, 1169
——Laws of mixed vapors, 98
——Steam boiler efficiency, 15
——Superheating steam, 392
Brent, H. K. Strike situation in San Francisco, 416
——Tokio electric street railway company, *1095

CAMPION, H. T. and WILLIAM McCLELLAN. Influence of design of railway structures on economy of operation, *771
Carpenter, E. C. Selecting and training of investigators and adjusters for the claim department, 709
Case, F. E. Recent improvements in control apparatus for railway equipment, 741
Chilton, St. John. Practical points in steam construction, *726
Clark, R. J. Electric railway development in Ontario, 30
Clark, W. J. Municipal ownership in Great Britain and in the United States, 134, 885
Clark, Walton. Report on municipal ownership, 105, 184
Commons, J. R. Report on municipal ownership, 103
Cooper, H. S. Problems of the small electric road, 876
Crafts, P. P. Light freight handling by electric lines, 872
Cunningham, E. R. Effect of the transmission line upon the reliability and efficiency of electric interurban railway service, *16

DAVIS, W. J., JR. High-voltage, direct-current and alternating-current systems for interurban railways, 357
Dawson, Philip. Electrical equipment of main line railways in Europe, *638
Dubee, Patrick. Electric railway development in Eastern Canada, 29

EDGAR, C. L. Report on municipal ownership, 105, 134

FOWLER, G. L. Hardness of corrugated rails, 506
French, M. J. Steel tie and concrete construction on Utica & Mohawk Valley Railway system, Utica, N. Y., *665

GREER, C. L. A weed burner, *952

HARDIN, C. B. The claim department and what should he done to make it most effective, 714
Hartmann, E. F. Practical wood preservation, 915
Heckler, Fred. Foundation brake-gear design for electric railway cars, *1058
Hewitt, J. R. A. C. electrification in the Illinois Traction System, *4
Hobbs, John. A partial check on lightning arrester operation, *349
——To the inventor of electric railway appliances, 505

JOHNSON, F. W. Instruction of employes in accident work, 711

KING, C. B. Standardization of electric railway equipment, 27
Kruesi, A. H. Curtis turbines in railway service, 754

MAC GAHAN, PAUL and H. W. YOUNG. Shunted type of graphic recording meters, *294
McHenry, E. H. Heavy electric traction on the N. Y., N. H. & H. R. R., *242
McKeon, P. J. Fire problem of car houses, 187
Maltbie, M. R. Report on municipal ownership, 133
Mayer, Joseph. Pantograph collector for high-speed electric railways, *951

NEAL, J. H. Where maintenance ends and depreciation begins, 700
Norris, H. H. The technically trained man and the railway profession, 768

PARSONS, FRANK. Report on municipal ownership, 107, 141
Pierce, H. J. Address by, 521
Polk, H. H. Freight service on electric railways, 877
Potter, A. E. Wages in Providence, c266
Pryor, F. J., Jr. Amusement park accounts, 701

REEL, C. G. Use of the T-rail in cities. *883

SARGENT, F. W. Brakeshoe tests, 176
Schoenen, R. H. The policy of the claim department to the injured employee, 710
Smith, F. E. Mechanical devices and other office appliances, 703
Smith, W. N. Single-phase electric motive power on the Rochester Division of the Erie R.R. *650
Stebbins, Theodore. Interurban fares, 866
Stevens, F. W. Address by, 520
Sullivan, J. W. Report on municipal ownership, 101
Sweetland, Ralph. The National Fire Protection Association, 770

TINGLEY, C. L. S. Address by, 804
Toltz, Max. Steam vs. electric locomotives, 453

VORIES, H. P. How I manage bad cases, 713
Voynow, C. B. Rail corrugation, c956

WAIT, H. H. An exhaust steam turbine plant, 1170
Warnock, A. W. Advertising from the standpoint of the street railway company, 870
Weihe, E. J. Maximum length of service for poles, ties and timbers, 668
White, J. H. A department of publicity, 874
Wilson, G. L. Care of electric railway tracks, 723
Winsor, Paul. Year's experience with gas engines, 725

YOUNG, H. W. and PAUL MAC GAHAN. Shunted type of graphic recording meters, *294

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Of this issue of the Street Railway Journal 8300 copies are printed. Total circulation for 1907 to date 222,350 copies, an average of 8235 copies per week.

Our Recent Volume

We rarely refer to our own publication in these columns, but we do not feel that we should commence a new volume without at least a brief reference to the record of the past six months. Since 1900 the STREET RAILWAY JOURNAL has been published in two volumes during the year instead of one, and now a single volume, or that including the issues for six months, is larger than any volume of this paper for twelve months before 1900. In other words, during the last seven years the reading pages of this paper have increased in number more than 100 per cent, in spite of the fact that the subscription price has been reduced 25 per cent. The record for the past six months has been in the same ratio as that since 1900; that is, the reading pages in Vol. XXIX., or for the first six months of 1907, have increased slightly more than 14 per cent over the reading pages issued during the corresponding period last year. To be exact, the number of columns of reading matter published from January to July, 1907, amounted to about 2620, corresponding to 1310 pages, which, reduced to a basis of $3 a year, means practically nine pages of the STREET RAILWAY JOURNAL for one cent. We have not referred in this analysis to the quality of the reading matter or to the improvement in this respect which we believe has accompanied the paper in its increase in size, but believe that we have demonstrated that for the reader who wishes to keep informed as to all of the important events in electric railroading—engineering, operating, financial, legal and news—the STREET RAILWAY JOURNAL is indispensable.

Standard T-Rail Specifications

Considerable progress is being made in standardizing the specifications and contour of rails for steam railroad service. At its meeting in Atlantic City, June 20-22, the American Society of Testing Materials voted to adopt, subject to a letter ballot, the standard specifications for steel rails which it has had under consideration for some time, though making no radical change in their wording. This action has been followed by the more or less definite rumor that the new Pennsylvania specifications include the cropping of the ingot 25 per cent, instead of the much smaller percentage now general, and to be otherwise so rigorous that they will increase the price of rails some $5 a ton. No rails, however, have been purchased under these specifications, and it is quite probable that when made public they will be found not to agree with the somewhat vague estimates which have been made of their terms.

During the debate on the subject of rails which has been so rife during the past year or so, many claims have been made that it would be better to substitute open hearth for Bessemer steel, as the former is considered better on account of its lower percentage of phosphorus. On the other hand, certain experts claim that immunity from breakage in rails is not so much a question of such slight differences in composition as would be secured by changing to the open-hearth process, or freedom from piping as would be gained by cropping the ingot, as it is of speed in rolling. According to this theory, it is claimed that with the present heavy A. S. C. E. sections, it is very diffi-

cult to roll these heavy sections without finishing them at too high a temperature.

In the meantime, the selection of a new standard section of T-rail is being discussed by the experts of the railroads and rail mills, but final decision on this subject is being withheld pending the report of the rail committee of the American Society of Civil Engineers. This committee was appointed in 1902, when it was found that the present A. S. C. E. standards needed modification. It is understood, however, that the Pennsylvania specifications referred to above take up the question of section of rail as well as its manufacture, so that there are really two independent bodies of engineers working upon this question.

Fortunately, the subject is not so pressing with street railway companies, and they can well wait until the matter reaches a more definite stage with the steam railroad companies.

The Interpole Motor

The interpole construction has already won a good reputation in stationary motors intended for a wide range of load and speed. The fundamental idea of counteracting the armature field by superimposing upon it an opposed magnetomotive force is an old one, and the recent interpole construction is novel more in detail than in principle. It is natural to expect benefits from an application of the same principle to railway motors, and the only wonder is that the announcement of interpole traction motors made last week at Niagara Falls and Lake Champlain was so long delayed. The papers by Messrs. Anderson, Hill and Renshaw, which we have already placed before our readers, put the principles involved very clearly and give good reason for some confidence in the excellence of the results. It must not be supposed, however, that the commutating pole is a panacea for all the ills that motors are heir to. As in the case of compound winding of generators, there are limits to be faced, and one can neither invoke compounding to remedy bad design nor to increase indefinitely the overload capacity. Intelligently applied, it is extremely useful and important. Just so with the commutating pole; it can do much but not everything, and it must be wisely applied and carefully designed in order to produce the best commercial results. It has some conspicuous virtues and a good many "talking points" to its credit.

Until the recent light broke upon us, we had, however, been under the impression that in recent railway motors sparking had been pretty thoroughly eliminated, so that heating was the thing which set a limit to good performance. We hardly know whether to confess our error and retract or not. Would we become the more beloved by taking the one horn of the dilemma or the other? With all seriousness, we are convinced that the interpole motor is theoretically excellent and practically very useful in certain cases. How thoroughly its range of applicability covers the field of electric traction remains to be shown by practice. It should seemingly make it rather easier to construct motors for high voltage, yet the maximum of 1700 volts for a 250-hp motor with an 18-in. commutator is not a very startling dénouement. M. Thury has already built a number of generators of similar output, six-pole machines at that, which are reported to give excellent commutation. It will doubtless prove somewhat easier to build a compact, high-voltage motor with commutating poles than without them, and for this gain there is good reason for congratulation. The coming of a practical and reliable large railway motor for 1500 to 2000 volts will certainly put a new face upon the heavier railway work. However well the single-phase commutating motor may turn out, we doubt whether even its most enthusiastic friend expects it to run with as perfect commutation as can be obtained in a d. c. motor of similar weight and output. The question is rather whether the a. c. motor will commutate satisfactorily considering its other advantages.

The future of the interpole motor—so far as heavy traction is concerned—must be determined by its own performance. A three-wire system worked on a four-motor equipment arranged in pairs, with 3000 to 4000 volts between the outside wires, would be an important addition to our means of heavy traction. It would give a thousand horse-power with hardly 300 amps. input, an amount of current that can be managed without great difficulty even from overhead conductors. For high-speed work it would be feasible, as Mr. Anderson indicates, to raise the voltage per motor even higher. With 5000 volts between the outside wires, the gain in distribution would be so great as to push a. c. operation hard, and especially if it be considered necessary to drop the frequency to about 15 cycles to get the best operating conditions.

This subject was also discussed at the Institute meeting, but until more operative data from large single-phase motors are available this question of frequency must be considered an open one. Certainly few engineers would wish to go to 15 cycles if good operation could be attained at 25. The commutating pole d. c. motor with its possibility of somewhat higher voltage most effectively strengthens the hands of engineers who, like Sprague, Parshall and Hobart, look with distrust on commutating single-phase motors. As we have many times intimated, high voltage on the working conductors is the desideratum in heavy electric traction; how it gets there and how it may be utilized are matters of minor importance. If the commutating pole construction can put 3000, 4000 or 5000 volts at our command with a simple and efficient motor equipment, a long step in advance will have been taken. It is now up to the builders of such motors to put them into active service and prove their virtues on a commercial scale.

The commutating pole motor is now also being built in considerable quantities for ordinary voltages. For this purpose it possesses many advantages over the older type, and while flashing over may occur, it is thought that by removing the incipient cause—sparking under the brush—together with copper and carbon dust, the chances of its occurrence would be greatly reduced. But although the gain in motors for ordinary voltage from this construction may be very material, it is insignificant compared with the possibilities in the larger sphere of electric traction.

Lightning and Lightning Protection

The papers on transmission line construction and lightning protection presented at the Niagara Falls convention of the A. I. E. E. give sufficient evidence that there are a great many things which are not yet fully understood with

respect to the troubles inherent in high-voltage transmission. Lightning has been from the beginning one of the most serious difficulties with which electrical power transmission has had to contend. It has been one of the most frequent causes of failure of service, to say nothing of the more direct damage produced by the burning out of machinery and instruments.

Lightning, in popular parlance, has generally included all serious and destructive high-voltage phenomena. In a certain sense this very loose classification has justified the use of certain preventive machines, applied with equal efficiency, or lack of it, to all high-voltage discharges, however produced. Many genuine effects of lightning are merely induced discharges, and are comparable with the electrical forces properly belonging to the line. Direct thunderbolts falling upon the line are comparatively rare, but are so dangerous that they constitute a very serious peril to transmission systems. It is toward the averting of this particular risk that this discussion bears. Speaking broadly, attempts to diminish lightning risks have followed three lines of operation; first, the insulation of lightning protective devices; second, the erection of lightning arresters or their equivalent to keep the lightning off the transmission circuit; third, such general strengthening of the insulation as to minimize the destructive effects of lightning.

Until comparatively recently the first course mentioned was the chief reliance of the engineer. There was a strong tendency to install more and more so-called lightning arresters along the line, so that if a line was struck by lightning an easy path to earth would be available. As time has gone on experience has tended to show that too great multiplicity of lightning arresters is almost as dangerous to continuity of service as their absence would be. Lightning arresters installed within the station to protect a definite group of valuable machinery is one thing; lightning arresters installed upon a line where they cannot be kept under observation are quite another. Arresters installed far out upon the lines are so many possible sources of formidable grounds that are likely to put the circuits out of business. This fact, however, does not argue against the use of the lightning arrester to protect certain exposed points of the line when the arrester installed there can be properly taken care of. In very many transmission systems there are exposed spots where, for example, the line passes over bare hill tops in a district of frequent thunder storms. Such points may be very suitable for the installation of protective apparatus.

Of late the introduction of steel tower transmission lines has greatly improved conditions with respect to protection against lightning. Such towers are peculiarly exposed to lightning, being pointed metallic structures of considerable height. In addition, for some reason which we never have been able fully to comprehend, constructors of tower lines have insisted, as a rule, upon making even the cross-arms of steel, thus throwing the whole responsibility of line insulation directly upon the insulators themselves. In a good many instances the result has been disastrous to continuity of service, since any failure of the insulator, however small, is likely to produce a dangerous ground. Given such structures, it was almost instinctive to try to convert them into lightning rods by pointed extensions carried well above the topmost wire. This construction has been at times heralded as a panacea against troubles from lightning. It unquestionably averts a certain proportion of strokes which might otherwise prove disastrous, but indications are that the protection is very far from being complete. The next natural step was to install a grounded wire well above the other wires, thereby in a measure bringing the earth potential up above the level of the transmission wires. A certain measure of protection is undoubtedly afforded by this procedure. Unfortunately, however, in a steel pole line the earth potential already comes fairly within the interiors of the insulators, only a few inches at most from the high-voltage wires, and lightning is quite apt to take this convenient path instead of the adjacent one cleverly provided.

Lightning rods and grounded wires seem rather to be palliatives than effective remedies, and in the last resort the burden of protecting the line is again thrown back upon the insulators. It is in improving the insulator itself that the best chance for added protection may be found. The greater the insulation strength of these the less likelihood that minor lightning discharges will break down the line and the better chance that a direct lightning stroke will take to the grounded wire rather than to the grounded cross-arms over or through the insulator.

A 50,000-volt line equipped with insulators having a factor of safety of three has 100,000 volts' worth of insulation to spare against an attack of lightning. The same line with a factor of safety of two has only 50,000-volt surplus to the good, while a 5000-volt line with the same factor of safety has but 5000 volts to spare. One ought, therefore, to find a very considerable protection against lightning in a high factor of safety in the insulator and in the use of such working voltages that this factor of safety shall have a large absolute value. We should expect upon the whole, therefore, to find high-voltage lines standing up against lightning better than those of lower voltage, owing merely to greater absolute spare insulation strength. The report of the committee on this subject before the National Electric Light Association bears out quite strongly this view of the case. The statistics of the last year indicate, as in the case of previous reports, that circuits of, say, 5000 to 10,000 volts and below, show in proportion to their numbers much more frequent damage by lightning than really high voltage systems and a considerably smaller percentage of complete immunity from damage. To be perfectly fair, one should perhaps eliminate from this reckoning the distribution plants operating at about 2300 volts, on account of their relatively very great mileage of exposed wire; but even after this is done inspection shows that the high-voltage plants, with their great absolute insulation strength, seems still to have considerable advantage.

It would probably be impracticable actually to insulate a line against heavy lightning discharges. It is comparatively easy, however, so to insulate it as greatly to increase the chances of effective operation of auxiliary protection such as is afforded by grounded wires, lightning rods, and other protective devices. The question of safety in the last resort is, therefore, put squarely up to the insulator, and the greatest need of electrical power transmission resolves itself to-day into better insulators with increased factors of safety.

A. C. ELECTRIFICATION ON THE ILLINOIS TRACTION SYSTEM

BY JOHN R. HEWITT

The Illinois Traction System is, without doubt, one of the largest electric traction interests in the country. It embraces every phase of interurban railroading and is at the present time extending in all directions in an astonishingly rapid manner. We believe that we are correct in stating that all the lines constituting this system were constructed by the Central Illinois Construction Company, and that they are operated by various operating companies which, in their turn, comprise the McKinley Syndicate.

The object of the present article is to deal with the extensive a. c. single-phase lines recently put into commission, together with those under construction which are to be put into operation in the near future, and to describe the apparatus employed in their operation; but owing to the many features of peculiar interest in this system as a whole, it seems advisable to preface this description with a few general remarks covering the most salient points.

The map published herewith in Fig. 1 will give a general idea of the territory served and the accompanying table will show the names of the different operating companies, the mileage of each line and method of operation, whether a. c. or d. c. At present the total mileage in operation amounts to 381.5 miles, and the proposed lines aggregate approximately 90 miles, making a total of 471.5 miles of road that will be in operation in the near future. Of these, 95 miles are at present operated on, or being equipped for, the a. c. single-phase system.

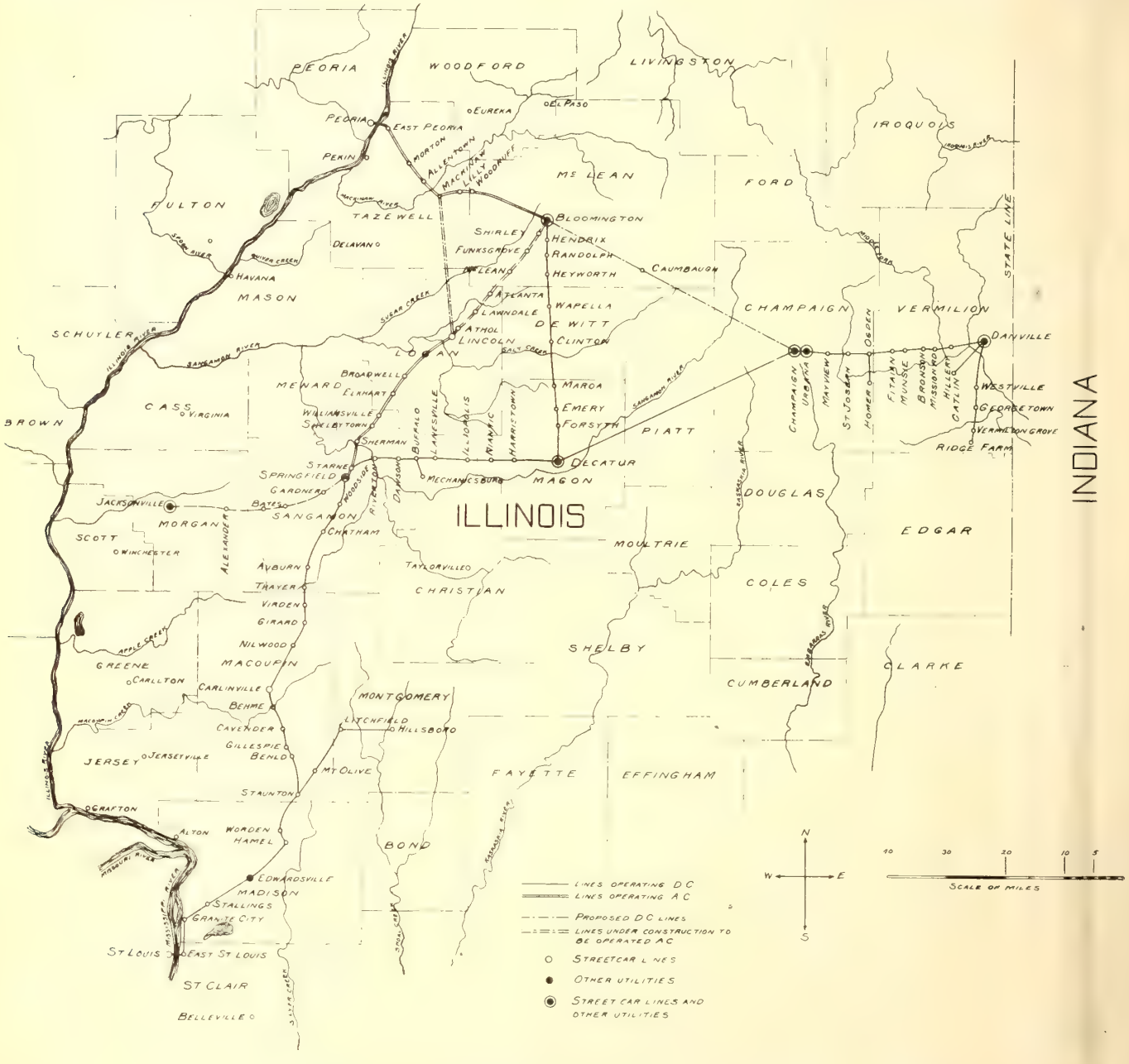


FIG. 1.—THE PRESENT AND PROPOSED LINES OF THE ILLINOIS TRACTION SYSTEM

Besides the roads already mentioned, it has been announced in the daily papers that a road, in connection with the Illinois Traction System, is to be constructed between Bloomington and Chicago, but it is too early to make any definite statements concerning this at the present time.

Over and above the operation of these electric roads as outlined above, the Illinois Traction System controls the city street railway lines in numerous cities in the Middle

West and provides for other public utilities, such as power and light, in these districts. Some of the towns served in this manner are indicated on the accompanying map, but in this respect the map is incomplete.

To operate this vast system there are at present nine power houses, located, respectively, at Danville, Champaign, Decatur, Bloomington, Peoria, Riverton, Edwardsville, Venice and Jacksonville. Most of these have already been described in the columns of the STREET RAILWAY JOURNAL.

The sub-stations, which are widely distributed over the system, are too numerous to describe in an article of this length, but at the same time it is interesting to note that considerable use is made of portable sub-stations, which can be used with such good advantage on a system of this size to reinforce the power on any portion of the road that is overloaded temporarily from any cause, or to provide power when construction work is being done which would otherwise cripple operation.

As is evident, the equipments are very numerous and comprise cars of many different types and a large variety of electrical apparatus. The cars range from the smaller type of street car to some of the finest specimens of interurban cars to be seen on the continent of America; prominent among these are the handsome sleeping cars running between St. Louis and Decatur, which have already been fully described.

The freight business, in all probability, has reached larger proportions on this system than on any other system of electric roads in the country; two 50-ton. d. c. electric locomotives are in daily operation, and a 40-ton a. c. locomotive will shortly be put into service on the newer sections of the road. Practically all the coal used in the various power houses is hauled over the syndicate's own roads electrically, and a very extensive business is being carried on in handling coal for domestic purposes as well.

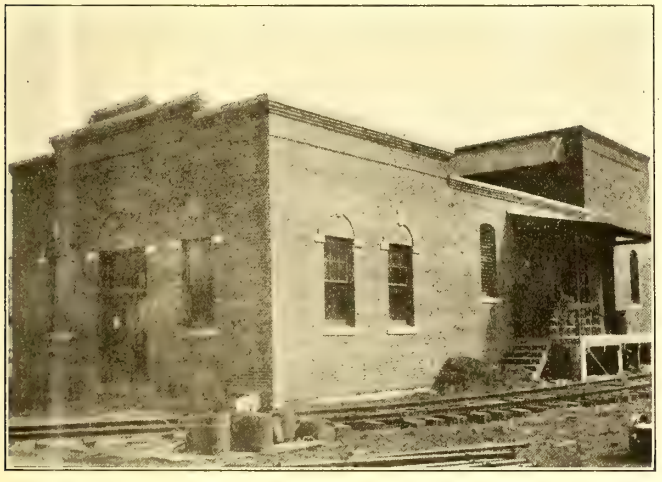


FIG. 3.—EXTERIOR OF DANVERS SUB-STATION, FREIGHT HOUSE AND WAITING ROOM

Carload lots of cattle and grain are also hauled by the electric locomotives, and a great deal is done in the direction of the express business. The usual load for the electric locomotive varies from ten to twelve loaded cars. To facilitate the handling of such large quantities of freight, belt lines are being built around many of the larger cities, notably at Springfield and Decatur. There are freight depots in all the towns and cities connected by the various lines.

Confining our attention now to the a. c. system recently put into operation and to those roads about to be converted from d. c. to a. c., the line from Peoria to Bloomington, which is 38 miles in length, is already in daily operation with single-phase current. This section was first operated from terminal to terminal on the new system on Sunday, April 1.

The line from Springfield to Lincoln, 30 miles in length, is at the present time in daily operation with direct current, but the catenary line is erected for high-tension a. c. operating and the sub-station buildings are completed, while the apparatus is at present being installed. This section will change from d. c. to a. c. operation in the course of a week or two.

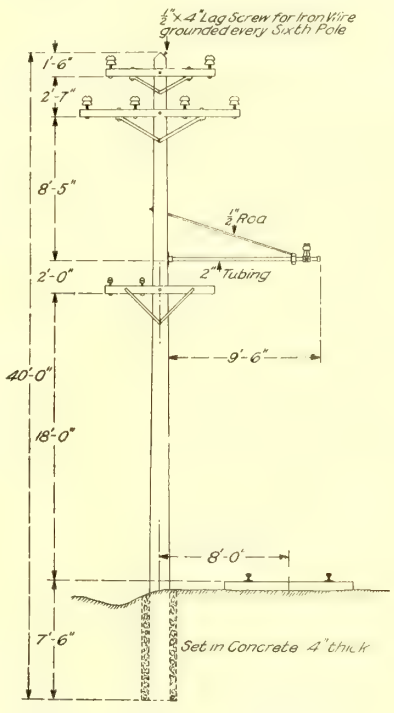


FIG. 2.—DETAILS OF HIGH-TENSION TRANSMISSION LINE

The road from Lincoln to Mackinaw, which will be operated a. c., will be approximately 27 miles long and is at present under construction.

GENERAL SCHEME OF ELECTRIFICATION

The general scheme of electrification of these roads now operating a. c. and those about to be put in operation during the next few months is as follows:

The power is generated at the new Peoria power house at a pressure of 2300 volts. It is stepped-up to 33,000 volts in the power house and is fed to the transmission line at this pressure. At the sub-stations this potential is reduced to 3300 volts for feeding the trolley. There are power houses situated at Bloomington and Decatur, from which it is also proposed to feed the transmission line if occasion demands.

To render this description more concise and avoid confusion, the Peoria to Bloomington section will be described in detail as being typical of the a. c. construction and equipment throughout. Special mention will be made where details of other sections differ to any marked degree.

POWER HOUSE

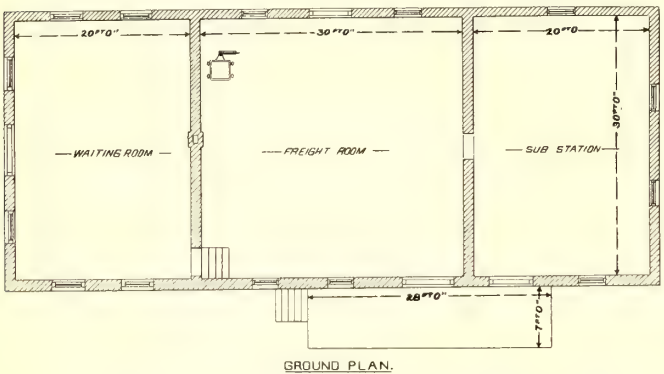
The steam equipment of the new power house, recently erected at East Peoria for supplying energy to the Peoria-Bloomington line, is a red brick structure with a roof of reinforced concrete and concrete floors.

The electrical equipment includes two Curtis turbines, each of a capacity of 2000 kw; these are four-stage condensing units operating with an average vacuum of 29 in. and at a normal speed of 750 r. p. m. The generators themselves are three-phase, 25-cycle General Electric machines; each has four poles and delivers current at a pressure of 2300 volts.

Two General Electric rotary converters have been installed to supply power for the city service; these are 750-kw, 10-pole, 25-cycle units running at a speed of 300 r. p. m., and supply 1250 amps. at 600 volts.

There are thirteen transformers in all—six 700-kw Westinghouse units wound for 33,000-2300 volts and six 250-kw Westinghouse transformers wound for 33,000-430 volts. The thirteenth is a General Electric transformer of 75-kw capacity, and is wound for 33,000-2300-1150 volts. All of these transformers are oil-insulated and water-cooled.

Two exciter sets are provided for supplying current to the fields of the main generators; one of these is a turbo exciter set and the other a motor-driven set. The former is a 75-kw, four-pole, horizontal Curtis turbine set, running at 2400 r. p. m., and supplies 600 amps. at 125 volts, while the latter consists of a 100-hp, 25-cycle induction motor direct coupled to a 70-kw generator which has a speed of 500 r. p. m. and supplies 560 amps. at 125 volts.



GROUND PLAN.

FIG. 4.—PLAN OF DANVERS AND MORTON SUB-STATIONS

The other principal items among the auxiliary apparatus are as follows: Two Wheeler condensers of the surface type, two horizontal air pumps by the Wheeler Condenser Company, one circulating pump and two feed-pumps by Dean Brothers; there are also two step bearing and two step bearing return pumps. The feed-water heaters are of the Cochrane type, manufactured by the Harrison Safety Boiler Works.

The boiler room is equipped with eight Stirling water-tube boilers, each having a capacity of 500 hp and providing steam at a working pressure of 190 lbs. per square inch. These boilers are stoked mechanically by motor-driven chain grates.

This description of the power house is far from complete, as a long and more detailed article will be published in the near future which will deal with the Peoria power house alone, and, therefore, will give fuller particulars.

HIGH-TENSION TRANSMISSION LINE

The illustration, Fig. 2, will show the details of the high-tension transmission line, and it will be seen that it does duty for supporting the trolley wire. Ultimately the transmission line will be in duplicate, but at present only three wires are strung.

The high-tension voltage is 33,000, three-phase, at 25 cycles per second. The wires are of No. 2 B. & S. hard-drawn copper supported on Locke No. 312 porcelain insulators tested to a pressure of 60,000 volts. The insulators are fixed to truss pins of malleable iron.

The pole line will certainly rank as one of the prettiest pole lines in the country; every pole is wonderfully straight and has the appearance of being turned in a lathe. They are of Spokane cedar, 40 ft. in length, with a diameter of 7 ins. at the top and range from 12 ins. to 14 ins. in diameter at the base. The poles are buried to a depth of 7 ft. in the ground, each being planted in cement, and, where the poles were planted on fills before the grading was completed, they are buried in barrels of cement.

The upper cross-arm, which is not at present in place, will carry two insulators, will be 4 ft. in length, and have a section of 3¼ ins. x 4½ ins. The lower arm carries four insulators, is 10 ft. long, and has a section of 3¾ ins. x 5¾ ins. The cross-arm for supporting the telephone insulators is 4 ft. in length. All the cross-arms are stiffened by means of galvanized iron angle braces. The distance from the center of track to the center of poles is 8 ft. The relative height of these cross-arms, the spacing of insulators and other dimensions will readily be seen by reference to the cut, Fig. 2. The poles are spaced 140 ft. apart on straight, level tangent, and at curves and street crossings the spacing is usually reduced to 100 ft., but this distance is varied to suit any special conditions.

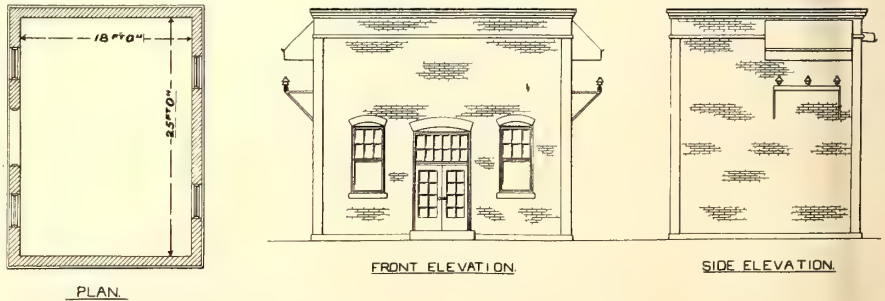
An efficient means of protecting the transmission line from damage by lightning is afforded by a No. 6 B. & S. galvanized iron wire strung for the entire length. This wire is grounded at every sixth pole and the ground wire is stapled to the poles at intervals of 3 ft. The wire is attached to each pole by means of a lag screw and two washers, the wire lying between the washers and being tied on either side of the lag screw by means of a length of iron wire which has its ends turned up for a distance of 6 ins. in a horn fashion. This device will add materially to the efficiency of the lightning protection.

SUB-STATIONS

The sub-stations on the Peoria to Bloomington section are located at Danvers and Morton, while the Springfield to Lincoln section is provided with sub-stations at Selbytown and Lincoln, and when this line is finished through to Mackinaw additional sub-stations will be built.

The Danvers and Morton sub-stations are identical in all respects. The external view shown in Fig. 3 and the plan in Fig. 4 will give a good idea of their general features.

It will be seen that a waiting room, freight house and sub-station are combined in one building, which, it may be interesting to note, is also a feature of a large number of the sub-stations on the different d. c. lines of the Illinois Traction System. The great advantage in this instance is that the man in charge of the freight house and waiting room can perform all the necessary work in the a. c. sub-station, which requires no attention excepting when the oil switch is thrown by an excessive overload. This arrangement entirely avoids, on the one hand, unnecessary delays when the switch is thrown, or, on the other hand, the expense of keeping at the sub-station an employee who would necessarily be idle for practically the whole time.



PLAN.

FIG. 5.—PLAN AND ELEVATIONS OF DANVERS AND MORTON SUB-STATIONS

The buildings are of red brick with reinforced concrete ceilings and concrete floors. The dimensions of the sub-stations proper at Danvers and Morton are: Length, 30 ft.; breadth, 20 ft., and height, 21.5 ft.; while those at Selbytown and Lincoln, which have no freight house or waiting room attached, are slightly smaller, being 25 ft. in length, 18 ft. in breadth and 21.5 ft. in height. Fig. 5 shows the plan and two elevations of the Selbytown and Lincoln sub-stations.

The equipment of those sub-stations already built as regards their main features and the capacity of electrical apparatus installed is identical. Each has a capacity of 400 kw, there being two 200-kw, 25-cycle transformers installed. These units are wound for 33,000 volts on the primary side and 3300 volts on the secondary; they are standard G. E. transformers and are controlled on the high-tension side by two K-6 oil switches, interlocked to form a double-pole unit. The low-tension side is controlled by a single pole form K-2 oil switch, which is mounted on the back of the low-tension panel. In addition to these switches there are three K-6 oil switches, for sectionalizing the high-tension transmission line, which are interlocked in such a manner as to form a triple pole unit. Two single-pole, 33,000-volt air brake disconnecting switches are provided for connecting the oil switches controlling the high-tension side of the transformers to either side of the line sectionalizing switch, and in this manner to enable the sub-station being fed from either end of the line as desired.

Between the oil switch controlling the high-tension side of the transformer and the transformers themselves, there are four 33,000-volt disconnecting switches, two for each transformer, which enables either unit being cut out of service at will, and in a similar manner two 3300-volt disconnecting switches are provided in the secondary circuit between the low-tension oil switches and the transformers. One lead from the low-tension side of each transformer is connected to a bus situated beneath the floor that leads to the track outside of the building.

The wiring diagram given in Fig. 6 will clearly demonstrate the relative positions of the various switches and also of the other electrical apparatus, while the views reproduced in Figs. 7 and 8 will show the actual position of the high-tension wiring, etc. A plan showing the arrangement of the electrical apparatus is given in Fig. 9, which

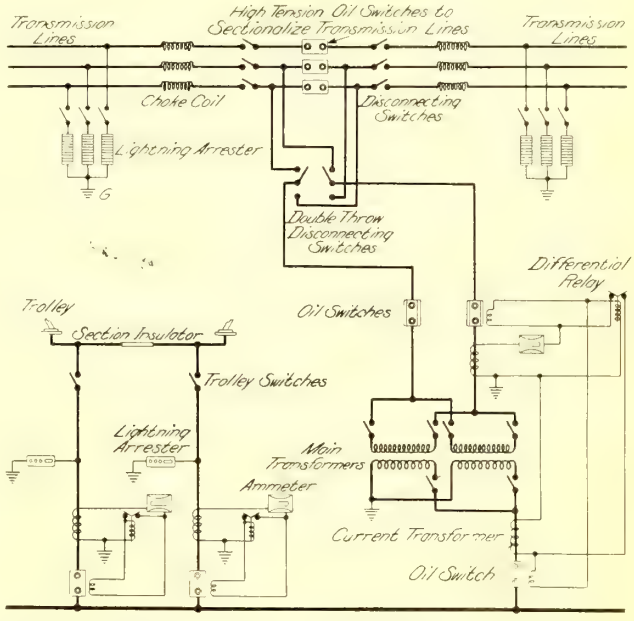


FIG. 6.—WIRING DIAGRAM FOR SINGLE-PHASE SUB-STATION AT MORTON AND DANVERS

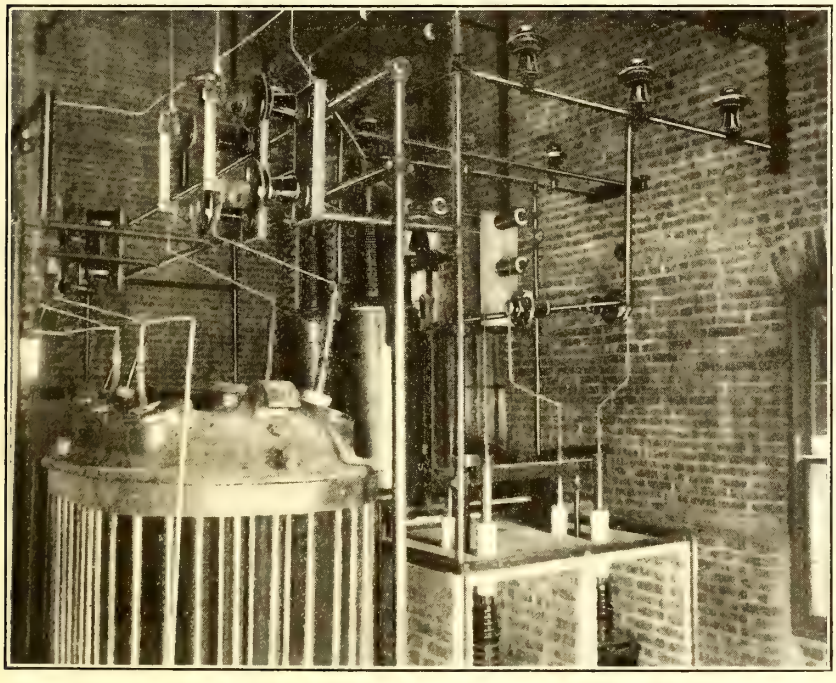


FIG. 7.—TRANSFORMER SWITCH COMPARTMENTS, ETC., IN THE MORTON SUB-STATION

arrangement is identical in all four sub-stations. In the Danvers and Morton sub-stations three transmission wires pass through the building, while at Selbytown and Lincoln only two wires are used; their appearances will be noted in Figs. 6 and 9, respectively.

The switchboard in each sub-station consists of four panels:

(1) A line section panel on which is mounted the operating mechanism for the line section switch.

(2) A high-tension transformer panel which controls either or both of the transformers, according to how many of the disconnecting switches are in circuit; on this panel there are mounted an ammeter, the operating mechanism for the double-pole, high-tension transformer oil switch and a differential relay.

(3) A low-tension transformer panel provided with an ammeter, the operating mechanism of the low-tension oil switch and an inverse time limit overload relay of the bellows type.

(4) A double-pole feeder panel equipped with two ammeters, two oil-switch operating mechanisms, and two inverse time limit relays of the bellows type. The feeder panels are illustrated in Fig. 10, which also shows the feeders passing through the sub-station wall to the trolley.

The relays on the low-tension transformers and feeder panels are made "time limit" in order to prevent their tripping when a large current is taken during the acceleration of the cars; they are set for about five seconds.

The differential relays on the high-tension transformer panels are not used at either Morton or Danvers, as the baggage man in these stations is called by an alarm bell whenever an oil switch is thrown. The differential relay will be used as an overload relay without any time limit

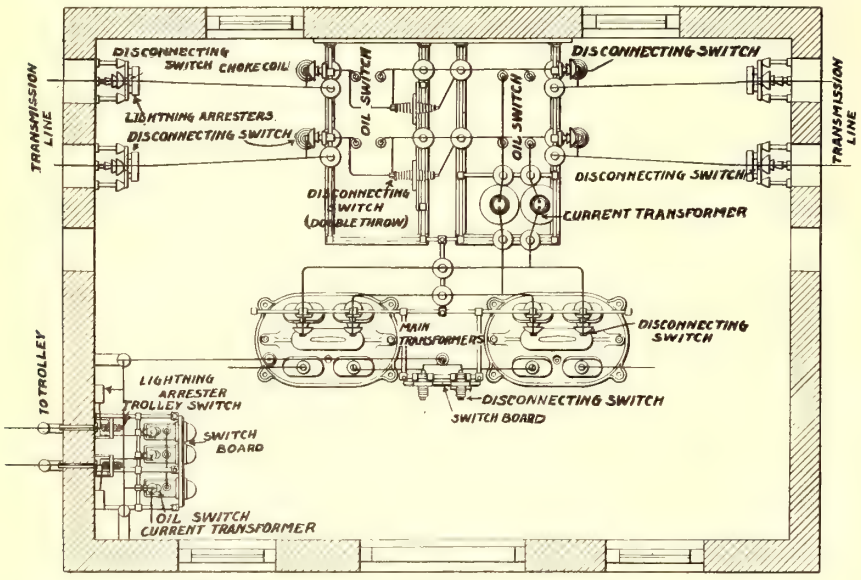


FIG. 9.—ARRANGEMENT OF APPARATUS IN SUB-STATION

feature, but it will be set to trip only on the most severe overload conditions.

As the sub-stations at Morton and Danvers stand back some distance from the transmission line, it was decided to bring the lines over the front of the building, and hence

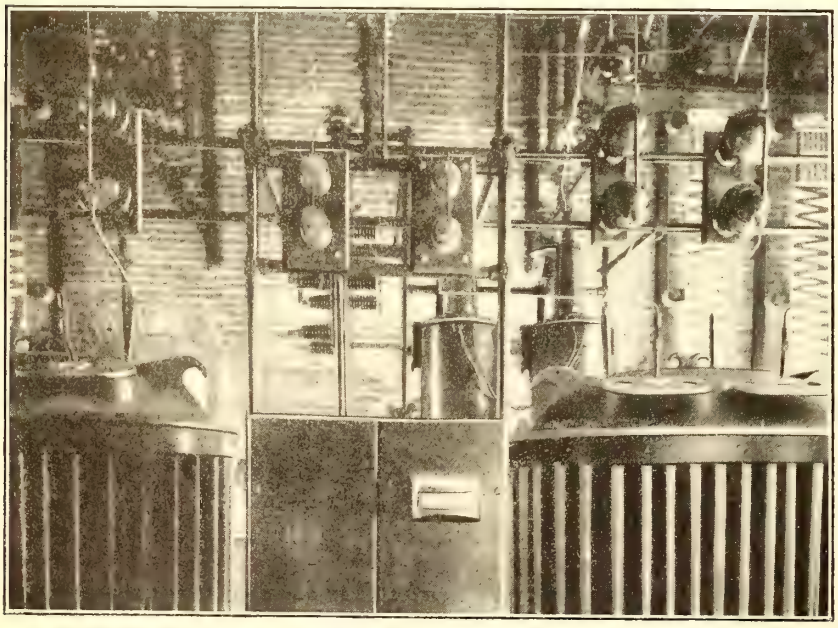


FIG. 8.—ELECTRICAL APPARATUS AND HIGH-TENSION WIRING IN MORTON SUB-STATION

the lines both enter and leave the sub-station at the front. Fig. 11 will show the details of construction where the lines enter and leave the building and the method of protecting the leads from weather; this picture was taken on the roof of the Danvers sub-station.

OVERHEAD CONSTRUCTION

The remarks already made concerning the high-tension transmission line apply in a large measure to the trolley construction, isasmuch as the transmission line poles serve for supporting the brackets; the whole of the overhead construction has a strikingly neat appearance. As is usual with single-phase railways, the trolley is of the catenary suspended type, consisting essentially of a 000 grooved copper wire suspended from a steel messenger cable; the latter is composed of seven strands of No. 11 B. & S. galvanized steel wire. The diameter of the messenger cable is 7/16 in. The potential of the trolley is 3300 volts at 25 cycles, and the messenger is supported on Locke No. 1032 insulators.

The main portion of the road is provided with the bracket type of construction, but through towns and cities of any size the span construction has been adopted. Figs. 12 and 13 are typical pictures of the line;

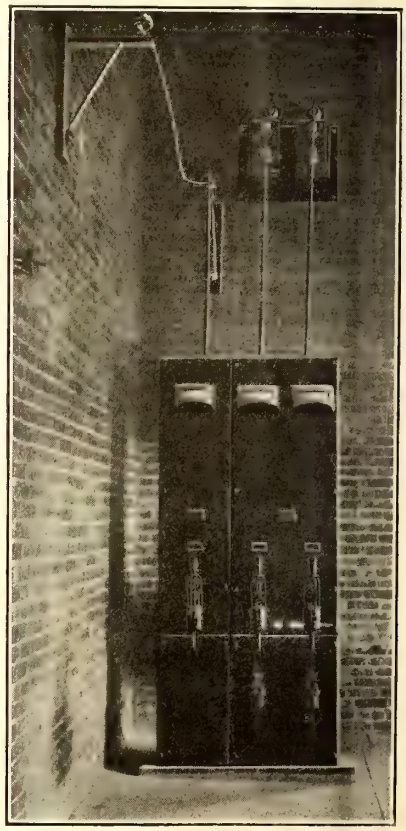


FIG. 10.—FEEDER PANELS IN THE MORTON SUB-STATION

Fig. 14 shows some special span work at the outskirts of Morton, while Fig. 15 illustrates the span construction through Danvers and further shows the point at which the high-tension transmission line enters the sub-station. This latter picture was taken before all the hangers were in position.

The details of the bracket construction will be seen by referring back to Fig. 2. The bracket proper consists of an iron pipe 2 ins. in diameter and 9 ft. 6 ins. in length spiked to the pole in the usual way. The bracket is 20 ft. above the track, making the distance from trolley to track 18 ft. and the height of the messenger cable above the track at insulators 20 ft. 6 ins.

As has been previously mentioned, the poles are spaced 140 ft. apart on straight, level tangent track. The three-point suspension has been adopted, which gives a support to the trolley from the messenger every 46 ft. 8 ins. The

suspension on curves and crossings are correspondingly closer together when the spacing of the poles are reduced. The illustrations, Figs. 16, 17 and 18, on the next page, will give a good idea of the form of hangers used, the views being confined to apparatus which has not previously been described in this paper. All of the line material was made by the General Electric Company. Fig. 16 shows the intermediate hangers; they consist of malleable iron "grips" or "sister hooks" and malleable iron clamps riveted to a stem of machine steel ⅛ in. x ⅝ in. The center point hanger, which is also made of malleable iron, is similar to that illustrated in an article by the author, published on page 556 of the STREET RAILWAY JOURNAL for Oct. 13, 1906. The grips of these clamps, as is the case with the intermediate hangers, are closed when in place so as to grasp the messenger cable. Fig. 17 shows the form of hangers used with bridle pull-offs; in this instance the stem is a steel rod. The bridle arrangement consists of pulling the hanger off at both top and bottom, which keeps the trolley and messenger in the same alignment and prevents tripping. All the pull-off wires, guy wires, etc., are insulated by means of hickory strain insulators. Fig. 18 shows the type of catenary anchored hangers used. The trolley is anchored every 1000 ft., in addition to the anchors at the approach and end of each curve.

On straight tangent track the trolley is staggered 10 ins.



FIG. 13.—TRANSMISSION LINE AND BRACKET CATENARY CONSTRUCTION NEAR BLOOMINGTON

every 2800 ft., to prevent excessive wear of the pantograph current collector. Besides the pull-offs and push-offs at every curve, there will be steady braces at each staggering point; these steady braces are essentially the same as the push-offs; the insulating material is hickory wood.

The type of section insulator used is shown in Fig. 19; there is a section insulator at each sub-station and one between sub-stations. The dead section, where the a. c. trolley ends and the d. c. trolley begins, is composed of two such section insulators with a 40-ft. length of dead trolley between. Dead sections are situated at about a mile from the terminal at each end of the line.

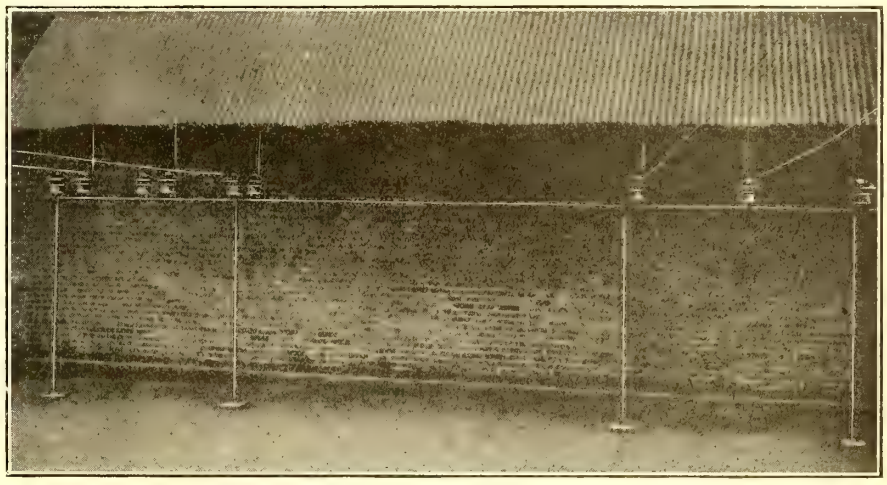


FIG. 11.—VIEW TAKEN ON THE ROOF OF THE DANVERS SUB-STATION, SHOWING PROTECTION OF HIGH AND LOW-TENSION LEADS

THE TRACK

The track from Bloomington to Peoria is laid with 70-lb. rails of the standard A. S. C. E. section spiked to the ties in the ordinary manner. The gage of the track is standard, and is bonded throughout with G. E. 10-in. ribbon bonds with solid copper terminals ⅞ in. in diameter. Each bond has a capacity equal to that of a 0000 trolley wire. The cross bonds are made of 000 trolley wire provided with

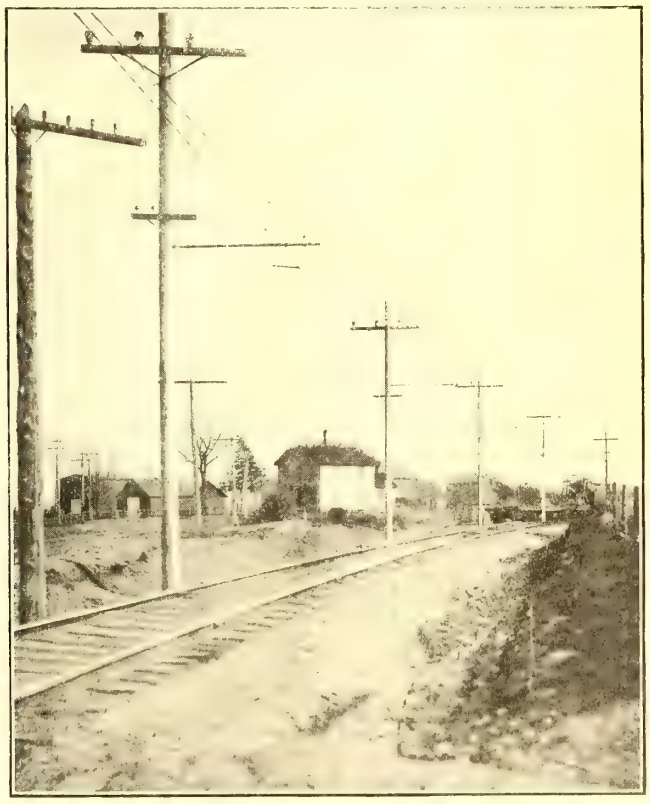


FIG. 12. TRANSMISSION LINE AND BRACKET CATENARY CONSTRUCTION NEAR MORTON

standard G. E. terminals. Continuous rail joints are used throughout, which cover the bond and avoid any chance of theft. The ties are of white oak of standard dimensions, namely, 8 ft. long, with a section of 8 ins. x 6 ins. They are spaced with 2-ft. centers. There are no very severe curves on the road, but some of the grades amount to 2½ per cent.



FIG. 14.—VIEW SHOWING SPECIAL CATENARY CONSTRUCTION THROUGH MORTON

Fig. 26 illustrates the handsome steel bridge erected across the Illinois River to East Peoria. It is 800 ft. in length, with five spans, one of which is a bascule draw span operated electrically from the Peoria power house. The piers are of concrete. A truss bridge with a span of 120 ft. has been erected across the Mackinaw River at Mackinaw.

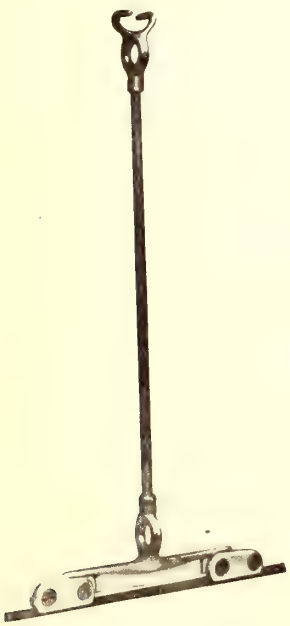


FIG. 16.—INTERMEDIATE SUSPENSION



FIG. 15.—CATENARY CONSTRUCTION THROUGH DANVERS

THE ELECTRICAL EQUIPMENT OF CARS

At the present time there are ten cars, and in the near future ten additional cars will be placed in service. Each car is equipped with four GEA-605 motors, which are 75-hp units capable of operating both a. c. and d. c. The motors are wound for a maximum of 250 volts; they have bar wound armatures of the iron-clad type wound with three coils per slot, which are connected to form a series drum winding. As these motors are of the same standard pattern as those which have been in operation on the Blooming-



FIG. 17.—CATENARY CURVE PULL-OFF SUSPENSION

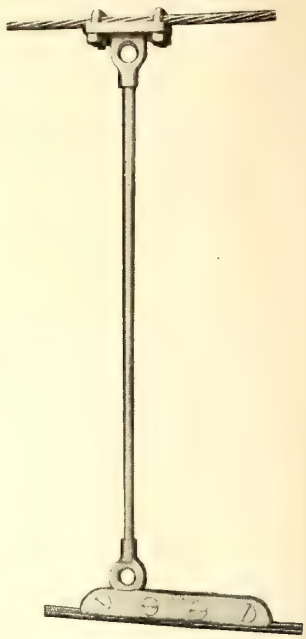


FIG. 18.—CATENARY ANCHOR SUSPENSION

ton, Pontiac & Joliet Railway for the past two years and on the Toledo, Chicago & Interurban Railway since its first being in operation, it is needless to enter into a detailed description here.

THE CONTROL

The control is of special interest, being of the Sprague-General Electric multiple-unit type adapted to the a. c.-d. c. operation of cars as single units or in trains of several cars. In adapting the multiple-unit system to both alternating and direct-current operation, the apparatus has been de-

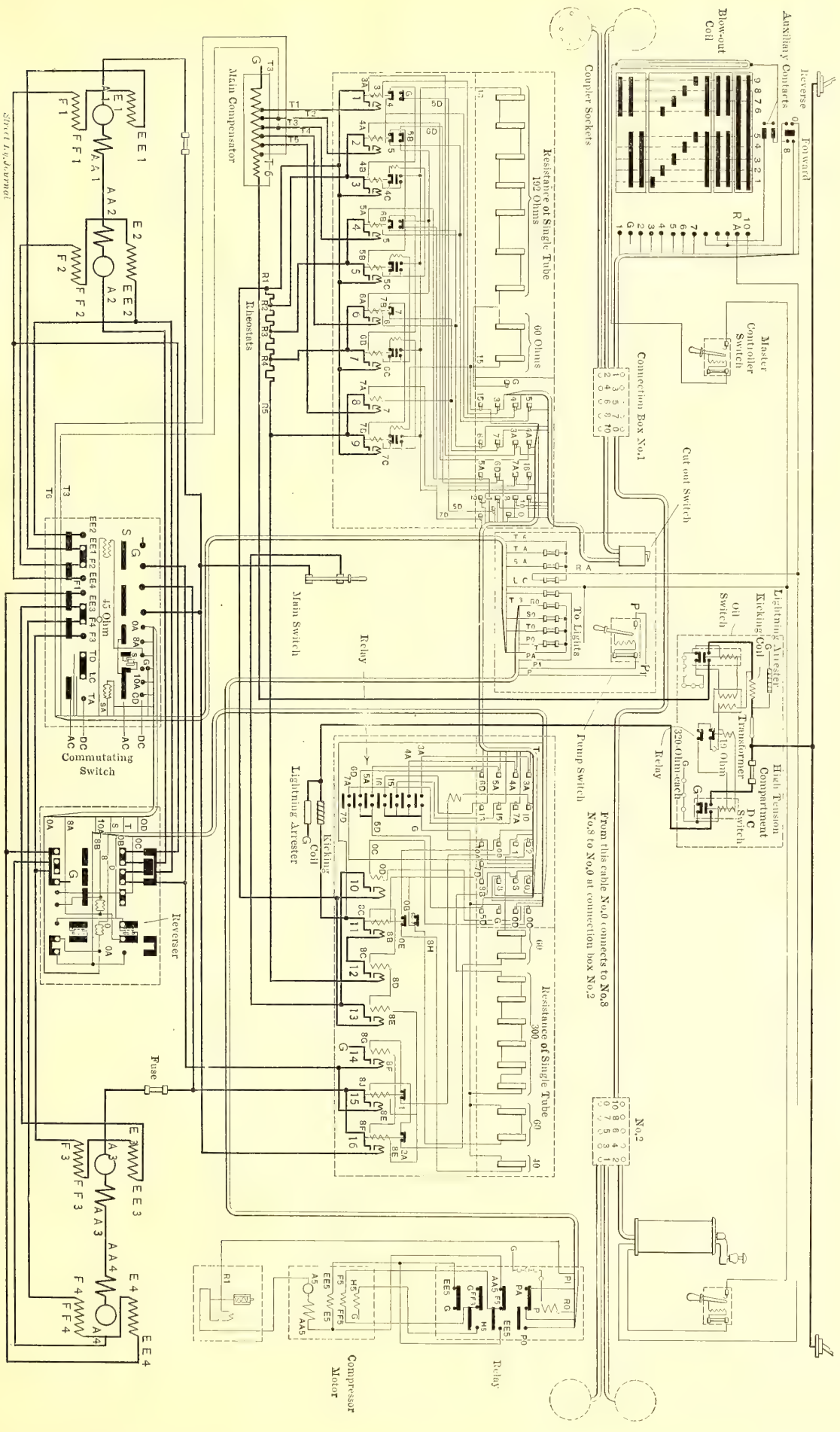


FIG 21.—CONNECTIONS OF TYPE M MULTIPLE-UNIT CONTROL SYSTEM, WITH FOUR COMPENSATED MOTORS FOR A. C.-D. C. OPERATION, ON THE ILLINOIS TRACTION SYSTEM

signed in such a manner as to render all changes in the connections, when the car passes from one source of power to the other, entirely automatic and independent of the motorman; or, in other words, the system has been made automatically selective.

The master controller is of the standard type, and its

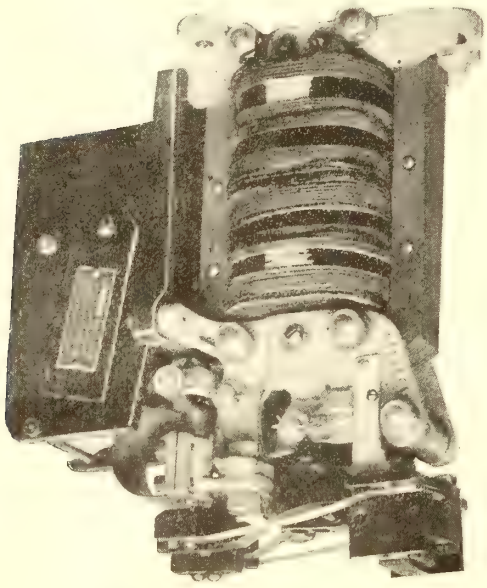


FIG. 22.—DIRECT-CURRENT CONTACTOR—MAGNET SIDE

function for a. c.-d. c. operation is precisely similar to when employed on straight d. c. service. The contactors are also virtually the same as those used in straight d. c. working, differing only in the fact that the former have a laminated magnetic circuit, while in the latter case the magnetic circuit is of solid metal. A standard type of reverser modified for the reception of an a. c.-d. c. operating coil is used to

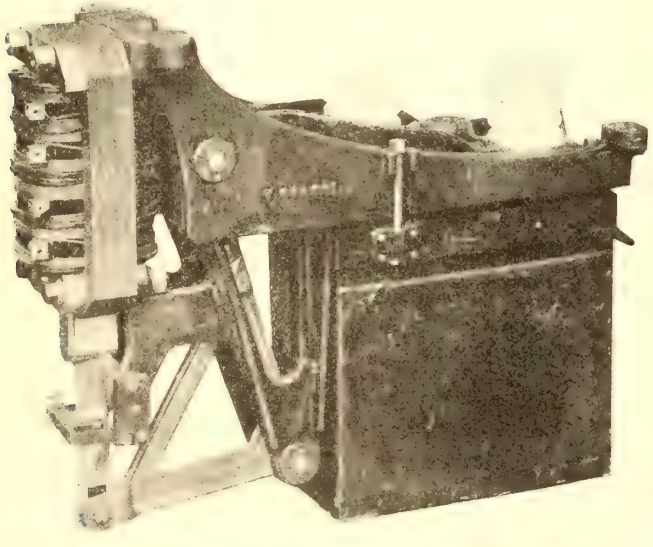


FIG. 20.—OIL BREAK CONTACTOR

change the direction of rotation of the motors. The commutating switch resembles the reverser in both size and operation; its function is to commute the motor fields and to control the trolley supply to the auxiliary circuits.

The connections which render the operation of the main a. c. and d. c. switches automatically selective are shown in the wiring diagram, Fig. 21. The operating coil of the a. c. switch is energized from the secondary of a transformer, and, therefore, is not affected by the direct current. The coil of the d. c. switch is in series with the primary of the same transformer, and, on account of the high inductance, is not affected by the alternating current.

The main a. c. oil switch or contactor is shown in Fig.

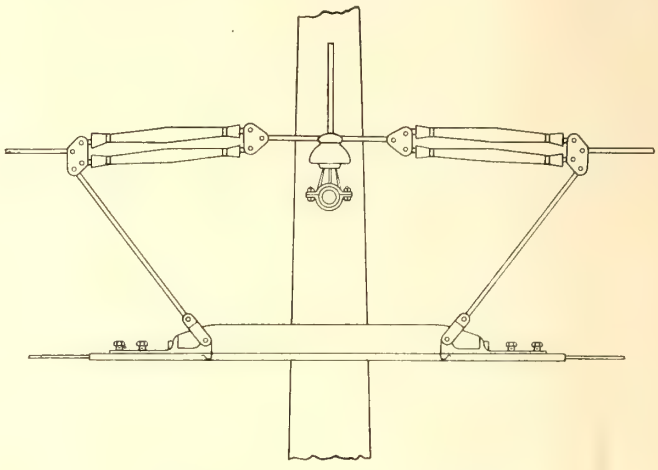


FIG. 19.—SECTION INSULATOR

20, while the two views of the direct-current switch are given in Figs. 22 and 23.

The circuits for the coils of the contactors are controlled

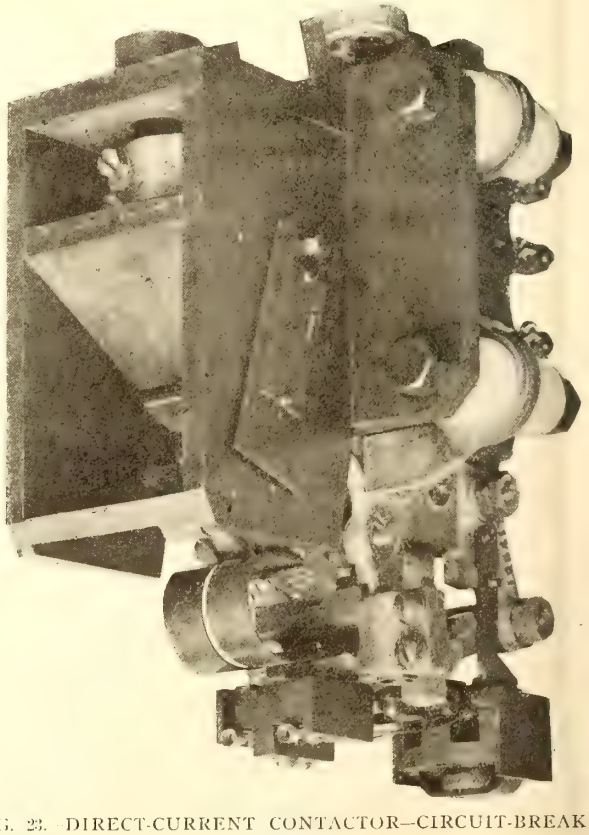


FIG. 23. DIRECT-CURRENT CONTACTOR—CIRCUIT-BREAKER SIDE

by an independent relay governed by the master controller, which relay has a gravity position for d. c. operation, and on a. c. power its coils are energized by alternating current. At the instant the leading car of a train passes from one source of power to another, all the main switches throughout the entire train and the relays controlling the circuits of the contactor coils are thrown, while the auxiliary circuits

of the rear cars, such as heating, lighting, etc., remain unchanged until the dead section is passed. Each car is provided with two-wheel trolleys and a pantograph, which can be used interchangeable if desired, although the pantograph is primarily intended for a. c. operation. Potential control is employed with a. c. operation. On the first point of the master controller the motors are connected to a compensator tap giving approximately half voltage; after this point acceleration is obtained by cutting in more sections of the compensator. During a. c. running the motors are permanently connected two pairs in series, while during d. c. operation the motors are brought partly up to speed while connected four in series and then thrown into two pairs in parallel. The wiring diagrams given in Fig. 21 will show all the details of connections, together with the relative position of the different pieces of apparatus one to another electrically.

All the heavier pieces of apparatus are situated under the car, and their location can be seen by referring to Figs. 24 and 25.

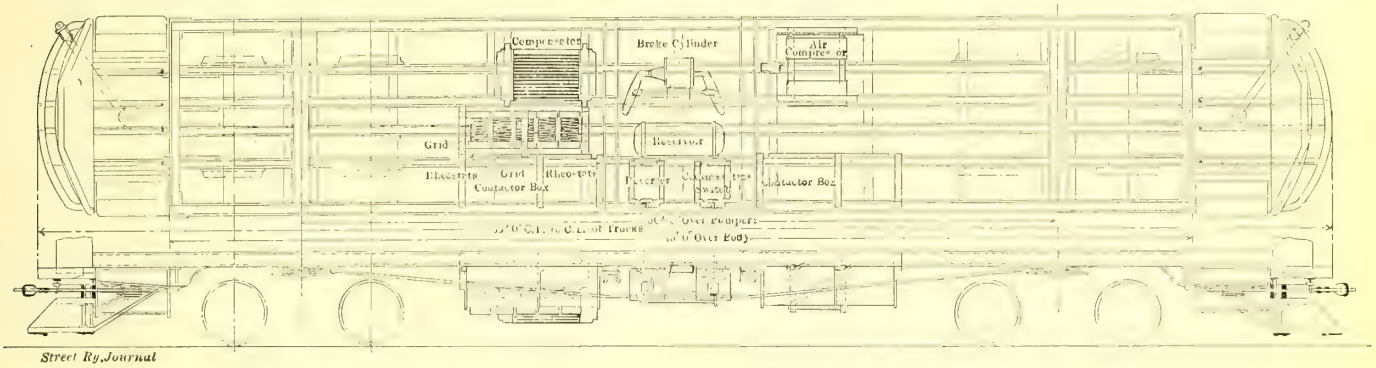


FIG. 24.—PLAN OF CAR, SHOWING GENERAL ARRANGEMENT OF APPARATUS

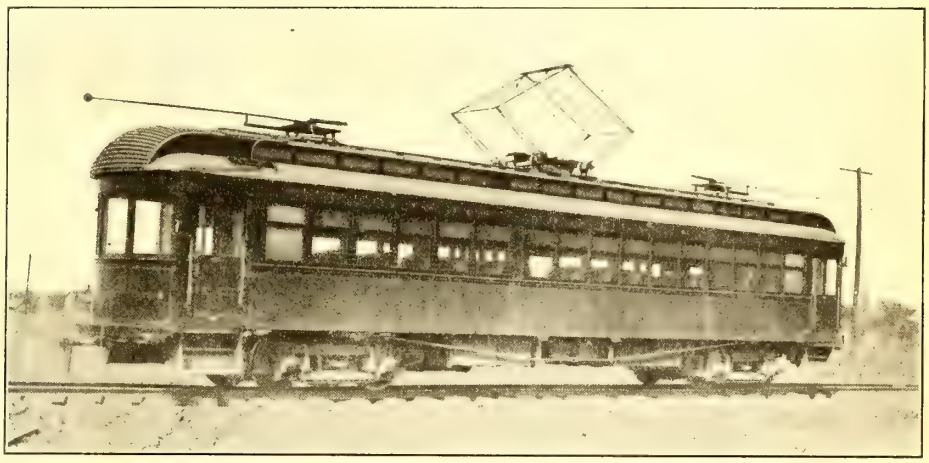


FIG. 26.—INTERURBAN CAR ON THE ILLINOIS TRACTION SYSTEM EQUIPPED FOR A. C.-D. C. OPERATION

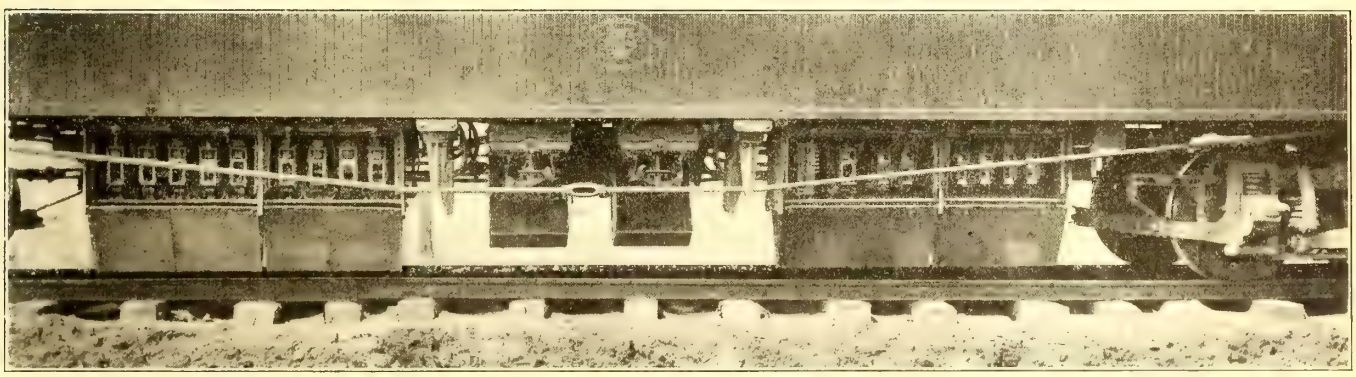


FIG. 25.—ARRANGEMENT OF APPARATUS UNDER CAR

The protective devices, including the main a. c. and d. c. switches, together with their protecting fuses, the a. c. lightning arrester, the 1.5-kw transformer (already referred to while describing the selective system), a tube rheostat (used in series with the coils of the main a. c. and d. c. switches), and a relay are placed in the high-tension cabinet, which is insulated with a lining of asbestos to prevent all fire risks. This cabinet is situated in the car and the general arrangement of the apparatus inside will be seen in Fig. 24. There is a small cabinet attached to the above which contains all the fuses for the auxiliary circuits.

CAR BODIES

The car bodies were built by the American Car Company, of St. Louis, Mo. They are of the interurban, double-ended type provided with a vestibule at each end. Their overall length is 56 ft., and each has a seating capacity of fifty-eight persons, the ordinary passenger compartments accommodating thirty-six and the smoker accommodating twenty-two people. Each car is provided with a toilet. Fig. 26 will show the general appearance of the cars.

The cars are of a handsome appearance, neatly finished in the interior with weathered oak. An electric heater by the Consolidated Car Heater Company, of Albany, N. Y., is situated under each seat, and, in addition, a Peter Smith hot air heater is provided in each car. The interior lighting is by incandescent lamps, while the headlights are Gen-

eral Electric enclosed arcs. Both trucks are motor trucks of the Brill 27-E type furnished with wheels 33 ins. in diameter. Each car is provided with a standard General Electric straight air brake equipment.

Road From — To —	Length in	Name of Operating Company.	Proposed, in Operation or Under Construction.	Operating at Present A. C. or D. C.	Operating A. C. or D. C. in Future.
Peoria—Bloomington	38 miles	Peoria & Bloomington Railway Co.	In operation	A. C.	A. C.
Champaign—Danville Including Homer, Catlin and Ridge Farm Divisions.	64 miles	Danville, Urbana & Champaign Railway Co.	In operation	D. C.	D. C.
Jacksonville—Springfield	33 miles	Illinois & Western Railway Co.	Under construction	....	D. C.
Springfield—Decatur	40 miles	Illinois & Central Traction Co.	In operation	D. C.	D. C.
Springfield—Lincoln	30 miles	Springfield & Northeastern Railway	In operation	D. C. Until June 1, 1907.	A. C. After June 1, 1907.
Lincoln—Mackinaw	27 miles	Springfield Lincoln & Peoria Railway Co.	Under construction	....	A. C.
Bloomington—Decatur	44 miles	Chicago, Bloomington & Decatur	In operation	D. C.	D. C.
Lincoln—Bloomington	30 miles		Proposed	....	....
Springfield—Staunton	60 miles	St. Louis & Springfield Railway Co.	In operation	D. C.	D. C.
St. Louis—Staunton—Hillsboro	57 miles	St. Louis & North Eastern Railway	In operation	D. C.	D. C.
Champaign—Decatur	48.5 miles	St. Louis, Decatur & Champaign Railway Co.	Operates June 1, 1907.	D. C.	D. C.



FIG. 26.—FIVE-SPAN BRIDGE CROSSING ILLINOIS RIVER AT PEORIA

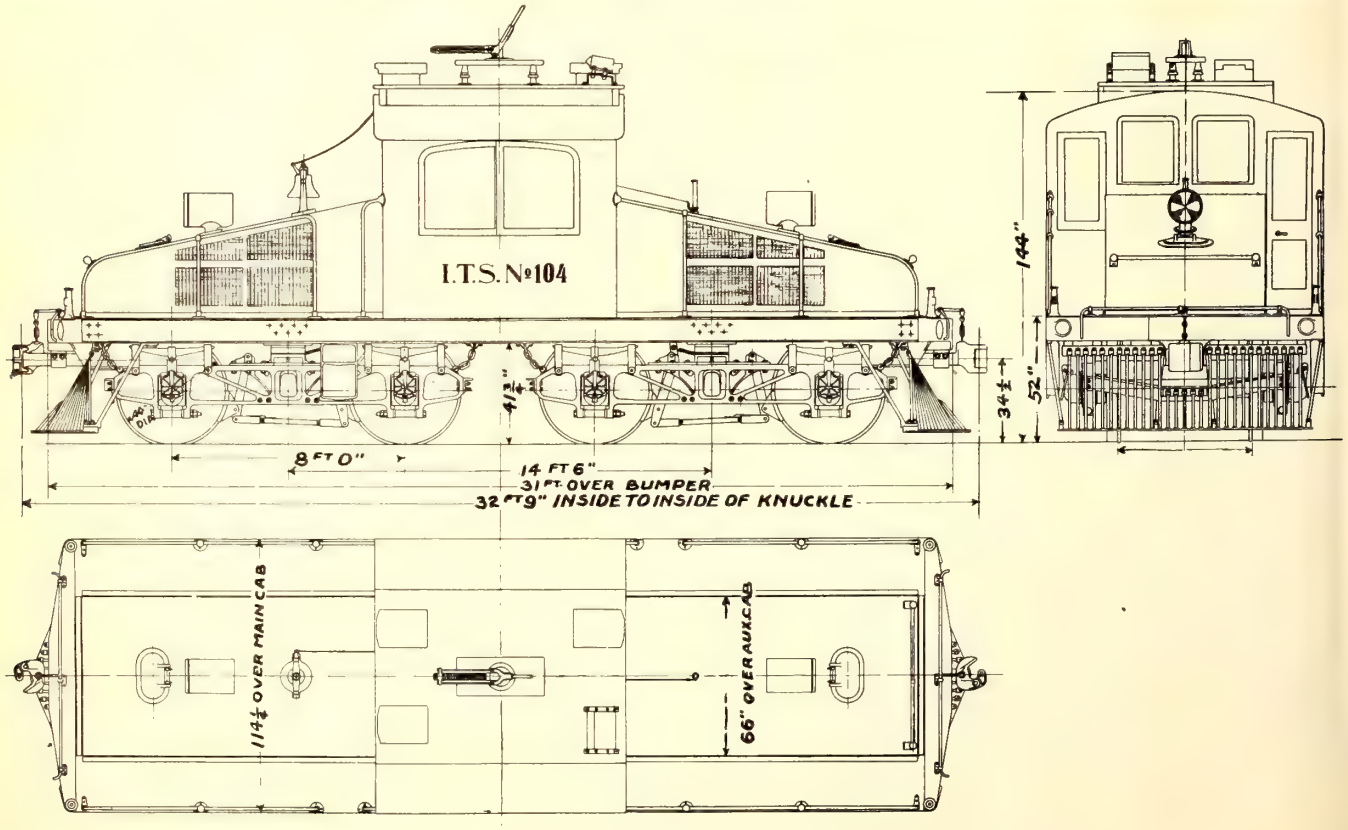


FIG. 27.—50-TON LOCOMOTIVE EQUIPPED WITH FOUR G E A-609 MOTORS

A. C. LOCOMOTIVE

The a. c. locomotive already referred to in the earlier part of this article will be used for hauling coal and miscellaneous freight over both the a. c. and d. c. sections of the system, it being equipped with a. c. motors and a. c. and d. c. control.

The total weight is approximately 50 tons, and it is equipped with four GEA 609 motors. These are slow-speed motors designed especially for locomotive service, and on their one-hour rating have a capacity of 150 hp each. At the full load rating of the motors, 600 hp, the locomotive develops a tractive effort of approximately 15,000 lbs., which is to say it will be capable of hauling a trailing load of 500 tons on a 1 per cent grade at a speed of 15 mph. On a level tangent track it will handle the same load at 27 mph.

The current collectors for both a. c. and d. c. are of the ordinary trolley wheel type, but the trolley base is specially

insulated for 3300 volts. The control circuits of the locomotive are shifted from a. c. to d. c. power automatically by a selective system similar to that already described while dealing with the car equipments. The motors are wound for 200 volts, and are connected permanently two pairs in series. For d. c. control the motors are connected in the series parallel combination.

Fig. 28 will show the general shape of the locomotive. It has a main operating cab in the center of the platform which contains the air compressors, engineer's seat and all the operating mechanism. The sloping end cabs, which extend from the main cab to the ends of the locomotive, contain the air tank, the compensator for reducing the a. c. trolley voltage, and all the auxiliary apparatus. Narrow side platforms run from the cab to the ends, giving easy access from the cab to the couplers and switching steps, and, further, they enable the engineer at his seat to have an unobstructed view of the track or of the switchman standing at the coupler.

The trucks have cast steel side frames of the truss pattern. The weight of the trucks and motors is carried on semi-elliptic journal box springs. The motors are nose suspended, half the weight being carried by the axles and half by the truck bolsters. The over-all dimensions of the locomotive are: Length over all, 32 ft. 9 ins., and width, 9 ft. 6 ins.

EXTENSIONS

A list of the roads composing the Illinois Traction System, with the length and character of equipment, is appended.

STEAM BOILER EFFICIENCY

BY W. H. BOOTH.

There has been more technical error allowed to creep into the reports of boiler tests than into almost any other matters of steam engineering. Whenever an efficiency of over 80 per cent is given on test for a boiler alone very grave doubts may be felt. Yet one may find tests recorded where even 87 per cent efficiency has been reported for a boiler apart from the feed heater or superheater. There are numerous sources of error which any honest tester, however, would be careful to point out for his own credit if so unlucky as to run a test showing 86 or 87 per cent. In the first place, there is the huge possible error of misjudging the fire at each end of a run. Then there are possible misreadings of pressure gages and of water measurements and errors in coal weighing.

One of the worst features of the modern record-breaking boiler test is that from the figures put down it may be easily discovered that the boiler has shown a real efficiency of over 100 per cent. No engineer should, therefore, publish his test figures until he has checked them in such a way as to find just what they mean in real efficiency. Let us explain what we mean by ordinary and by real efficiency.

By ordinary efficiency we mean the percentage of the total calorific capacity of the fuel which appears in the steam and has been added by the boiler. If this is 80 per cent, then the remaining 20 per cent has gone in the chimney gases and in loss by radiation, and if a better result than 80 per cent is obtained the difference is either due to priming or to errors of observation. By real efficiency is meant that proportion of the heat presented to the boiler, at or above its own temperature, which appears in the steam. Thus the boiler has a temperature of 360 degs. F. It cannot possibly absorb heat of a lower temperature than this. In practice it will not absorb heat below about 560 degs. F.

If the heat in the gases below 360 degs. F. be calculated out it will be found considerable. Its amount will necessarily depend upon the ratio of air employed, and this may be found approximately by chemical analysis of the gases. In this way the amount of heat of the coal which goes to waste inevitably may be determined. Subtracted from the total heat of the coal we find the amount of heat actually offered to the boiler which it can in theory absorb. What it actually does absorb marks, therefore, the true efficiency of the boiler, for it is obviously wrong to base its efficiency on a datum to which it cannot conform. So the real efficiency is high at 87 per cent, yet tests have been published showing this much of ordinary efficiency, and some of these have been worked out and shown to represent a real efficiency of over 100 per cent.

The use of the real efficiency has been advocated in Great Britain on the ground first that it tends to place a check on the ridiculously high claims made for tested boilers and in order that a fairer comparison may be made between boilers tested at different pressures, for naturally a high-pressure boiler cannot show the ordinary efficiency of a lower pressure, and, therefore, lower temperature, boiler. But if put upon a basis of real efficiency the pressure difference becomes nullified by the shifting of the datum line to an approximately equivalent level for each case. Boiler test records had been getting out for which there was no excuse beyond the apathy of the public, who did not investigate the figures presented. Their analysis of the actual efficiency method made one of the more blatant of the apparatus sellers exceedingly angry, for it overturned many of his boldest and least truthful figures.

AUSTIN, TEX., SHOP NOTES

The Austin Electric Railway casts all its trolley wheels, journal brasses, and makes other brass castings in its own shop. The brass is melted in a No. 18 crucible over a fire similar to a blacksmith forge. The crucible holds only enough metal to pour about half a dozen trolley wheels. These wheels are cast in iron molds.

Cars are brought in the shop for a thorough inspection every ten days. The inspection is so thorough that if nothing is found the matter with the car an hour's time of two men is required to make it. With this method of inspection only two armatures have been lost during the past eighteen months and these were grounded on the same day. The motors are of the G. E. 54 type.

ANNUAL OUTING AT CINCINNATI

The annual outing of the Cincinnati Street Railway Employees' Mutual Protective Association took place at Chester, June 20. More than 90,000 tickets had been sold by the motormen and conductors, and it is said that at least one-fourth of them were used. W. Kelsey Schoepf, president of the company, was present, and aided in the entertainment features, as did Superintendent Lee and other officials. The car runs were arranged so that almost all the employees were present some time in the day or evening. A display of fireworks in the evening closed the event.

THE EFFECT OF THE TRANSMISSION LINE UPON THE RELIABILITY AND EFFICIENCY OF ELECTRIC INTERURBAN RAILWAY SERVICE

BY E. R. CUNNINGHAM,
Electrical Superintendent of the Des Moines City and the Inter-Urban Railway Companies.

Probably more interruptions to service on a modern interurban railway system come from a disturbance or disarrangement of one or more of the three wires composing the transmission line than from any other source. As these small wires nearly always stretch across long ranges of unguarded country where they are subjected not only to atmospheric disturbances, but to the malicious or thoughtless ever-present small boy with slingshot, stones and other missiles, and to the older ones, who ought to know better, with shot gun and rifle, a great deal of thought and care should be given to the construction and protection of the transmission line. But however well the line is constructed and however well protected, it will probably continue to remain the most sensitive part of the entire system.

Transmission systems for railway work are generally three-phase, three-wire, and all three wires must be in good condition to operate, so that the loss of any one of them usually interrupts the service until the repair crew can get over the line and repair the break. Interruptions of this kind are not only very annoying, but very disastrous to the service and the reputation of the line.

It is one of the objects of this paper to discuss the methods of connecting the transformers and starting the rotary converters in the sub-stations so that a loss of one, or even two, of the transmission wires will not interrupt the service, and also to consider other details affecting the reliability and efficiency of the service.

There are three methods in general use of starting rotary converters in sub-stations, all of which have their advantages. Two of them require alternating current to start and the other direct current. One method of starting a. c. is to introduce alternating current to the armature of the rotary from fractional transformer voltage taps, bringing the armature up to speed as an induction motor with a field induced by the a. c. armature current. When the armature comes up to speed, the d. c. field is closed, and the a. c. starting switch is thrown quickly to full voltage. The other a. c. method is to introduce alternating current to a small induction motor mounted on the shaft of the rotary, bringing the armature up to speed. The rotary is then synchronized with and thrown on to the a. c. line. With the d. c. method the rotary is started up as a direct-current motor, either from direct current from other rotaries running in the same station or from the d. c. trolley and feeder lines. It is then synchronized with and cut on to the a. c. lines.

Without attempting to discuss the relative merits of the three systems of starting, I will say that it is my experience that at least two methods should always be provided, and one of them, of course, should be the d. c. method. To start a. c., either by introducing alternating current to the armature of the rotary of to an induction motor, three-phase current must be available. If one transmission line is down and the transformers are connected delta-delta, it is impossible to start from the a. c. side. If means are provided for starting d. c., the rotary can be brought to speed by direct current, synchronized on one phase and then operated single-phase. It is, therefore, essential that means be provided for starting d. c., even though the usual method of starting is a. c.

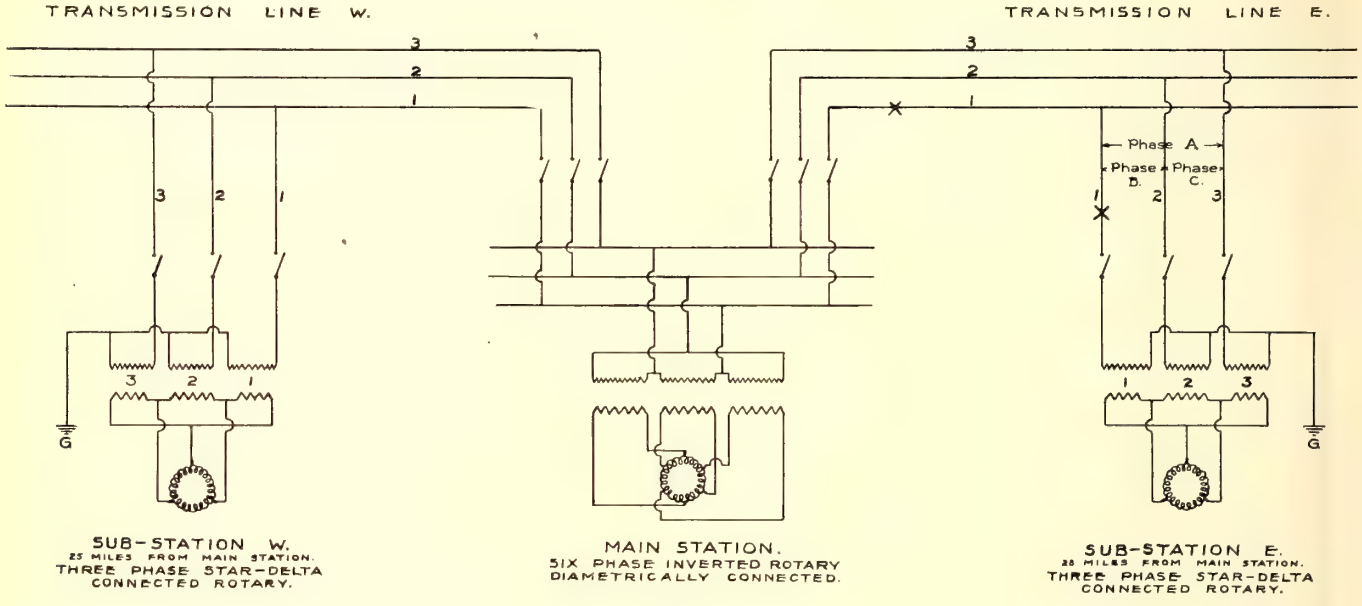


FIG. 1

The reliability of the service is affected to a large extent by the method of transformer connections adopted, especially when one or more of the transmission wires are out of service. There are four methods in general use of connecting transformers between the transmission line and the rotary converter. The transformers can be connected delta-delta, star-star, delta-star or star-delta. In other words, both primary and secondary can be connected delta or both can be connected star, or one can be connected star and the other delta. While each system of connection has its advantages in special cases, the first and last mentioned are the ones in most general use.

With the delta-delta system, if a transformer burns out the rotary can still be operated three-phase on open delta, but if one of the transmission wires has to be cut out of service, it is impossible to operate at all unless the sub-stations are arranged for d. c. starting. In that case the rotaries can be run single-phase at one-third their capacity on one transformer and two transmission wires. With the

star-delta arrangement the rotaries in a sub-station cannot only be operated three-phase with two transformers, but three-phase with two transmission wires, providing the nuetral point of the star connection is grounded at both the transmitting and receiving ends of the transmission line. It is also possible to operate single-phase with only one transmission wire, providing the sub-station is equipped for d. c. starting. Thus, in case of trouble on the transmission line, a sub-station can be run with one less wire with the star-delta connection than with the delta-delta connection.

The writer has gone still further and started up rotaries from the a. c. end with only two transmission wires in service when step-up transformers at the main station were connected delta-delta, and, of course, not grounded. This is accomplished by means of having a sub-station on at least two different lines leading from the main station in the same or different directions, connected star-delta, with the neutral point grounded, as illustrated in Fig. 1. If one wire breaks or becomes disabled on either transmission line E or W, the rotary on that line can be started up and operated three-phase with the two remaining wires and ground, providing a station with grounded neutral is running on the other transmission line. For example, if wire

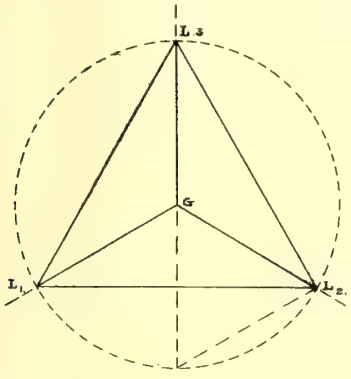


FIG. 2.

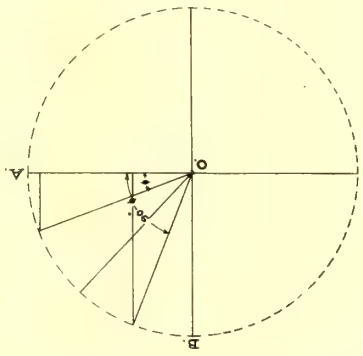


FIG 3.

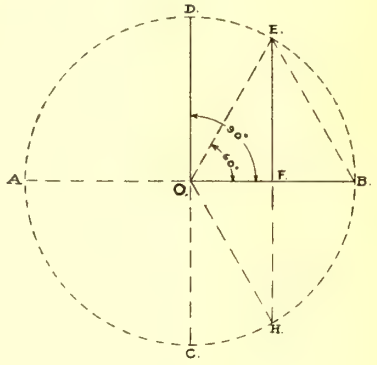


FIG. 4.

No. 1 on transmission line E is disabled and has to be cut out, the rotary in station E can be started from the a. c. end by means of three-phase current. On phase C the current, of course, passes in series through transformers 2 and 3 in station E. On phase B the current alternates between line 2 through transformer 2 in station E, through ground, and transformer 1 in station W and line 1. On phase A, the current alternates between line 3 through transformer 3 in station E through ground and transformer 1 in station W and line 1. On this phase transformer 1 in station W acts as a series transformer, receiving sufficient current to bring the rotary up to speed. The writer has operated stations in this manner for several days without any bad results except that a difference of potential is induced between the telephone lines and ground, due to the unbalanced condition of the transmission line.

The relations existing between the delta and star connections may be seen by reference to Fig. 2. Lines L_1 L_2, L_2 L_3, and L_3 L_1 represent either the primary or secondary coils of three transformer connected delta; lines L_1 G, L_2 G and L_3 G represent either the primary or secondary coils of three transformers connected star and grounded at G. It follows from the diagram, Fig. 2, that L_1 L_2 is $\sqrt{3}$, or 1.73 times L G. In other words, the voltage across the delta connected coils is $\sqrt{3}$ times the voltage across the star connected coils, although the voltage between lines L_1, L_2 and L_3 is the same in each case, being equal to the voltage of the delta connected coils. In the star connection, therefore, the line voltage is $\sqrt{3}$, or 1.73 times the voltage across any one transformer, and in the delta connection the line voltage is, of course, equal to the voltage across any one transformer. Stating it in another way, the voltage across the star connected transformer is only 58 per cent. of the voltage across the delta connected transformer, and only 58 per cent of the effective line voltage, and, as the neutral point G is grounded, the difference of potential between the transmission lines and the ground is only 58 per cent of the line voltage. With the same working voltage and the same line insulation, the transmission line is, therefore, much less liable to break down when the transformers are star connected on the high or line side.

What is true of the transmission line is equally true of the transformers themselves. The strain on the insulation of the transformers working on a given line voltage is very much less when star connected on the primary or line side than when delta connected. Moreover, the ratio of primary winding to secondary winding is only 58 per cent as great for the same ratio of transformation, and consequently a cheaper transformer can be used.

Combinations of delta and star connections furnish a very wide range in ratios of transformation, a condition which is often very convenient, especially if the voltage of transmission should be raised and it should be desirable to use transformers wound for different voltages on the same line. Since the primary can be connected star and the secondary delta, or vice-versa, a very wide range of transformation can be obtained, the ratio of star-delta connection being three times that of the delta-star connection. In other words, transformers wound for a line voltage of say, 34,640 volts primary and 360 volts secondary when delta connected, will operate on 6000-volt primary and 360-volt secondary lines when star-delta connected, and on 20,000-volt primary and 360-volt secondary lines when delta-star connected.

It is quite customary to buy transformers and connect them delta-delta for a given line voltage, expecting later on to connect them star-delta and thus raise the voltage 73 per cent. There seems to be no good reason for this practice, because with the higher line voltage one-third of the copper is required and the benefit could be derived at once. The strain on the line insulation and transformer is not appreciably greater at the higher star-delta voltage than it is at the delta-delta voltage, and the benefits to be derived from the higher voltage are very attractive, especially at

the present price of copper. The fact that the strain on the line insulation, as well as that on the transformer insulation when transformers are star-delta connected, is but 58 per cent of what it would be if delta-connected, is, in the opinion of the writer, sufficient reason to commend it to the practical operator.

Although the maximum potential of any a. c. circuit is $\sqrt{2}$, or 1.42 times, an equally effective d. c. potential, the strain on the insulation of the circuit is not any greater than it is on the d. c. circuit. Sudden changes of load in direct-current operation and the making and breaking of the circuit under heavy load induce e. m. f.'s greatly exceeding the maximum e. m. f. of an equally effective a. c. potential.

In this connection it might not be out of place to review the relations between the maximum values and the mean effective values of the potentials on a. c. circuits. The mean effective value of an alternating-current wave, or the value representing the same effect as with direct current, is the square root of the mean square of the periodically varying wave, which for practical purposes can be assumed to be of sine form. Let $A\ O\ B$, Fig. 3, represent the quadrant of a circle. The square of the sine of any angle ϕ plus the square of the sine of the complimentary angle $(90^\circ - \phi) = 1$, thus $\sin^2 \phi + \sin^2 (90^\circ + \phi) = 1$. Since all the sines in the quadrant $A\ O\ B$ can be arranged into pairs so that the sum of the squares of each pair will equal 1, the mean square of all the sines would equal ½ and the square root of the mean square would be the square root of ½, or 0.707. This then, in a single-phase rotary, is the ratio between the d. c. and a. c. voltages.

In a three-phase rotary current is taken off at three equidistant points so that the maximum a. c. potential would be in proportion to ½ the cord of a full period, or 120 degs., or what is the same thing, the sine of the angle of a half period, or 60 degs. This is represented in Fig. 4 by the line $E\ F$, whose value will be seen by the diagram to be equal to ½ $\sqrt{3}$, or 0.867. Since the effective value of any sine function is the square root of ½, or 0.707 times the maximum value, the effective value or the voltage of the a. c. end of a three-phase rotary would be 0.707×0.867, or 0.613 times the voltage of the d. c. end.

In a two-phase rotary, since each phase is taken off at an angle of 180 degs., one phase being taken off 90 degs. behind the other, the voltage of the a. c. end would be 0.707 of the d. c. voltage, the same as for single phase. In a six-phase rotary diametrically connected, since the current is taken off 180 degs. apart, the a. c. voltage would also be 0.707 of the d. c. voltage, the same as for single phase. Stating the same thing in another way, the d. c. voltage in a single, two or six-phase rotary is 1.42 times the a. c. voltage, and 1.63 times the a. c. voltage for a three-phase rotary.

In practice the ratio of the d. c. to the a. c. voltage may be varied a little from these figures by changing the excitation of the fields; over-excitation increases the ratio and under-excitation diminishes it. It is, however, not good practice to attempt to regulate the d. c. voltage by the excitation of the fields, as over-excitation produces a leading current and under-excitation a lagging current, consequently a poor power factor, and causes the rotaries and transformers to heat up unnecessarily. If the d. c. voltage is not right, the transformer should be provided with suitable voltage taps, so that the proper voltage can be secured by changing the taps and not by changing the field excitation at the expense of the power factor.

ANOTHER TUBE FOR LONDON

With the opening of the Charing Cross, Euston & Hampstead Railway, the program of railway communication in London, planned by the Underground Electric Railways Company, has been completed. This line will exercise an important influence on the other tubes controlled by



ENTRANCE TO THE HIGHGATE STATION

the Underground Electric Railways Company (the Bakerloo & Piccadilly) and on the District Railway. The new tube exchanges traffic with all three of the above lines, in addition to linking up with the City & South London and Central London tubes, and the North-Western and South-Eastern Railways. By means of these connections, especially those given by the Piccadilly and Bakerloo tubes,



HIGHGATE TICKET OFFICE

the Hampstead tube will become part of the new system of through routes that enables direct journeys to be made between practically any of the London terminals. The new line will also enable the earning capacities of the other associated tubes to be shown for the first time, since the three tube lines in question cannot be said to be in thorough working order before the completion of all of them.

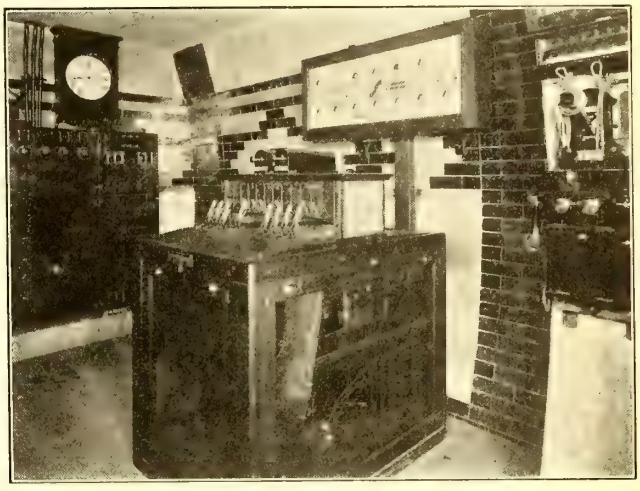
Everyone has heard of the great lack of means of intercommunication in London—many have learned it by weary experience. This has been especially the case in the central area, from which railways were debarred by Parliament more than half a century ago, just when the need for them was becoming apparent. The great initial step for reducing the evil was taken when the first "tube" railway was devised and constructed by the late J. H. Greathead. This pioneer line, the City & South London Railway (opened in 1890), proved that deep tunnel railways could be constructed through the center of London much more conveniently than railways on or just under the surface. After an interval of years came the Waterloo & City Railway, the Central London Railway and the Great Northern & City Railway. Several other tube lines were authorized, but delayed owing to difficulty in raising capital.

The Baker Street & Waterloo Railway was opened for public service on March 10, 1906, the Metropolitan District Railway has been worked electrically for over two years, the Great Northern, Piccadilly & Brompton Railway, which is a union of the two schemes previously mentioned, was opened on Dec. 15, 1906, whilst the Charing Cross, Euston & Hampstead Railway is now being opened for public use. Altogether, there are embraced in the enterprise 22 miles of tube railway (44 miles of single tunnel), about 40 track miles of the District Railway and its connections which have been electrified, and the London United Tramways, of which 48 miles have been constructed and are in operation. In round figures, the capital involved, including that for the Chelsea power station, approximates twenty-four million pounds.

The Charing Cross, Euston & Hampstead Railway, which has now an authorized capital of £5,768,000, including loan capital, was sanctioned by the Charing Cross, Euston & Hampstead Railway Acts of 1893 and 1899, and on the Underground Electric Railways Company acquiring the rights to construct the line, it obtained further powers from Parliament in 1902. Within its total length of 8.2 miles there are sixteen stations, giving an average interval between stations of about half a mile. The popular residential districts of Highgate, Hampstead and Golders Green are, for the first time, brought into direct communication with the ceneral area of London, whilst convenient subway connections with other tubes provide expeditious routes to the city and West End.

Trains will run, on week-days, every two minutes between Charing Cross and Camden Town, every four minutes over the Highgate branch, every four minutes to Hampstead, and every twelve minutes to Golders Green, the headway being slightly increased during slack hours. On Sundays the service will be based on three minutes' headway between Charing Cross and Camden Town, varied as traffic may require.

Arrangements have been made for the issue of through



INTERIOR OF A SIGNALING STATION

tickets between stations on the Hampstead tube and stations on the Piccadilly, City & South London and London & North-Western lines, and through fares are in course of arrangement with other railways whose systems connect by interchange stations with that of the Hampstead tube. Season tickets are also issued at cheap rates, and through season tickets have been arranged with connecting lines.

THE TUNNELS AND EQUIPMENT

Each track is contained in a separate circular tunnel, 11 ft. 8 ins. diameter, on the straight, and ranging up to 12 ft. 6 ins. on sharp curves. The ties on which the rails are laid are of Karri wood. The spaces between are filled with crushed granite. Besides the track rails there are two conductor rails. One of these is close to the tunnel wall and the other between the track rails. Should a train break down, the current would be instantly shut off from the conductor rails, but the tunnel lighting would not be affected, as that is supplied by wholly independent circuits.

The tunnels at the stations are enlarged to 21 ft. 2½ ins. in diameter. All the platforms are of concrete. The



A TRAIN OF CARS AT GOLDER'S GREEN

walls are lined with glazed tiles with patterns of different colors for each station.

The depth of the line from the surface varies considerably. At Hampstead station a depth of 192 ft. is reached and 1900 ft. north of that station the tunnel runs at a depth of 251 ft. below the surface.

The station buildings are very handsome, being faced with ruby-colored glazed blocks and schemed in a series of large arches. The walls of the booking halls are in green and white enameled tiles. At present each building has a ground and mezzanine floor with a flat roof, so that upper stories can be added as required. At sixteen stations forty-seven large passenger lifts have been provided, the station at which there are no lifts being Golders Green, where the platforms are on the surface. All the elevators are worked by electric winding gear, and they are provided with elaborate safety appliances. They are entirely constructed of steel, except the floors, which are of non-flammable wood. Each can take about seventy passengers at a time. The passengers leave by the opposite side from that at which they enter, and the exit gates are opened and closed by compressed air controlled by the lift attendant. At all stations emergency stairs are provided. The stations are lighted by arc lamps fed from the lift circuits; these lamps can, if necessary, be supplied from the conductor rails. The stations are also lighted by incandescent lamps on the same circuits as the tunnel lamps, and a third set of station lamps, also incandescent, are supplied with current from the local electric supply companies. Thus every precaution is taken against the stations ever being left in darkness. All the three sets of lamps are continually in use. The ventilation of the tunnels is through eleven large exhaust fans distributed among the underground stations. These collectively draw no less than about 3,200,000 cu. ft. of air per hour out of the tunnels.

An elaborate system of electro-pneumatic automatic signaling with automatic stops is employed for working the traffic. Semi-automatic signals at interlockings and also points at crossovers are controlled from frames in signal cabins, and there also are to be found ingenious illuminated track diagrams, which show at a glance what sections of the railway in the neighborhood are occupied by trains. The occupied sections are dark on the diagram, and those unoccupied are illuminated. The little electric lamps behind the diagram light up or go out in unison with the working of the signals on the line. As an additional safety precaution there is a complete system of telephones over the whole railway. Every motorman is provided with a portable instrument which he hooks on to two bare wires running along the tunnel wall.

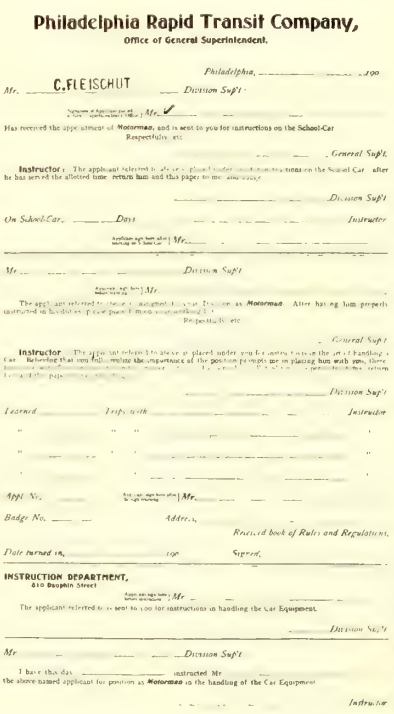
The rolling stock consists of 150 cars, 60 of which are motor cars and the remainder trailers. The carriages, with the exception of the inside fittings, are built entirely of steel and are absolutely fireproof. The mahogany paneling inside is only a thin veneer, but is chemically treated so as to be non-inflammable, and is mounted on asbestos slabs. The rattan seating is also non-inflammable. Each car is 50 ft. long, and has both cross and longitudinal seats. The motor car will seat forty-two and the trailer car fifty-two people. The cars are all fitted with Westinghouse pneumatic brakes. The cars are equipped with G. E. 69 200-hp motors and type M multiple-unit control.

Car houses and repair shops have been established at Golders Green, where everything necessary has been provided for cleaning, maintaining and repairing the rolling stock and equipment.

The engineers who designed the railway are Sir Douglas Fox and R. Galbraith. For carrying out the tunnel construction on behalf of the Underground Electric Railways Company, H. H. Dalrymple-Hay was the engineer, while James R. Chapman, engineer-in-chief of the Underground Electric Railways Company, was responsible for everything connected with the equipment.

INSTRUCTION FOR MOTORMEN AND SHOP MEN IN PHILADELPHIA

The Philadelphia Rapid Transit Company has recently opened a school at its Dauphin Street car house, where instruction is given to its motormen and shopmen in the nature and use of car equipment. The school is not employed for the preliminary training of motormen, but simply for rounding out their education after they have spent the usual time under the regular motorman instructor. The teaching, however, is not confined to new motormen, for any old employee who gets into trouble through lack of familiarity with his apparatus may be ordered by his division superintendent to attend one or more of these lectures and go through the course. The forms covering both cases are shown in Figs. 1 and 2. Fig. 3 is a record card made out and retained by the instructor for his own information.


Philadelphia Rapid Transit Company,
Office of General Superintendent.

Philadelphia, ____ 190

Mr. C. FLEISCHUT Division Supt.

Mr. ✓

Has received the appointment of Motorman, and is sent to you for instructions on the School-Car.

Respectfully, etc.

General Supt.

Instructor: The applicant referred to above is placed under your instructions on the School Car after he has served the allotted time, return him and this paper to me at once.

Division Supt.

On School-Car, ____ Days Instructor.

Mr. ____ Division Supt.

The applicant referred to above is assigned to you as Motorman. After having him properly instructed in handling car you will please return him with this paper.

Respectfully, etc.

General Supt.

Instructor: The applicant referred to above is placed under your instructions on the art of handling a car. Remember that you fully realize the importance of the position you are in placing him with you, there [illegible] to you this paper.

Division Supt.

Learned ____ Trips with ____ Instructor.

Appl. No. ____ Mr. ____

Badge No. ____ Address, ____

Received book of Rules and Regulations.

Date turned in, ____ 190 Signed, ____

INSTRUCTION DEPARTMENT,
810 Dauphin Street

Mr. ____

The applicant referred to is sent to you for instructions in handling the Car Equipment.

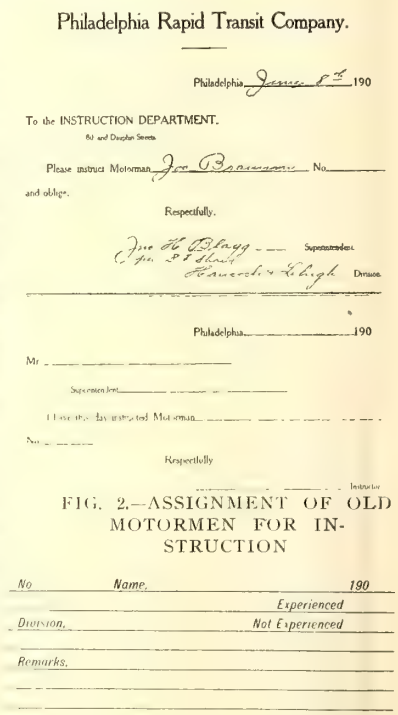
Division Supt.

Mr. ____ Division Supt.

I have this day ____ instructed Mr. ____ the above named applicant for position as Motorman in the handling of the Car Equipment.

Instructor.

FIG. 1.—ASSIGNMENT CARD OF NEW MOTORMAN FOR INSTRUCTION


Philadelphia Rapid Transit Company.

Philadelphia June 8th 190

To the INSTRUCTION DEPARTMENT.
810 and Dauphin Streets.

Please instruct Motorman Jos Brannan No. ____

and oblige.

Respectfully.

Jno H Bluyg Superintendent.
Supt. 2nd Div.
Kensington & Lehigh Division.

Philadelphia, ____ 190

Mr. ____

Superintendent.

I have this day instructed Motorman ____

No. ____

Respectfully

Instructor.

FIG. 2.—ASSIGNMENT OF OLD MOTORMEN FOR INSTRUCTION

No. Name. 190

Experienced

Division. Not Experienced

Remarks.

FIG. 3.—INSTRUCTOR'S RECORD CARD

The instruction is carried out with a skeleton car, on which a full motor and control equipment is mounted, together with a hood switch, circuit-breaker, lamps, headlight, wiring layout, etc. After explaining the functions of every part of the apparatus the instructor tests the knowledge of the student by surreptitiously pulling down the trol-

ley pole, pushing the hood switch to the off position, watching the student's handling of the controller when given stop, start and reverse signals, and, in short, doing all he can to simulate the conditions arising in service. The motormen are also shown how to cut out defective motors, but, in general, no attempt is made to give them more knowledge than is necessary for their regular positions.

In addition to the foregoing work, which is carried out during the day, more elaborate instruction is given in the evening to shop mechanics. The attendance of the latter is entirely voluntary, and, in fact, this kind of instruction has greatly increased the interest of the shopmen in their daily duties. The principal instruction of these students relates to the location and correction of controller and motor troubles. Every type of controller used by the Philadelphia Rapid Transit Company is connected to a lamp board which is so wired that the different lamps show exactly what happens in the resistances and in the armatures and fields of either two or four-motor equipments when any given controller is moved from step to step. The board has snap switches to afford an almost endless variety of trouble-making circuits to enable the teacher to show different connections.

GROSS RECEIPTS FOR 1906

The publication of American Street Railway Investments, "The Red Book," for 1907 makes available the operating reports for 1906 of the principal electric railways of the country. The gross receipts for the past year, and also in most cases for 1905, of 481 companies, as printed in the Red Book, are presented herewith. In most cases the figures cover the reports of operating companies only, but the reports of a few holding companies are given. In a great many cases the size of the system has been increased by consolidation, so that in most cases the figures do not represent earnings of the same trackage. The fiscal year of the companies also varies. In the case of most of the Pennsylvania and New York companies the earnings given are for the fiscal year ending June 30. In the case of the Massachusetts companies the fiscal year, as a rule, is that ending Sept. 30, while in the case of many of the other roads it is the same as the calendar year.

The 1907 edition of the Red Book contains 453 pages of statistical matter, or an increase of 21 pages over the edition of 1906. There are forty-four maps this year, on which the systems of forty-seven companies are shown .

COMPANIES HAVING GROSS RECEIPTS FOR 1906 OF OVER $1,000,000.

NAME OF COMPANY.	1905.	1906.
Interborough Rapid Transit Co., New York	$17,328,411	$20,411,097
New York City Ry. Co., New York	17,789,490	19,092,385
Brooklyn Rapid Transit Co., Brooklyn, N.Y.	16,585,530	18,797,264
Philadelphia Rapid Transit Co	16,374,626	17,676,249
Boston Elevated Ry. Co., Boston, Mass	12,741,569	13,634,612
Pittsburg Railways Co., Pittsburg, Pa	9,762,867	10,316,523
Chicago Union Traction Co., Chicago, Ill	9,208,530	10,091,968
United Railways Co.of St.Louis, St.Louis, Mo.	8,460,016	9,146,348
Chicago City Ry. Co., Chicago, Ill	7,322,080	7,871,126
Massachusetts Elec.Companies, Boston, Mass.	6,734,128	7,518,240
United Ry. & Electric Co., Baltimore, Md.	6,023,698	6,587,827
Detroit United Ry., Detroit, Mich	5,169,639	6,121,940
United Railroads of San Francisco, Cal	7,066,892	†5,955,786
New Orleans Ry. & Lt.Co., New Orleans, La.	5,093,710	5,773,190
Twin City Rapid Transit Co., Minneapolis Minn	4,759,263	5,644,988
International Traction Co., Buffalo, N. Y	4,484.643	4,972,688
Kansas City Ry. & Lt. Co., Kansas City, Mo.	3,923,346	4,460,096
American Cities Ry. & Lt. Co., New York	3,870,807	4,710,638
Boston & Northern St. Ry. Co., Boston, Mass.	3,961,954	4,412,035
Cincinnati Traction Co., Cleveland, O	3,806,705	4,120,788
Consolidated Ry.Co. (The), New Haven, Conn.	2,122,460	3,989,542
Milwaukee Elec. Ry. & Lt. Co. (The), Milwaukee, Wis	3,348,696	3,679,229
Rhode Island Co. (The), Providence, R. I	$3,242,972	$3,561,242
Portland Ry., Light & Pwr.Co., Portland, Ore.		3,452,607
Washington Ry.& Elec. Co., Washington, D.C.	2,905,907	3,133,240
Toronto Ry. Co., Toronto, Ont., Can	2,747,324	3,109,740
Seattle Electric Co., Seattle, Wash	2,565,914	3,101,386
Montreal Street Ry. Co., Montreal, Can	2,707,474	3,100,487
Illinois Traction Co., Danville, Ill		3,013,107
Old Colony Street Ry. Co., Boston, Mass	2,509,612	2,795,489
Metropolitan West Side El. Ry. Co., Chicago.	2,452,327	2,697,239
Louisville Ry. Co., Louisville, Ky	2,355,820	2,523,343
Oakland Traction Oakland, Cal	1,441,471	2,226,017
Rochester Ry. Co., Rochester, N. Y	1,765,463	2,105,421
Toledo Railways & Light Co., Toledo, O	1,913,456	2,047,610
East St.Louis Suburban Co., East St.Louis, Ill.	1,351,579	2,041,451
Connecticut Ry. & Ltg.Co., Bridgeport, Conn.	1,627,483	2,011,032
Birmingham Ry., Light & Power Co., Birmingham, Ala	1,655,122	1,972,945
Northwestern Elev. R. R. Co., Chicago, Ill.	1,786,414	1,948,727
Columbus Ry. & Light Co., Columbus, O	1,798,463	1,941,199
South Side Elevated R. R. Co., Chicago, Ill.	1,713,348	1,788,975
United Traction Co., Albany, N. Y	1,732,452	1,785,113
Capitol Traction Co., Washington, D. C	1,656,659	1,727,054
Northern Ohio Trac. & Light Co., Akron O.	1,552,970	1,703,340
Portland Ry. Co., Portland, Ore		1,684,156
Public Service Corporation, Newark, N. J	1,548,728	1,677,798
Mahoning & Shenango Ry. & Light Co., Youngstown, O		1,670,088
Coney Island & Brooklyn R.R. Co., Brooklyn.	1,605,861	1,663,279
Havana Electric Ry. Co., Havana, Cuba	1,542,870	1,662,072
Norfolk & Portsmouth Trac. Co., Norfolk, Va.	1,498,366	1,657,941
Washington Water Power Co., Spokane, Wash.	1,277,919	1,615,004
Worcester Consolidated Street Ry. Co., Worcester, Mass	1,379,015	1,523,964
Union Railway Co. of New York City	1,399,634	1,521,182
Memphis Street Ry. Co., Memphis, Tenn	1,114,022	1,429,046
Nashville Ry. & Light Co., Nashville, Tenn.	1,174,377	1,395,234
British Columbia Elec. Ry. Co., Vancouver, B. C	903,014	1,290,671
Tri-City Rys. & Light Co., Davenport, Ia	1,091,693	1,251,507
Springfield St. Ry. Co., Springfield, Mass	1,013,696	1,229,028
Fort Wayne & Wabash Valley Traction Co., Fort Wayne, Ind	949,298	1,109,192
Hamilton Cataract Power, Light & Traction Co., Hamilton, Ont., Can	878,164	1,039,342
Syracuse Rapid Transit Co., Syracuse, N. Y.	894,622	1,027,340
Dallas Electric Corporation, Dallas, Tex	934,707	1,023,136
Forty-Second St., Manhattanville & St. Nicholas Ave. Ry. Co. (The), New York, N. Y.	879,083	1,004,103
Total, 63 companies	$237,506,359	$275,245,406

†Decrease in 1906 due to earthquake.

COMPANIES HAVING GROSS RECEIPTS FOR 1906 BETWEEN $1,000,000 AND $500,000.

NAME OF COMPANY.	1905.	1906.
West Penn. Railways Co., Pittsburg, Pa		$997,098
Scranton Ry. Co., Scranton, Pa	$916,684	989,178
Grand Rapids Ry. Co., Grand Rapids, Mich.	820,469	910,028
Manila Electric R. R. & Lt. Co., Manila, P.I.		909,080
Utica & Mohawk Valley Ry. Co., Utica, N.Y.	789,796	902,321
Chicago & Oak Park Elec. Ry. Co., Chicago	842,945	890,555
Chicago & Milwaukee Elec. R.R.Co., Chicago	594,873	884,207
Schenectady Ry. Co., Schenectady, N. Y.	726,542	882,206
Wilkes-Barre & Wyoming Valley Traction Co., Wilkes-Barre, Pa	840,067	869,403
Lake Shore Electric Ry. Co., Cleveland, O.	788,268	866,970
Northern Texas Elec. Co., Ft. Worth, Tex	661,037	854,135
New York & Queens County Ry. Co., Long Island City, N. Y	745,734	852,193
St. Joseph Ry., Lt., Ht. & Pwr. Co., St. Joseph, Mo	754,954	834,438
Terre Haute Trac.& Lt.Co., Terre Haute, Ind.	629,760	823,162
Tacoma Ry. & Power Co., Tacoma, Wash	657,451	797,433
Fonda, Johnstown & Gloversville R. R. Co. Gloversville, N. Y	705,583	776,885
Duluth Street Ry. Co., Duluth, Minn		768,875
United Traction Co., Reading, Pa	666,111	762,850
Northwestern Pacific R. R. Co., San Francisco, Cal	721,897	741,847
Milwaukee Light, Heat & Traction Co., Milwaukee, Wis	639,129	733,049
Portland R. R. Co., Portland, Me	724,798	727,979
San Francisco, Oakland & San Jose Ry., Oakland, Cal	535,133	668,832
Central Pennsylvania Traction Co., Harrisburg, Pa	529,526	665,966
Puget Sound Electric Ry. Co., Tacoma, Wash.	511,339	663,206
Charleston Consolidated Ry., Gas & Electric Co., Charleston, S. C	614,963	654,390
Cleveland, Southwestern & Columbus Ry. Co., Cleveland, O	543,226	645,849
Conestoga Traction Co., Lancaster, Pa	525,078	629,320
Winnipeg Electric Ry. Co., Winnipeg, Man.		627,127

NAME OF COMPANY.	1905.	1906.
Savannah Electric Co., Savannah, Ga.	$586,236	$611,215
Houston Electric Co., Houston, Tex.	517,315	591,351
Hudson Valley Ry. Co., Glens Falls, N. Y.	506,317	570,689
Pueblo & Suburban Traction & Ltg. Co., Pueblo, Col.	524,559	553,606
Thirty-fourth Street Crosstown Ry. Co. New York City.	529,254	553,417
Peoria Ry. Co., Peoria, Ill.		538,355
Little Rock Ry. & Elec. Co., Little Rock, Ark.	496,259	533,950
Mobile Light & R. R. Co., Mobile, Ala.	419,062	530,314
Ottawa Electric Ry. Co. (The), Ottawa, Can.	449,634	525,747
Cincinnati Northern Trac. Co., Cincinnati, O.	508,332	521,684
Boston & Worcester St. Ry. Co., Boston, Mass.	448,366	514,465
Altoona & Logan Valley Elec. Ry. Co., Altoona, Pa.	439,210	510,949
Rockford & Interurban Ry. Co., Rockford, Ill.	330,524	510,042
Knoxville Ry. & Lt. Co., Knoxville, Tenn.	394,036	505,341
Chicago, So. Bend & Northern Indiana Traction Co.,	394,514	503,275
Inter-State Ry. Co., Philadelphia, Pa.	405,584	502,278
Total, 44 companies,	$23,434,565	$30,905,269

COMPANIES HAVING GROSS RECEIPTS FOR 1906 BETWEEN $500,000 AND $100,000.

NAME OF COMPANY.	1905.	1906.
Lehigh Valley Transit Co., Allentown, Pa.	$616,346	$494,361
City Ry. Co. (The), Dayton, O.	442,174	493,661
Trenton Street Ry. Co., Trenton, N. J.	453,650	492,948
Lexington & Interurban Rys. Co., Lexington, Ky.	471,324	488,546
American Railways Co. (The), Phila., Pa.	444,254	486,712
Chattanooga Rys. Co. Chattanooga, Tenn.	424,262	481,831
Dry Dock, East Broadway & Battery R. R. Co., New York City.	472,772	477,860
Tampa Electric Co., Tampa, Fla.	411,763	469,222
New Jersey & Hudson River Ry. & Ferry Co. (The), Hackensack, N. J.	376,618	450,686
Holyoke Street Ry. Co., Holyoke Mass.	420,652	446,921
Johnstown Passenger Ry. Co., Johnstown, Pa.	341,189	425,571
Southwest Missouri R. R. Co., Webb City, Mo.	317,812	423,705
Michigan United Rys. Co., Lansing, Mich.	363,966	410,407
Manchester Trac., Light & Power Co., Manchester, N. H.	358,505	406,673
Detroit, Jackson & Chicago Ry., Detroit, Mich.	202,440	406,539
Union Street Ry. Co., New Bedford, Mass.	371,563	396,093
El Paso Electric Co., El Paso, Tex.	288,943	391,656
Halifax Elec. T'way Co., Ltd., Halifax, N. S.	370,368	387,518
Chicago & Joliet Electric Ry. Co., Joliet, Ill.	341,030	378,223
Lincoln Traction Co., Lincoln, Neb.	316,922	372,461
Evansville & Southern Indiana Trac. Co., Evansville, Ind.	230,987	371,399
Newton St. Ry. Co., Newton, Mass.	323,743	361,596
Schuylkill Valley TractionCo., Norristown, Pa.	320,224	359,129
Honolulu Rapid Transit & Land Co., Honolulu, Hawaii.	284,319	355,590
People's Railway Co. (The), Dayton, O.	308,391	351,666
Columbia Electric Street Ry., Light & Power Co., Columbia, S. C.	241,197	350,891
Toledo, Urban & Interurban Ry. Co., Toledo, O.	307,571	347,931
Yonkers R. R. Co. (The), Yonkers, N. Y.	305,917	341,258
Westchester Electric R. R. Co., New York City	327,536	332,273
Augusta Ry. & Electric Co., Augusta, Ga.	286,023	329,747
Jacksonville Electric Co., Jacksonville, Fla.	305,639	326,468
Chester Traction Co., Chester, Pa.	303,113	322,070
Springfield Ry. & Light Co., Springfield, Mo.	280,000	320,094
Galveston Electric Co., Galveston, Tex.		315,135
Manchester Street Ry. Co., Manchester, N. H.	291,730	313,013
Auburn & Syracuse Elec. R. R. Co., Auburn, N. Y.	269,574	311,109
Easton Transit Co., Easton, Pa.	251,365	309,925
Bangor Ry. & Electric Co., Bangor, Me	193,866	303,609
Western Ohio Ry, Co. (The), Lima, O.	230,758	300,197
Erie Electric Motor Co., Erie, Pa.	262,367	299,546
Atlantic Coast Elec. Ry. Co., Asbury Park, N. J.	267,675	298,732
St. John's Ry. Co. (The), St. John's, Can.	280,569	296,858
Wilkes Barre & Hazelton R.R. Co., Hazelton, Pa.	279,839	294,592
Binghamton Ry. Co., Binghamton, N. Y.	277,032	291,943
East Liverpool Traction & Light Co. (The), East Liverpool, O.		294,100
Columbus Electric Co., Columbus, Ga.		291,244
Macon Ry. & Light Co., Macon, Ga.	273,673	290,345
Atlantic Shore Line Ry., Sanford, Me.	274,006	290,033
Topeka Ry. Co. (The), Topeka, Kan.	252,000	285,297
Kansas City Western Ry., Kansas City, Kan.		282,290
Fitchburg & Leominster Street Ry. Co., Fitchburg, Mass.	242,002	279,904
Whatcom County Ry. & Light Co., Bellingham, Wash.	195,009	279,469
Beaver Valley Traction Co., Beaver Falls, Pa.	248,248	276,941
Cleveland, Painesville & Eastern R. R. Co., Cleveland, O.	245,089	271,100
Indianapolis & Eastern Ry. Co., Indianapolis, Ind.		$270,909
Berkshire Street Ry. Co., Pittsfield, Mass.	$188,736	266,672
Albany & Hudson R. R. Co., Hudson, N. Y.	242,866	265,671
Niagara, St. Catharines & Toronto Ry. Co., St. Catharines, Ont., Can.	246,311	265,071
Lynchburg Trac. & Lt. Co., Lynchburg, Va.	178,925	264,967
Richmond Lt. & R. R. Co., Richmond, N. Y.	329,355	264,539
Scioto Valley Traction Co., Columbus, O.		263,766
Cape Breton Electric Co., Ltd., Sydney, N. S.	211,980	258,417
Pottsville Union Traction Co., Pottsville, Pa.	251,123	256,002
Lewiston, Brunswick & Bath Street Ry. Co., Lewiston, Me.	237,814	254,343
Washington, Alexandria & Mt. Vernon Ry. Co., Washington, D. C.	148,726	252,999
Eastern Ohio Traction Co., Cleveland, O.	230,765	240,108
Indianapolis, Columbus & Southern Traction Co., Indianapolis, Ind.	210,259	240,034
Asheville Electric Co., Asheville, N. C.	203,026	239,099
Rochester & Eastern Rapid Ry. Co., Canandaigua, N. Y.	221,331	237,905
Wisconsin Lt., Ht. & Pwr. Co., Appleton, Wis.	218,671	235,787
Springfield Ry. Co., Springfield, O.	212,839	231,280
Quebec Ry., Lt. & Pwr., Que., Ont., Can.		229,754
Illinois Central Traction, Co., Springfield, Ill.		229,691
Houghton County St. Ry. Co., Hancock, Mich.	167,067	229,245
Paducah Traction & Lt. Co., Inc., Paducah, Ky.	168,345	227,279
Consolidated Rys., Lt. & Pwr Co., Wilmington, N. C.	192,198	226,467
Interurban Ry. & Terminal Co., Cincinnati, O.	208,614	226,055
Phila. & West Chester Traction Co., Phila., Pa.	182,737	219,122
Montreal Park & Island Ry. Co., Montreal.	179,559	218,604
New York & Long Island Traction Co. (The), Long Island City, N. Y.	104,806	207,301
Elmira Water, Light & R. R. Co., Elmira, N. Y.	194,334	206,570
London Street Ry. Co., London, Ont.	194,026	202,911
Pittsburg, McKeesport & Greensburg Ry. Co., Greensburg, Pa.	168,541	201,209
Staten Island Midland R. R. Co., S. I., N. Y.	170,049	196,266
Schuylkill Ry. Co., Girardville, Pa.	165,260	194,431
Pennsylvania & Mahoning Valley Ry. Co. Youngstown, O.		194,102
Wichita R. R. & Light Co., Wichita, Kan.	166,910	194,002
Venango Power & Traction Co., Oil City, Pa.	173,172	191,705
Eastern Wisconsin Ry. & Lt. Co., Fond du Lac, Wis.		189,996
Mansfield Ry., Light & Power Co., Mansfield, O	179,938	189,906
Newport & Fall River St. Ry. Co., Newport, R. I.	187,461	187,392
Pittsfield Electric St. Ry. Co., Palmer, Mass.	161,635	187,283
Long Island Electric Ry. Co., Jamaica, Long Island, N. Y.	162,416	184,808
Cincinnati, Georgetown & Portsmouth R. R. Co., Cincinnati, O.	157,464	184,731
Dayton & Troy Electric Ry. Co., Dayton, O.	154,098	184,646
Toledo & Indiana Ry. Co., Toledo, O.	135,641	183,640
Fries Manufacturing & Power Co. (The), Winston-Salem, N. C.	148,997	181,867
Valley Traction Co., Lemoyne, Pa.	143,643	179,304
Oklahoma City Ry. Co., Oklahoma City, Okla.	125,768	178,726
Twin City Gas & Electric Co., Brattleboro, Vt.		176,667
Milford & Uxbridge St. Ry. Co., Milford, Mass.	150,927	176,590
Camden & Trenton Ry. Co., Camden, N. J.	131,318	175,933
Dartmouth & Westport St. Ry. Co., New Bedford, Mass.	154,499	175,204
Connecticut Valley Light & Ry. Co., Northampton, Mass.	119,803	173,622
Interstate Consolidated Street Ry. Co., North Attleboro, Mass.	152,036	170,855
Stark Electric R. R. Co., Alliance, O.	142,883	172,296
Hartford & Springfield Street Ry. Co., Warehouse Pt., Conn.	128,169	170,277
Meridian Light & Ry. Co., Meridian, Miss.	142,168	169,625
Kokomo, Marion & Western Traction Co., Kokomo, Ind.	122,860	168,872
Interurban Ry. Co., Des Moines, Ia.	144,042	168,360
Steubenville & East Liverpool Ry. & Light Co., Steubenville, O.	153,437	166,325
Allentown & Reading Trac. Co., Allentown, Pa.	145,699	165,576
Waterloo, Cedar Falls & Northern Ry. Co., Waterloo, Ia.	152,658	163,763
Lehigh Traction Co., Hazleton, Pa.	166,544	163,734
Northampton St. Ry. Co., Northampton, Mass.	151,205	163,705
Twenty-Eighth & Twenty-Ninth Sts. Crosstown R. R. Co.	153,070	162,037
Lexington & Boston St. Ry. Co., Boston, Mass.	162,404	160,582
Jamestown St. Ry. Co., Jamestown, N. Y.	153,358	157,794
Worcester & Southbridge Street Ry. Co., Worcester, Mass.	120,958	152,221
Cincinnati, Lawrenceburg & Aurora Electric Street R. R. Co., Cincinnati, O.	118,971	151,914
Atchison Ry., Lt. & Pwr. Co., Atchison, Kan.	114,003	151,552
Grays Harbor Ry. & Lt. Co., Aberdeen, Wash.	106,171	150,072
York Street Ry. Co., York, Pa.	150,363	148,499

NAME OF COMPANY	1905.	1906.
Quincy H. Ry. & Carrying Co., Quincy, Ill...	$140,617	$147,821
Boston & Maine R. R., Concord, N. H.....	141,685	147,459
Indianapolis & Martinsville Rapid Transit Co., Indianapolis, Ind.....	127,778	147,117
Lorain Street R. R. Co., Lorain, O.....	108,240	146,878
Winnebago Traction Co., Oshkosh, Wis.....	126,746	144,315
Niagara Gorge R. R. Co., Niagara Falls, N.Y.	122,311	143,272
Oakwood Street Ry. Co., Dayton, O.....	125,240	142,122
Kingston Consol. R. R. Co., Kingston, N. Y.	126,230	140,303
Benton Harbor-St. Joe Ry. & Light Co., Benton Harbor, Mich.....		139,990
Wilkes Barre & Hazleton Ry.Co., Hazleton, Pa.		139,206
Sheboygan Lt., Pwr.& Ry.Co., Sheboygan, Wis.	124,271	138,835
Green Bay Traction Co., Green Bay, Wis....	120,887	137,989
New York & Stamford Ry. Co , Port Chester, N. Y.....	125,894	137,477
Railways Company General, New York, N.Y.	38,125	135,512
Fairmount Park Transp't'n Co., Phila., Pa...	128,166	134,501
Rockland, Thomaston & Camden St. Ry. Co. Rockland, Me.....	125,225	134,151
Tamaqua & Lansford St. Ry. Co., Lansford, Pa.	128,758	133,483
Bridgeton & Millville Trac.Co. Bridgeton, N.J.	119,233	132,656
Anniston Electric & Gas Co., Anniston, Ala..	106,015	130,659
Madison & Interurban Trac.Co., Madison, Wis.	108,684	130,255
Orange County Traction Co., Newburgh, N.Y.	119,731	129,991
Olean Street Ry. Co., Olean, N. Y.....	118,306	128,465
Tarrytown, White Plains & Mamaroneck Ry. Co., White Plains, N. Y.....	106,880	128,548
Hamburg Ry. Co., Hamburg, N. Y.....	104,930	126,696
Portsmouth St. R. R.& Lt.Co., Portsmouth, O.	97,867	125,724
Jackson Consolidated Trac.Co., Jackson, Mich.	112,067	125,566
Jefferson Traction Co., Punxsutawney, Pa..:	104,975	124,092
Haverhill & Amesbury St. Ry. Co., Haverhill, Mass.....	111,486	123,009
Williamsport Pass. Ry. Co., Williamsport, Pa.	116,231	122,956
Sandwich, Windsor & Amhurstburg Ry. Co., Windsor, Ont.....	107,783	122,000
Woonsocket St. Ry. Co., Woonsocket, R. I..	102,567	121,133
Louisville & Eastern R.R. Co., Louisville, Ky.	106,976	120,262
Austin Electric Ry. Co., Austin, Tex.....		118,476
Indianapolis & Cincinnati Traction Co. (The), Indianapolis, Ind.....	104,721	117,444
Oneonta & Mohawk Valley R. R. Co., Oneonta, N. Y.....	118,362	116,767
Washington & Canonsburg Ry. Co., Washington, Pa.....	106,756	116,244
Pennsylvania & Ohio Ry. Co., Ashtabula, O.	98,000	115,825
La Crosse City Ry. Co., La Crosse, Wis.....	105,750	115,459
Darby, Media & Chester Ry.Co., Chester, Pa.	91,206	115,288
Boston & Worcester Elec. Cos., Boston, Mass.	108,043	114,473
Brockton & Plymouth Street Ry. Co., Brockton, Mass.....	104,406	114,429
Vicksburg Ry. & Light Co., Vicksburg, Miss.		114,116
Sydney & Glace Bay Ry. Co., Sydney, N. S..	87,118	113,129
Holmesburg, Tacony & Frankford Electric Ry. Co. (The), Philadelphia, Pa.....	100,954	113,019
Groton & Stonington St.Ry.Co., Groton, Conn.	35,122	112,711
Dayton & Xenia Transit Co., Dayton, O.....	109,961	111,596
Ithaca Street Ry. Co., Ithaca, N. Y.....	103,946	110,944
Southern Lt. & Trac. Co., Natchez, Miss....	97,955	107,505
Washington, Arlington & Falls Church Ry. Co., Washington, D. C.....	87,456	107,422
Ponce Elec. Co., Ponce, P. R.....	88,574	107,327
Poughkeepsie City & Wappingers Falls Electric Ry. Co., Poughkeepsie, N. Y.....	106,712	107,152
Lewistown & Reedsville Electric Ry. Co., Lewistown, Pa.....	78,193	106,564
Syracuse & Suburban R.R. Co., Syracuse, N.Y.	92,678	106,078
Citizens' Electric Street Ry. Co., Newburyport, Mass.....	96,227	105,657
New Jersey & Pennsylvania Traction Co., Trenton, N. J.....	101,326	104,259
Augusta, Winthrop & Gardiner Ry. Co., Augusta, Me.....	97,989	103,596
Cleveland, Painesville & Ashtabula R. R. Co., Cleveland, O.....	98,558	103,095
Augusta & Aiken Ry. Co., Augusta, Ga.....	91,753	102,722
Woronoco Street Ry. Co., Westfield, Mass...	92,720	101,631
Danbury & Bethel St. Ry. Co., Danbury, Conn.	92,747	101,563
Peekskill Lighting & R. R. Co., Peekskill, N.Y.	88,698	100,699
Natick & Cochituate St. Ry.Co., Natick, Mass.	90,138	100,494
Total, 184 companies.....	$32,658,939	$40,645,004

COMPANIES HAVING GROSS RECEIPTS FOR 1906 BETWEEN $100,000 AND $50,000.

NAME OF COMPANY.	1905.	1906.
Astoria Electric Co., Astoria, Ore.....		$99,422
Burlington Traction Co., Burlington, Vt.....	$85,862	99,207
Lebanon Valley Street Ry. Co., Lebanon, Pa.	82,148	98,596
Shamokin & Mt. Carmel Transit Co., Shamokin, Pa.....	113,569	98,475
Northampton Traction Co., Easton, Pa.....	91,949	98,333
Iowa & Illinois Ry. Co., Chinton, Ia.....	$40,486	$98,249
Delaware Co. and Philadelphia Electric Ry. Co., Philadelphia, Pa.....	89,986	97,241
Rutland Ry., Lt. & Pwr. Co., Rutland, Vt....	87,574	96,847
New Bedford & Onset St. Ry. Co., New Bedford, Mass.....	75,706	96,426
DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill.....		95,898
Warren St. Ry. Co., Warren, Pa.....	90,147	94,231
Hudson, Pelham & Salem Electric Ry. Co., Hudson, N.H.....	84,126	94,147
Athens Electric Ry. Co., Athens, Ga.....	76,321	93,728
Bristol & Plainville T'way Co., Bristol, Conn.	85,788	93,168
Pascagoula St. Ry.& Pwr.Co., Scranton, Miss.	79,701	92,248
Dayton, Covington & Piqua Traction Co., Dayton, O.....	85,637	92,228
Dover, Somersworth & Rochester St. Ry. Co., Dover, N. H.....	82,945	91,882
Cedar Rapids & Iowa City Ry. & Lt. Co.....	71,597	91,609
Electric Ry., Lt.& Ice Co., Cedar Rapids, Ia..	73,548	91,449
Milford, Attleboro & Woonsocket Ry. Co., Milford, Mass.....	77,928	91,342
Galt, Preston & Hespler St. Ry. Co., Ltd., Galt, Ont.....	68,562	91,091
Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Co., Geneva, N. Y.....	86,414	90,755
Montreal Terminal Ry. Co., Montreal, Ont..	82,297	88,536
South Middlesex St. Ry. Co., Natick, Mass..	70,812	88,289
Providence & Danielson Ry. Co., Providence, R. I.....	85,970	88,194
Kingsbridge Ry. Co., New York City.....	83,795	88,120
Blue Hill Street Ry. Co., Canton, Mass.....	78,294	86,344
Springfield, Troy & Piqua Ry. Co., Springfield, O.....	54,202	86,125
West Chester St. Ry. Co., West Chester, Pa..	66,532	85,374
Ohio Central Traction Co., Galion, O.....	80,098	85,752
Atlantic City & Suburban Traction Co., Atlantic City, N. J.....	82,363	85,060
Pittsburg Ry. & Lt. Co. (The), Pittsburg, Kan.		83,703
Hudson River Traction Co., Rutherford, N.J.	75,897	83,252
Conneaut & Erie Trac. Co., Erie, Pa.....		82,955
Sea View R. R. Co., Wakefield, R. I.....	63,614	82,279
Philadelphia & Eastern Ry. Co., Doylestown, Pa.....	57,220	81,559
Chippewa Valley Elec. R. R. Co. (The), Eau Claire, Wis.....	69,170	81,290
Hull Electric Co. (The), Aylmer, Que., Can..	83,532	81,221
Freeport Ry., Lt. & Power Co., Freeport, Ill.	64,289	80,727
Philadelphia, Bristol & Trenton St. Ry. Co., Philadelphia, Pa.....	76,348	80,681
Black River Traction Co., Watertown, N. Y..	68,843	79,338
Nashua Street Ry. Co., Nashua, N. H.....	72,458	78,602
Columbia & Montour Electric Ry. Co., Bloomsburg, Pa.....	71,225	78,270
Meriden, Southington & Compounce Tramway Co., Meriden, Conn.....	62,553	77,738
Lawrence & Methuen Street Ry. Co., Lawrence, Mass.....	63,867	77,079
Toledo, Fostoria & Findlay Electric Ry. Co., Findlay, O.....	58,542	76,623
Worcester & Blackstone Valley Street Ry. Co., Worcester, Mass.....	67,064	75,750
Rochester & Suburban Ry. Co., Rochester, N. Y.....	58,907	74,388
Erie Traction Co., Erie, Pa.....	65,279	73,930
Waterville-Fairfield Ry. & Light Co., Waterville, Me.....	50,402	73,674
Matoon City Ry. Co., Matoon, Ill.....		73,500
Waverly, Sayre & Athens Traction Co., Waverly, N. Y.....	64,593	72,738
Allegheny Valley St. Ry. Co., Tarentum, Pa.	64,859	72,156
Trenton & New Brunswick R. R. Co., Trenton, N. J.....	75,152	71,582
Georgetown, Rowley & Ipswich Street Ry., Georgetown, Mass.....	52,662	71,507
Chautauqua Traction Co., Jamestown, N. Y.	46,061	70,750
Youngstown Park & Falls Street Ry. Co., Youngstown, O.....	63,908	70,418
Butler Passenger Ry. Co., Butler, Pa.....	64,264	70,296
Gardner, Westminster & Fitchburg Street Ry. Co., Gardner, Mass.....	62,300	68,620
Norfolk & Bristol St. Ry. Co., Norwood, Mass.	55,719	68,135
Warren, Brookfield & Spencer Street Ry. Co., Brookfield, Mass.....	61,416	65,741
Steubenville & Wheeling Traction Co., Steubenville, O.....	58,291	65,261
Portsmouth Electric Ry., Portsmouth, N. H..	63 864	65,083
Dunkirk & Fredonia R. R. Co., Fredonia, N.Y.	58,789	64,945
Newport & Providence Ry.Co., Newport, R.I.		64,925
Jersey Central Traction Co., Keyport, N. J...	54,277	64,713
Wilkes-Barre, Dallas & Harvey's Lake Ry. Co., Wilkes-Barre Pa.....	57,090	63,900
Newton & Boston Street Ry., Newton, Mass.	63,323	63,658
Biddeford & Saco R. R. Co., Biddeford, Me..	60,990	63,490

NAME OF COMPANY.	1905.	1906.
Burlington County Ry. Co., Mt. Holly, N. J.	$62,162	$62,798
Southwestern Street Ry. Co., Phila., Pa.	55,804	62,538
Chillicothe Elec. R. R., Light & Power Co., Chillicothe, O.	56,229	62,355
Springfield & Xenia Ry. Co. (The), Xenia, O.	57,816	61,989
Providence & Fall River Street Ry. Co., Swansea Centre, Mass.	50,537	61,746
Sharon & Wheatland St. Ry. Co., Sharon, Pa.	46,433	61,413
Bristol Gas & Electric Co., Bristol, Tenn.	53,455	60,738
Concord, Maynard & Hudson Street Ry. Co., Maynard, Mass.	50,556	60,130
Ashtabula Rapid Transit Co., Ashtabula, O.	50,489	59,738
Trenton, New Hope & Lambertsville St. Ry. Co., Yardly, Pa.		59,399
Wrightsville & York St. Ry. Co., York, Pa.	56,065	59,382
Cortland County Traction Co., Cortland, N.Y.	49,627	59,143
Ohio River Elec Ry.& Pwr. Co., Pomeroy,O.	53,197	58,980
Newtown Electric St. Ry. Co., Newtown, Pa.	56,820	58,637
Monmouth County Elec. Co., Red Bank, N. J.	50,408	57,809
Van Brunt St. & Erie Basin R. R. Co., New York City	55,010	57,541
Oshawa Ry. Co. (The), Oshawa, Ont., Can.	43,442	58,511
Kittanning & Leechburg Rys.Co., Kittanning, Pa.	44,015	57,321
Farmington Street Ry. Co., Hartford, Conn.	51,029	56,220
York & Dallastown Electric Ry. Co., York, Pa.	32,343	55,564
Cohoes Ry. Co., Cohoes, N. Y.		55,063
Norton & Taunton St. Ry. Co., Norton, Mass.	52,930	55,000
Torrington & Winchester Street Ry. Co., Torrington, Conn.	50,251	54,835
Tiffin, Fostoria & Eastern Electric Ry. Co., Tiffin, O.	50,115	54,648
Oswego Traction Co., Oswego, N. Y.	49,585	54,501
Ocean Electric Ry. Co., Rockaway, N. Y.	42,120	54,281
Walkill Transit Co (The), Middletown, N. Y.	44,619	54,225
Levis County Ry., Levis, Que., Can.	11,903	52,829
Columbus, New Albany & Johnstown Ry. Co., Columbus, O.	34,513	52,582
Nahant & Lynn St. Ry. Co., Lynn, Mass.		50,032
Centre & Clearfield Street Ry. Co. (The), Phillipsburg, Pa.	48,979	50,612
Slate Belt Electric St. Ry. Co., Bethlehem, Pa.	44,586	50,642
Evansville Suburban & Newburg Ry. Co., Evansville, Ind.		52,793
Exeter, Hampton & Amesbury Street Ry. Co., Exeter, N. H.	45,226	52,496
Taunton & Pawtucket St. Ry. Co., Taunton, Mass.	35,361	52,338
Valley Street Ry. Co. (The), Sharon, Pa.	43,091	52,273
Port Arthur Electric St.Ry., Port Arthur, Que.	39,279	51,984
Warren & Jamestown Street Ry. Co.		51,677
Kenosha Electric Ry. Co., Kenosha, Wis.	42,214	51,660
Morris County Traction Co., Morristown, N.J.	29,751	51,045
Citizens' Electric Co., Eureka Springs, Ark.	43,080	50,225
Total 100 companies,	$6,160,105	$7,959,936

COMPANIES HAVING GROSS RECEIPTS FOR 1906 BETWEEN $50,000 AND $25,000.

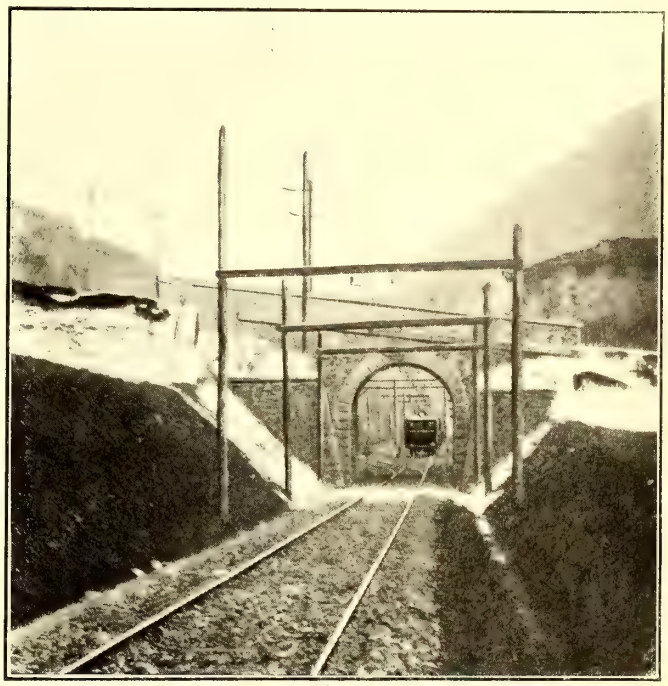
NAME OF COMPANY.	1905.	1906.
People's Street Ry. Co., Nanticoke, Pa.	$52,609	$49,895
Phillipsburg Horse Car R. R. Co., Phillipsburg, N. J.	42,868	49,437
Uniontown & Monongahela Valley Electric Ry. Co., Uniontown, Pa.	59,825	49,249
Haverhill & Southern New Hampshire Street Ry. Co., Haverhill, Mass.	42,409	48,228
Corning & Painted Post Street Ry. Co., Corning, N. Y.	42,005	48,157
Coney Island & Gravesend Ry. Co., Brooklyn, N. Y.	46,339	48,028
Chambersburg, Greencastle & Waynesboro Street Ry. Co., Waynesboro, Pa.	65,337	47,516
Erie Rapid Transit Street Ry. Co., Erie, Pa.	43,318	47,435
Bennington & Hoosick Valley Ry. Co., Hoosick Falls, N. Y.	41,673	47,332
Fishkill Electric Ry. Co., Fishkill, N. Y.		47,303
Escanaba Electric St. Ry. Co., Escanaba, Mich.	45,907	47,043
Westchester, Kennett & Wilmington Electric Ry. Co., Westchester, Pa.		46,972
Southern Boulevard R. R. Co., New York.	51,361	46,785
Barre & Montpelier Traction & Power Co., Barre, Vt.	41,676	46,748
Mason City & Clear Lake Ry.Co., Mason City, Ia.	35,921	46,486
Pottstown Passenger Ry. Co., Pottstown, Pa.	44,262	45,585
Athol & Orange Street Ry. Co., Athol, Mass.	40,654	44,958
Worcester & Holden St.Ry. Co., Holden, Mass.	41,598	44,854
Vincennes Trac. & Lt. Co., Vincennes, Ind.	41,376	44,913
Berlin Street Ry. Co. (The), Berlin, N. H.	40,569	44,654
Claremont Ry. & Ltg. Co., Claremont, N. H.	36,672	44,415
Buffalo Southern Ry. Co., Buffalo, N. Y.	33,352	44,266
Portland & Brunswick Street Ry. Co., Brunswick, Me.	42,604	43,371
Westmoreland County Ry. Co., Pittsburg, Pa.	$10,403	$43,217
Shamokin & Edgewood Electric Ry. Co., Shamokin, Pa.	31,970	42,667
Templeton Street Ry. Co., Templeton, Mass.	36,394	42,653
Cedar Rapids & Marion City Ry. Co., Cedar Rapids, Ia.	38,194	42,610
Meadville Traction Co., Meadville, Pa.	40,329	42,471
Pottstown & Reading Street Ry. Co., Pottstown, Pa.		42,420
Grand Valley Ry. Co., Brantford, Ont., Can.	29,742	42,161
Titusville Electric Traction Co., Titusville, Pa.	39,103	42,077
Belton & Temple Trac. Co., Temple, Tex.	37,209	42,028
International Transit Co. (The), Sault Ste Marie, Ont.	56,517	42,024
York-Haven Street Ry. Co., York, Pa.	38,692	40,209
Columbian Street Ry. Co., Pascoag, R. I.	33,791	40,040
Eastern New York R. R. Co., Ballston Spa.	39,258	39,771
DuBois Traction Co., DuBois, Pa.	35,977	39,694
Meadville & Cambridge Springs Street Ry. Co., Meadville, Pa.	42,043	39,646
Chambersburg & Gettysburg Electric Ry.Co., Chambersburg, Pa.	34,900	39,377
Galesburg & Kewanee Electric Ry. Co., Galesburg, Ill.	27,439	38,934
Amherst & Sunderland Street Ry. Co. (The,) Amherst, Mass.	31,423	38,363
Springfield Electric Ry. Co., Springfield, Vt.	39,578	38,283
Egerton Tramway Co., Sydney, N. S., Can.		38,103
Montgomery Traction Co., Norristown, Pa.	32,948	37,660
East Taunton Street Ry. Co., Taunton, Mass.	33,721	37,304
Webster, Monessen, Belle Vernon & Fayette City Street Ry. Co., Webster, Pa.	30,883	36,981
Anderson Traction Co., Anderson, S. C.		36,844
Sarnia Street Ry Co., Sarnia, Can.	36,962	36,234
Millville Traction Co., Millville, N. J	32,810	35,394
Western Massachusetts St.Ry. Co., Westfield.		35,049
Vallamont Traction Co., Wilkes-Barre, Pa.	33,798	34,532
Marlborough & Westborough Street Ry. Co., Westborough, Mass.	31,884	33,933
Buffalo & Williamsville Electric Ry. Co., Williamsville, N. Y.	29,575	33,872
Menominee & Marinette Light & Traction Co., Menominee, Mich.	31,526	33,803
Lancaster & York Furnace Street Ry. Co., Lancaster, Pa.	28,335	33,606
Haverhill, Plaistow & Newton St. Ry. Co., Plaistow, N. H.		33,042
Troy & New England R. R. Co., Troy, N.Y.	31,631	32,958
Carbon Street Ry. Co., Mauch Chunk, Pa.	14,060	32,520
Price Hill Inclined Plane R. R. Co., Cincinnati, O.	29,332	31,401
Sharon & Newcastle St Ry. Co., Sharon, Pa.	29,401	31,350
Toronto Suburban Street Ry. Co., Toronto Junction, Ont.	31,679	31,051
Henderson City Ry. Co., Henderson, Ky.	30,416	30,988
Fulton Street R. R. Co., New York City.	29,400	30,931
Danville & Bloomsburg Street Ry. Co., Grovanna, Pa.	16,369	30,914
Waterville & Oakland St.Ry., Waterville, Me.	30,204	30,896
Ogdensburg Street Ry. Co., Ogdensburg, N.Y.	27,686	30,655
Laconia Street Ry., Laconia, N. H.	26,487	30,493
Berlin & Waterloo St. Ry. Co., Berlin, Ont., Can.	25,776	30,371
Lancaster Trac. & Pwr. Co., Lancaster, O.	25,316	29,933
Peterborough Radial Ry. Co., Peterborough, Ont.	17,646	29,701
Calais Street Ry. Co., Calais, Me.	27,855	29,099
Five Mile Beach Elect Ry. Co., Anglesea, N.J.	22,024	29,074
Brantford Street Ry. Co., Brantford, Ont.	23,848	28,983
Chicago, Harvard & Geneva Lake Ry. Co., Walworth, Wis.	23,842	28,717
Guelph Radial Ry. Co., Ltd., Guelph, Ont.	24,619	28,509
York & Dover Electric Ry. Co., York, Pa.	26,695	28,344
People's Traction Co., Galesburg, Ill.		28,339
Uxbridge & Blackstone Street Ry. Co., Uxbridge, Mass.	24,355	28,028
Sherbrook St. Ry. Co., Sherbrook, Que., Can.	25,975	28,000
Susquehanna Traction Co., Lock Haven, Pa.	26,586	27,882
Radford Water Power Co., Radford, Va.		27,583
Kingston, Portsmouth & Cataraqui Electric Ry. Co., Kingston, Ont., Can.		27,555
Providence & Burrillville Street Ry. Co., Woonsocket, R. I.		27,628
Philadelphia & Chester Ry. Co., Chester, Pa.	24,008	27,188
Keene Electric Ry. Co., Keene, N. H.	27,312	26,530
Latrobe Street Ry. Co., Latrobe, Pa.	25,005	26,497
Bangor & Portlar d Traction Co., Bangor, Pa.	22,495	26,201
Penn Yann, Keuka Park & Branchport Ry., Penn Yann, N. Y.	25,594	26,195
Hornellsville & Canisteo Ry. Co., Hornell, N. Y.	22,550	25,689
Medfield & Medway St.Ry.Co., Westwood, Mass.	22,937	25,385
Total, 90 companies,	$2,658,842	$3,287,458

THE BREMBANA VALLEY SINGLE-PHASE ELECTRIC RAILWAY

Lombardy, in Northern Italy, has been the scene of a great amount of electrical progress. Milan, its principality, is noted for its enterprise and industry, and one of the first Edison illuminating central stations in Europe was established in that city. In the early part of the present century the direct-current, third-rail line between Milan and Gallarate and Porto Ceresio constituted the first large installation of this system, and it is probably still the most extensive in Europe. The Valtellina three-phase railway, just north of Milan, is still the most conspicuous example of that form of traction, and the Bergamo & Brembana Valley Railway, which has recently been put in operation, is one of the first examples of single-phase traction on a large scale in Europe.

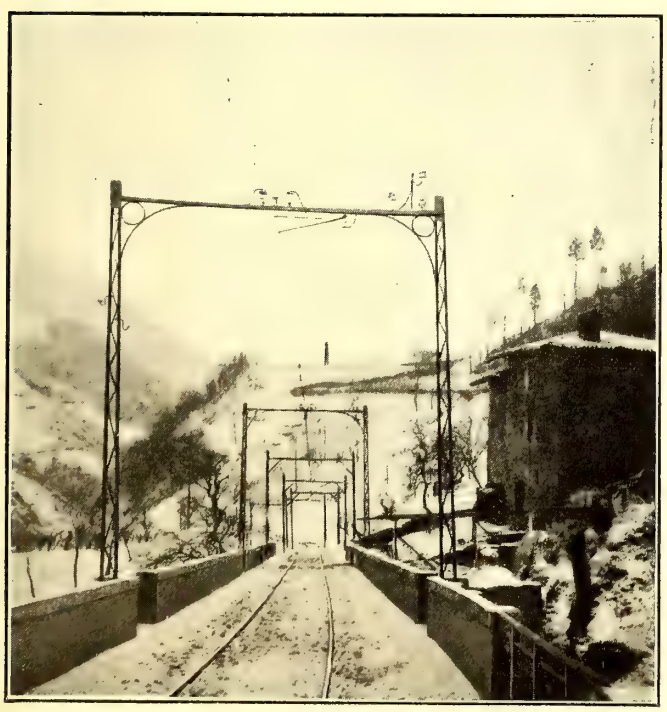


MAP SHOWING THE BREMBANA VALLEY RAILWAY AND STEAM CONNECTIONS SHOWN IN FULL LINES



CATENARY CONSTRUCTION, WITH WOODEN BRIDGES, ON THE BREMBANA VALLEY RAILWAY

Bergamo, with a population of 45,000 inhabitants, as shown on the accompanying map, is not far from Lecco, the southern extremity of the Ganz three-phase road, and lies in one of the picturesque valleys which are situated on the southern slope of the Alps. The Bergamo & Brembana Valley Railway, the subject of this article, connects Bergamo, 810 ft. above sea level, with the village of San Giovanno Bianco at an altitude of 1300 ft. The length of the line is 30 km, or a little over 16 miles. It is laid with a



CATENARY CONSTRUCTION WITH LATTICE POLES ON THE BREMBANA VALLEY RAILWAY

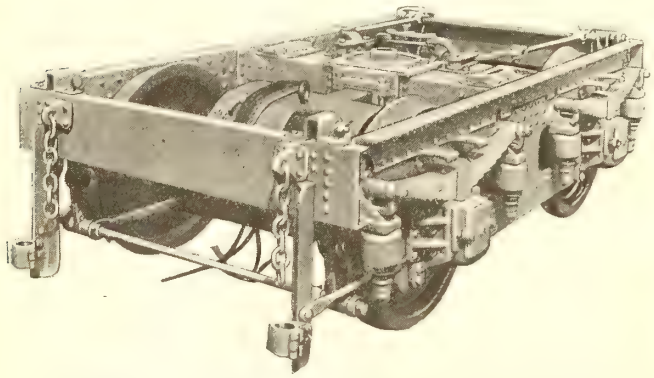


ELECTRIC TRAIN IN THE BREMBANA VALLEY, SHOWING WOODEN BRACKET POLES

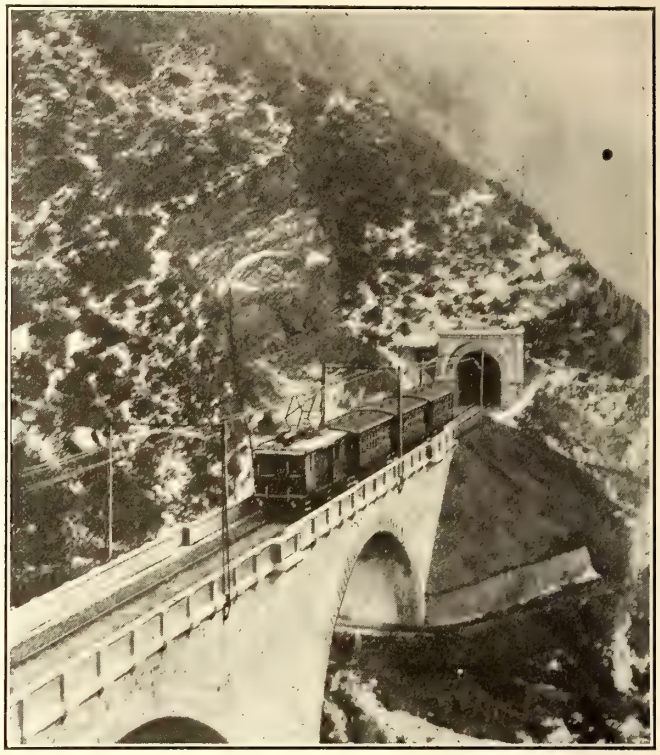
single track of standard gage. The minimum curve radius is 150 m. (about 500 ft.) and the maximum grade is 2.4 per cent. There are seventeen tunnels on the line, some of them more than 200 m., or one-eighth of a mile, in length, and the road crosses the Brembo River at various points.

The adoption of electric power was dictated largely by the amount of available water-power in the neighborhood. Current is generated at 25 cycles at a hydro-electric power station high in the mountains, 3300 ft. above the terminal station at San Giovanno Bianco. It contains three 500-k. v. a. turbo-units for traction service and one 50-k. v. a. alternator for power and lighting purposes. The turbines were supplied by Riva Monneret & Company, of Milan, and Westinghouse six-pole, 6000-volt, 25-cycle alternators are used. The potential on the line is 6000 volts.

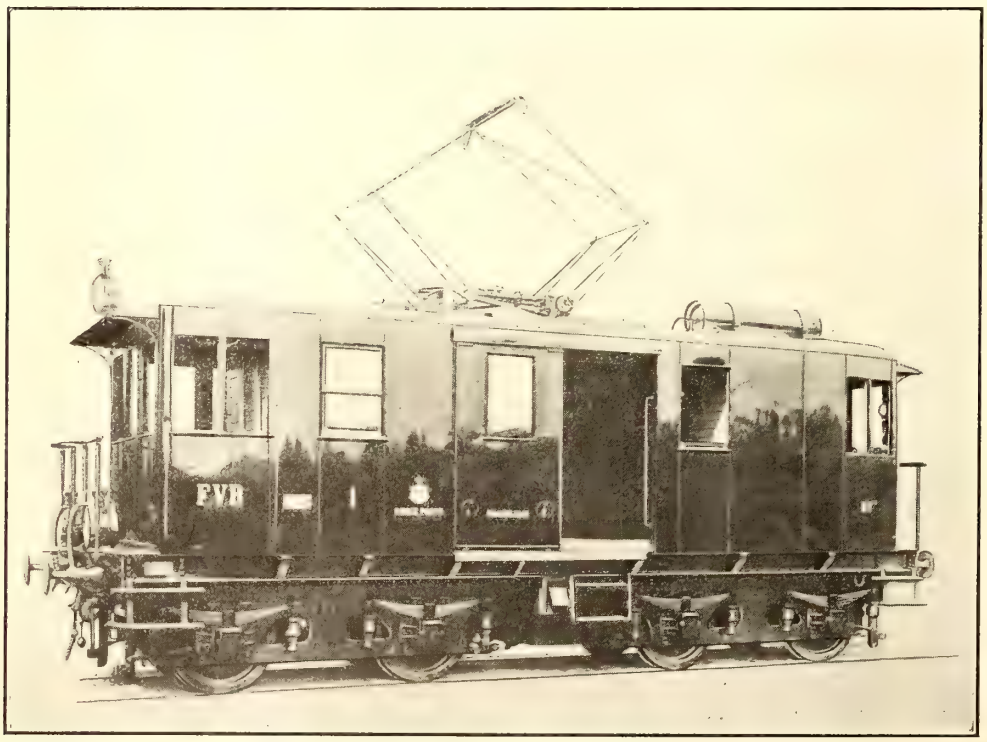
The overhead construction is of the catenary type. At some points it is carried on steel span bridges of a light and tasteful design, as shown in two of the engravings, at other points on wooden bridges and at still other points on bracket poles. The trolley wire itself is 8 mm in diameter, Fig. 8 in section, and is supported from the messenger cable by fourteen hangers to a span of 35 m (115 ft.). As the sag is 30 cm (6 ft. 3 ins.), the tension in the messenger cable is 450 kg at 0 deg. C. The messenger cable consists of seven strands of steel wire. At curves the poles or supporting structures are placed closer together than elsewhere



LOCOMOTIVE TRUCK WITH TWO 75-HP SINGLE-PHASE MOTORS



ELECTRIC TRAIN CROSSING A BRIDGE OVER THE BREMBO RIVER



ELECTRIC LOCOMOTIVE FOR THE BREMBANA VALLEY RAILWAY, WITH AIR TANK ON THE ROOF

In addition to the trolley wire there is a feeder of 50 sq. mm, or about a No. 0 section, and a lighting circuit of two copper wires of No. 8 wire or 4 mm in diameter each.

For the return circuit the rails are bonded with Chicago bonds and ground connections are made at distances of 1 km, or two-thirds of a mile apart.

Electric locomotives are used. Five are required to operate the line and each is equipped with four 75-hp Westinghouse single-phase motors with a maximum speed of 700 r. p. m. and a gear ratio of 70:15. The usual pneumatically-operated pantograph trolley is employed. The motors are equipped with the standard pneumatic unit switch control system and Wurtz lightning arresters. The average weight of train is 90 tons, but the locomotives have hauled loads of 120 tons on a 2 per cent grade at a speed of 18 km per hour. Tests have shown an aceleration exceeding 50 cm per second (1½ m. p. h.) per second.

The line is owned by the Società per la Ferrovia Elettrica di Valle Brembana.

PROCEEDINGS OF THE CANADIAN STREET RAILWAY ASSOCIATION AT WINDSOR, ONTARIO, JUNE 14-15.

ANNUAL MEETING OF THE CANADIAN STREET RAILWAY ASSOCIATION

The annual meeting of the Canadian Street Railway Association was held at Windsor, Ont., on June 14-15, and was attended by representatives from Montreal, Toronto, Ottawa, Amherstburg and other cities in Canada, as well as from Detroit and other cities in the United States. W. H. Moore, assistant to the president of the Toronto Railway Company and manager of the Toronto & York Radial Railway Company, is president of the association this year, and presided at the meetings.

The report of the executive committee and the secretary-treasurer dealt with a number of important matters, particularly the legislation affecting electric railway interests passed at the last session of the Ontario Legislature and the proceedings of the Ontario Railway and Municipal Board. Papers were read on the standardization of electric railway equipment by C. B. King and on electric railway development in Ontario and Quebec by R. J. Clark and P. Dubee. These papers appear in full or in abstract below.

In the evening of June 14 the members of the association, on the invitation of J. Anderson, manager Sandwich, Windsor & Amherstburg Railway, and accompanied by several prominent Windsor citizens and officials of the Detroit United Railway Company, which owns the S. W. & A. Railway, went by special car from Windsor to Amherstburg and dined in the pavilion on Bois Blanc Island, in the Detroit River, a charming outing spot, which is a favorite rendezvous for Detroit and Windsor people. A number of interesting speeches were made.

On Saturday afternoon, upon invitation of the Detroit United Railway Company, the members visited Detroit and inspected the railway repair shops, power stations and offices of the company there. Later a trip was taken on the Lake Shore line in one of the private cars of the Detroit United Railway Company.

The next meeting of the association will be held at Montreal in September, at the same time as the Canadian Electrical Exhibition, which is to be held in that city.

STANDARDIZATION OF ELECTRIC RAILWAY EQUIPMENT

BY C. B. KING
Manager London (Ont.) Street Railway

The word "standard," like the word "arbitration," the expression "municipal ownership," and some others, have a very peculiar and subtle effect upon one, especially when an effort is made by a traveling salesman, a labor agitator or a politician to be captivating. When we hear the word "standard," the impression is immediately conveyed that the most nearly perfect has been obtained and that there need be no further argument. But as perfection is impossible, complete standardization is likewise impossible from the fact that about the time we adopt a standard an improvement is made which we must adopt, and so we lose our standard. There are, however, certain elements, consisting almost entirely of dimensions, in our present electric railway equipments, which can be successfully standardized, for the reason that so many similar parts of so nearly the same sizes have been in use so long that our experience has shown that one set of dimensions can be selected that would suit all. It is to this class of standardizing that my interest inclines, and to which I beg to call your attention. A great deal in this line has already been done by the Master Car Builders' Association and by the American Society of Civil Engineers which has been of benefit to electric railways, and which I think we should follow where possible or point out some good reason why we should not. Similar organizations to the Canadian Street Railway Asscіation, such as the American Street and Interurban Railway Association, The New York Street Railway Association and the Central Electric Railway Association, have also done something, the most thorough and effective work having been done by the latter association.

The M. C. B. Association was impelled to determine upon its well-known standards because of its interchange of cars and the necessity of one road repairing cars belonging to another. Electric railways hardly need it for this reason now, but they will soon, because of the development of interurban lines and their several connections. But I think we have a reason which is very similar to that which caused the A. S. C. E. to determine upon rail sections, and that is, that we are getting so many motors of different designs which must be kept in repair. Each design has its own particular gear, pinion, bearings, etc., and so we must add to our stock of supplies, and thereby add to our storeroom difficulties. To reduce these difficulties, if for no other reason, I beg to suggest that we classify motors and adopt standard designs for all the wearing parts possible. Electric railways are connecting, to an increasing extent, with steam railways, and so I think electric railway associations should adopt the M. C. B. standards as far as possible. The electric railway associations have enough to do to establish standards for the electric equipment, which, if they do their work well, will in turn be adopted by the M. C. B. Association when the steam railways adopt electric operation.

The Central Electric Railway Association appointed a committee last September to recommend standards for various parts, and at its meeting last month this committee reported upon the subjects of rails, wheels, journals, journal boxes, axles and brake-shoes. I believe it is to yet report upon various other parts. As you have no doubt read the reports, as recently published in the journals, I will only review, with perhaps some criticisms, what it has suggested.

Its adoption of the 70-lb. American Society standard rail for interurban work is all right for the present, but I have no doubt that the time will come when the association will consider this rail too light. Then, of course, it can adopt the next size, or the 80-lb. American Society standard. Its adoption of a 7-in. high T-rail for city work suits its local conditions, for most of the cities in that territory permit the use of T-rail. However, I think a grooved girder rail and a guard rail should be standardized, so that the repair and replacement of track work will not be so troublesome and expensive as it is at present, when we find it very diffi-

cult to get rails of the same section as those we may have in use at present. Two other things about track work which might be standardized to advantage are the tongue switch pieces and the frogs in the special work. As tongue switch pieces having a radius of either 100 ft. or 150 ft. are suitable for the beginning of curves of almost any radius, it would be a great advantage in the replacement of these parts if the radius of the tongue switch piece and its length were standardized, and so made by the manufacturers. The tongues should also be of the standard length, so that they will be interchangeable. In the frogs, the length of the arms is about the only thing that could be standardized, but even this would be of some advantage, for then we should know that a frog made for a 50-ft. radius curve would fit at any intersection where there is a 50-ft. radius curve, without regard to the length of the arms.

One more thing which I have in mind regarding track work is that of paving block. Those who have had any experience with this kind of paving must have found how troublesome it is to do any patching if the old bricks are broken to any extent when track repairs have to be made, and you find the new block which you have to be of a different size. I am a believer in large paving blocks, for the reason that these blocks wear at the edges first, and, therefore, the less number of edges, the less will be the wear. I would suggest that a paving block 4 ins. thick, 6 ins. wide and 12⅛ ins. long would be a very good one for track work, the 4 ins. in depth being enough to give it body, and being just about the right thickness for paving over ties with a 6-in. rail. The 6 ins. in width would give a good broad wearing surface, while the 12⅛ ins. in length would be just right for fitting with two blocks laid sideways, if it should at any time be desired to lay them this way.

Coming back, for a moment, to the subject of rails, I have often thought that a good method of standardizing rails might be to adopt such rails as the American Society standards for all work in the country, in unpaved streets or roadways, and then to use this same rail in the paved streets or roadways by making what might be termed a compound rail, consisting of an upper section of the ordinary A. S. C. E. standard rail, and of a lower section consisting of a specially rolled I-beam, very much like the Carnegie steel tie, having an upper flange 4⅝ ins., which is the same as the base of the 70-lb. rail, a lower flange of about 6 ins. wide, and a height of about 5 ins.

These two sections would be held together, at frequent intervals, by rolled steel clamps, bolted through the webs. By laying the two sections so that the joints of the upper section and the joints of the lower section would not come together, a very good form of continuous rail would be obtained, which would yet have sufficient joints to allow for the necessary contraction and expansion. Where a groove section rail is required, a very light guard could be rolled and bolted to the inside of the ordinary T-rail. If it were desired to use a regularly rolled girder groove rail, one very similar to the Lorain Steel Company's section 80, No. 337 could be used and clamped to the lower section just as well. This method of construction would save ties, because a less number of ties would be necessary, and as the ties could be buried deeper in the foundation of concrete or otherwise if desired, the roadbed should stand the wear better than when light rail is used and the ties are laid close under the pavement. Then, when it became necessary to renew the rails because of wear, only the upper section would have to be replaced. This would be particularly advantageous in special work at curves and intersections, for the reason that they wear so much more rapidly than rail on straight track. The amount of material used in the replacements would then be reduced to a minimum. The depth of the upper section, 4⅝ ins., would still be sufficient to use the hard steel centers or the solid manganese pieces, as might be desired. All of these pieces, for special work, should have a section of a standard design, so that no matter what manufacturer they might be obtained from the one would fit with the other, using the same kind of fish plates or splice bars. This kind of track would, of course, cost from 25 to 50 per cent more; but I believe that, in the course of ten to fifteen years' wear and repair, the benefits to be derived would greatly repay this difference.

With regard to the truck parts which might be standardized, I hope you will agree with the suggestion that, as far as possible, the M. C. B. standards be adapted to all those parts of the truck not influenced by the electric equipment. We cannot, of course, adopt the M. C. B. wheel, and so I think the one selected by the Central Electric Railway Association to be the wheel which is about correct, being not too large for city work, and yet plenty large enough for interurban work. That association has also adopted the M. C. B. journals, making some of them smaller, of course, than those actually used by the Master Car Builders, but yet of the same design. It has also adopted a brake-shoe very similar to the M. C. B. design, and until I learn the reason for not adopting the regular M. C. B. design I think the latter should be adopted; but, of course, the M. C. B. design would have to be modified to suit the smaller wheel, and if this is the only difference, the shoe adopted will, of course, be all right. The axles which the association has adopted seem to be for heavier work than that to which we are accustomed in ordinary street railway work; however, it might pay to adopt these heavier axles, even for light street car work, for there is no doubt that some breakage would be saved by so doing. I find very little reason for adopting the standard journal box, except in order that it may contain the standard journal, as the journal box itself wears very little, and is, therefore, not subject to frequent replacement.

When it comes to standardizing certain parts of the electrical equipment of cars, some difficulty may be encountered, for the reason that the two or three large manufacturers of railway equipment may want to maintain their individuality in certain details. However, as it is only the wearing parts which I propose to standardize, and such parts as are now so nearly alike, I do not see that this difficulty should be considered insurmountable. My desire for standardizing these parts is not so much that we may all use the same thing, as it is to make these wearing parts interchangeable between motors of different design but of about the same size. To this end I would suggest that those wearing parts be designed for three different sized motors, of 50, 75 and 100-hp sizes, respectively. Motors ranging in horse-power under 50 would then be designed to use those wearing parts which would be just large enough for a 50-hp motor. Those motors rated between 50 and 75 hp would use wearing parts just large enough for 75-hp motors, but which, I think, would not be too large for anything between 60 and 75. I make the 50-hp class the smallest, for the reason that no modern street railway motors are now built of less than 35 hp, and I take it that the gears, pinions and bearings of a 50-hp motor would not be objectionably large for a 35-hp motor. Gears and pinions, beside being classed into 50, 75 and 100-hp sizes, would have to be also classed according to gear ratio desired.

Axle and armature bearings, however, could be simply classed into 50, 75 and 100-hp sizes, the motor frames being bored out for these respective sizes, and then if it might be desired to use a 50-hp motor in a two-motor equipment on a truck having a smaller axle, the only difference would be in the cast-iron shell of the babbitt-lined bearing, and the change could be readily made. Standardization of motor parts might be carried even further to commutators and brushes, which, however, would require the same number of coils in the armature. Commutators of the General Electric and of the Westinghouse motors, of relatively the same size, are now so nearly alike that I see no reason why the armature shafts might not be turned to a standard size and the commutators likewise made of a standard size, so that one would be interchangeable with the other, and the same might apply to brushes, bearing in mind all the time that they are to be classed into the above-mentioned sizes, or something similar. On our small road we have three kinds of motors, all of approximately the same size, viz., G. E. 800, G. E. 1000 and Westinghouse 92-A, and anyone can readily see what a saving in supplies to be carried on hand and in the flexibility of repairs would be brought about were it possible to use the same gears, pinions, bearings, commutators and brushes on any of these motors. And if we would go this far, why might we not go the entire length of the rope and draw up complete specifications for motors of 40, 50, 60, 75 and 100-hp sizes, so that armature coils, field coils, and, in fact, all parts, would be interchangeable? Surely the several master mechanics and electricians who have had many years of experience with the use of motors could get together and sift down their several opinions so that a motor design satisfactory to all would be obtained. Controllers should also be so constructed that the contact fingers, especially that part of the finger which wears the most rapidly, could be standardized so that they also would be interchangeable with any other controller of similar size. Trolley bases should be standardized with regard to pins, and the socket into which the pole is to fit, so that bases and poles would be interchangeable. If the sockets are standardized, of course the poles would naturally become so. Trolley harps and wheels should also be standardized, so that they might be interchangeable.

As before stated, my reason for desiring that these various wearing parts be standardized is to facilitate repairs and the expenses thereof, on any one road or system where it seems we cannot get away from several different designs of motors, and not so much simply for the sake of using the same size or style parts that other roads do. However, I readily recognize that this state of affairs can never be brought about until such associations as our own, and others of like nature in the United States, get together, establish the standard dimensions necessary and demand of the several manufacturers that they be produced. Of course, I understand that the manufacturers will object, as they may not then be in such a good position to continue supplying repair parts; however, I believe that if this matter is handled properly enough pressure can be brought to bear upon the manufacturers to produce the motors and parts as we want them. I am a little disappointed that the largest organization of the kind, the American Street and Interurban Railway Association, has not already taken hold of this subject more vigorously than it appears to have done, for I believe that the best results are to be obtained through action by the largest organization. However, if the minor organizations, such as our own, the New York State Association, the Central States Association and others, take hold of the subject themselves, or urge upon the large association to take hold of it, the agitation of the subject and the work that may be put upon it can hardly fail to bear fruit, and we may ere long have the electric railway standards which will no doubt be commonly known as the E. R. standards.

ELECTRIC RAILWAY DEVELOPMENT IN EASTERN CANADA

BY PATRICK DUBEE
Secretary Montreal Street Railway Company

The question of the introduction of cars propelled by electricity in Eastern Canada was taken up in the principal cities almost simultaneously with the various systems in the United States. The introduction of the system, however, was regarded as exceedingly doubtful, owing to the general belief that the climatic conditions were such as would prevent the successful operation of the system in the winter months. The writer remembers that when the Montreal Street Railway Company accepted the franchise to operate in the city of Montreal the majority of the shareholders sold out their holdings in the company and predicted that within a few years at the most the company would be bankrupt. In fact, were it not for the strong financial backing of such men as the Hon. L. J. Forget, Jas. Ross, R. B. Angus and others, it is questionable whether the same would have been carried through successfully. This incident is given in order that the members may more fully appreciate the marked difference in the climatic conditions existing between the different cities in the Dominion.

The first city in Eastern Canada to adopt the electric system was Ottawa, the first car being in operation on June 24, 1891. In the fall of the following year electric cars were in operation in Montreal; in September, 1892, in St. John, N. B.; in 1896 in Halifax, and in 1897 in Quebec, and since then in Cornwall, Levis, Sherbrooke, Yarmouth, etc.

The progress of the electric system in Eastern Canada, when the difficulties and the large expense to be met in operating in the winter months is considered, has been very satisfactory, as can be seen by the following statement:

	1892	1906
Miles of single track	92	351
Passengers carried	28,392,450	103,232,140
Gross earnings	$860,000.00	$5,578,494.00
Capital invested	$4,000,000.00	$22,782,133.00

In considering these figures, it is important to bear in mind that there are practically no suburban lines in Eastern Canada, and that there are only four cities of a population of over the 50,000 mark, and twelve cities in which electric cars are in service.

The success of the electric railway system is due to the fact that the different companies succeeded in keeping in operation and maintaining a good service during the winter months, although the climatic conditions are so adverse to it. During the first two winters it was doubted whether success would crown their efforts. The snow-fighting equipments in the early days were not as competent to do their work as to-day, but now the improved sweeper with its standard equipments, the snow-plow and salt cars, together with the heavier cars in use, materially assist in making the work easier for the men, and it is seldom that the service is affected, no matter how serious the storm. To give the members an idea of the volume of snow which falls during the course of a year, it is only necessary to

mention that statistics kept at McGill University show that the average yearly snowfall for the last fifteen years was 117 ins. It will also be of interest to know that the average cost of operation in winter for the last ten years on the Montreal Street Railway system has been about 70 per cent against about 52 per cent during the summer for the same period. Other factors which have assisted in making the electric system so successful have been the great improvements made in the roadbed and track construction, rolling stock and supply of electric current, as may be readily seen in the following brief resume:

The present rail is 87 lbs. per yard, T section, and laid in paved streets with tie rods and steel ties, the groove for the flange of the wheels being cut out of the blocks, making less noise in operation than the grooved rail and a better surface. The rail is well surfaced with concrete stringers. The 87-lb. T-rail in macadam is laid on well-spaced wooden ties, and with the tie rods every 6 ft., and well surfaced and packed with good, clean macadam. On hills and in some locations 96-lb. girder rail is used, but T-rail is used wherever practicable. Intersection work is now made of the best manganese steel, and switches, crosses, and diamonds are now all of one piece, instead of built-up work, or insert pieces, as formerly.

A few comparisons showing changes in cars during the last ten years are interesting:

	1897	1907
Length of body	21	35 ft.
Length over all	30	50 ft.
Motor equipment	60	180 h.p.
Seating capacity	28	50
Weight empty	16,000	50,000 lbs.
Weight per passenger	570	1,000 lbs.
Cost	$2,500.00	$6,000.00

It will be noticed that, first, the deadweight of car per passenger seat has almost doubled. This would indicate a very large increase in the amount of power consumed and in the wear and tear of equipment and roadbed per passenger. To offset these items, there has been a decrease in the amount of platform labor required. The latter influence seems to have overshadowed all others in later developments on account of the great increase in the cost of labor during the last decade. There is no doubt that low cost of power and maintenance have been more or less sacrificed to permanency of construction and limitation of pay-rolls. It is also evident that although there has been a very great advance in the standards of comfort, durability, elegance and continuity of service, there has not been a very great increase in the cost of cars per seated passenger.

ELECTRIC RAILWAY DEVELOPMENT IN ONTARIO

BY R. J. CLARK
Assistant to the Comptroller, Toronto Railway

It is customary to hear the layman state that electricity is yet in its infancy. If this is the case, it must be added that the child is precocious and rapidly maturing. Moreover, no part of the child's anatomy shows a hardier muscle, combined with greater vigor and endeavor, than the limb of electric traction. In this country of ours the progress of electric traction has been very marked, and the future holds out vast possibilities to our view—possibilities which will soon, no doubt, become probabilities and later on accomplished facts.

Before passing on to any historical details of the pioneer lines of Ontario and other matters which may be of interest, it will not be amiss to give some figures showing the general growth of railways in the Dominion. In 1895 there were twenty-one electric railway companies, with a capital of $13,035,263, operating 354½ miles of track, carrying 55,348,612 passengers. In 1898 there were thirty-five companies, with a capital of $28,763,328, operating 635 miles of track, carrying 94,616,344 passengers. In 1901 there were forty-three companies, with a capital of $38,637,495, operating 672 miles of track, with gross earnings of $5,422,539. In 1905 there were forty-six companies, with a capital of over $50,000,000, operating 793 miles of track, with gross earnings of $9,357,126, and net earnings of $3,438,931.

To show, moreover, that the ever rapid increase shown above gives every sign of being continued, the following figures are given:

Year.	Total Train Mileage.	Passengers Carried.	Freight Carried.	Earnings.	
				Gross.	Net.
1901	31,750,754	120,934,656	287,926	$5,768,283	$2,333,120
1902	35,833,841	137,681,402	266,182	6,486,438	$2,683,583
1903	38,023,529	155,662,812	371,286	7,233,677	2,760,819
1904	42,066,124	181,689,998	400,161	8,453,609	3,127,092
1905	45,959,101	203,467,317	510,350	9,357,126	3,438,931

Such has been the growth of electric railways in Canada, indicating a remarkable extension of systems, successful and efficient operation, and remunerative business, without disappointments in the way of setbacks.

EARNINGS AND OPERATING EXPENSES

	1895.		1898.	
	Gross.	Op. Exp.	Gross.	Op. Exp.
Halifax				
Ottawa			$231,802	$159,159
Montreal	$1,110,000	$650,000	1,450,000	760,000
Toronto	976,031		1,210,618	578,857
London, 1896	94,194	54,171	113,812	65,665
N. S. & T.				
Winnipeg				
Vancouver			187,274	

	1901.		1906.	
	Gross.	Op. Exp.	Gross.	Op. Exp.
Halifax	$251,644	$142,412	$387,518	$215,709
Ottawa	313,172	235,128	525,747	345,062
Montreal	1,900,680	1,105,267	3,100,487	1,850,720
Toronto	1,661,017	857,612	3,109,740	1,646,515
London, 1896	141,846	84,557	202,912	159,428
N. S. & T.	172,840	126,973	265,071	174,051
Winnipeg	831,737	427,754	1,416,305	701,964
Vancouver	413,923	Not stated.	698,305	Not stated.

PASSENGERS CARRIED

	1895.	1898.	1901.	1906.
Halifax			3,037,268	3,783,801
Ottawa		5,133,938	7,188,781	11,408,422
Montreal	26,900,000	35,000,000	46,741,660	76,356,099
Toronto	23,353,228	28,710,388	39,848,087	76,958,488
Hamilton			4,810,237	8,018,350
London, 1896	2,432,416	2,841,568	3,744,469	5,502,555
N. S. & T.			1,368,252	2,167,102
Winnipeg			9,504,051	17,229,554
Vancouver			7,670,468	12,395,582

The figures for Hamilton include Hamilton Street Railway, Hamilton Radial Railway, Hamilton & Dundas Railway. The passengers carried are exclusive of transfers. The figures given for Halifax cover income from all sources.

Manifestly, it would prove an arduous task to cover the history of all the electric railways in the Dominion, consequently the committee deemed it advisable to limit this paper to a brief history of the growth of electric railways in Ontario. The people of Ontario are indebted to the late Charles Vandepoele for the installation of the first electric line in Canada, which was also the second on the American Continent. Mr. Vandepoele was a Belgian by birth, and came to America in 1869. In 1883, in the United States, he had equipped a small track, 400 ft. long with a single car running thereon, operated by a 3-hp motor. Later in the year he constructed an overhead line for the Chicago State Fair, which remained in operation for six or seven weeks. It was in Toronto in 1884 that Mr. Vandepoele operated the first electric railway in the Dominion. Toronto had at that time a population of 100,000. In July of that year he installed the exhibition line from the foot of Strachan Avenue along the G. T. R. tracks to the eastern entrance of the Industrial Exhibition—a distance of 3000 ft. There appears to have been a single motor car with three trailers. The car was equipped with a 30-hp motor, and 200 people altogether could be carried at a time.

In 1885 Mr. Vandepoele used an overhead trolley and during the last five days of that year's fair 50,000 people were carried to and fro.

The second electric railway was the Windsor Electric Railway, where the underground conduit was used. This line was laid down in 1886 also by Mr. Vandepoele. The first attempt on this railway to operate by electricity was not successful, and electricity was finally abandoned and horses once more drew the cars. In 1891 the Sandwich, Windsor & Amherstburg Railway was electrified between Windsor and Sandwich, and in 1893 the line between Windsor and Walkerville was purchased.

In 1887 Mr. Vandepoele was able to make the proud boast that "as the matter now stands, we have more miles of electric railway in successful operation than all the electrical railways in the world combined." It only required six roads and 14¾ miles of track to verify this boast.

The third electric railway in the Dominion (also a Vandepoele) was the old Port Dalhousie, St. Catharines & Thorold Electric Street Railway, originally a horse car line, which was converted to an electric line in 1887, the first car running on October 6 of that year. In January, 1893, the Niagara Falls Park & River Railway was commenced, and was opened May 24, 1893. In that week as many as 17,500 passengers were carried in a single day. In 1891 the Ottawa Electric Street Railway system was inaugurated with a capital of $1,000,000, and between 1891 and 1894 22 miles of single track were laid down by Ahearn & Soper. In 1893, 2,700,000 passengers were carried, and the number of cars in operation was sixty-five. It was the first line to demonstrate the practicability of giving an uninterrupted service throughout the winter season. A clause had been inserted in the contract with the city, providing for the use of sleighs in the event of its being impossible to run electric cars. Happily the occasion for using them never came, and in 1893 the road amalgamated with the Ottawa City Passenger Railway Company, which had been operating horse cars since 1870, and electricity was adopted throughout the whole system. To-day the company may be congratulated on having a higher percentage of net earnings than any other in Canada.

The Toronto Railway Company was incorporated by special act of the Ontario Legislature on April 14, 1892, after the expiration of the original charter for the street railway system granted in 1861. In 1891 the city did not renew the franchise, but bought the property of the retiring company for $1,500,000; the plant and franchise were then sold to the highest bidder, and were purchased at the appraisement of arbitrators, the city making certain reservations which have ever since proved bones of contention. The group of pioneers who in 1892 incorporated the present system comprised Wm. Mackenzie, H. A. Everett, Jas. Ross and others, who have since become famous. The syndicate undertook to convert the existing horse lines into electric lines as rapidly as possible and to pay the city $800 per mile of single track per annum and the following percentage on gross profits:

From 1 to 1,000,000	8%
From 1,000,000 to 1,500,000	10%
From 1,500,000 to 2,000,000	12%
From 2,000,000 to 3,000,000	15%
From 3,000,000 upwards	20%

This agreement, while the envy of less fortunate municipalities, has ever been the subject of much litigation, but that the city was not always in the right is now shown by the recent decision of the Privy Council, which fully substantiated the company's interpretation of the agreement on many points at issue.

CAMBRIDGE SUBWAY PLANS PRESENTED

The Boston Elevated Railway Company has presented its plans of the proposed Cambridge subway to Mayor Wardwell, of Cambridge, Mass. The plans provide for two stations, one being at Harvard Square and the other at Central Square. At Harvard Square the station will be under Massachusetts Avenue, extending from Dunster Street to Linden Street, with exits and entrances at either end. The station will be 500 ft. long. Surface cars from Arlington Heights, North Cambridge and Huron Avenue will enter the subway via an incline east of Garden Street, and cars from Newton, Mt. Auburn, Waverley and Belmont will enter at a point west of Brattle Square. The station for all these lines will be under Harvard Row.

Transfer between this station and the subway trains will be made by a sub-subway passage. To transfer from the outward bound subway cars to the sub-surface cars at Harvard Square the outbound subway tracks will be at a higher grade than the inbound tracks, and a staggered platform will connect the subway station on the east side with the station for the sub-surface cars. It is probable that the present Arlington Heights surface cars will be run to Newton and back via Harvard Square, transferring of passengers to and from Boston being made at the latter point.

The subway station at Central Square will probably be located between Essex and Pearl Streets, with exits and entrances in the middle. This station is also planned 500 ft. long with double-track subway lines, but at this point the surface cars will not be carried below the street level. Transfer checks will be given at this station.

In reference to the report of W. B. Parsons, of New York, on the number and location of stations desirable, the company points out that the recommended location at Sixth Street would not accommodate the manufacturing district, which is near Kendall Square. The latter point is very near Boston, and most of the passengers are as well served by surface cars as they would be by a subway station. Most of the passengers in this neighborhood travel to Boudoin Square or South Boston, and not to Park Street.

NOTES FROM BUENOS-AIRES

The most recent order for street railway equipments placed in Buenos-Aires is that of the Tramways Electricos del Sud, which last week closed with the St. Louis Car Company for forty-two new cars for the new line from Buenos-Aires to Adrogué, which will be inaugurated next November. These cars will be equipped with two G. E. 87 motors of 60 hp each.

The La Capital Company has recently installed on a number of cars a protective device invented by J. K. Forrest, of that company. This is a sort of fender for use between the motor car and the trailer, and is intended to prevent the possibility of passengers alighting from the former being struck by the latter, which it does most effectually. Its great advantages over those now in use are that it does not project beyond the line of the cars themselves, as do the present ones.

The German Transatlantic Electricity Company, which supplies the entire street railway current of the city, is putting Jones underfeed stokers under all the boilers in its Boca station, as a result of the excellent showing made by the initial installation at their three-phase station, where the economy shown was something like 35 per cent over hand firing, using the best Cardiff steam coal. This company is preparing to build a 120,000-hp turbine-operated power station, which will be located in the Darsena Sud.

An order has just been closed by the St. Louis Car Company, through its representative, Ralph Morrison, for sixty large passenger coaches for the Chilian State Railways. The order represents a value of some $900,000 gold. Mr. Morrison is also understood to have secured the order for nine coaches for Peru.

The Gandulfo franchises for the construction and operation of a double-track electric railway along the Port Works have been turned over to the Port & City Electric Railway Company, who will carry out the work. This is a system of about 7 miles of single track.

During April, 1907, the number of passengers carried by the tramway companies of Buenos-Aires was 18,156,210.

INTERURBAN ELECTRIC WORK AROUND LOS ANGELES

The new power station being built by the Los Angeles-Pacific Railway Company at Ivy, a short distance from this city, is now almost completed. The building is 100 ft. long by 80 ft. wide, stands just west of the present power plant and will house four sets of machinery, furnishing 3300 kw, as against 300 kw which are now produced. The equipment of Vineyard station and the Sunset Avenue and Sherman plants are being increased. All of the new standard gage cars are equipped with 5-hp motors. The new car house at Sherman is now completed, and contains trackage for one hundred cars. The building is of brick, with many modern improvements. Other immediate plans for this station include a carpenter shop, 100 ft. by 140 ft. The third rail is now being laid on the Sherman and Sawtelle line from the shops to the brickyard spur at Twenty-Sixth Street in Santa Monica, so that the new standard gage cars may be hauled there for alterations that must be made.

One of the projects recently conceived by the engineering department of the road is a scenic line extending from the Laurel Canyon route west through Hacienda Heights along the border of Sherman Heights, through Beverly Hills and connecting with the Brentwood line, which runs to Santa Monica and the sea. Surveys have already been made for this line, which will afford passengers an unsurpassed view of mountains, sea and fertile valleys. It is this route that report connects with the Malibu line now being built on the Rindge estate in the Santa Monica mountains.

The Los Angeles-Pacific Company is conceded by railroad contractors and others who have studied the question to have solved the problem of keeping day laborers contented as well as it is possible to do. Houses are provided for all the Mexicans employed in track-laying and other hard labor, and little difficulty is experienced in keeping steady service. The improvements already begun by the road will take several years, and it is the purpose of the company to keep the same force if possible. More than 700 Mexicans are now working and many more will be employed in the next four months. Three camps of one-story frame houses have been built for these men. One is located at Ivy Park station, and is called Campa Lawton; another is at Ocean Park near the Sunset Avenue car houses, and the third is at Sherman. The Mexicans are paid $1.50 per day, and are given house room, electric light and water by the company. Commissaries are maintained at each camp and supplies sold at current prices. Much of the cooking is done out of doors after the Mexican fashion, a stove of brick and sheet iron being used.

The company has petitioned the Board of Supervisors to advertise for sale a franchise for an electric railroad to extend from Santa Monica Avenue on Western Avenue to Prospect Avenue. This is for a new connection between the Colegrove branch and the Hollywood branch of the company's system. The proposed franchise contains the freight-carrying clause. The board ordered the franchise offered for sale.

FRANCHISE TAXES IN LOS ANGELES

Los Angeles is just beginning to reap the benefit of the franchise law. The Los Angeles Interurban Railway Company has been notified that the 2 per cent assessment on the gross income of its Jefferson Street extension is now delinquent. Under the Broughten law this assessment must be paid forthwith or the franchise is forfeited to the city. A similar notice has been served on J. W. Eddy, holder of the franchise for the Angel's Flight Railway franchise. These franchises are the first on which companies are required to pay to the city 2 per cent of the gross receipts. The city's revenue from franchises this year will be but a few thousand dollars, but the amount will increase rapidly as the years roll by. At the end of five years the city will receive 2 per cent of the gross receipts from the operation of fifty-six franchises. At the expiration of ten years it is estimated that the 2 per cent on the gross franchise earnings will net the city $250,000 a year.

"By Trolley and Boat Between Boston and New York" is the title of a special four-page folder issued by the Old Colony Street Railway Company, of Boston. The trip can be made for $1.75, and is by trolley from Boston to Fall River and thence to New York by boat. The cars of the Old Colony Street Railway Company start from Post Office Square, Boston, daily at 2:30 p. m., except Sundays. The boats of the Enterprise Transportation Company leave the pier at Fall River at 6:30 p. m. The boats leave Pier 10, East River, New York, at the foot of Wall Street, at 5 p. m. every day but Sunday. The trolley car leaves Fall River in the morning on the arrival of the boat.

MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS AT NIAGARA FALLS, JUNE 25-28

The following three abstracts of papers read at the Niagara Falls meeting of the American Institute of Electrical Engineers are in addition to the papers and abstracts published in last week's STREET RAILWAY JOURNAL. This issue also includes a condensed report of the discussion on high-tension transmission, lightning protection, insulators, etc., as well as on the railway papers relating to interpole motors and choice of frequency published last week.

ONE-PHASE, HIGH-TENSION POWER TRANSMISSION

E. J. Young presented a paper discussing the advantageous features of a high-tension one-phase system, and compared it with equivalent three-phase and direct-current systems. In the one-phase system assumed one-phase generating apparatus is used for supplying energy to step-up transformers. The center of the high-tension winding is permanently grounded, thereby reducing the e. m. f. from line to ground to one-half that between the line wires. With this connection the one-phase transmission system is on a par with the three-phase system in the matter of economy of conducting material. In comparing the different systems a case was assumed in which 15,000 kw was to be transmitted 100 miles with 10 per cent loss, the e. m. f. to be 70,700 volts maximum between line and ground at the receiving end. For three-phase equipment the weight of the copper per mile of line would be 6875 lbs.; the weight for one-phase would be the same, the effective value of the e. m. f. in each case being 50,000 volts. The direct-current system under the same conditions as the alternating current could use an e. m. f. of 70,700 volts, so that the weight of copper per mile of line would be 2792 lbs. It is seen, therefore, that as far as transmission material is concerned, the direct-current system is far more economical than either the three-phase or the one-phase system. In comparison with the three-phase system the one-phase requires fewer insulators and less expense in stringing the wires. Moreover, by taking advantage of the ground as a return circuit, the single-phase system can be operated in emergencies under conditions which would render the three-phase inoperative. Thus the necessity of a duplicate line is less with one-phase than with three-phase. The ability to operate with a grounded circuit can more readily be availed of with the one-phase system than with the direct-current system. The author stated that where very long lines are contemplated, such as the 250-mile line in France, the one-phase system is not only the simplest, but it unites the maximum reliability of service with the minimum number of transmission wires.

PROTECTION OF TRANSFORMERS

Two introductions to the discussion of choke coils versus extra insulation of the end windings of aransformers were presented by S. M. Kintner and W. S. Moody, the former presenting the advantages of the choke coil and the latter the advantages of extra insulation. Mr. Kintner stated that separate choke coils possess the following advantageous features: First, on a choke coil there is normally no voltage between turns, and consequently no tendency to hold a short circuit in the event of a momentary surface discharge. Second, the choke coil permits the construction of a transformer with uniform insulation throughout. Third, the choke coil allows the safe use of a cheaper transformer. Fourth, the choke coil can be insulated much more strongly than can a transformer. The recognized disadvantages are an increase in the number of pieces of apparatus and an increase in complication of separate wiring when externl choke coils are used. Each of the advantages and disadvantages was discussed in detail. For some installations it is possible to use choke coils mounted out in the air and thereby made a part of the station wiring, but in general an oil-insulated coil is to be preferred. It has been customary to use oil-insulated choke coils, each mounted in its own tank, but there seems to be no good reason why the coils cannot be placed inside the transformer tank and thus save considerable floor space, as well as outside wiring. Mr. Kintner expressed the opinion that for a given expenditure to provide protection against surges better results can be obtained by the use of choke coils than by extra insulation on the transformer.

Mr. Moody stated that although choke coils are quite effective in protecting transformers, their use is attended with some objections. If the reactance is such as to be effective against moderately high frequency oscillations it must, since it is connected between the lightning arrester and the transformer, offer a very high impedance to the high frequency of the oscillatory currents which will usually be set up within the transformer itself when a bound charge within it is released by a stroke of lightning relieving some overhanging cloud. Under such conditions it is almost as bad to hold back a charge in the transformer as to keep it from entering under other conditions. Experience during the last four years shows that very little preventive reactance is necessary for protecting the windings of a transformer whose outer turns are heavily insulated. It is practicable to reinforce a considerable portion of the turns of a large transformer coil so that it will withstand from 2000 to 20,000 volts per turn, without greatly decreasing the space factor of the winding or causing any considerable increase in cost. In thus providing protection for a transformer one should aim to use, not a given insulation strength per turn in the reinforced portion of the winding, but a certain strength per foot. In large transformers wound for 75,000 volts or less, it is practicable to resist a high frequency wave whose magnitude is equal to the working voltage in some hundred feet or less.

Few transformers for transmission work are built at the present time with taps to admit of operation with different ratios of transformation. Frequently such taps cover a range from 10 to 30 per cent of the winding, and if they are located so as to cut out the end portions of the turns one must reinforce the insulation well inside the inside tap, or perhaps some 40 per cent of the total winding. It has been the practice of the General Electric Company for some years so to locate tap connections that they will cut out centrally located turns instead of end turns, thereby not only placing them in an essentially safer position, but also avoiding the necessity of any more reinforcement than is required when all of the winding is in service. Mr. Moody stated that transformers having a total rating of about 750,000 kw, embodying the above-mentioned construction, have been built in sizes ranging from 300 to 7500 kw and wound for voltages from 5000 to 80,000, in both the air-blast and the oil-immersed types. Most of these have been installed with a small protective reactance, but many without such protection, and not one of these transformers has yet failed from any weakness of the internal insulation, although a considerable portion of the transformers has been installed for three years.

PROTECTION OF TRANSMISSION LINES

A paper by Norman Rowe described certain experiences with lightning rods and grounded cables as a means for protecting transmission lines against lightning. The paper gave a summary of lightning trouble during the years 1904, 1905 and 1906 on a steel-tower, long-span transmission line in the States of Michaocan and Guanajuato, Mexico. The transmission line towers are of standard type, the height being 40 ft. from the top of the cross-arm to the ground. When the wires were first installed they were placed upon the towers at the vertices of an equilateral triangle, the upper wires being supported upon a 3-in. extra heavy pipe, which forms the continuation of the tower, the other two being placed at the ends of a double-channel iron cross-arm approximately 7 ft. in length, the sides of the triangle being 6 ft. Throughout the rainy season of 1904 the only protection against any high voltage due to lightning discharges was afforded by the line insulators. During 1905, however, lightning rods were placed in pairs on the pole tops.. During 1906 the transmission wire was removed from the top of the tower and for it was substituted a steel cable grounded at each tower over the entire line. The transmission line was placed on a special bracket located at a proper distance below the other two transmission lines. During the season of 1904 there was considerable trouble with lightning; during the next season there was less, and during the season of 1906 comparatively little trouble was experienced. On the strength of the experience during the three seasons, Mr. Rowe offered the following suggestions: First, insulators should not be disposed upon poles or towers so that they will be in the path of bolts of lightning going to ground by way of the supporting structure. Second, a grounded cable, strung above the transmission wires at the highest point of the tower, is certainly more effective than lightning rods in protecting the insulators and conductors from direct bolts of lightning. Third, lightning arresters for discharging the line in case very high voltages are present on the wires would be of some value if located along the line at frequent intervals. Fourth, on steel construction the insulator should have a margin of safety against puncture and arcing over.

Following are abstracts of the discussion of some papers read Wednesday, Thursday and Friday, June 26, 27 and 28:

TRANSFORMERS

This discussion was opened by A. H. Pikler, who expressed the opinion that neither the extra insulation of the end turns of a transformer nor the use of choke coils can be considered as a perfect preventive of troubles from lightning, when used alone. It is far preferable to provide a moderate amount of extra insulation for the end turns and to use a small amount of external inductance. K. C. Randall stated that it is extremely desirable in any event to use a certain amount of external inductance.

D. B. Rushmore discussed in detail the disastrous effect of an arcing ground in producing high potential strains in a transformer. Under some conditions a choke coil is undoubtedly desirable, but there are cases where it in itself may cause excessive voltage rises. P. M. Lincoln agreed with the conclusions of Mr. Kintner as to the value of an external choke coil, because, although there is an active voltage between each turn of a transformer, and a short circuit between such turns may produce an enormous current, an exactly equal short circuit in a choke coil due to any excessive voltage across such coil can produce no result worse than eliminating the coil from the circuit.

W. M. Smith called attention to the increased expense of repairing any defects in a transformer which depends upon the extra insulation of the end turns for protection in comparison with the expense connected with replacing a damaged choke coil. The time has arrived when choke coils should be standardized. Each coil should be placed where no flash can reach it, and where it can cause no damage in itself. C. W. Stone stated that choke coils have not been found advantageous for use with cables on account of their inability to protect a cable from internal disturbance. Prof. E. E. F. Creighton explained, on the basis of resonance, the phenomenon sometimes observed of a higher voltage being produced at the transformer terminals inside of the choke coil and at the outside of the choke coils nearer the transmission line. He stated that cases have been known where inner turns of a transformer have been damaged without injuring the insulation of the end turns, even when the inner turns were equally as well protected as the outer turns. William McClellan expressed the opinion that it will be necessary to continue the use of choke coils in connection with transformers until there has been produced an arrester having the essential characteristics of a safety valve. Such a transformer is promised in the new electrolytic type.

Prof. Morgan Brooks reported the results of a series of observations which showed that excessive voltages may be produced in the secondary of a transformer by closing the primary circuit at certain points of the e. m. f. wave. W. S. Lee expressed his preference for the installation of both choke coils and extra insulation of the end turns in connection with lightning arresters. Experience has shown that the weakest point of the high potential transformer is in the terminals, rather than in either the end turns or in the choke coils. Ray P. Jackson stated that the effectiveness of a choke coil depends almost exclusively upon its inductance. The experience seems to indicate that the inductance should have a value of about 0.04 or 0.05 henries. If the end turns of a transformer are insulated and used for protection, the extra insulation should cover such a length of turn as to include this amount of inductance.

Dr. C. P. Steinmetz said that choke coils may be advantageously located within the transformer tank when oil insulation is used. They should, however, be so placed as to protect all of the apparatus within the station or substation. Thus, if a switch is located between the transformer and the external line a choke coil in the transformer case will not protect the switch. For most installations it is preferable to place the choke coil out of doors and depend upon air insulation. The transformer itself should also be protected by means other than the choke coil itself. At a very high frequency, such as 30,000 cycles per second, there may be an enormous rise of e. m. f. inside of a choke coil due to resonance. It is desirable in most cases to use only that amount of inductance which is absolutely essential to the operation of the lightning arrester equipment. R. D. Mershon called attention to the fact that even in case a transformer is wound for two voltages, one having half the value of the other, it is not necessary to use an extra amount of insulation for the end turns, because the turns which are given extra insulation may be designed for the largest current which the transformer will carry and may be used to carry such current both when the coils are connected in series and in parallel. In any event, however, the best results will be obtained when a choke coil is used and such choke coil should be of the air-insulated type and placed out of doors.

TRANSMISSION LINES

D. R. Scholes presented a paper on "Transmission Line Towers and Economical Span," which was followed by a paper by Norman Rowe on "Lightning Rods and Grounded Cables as a Means of Protecting Transmission Lines Against Lightning." These papers were discussed by Messrs. Hoopes, Fleming, Neall, Mershon, Thomas, Lee, Paine and Ricker. Mr. Mershon stated that the Niagara, Lockport & Ontario Power Company is now employing horn arresters, which are so arranged as to act both as arresters and as lightning rods; that is to say, the side of the horn arrester which is connected to the ground is extended upward above the transmission line so as to act in the capacity of a lightning rod.

At the session of Wednesday evening William McClellan stated that the durability and effectiveness of a transmission installation depends to a large extent upon the insulators. The insulator described by Mr. Hewlett seems to be almost ideal in this respect. Mr. Hewlett stated that each of the disks of the link insulator is capable of withstanding a voltage of about 65,000. It is rated at 25,000 volts, so that a large factor of safety is used. For 60,000-volt transmission work either two or three disks are placed in series.

THE ELECTRIC RAILWAY

The papers relating to electric railways gave rise to an interesting discussion. The titles of the papers are as follows: "Single-phase versus Three-phase Generators" and "Choice of Frequency for Single-phase Railways," by A. H. Armstrong; "Twenty-five versus Fifteen Cycles for Heavy Railways," by N. W. Storer; "Commutating-Pole Direct-Current Railway Motors," by E. H. Anderson. The discussion was opened by Paul M. Lincoln, who said that in the electrification of steam railroads the electrical equipment used for propulsion will not be connected in any way with other electrical equipments, so that any discussion of the limitations of a certain equipment for combined duties is irrelevant. H. G. Stott showed that a three-phase star-connected generator can supply power to single-phase and three-phase loads by using the equivalent of a four-wire system for single-phase loads, and a three-wire system for the polyphase loads. Wm. McClellan showed that some simplicity is obtained by using a T-connection, because in this event the load need be divided into only two instead of three parts, and an inequality of the two parts does not seriously affect the operation of the system.

Prof. C. P. Steinmetz explained that an induction regulator cannot be employed for supplying a balanced load on a polyphase generator when the load on the system is single-phase. He showed that the effect of a single-phase load between two leads on a three-phase system tends to decrease the voltage between these two leads and between one of these leads and the third lead; the voltage between the other lead and the third lead is, however, affected very little. Any lamp load should be placed across between the latter two leads. E. J. Berg called attention to the fact that the speed limitations in low-frequency generator design have been overcome in the Stanley alternator, which is a special type of generator supplied with low-frequency alternating excitation.

Dr. Steinmetz showed that for each type of alternating-current apparatus there is a certain range of frequency at which it operates most advantageously. Small induction motors can be built more economically for 60 cycles than for 25 cycles, while the reverse is true of large motors. The proper frequency for rotary converters is about 25 cycles. The single-phase series motor operates more and more economically the lower the frequency. Such is not true, however, of the alternating-current railway motor invented by E. F. W. Alexanderson. This motor operates more economically at 25 cycles than at 15 cycles and the commutation is excellent. In this motor the improvement in commutation is due to the neutralization of the e. m. f. in the short-circuited coil, rather than to a lowering of the frequency for a given flux of the insertion of resistance to decrease the short-circuit current.

In reply to a question as to the extent to which high-voltage railway motors have been employed, Mr. Anderson stated that although no 1200-volt railway motors are yet in service, many orders have been received for such machines and the motors have been built and tested. Even at an e. m. f. of 1800 volts the commutation has been found to be entirely satisfactory. The danger of flashing has been eliminated by removing the prime cause therefor, namely, the collection of carbon dust on the commutator and neighboring insulated parts. A commutating-pole motor is subject to so little disintegration of the brushes that there is no accumulation of carbon dust.

ALTERNATING-CURRENT MOTORS

In the discussion of a paper by William Cooper on the "Regeneration of Power with Single-Phase Railway Motors," W. I. Slichter said that the method outlined by Mr. Cooper is exceptionally advantageous for heavy railway work. He showed that the amount of power returned during retardation can conveniently be varied by changing the excitation of the exciting motor. L. B. Stillwell stated that the most advantageous feature of regeneration is in the minimizing of wear and tear on the rolling stock. Even with three-phase motors, the regeneration is of considerable importance. Thus it is possible with such motors to maintain an average speed equal to that with series-wound motors and yet obtain a large saving in energy. For example, instead of climbing a hill at 20 miles per hour and descending at 40 miles per hour, it is preferable to travel at the mean speed of 30 miles per hour, requiring extra power for ascending and returning power in descending. In reply to a question by J. A. Lincoln, Mr. Cooper stated that when a railway motor is used both for propelling and for braking the wear on the gear is somewhat increased over that during simple motor operation, but the increase is not large and is of no importance.

ELECTRIC POWER TRANSMISSION

"One-Phase High-Tension Power Transmission" was the subject of a paper presented by E. J. Young. In its discussion, Dr. Steinmetz said that in the early days of low-tension transmission, when wooden poles and cross-arms were in use, the limiting factor in the increase in the voltage was the e. m. f. between wires; on the basis of such e. m. f. the three-phase system requires only three-fourths as much copper as the one-phase. Under modern conditions the limiting factor is the voltage between each line wire and the grounded insulator pin; on the basis of this e. m. f. the one-phase system is equally as economical as the three-phase. Much discussion has arisen as to whether the one-phase and the direct-current system should be compared on the basis of the maximum, the effective e. m. f. or some value between these two. In any event, it is not probable that the direct-current transmission system will be used in this country in preference to the three-phase system.

CORRESPONDENCE

METHODS OF REGULATING SUPERHEATERS

111 Broadway, New York, July 2, 1907.

Editors Street Railway Journal:

We notice on page 1050 of your issue of June 15 that you have an editorial on superheated steam, in which you divide all superheaters into two classes, "controllable" and "uncontrollable," and define the "control" as by means of hot water circulating through pipes, etc.

We desire to call your attention to the fact that there are other means of controlling superheaters besides this, and in one which we advocate a damper regulates the amount of heat given to the superheater. The damper is operated by thermostatic control.

Power Specialty Company,
E. H. Foster, Vice-President.

DROP SASH FOR VESTIBULE DOORS

New York, June 29, 1907.

Editors Street Railway Journal:

As an "ex"-locomotive engineman now running an electric train, I believe that it would be very advisable that cars should be built so that the sash in the side vestibule door next the motorman could be dropped or taken out. This would afford the motorman a convenient window to lean out of and see the rear of his train. The usual plan of placing the door in the half-open position is a very poor substitute for a cab window. It seems strange that passengers may raise or lower the side car windows and lean out, although, of course, at their risk, while the man at the head of the train should be boxed up in a closed vestibule. I hope the designers of cars for this service will notice this article and remedy this oversight on their part. The change would cost very little in a new car, and by making the door a little thicker a convenience would be afforded to the motorman which would be very much appreciated by him.

A Subscriber.

MEETING OF EMPIRE STATE GAS AND ELECTRIC ASSOCIATION

Following the annual meeting of the New York State Street Railway Association at Hotel Champlain, Lake Champlain, reported last week, a meeting was held at the same place on June 27 by the Empire State Gas and Electric Association, to consider the relationship of the traction and lighting interests to the new public utilities law. Delegates to the street railway convention were invited to stay over for the meeting, and many of them did so. In the absence of President Palmer, the meeting was called to order by T. R. Beal, who stated briefly the objects sought.

The first business was the reading, by H. H. Curran, of a paper or report on the publicity work of the association, showing how much had been done to secure the publication of facts and data in the newspapers, informing the public and helpful to public service corporations. Details were given as to the wide use of a number of special articles on facts connected with the industry. On the political side also good work had been done in combating misrepresentation as to the results of municipal ownership, alleged fires caused by electricity, etc. An average circulation of about 300,000 had been enjoyed by the articles issued by the bureau for the association. This work is estimated to cost about $10,000 a year, including the maintenance of the association secretary's office and staff. Arthur Williams, of the New York Edison Company, pointed out various ways in which the work might be extended.

J. N. Shannahan, ex-president of the New York Street Railway Association, gave, by request, a brief discussion of the scope and bearing of the public utilities law, in regard to which he felt that the companies in allied fields must work together, possibly through some joint organization that could handle the subject efficiently and present a common front for them to the people who legislate or who seek legislation at Albany. Where there is no concerted action, bad measures slip through.

Mr. Beal suggested that as the law treated them all in the same manner, it might be well to combine all interests in one federal association. Indeed, many of the companies were interested in three or four fields of public service.

Arthur Williams pointed out that among the national associations that was virtually accomplished not by amalgamating, but through "public policy" committees that worked together. That seemed to him a better way. Each industry had its own problems. At the recent meeting of the National Electric Light Association seventy papers were read on as many topics.

W. W. Freeman returned to the main topic of the new law, which many of them, he said, regarded as unduly harsh and drastic. He thought that the association ought to have a clearing house whereby a report could be had on the general operation of the law, enabling the body to suggest proper and necessary modifications. It would be helpful to keep a complete record of every transaction of the members with the commission as a basis for future effort.

A brief discussion then ensued as to the Massachusetts law and as to one or two features of the New York law.

James M. Wakeman then suggested the desirability of a State public utilities committee, an idea which was generally approved. He made a motion to the effect that the meeting refer to the executive committee of the association, for consideration and action, the appointment of such a committee composed of representatives from the association to collect information relative to the action of the public utilities commission in regard to applications made to it during the year; that the committee suggest to the executive committee of the Street Railway Association of New York State that it also should appoint such a committee; that these two committees shall meet jointly and make a report which shall be read by the secretary of each association at its annual meetings; that the committee consist of three members from each of the associations, the secretary of each being a member ex-officio, and that the secretaries obtain the information presented to the committee and make reports to the respective associations. This was unanimously adopted. There was a little further discussion, but no other action on the subject.

The next matter treated was that of uniform accounting. Prof. B. V. Swenson, secretary of the American Street and Interurban Railway Association, referred to the general adoption of a standard system by street railways, recognized also by State boards and by the United States Census Office.

The subject of gas accounting in its relation to the requirements of the law was also discussed, and the topic was also treated in a paper by C. H. Hart, who submitted a scheme and general outline for gas and electric companies. It was finally agreed to recommend to the executive committee the appointment of a committee of three accountants to work in conjunction with corresponding committees of the American Gas Light Association and the American

Street and Interurban Railway Association for the purpose of formulating a method of accounting to meet as nearly as possible the conditions found in the various lighting companies of the State.

R. A. Davidson then read a brief paper on "Fire and Liability Insurance for Gas and Electric Companies," suggesting methods by which the companies could secure lower rates than are now accorded them. There was a brief discussion on mutual insurance, and such practice in Cleveland as to street railways and in New York as to lighting plants was cited by different members. The meeting then adjourned.

ESTABLISHMENT OF THROUGH ELECTRIC SERVICE ON THE NEW YORK CENTRAL

On July 1 the New York Central & Hudson River Railroad took off its last steam trains, ten in number, which were running into its Forty-Second Street terminal, and substituted electric locomotives for them, thus completing the electrification of the system to High Bridge on the Central Division and Wakefield on the Harlem Division. The New Haven trains are still being run into the Grand Central Station by steam.

PROPOSED ELECTRIFICATION IN VICTORIA

Thomas Tait, of Australia, chairman of the Victorian Railway Commission, has been making an extensive tour in Europe, where he has visited the important railways which have been changed from steam to electric power, and is now returning to Melbourne by way of the United States. Upon reaching Melbourne he expects to make a report on the technical studies undertaken by him, as the electrification of the Victorian suburban steam railways and of the cable system in Melbourne is under consideration by the Railway Commission. The commission has also engaged Charles H. Merz, the well-known engineer, of London, to visit Victoria and make an exhaustive report on the proposed electrification.

The following statistics relate to the suburban mileage of the Victorian railways, whose conversion to electric power is now being considered by the commission. They are for the year ended June 30, 1906:

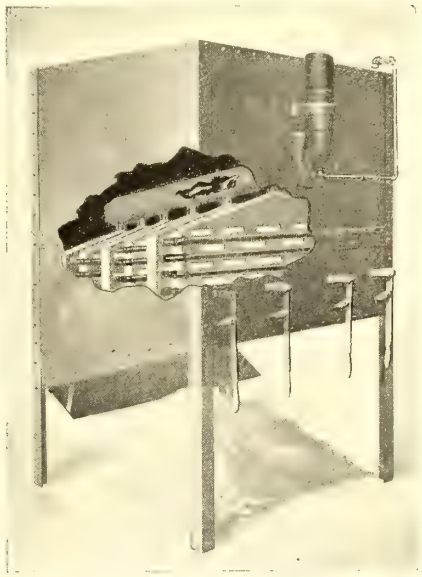
Mileage of suburban railways	147
Mileage of suburban tracks	262
Suburban passenger revenue (not including parcels mails and miscellaneous)	£595,669
Suburban passenger train-mileage	2,863,124
Suburban passenger car-mileage	23,075,648
Suburban passenger journeys	59,477,123
Miles traveled by passengers in suburban passenger trains	286,679,733
Average distance traveled by each suburban passenger, miles	4.82
Average fare paid by each suburban passenger	2.40
Revenue per passenger per mile	0.50d
Population of Melbourne and suburbs, Dec. 31, 1905	515,350
Approximate amount paid in fares for Melbourne and suburban traveling by suburban railways and tramways per head of population per annum	£2.083
Approximate number of passengers per week-day arriving at and departing from Central Suburban Station	140,000
Number of trains carrying suburban passengers arriving at and leaving Central Station per week-day	1,332
Number of suburban stations	145

NEW TRAFFIC AGREEMENT AT ATLANTIC CITY

Under a new traffic arrangement entered into between the West Jersey & Seashore and the Shore Fast Line, Superintendent S. S. Neff, at present in charge of the Atlantic City & Shore Railroad, described in the last issue of this paper, will become the managing director of the allied trolley lines in Atlantic City. This arrangement will take effect, it is said, on July 15. This announcement indicates the close relations of the Shore Railroad interests and those of the Pennsylvania Railroad Company.

A STEAM SAND DRYER

Although many steam sand dryers have been devised, few have been entirely successful in drawing the moisture from the sand. This and other desirable features are claimed for the Howe steam sand dryer, which is being sold to railroad companies in large numbers by Towne & Phymister, of Binghamton, N. Y. The dryer furnished by this company consists of a series of live steam pipes with vapor boxes arranged vertically between the steam pipes. The sand to be dried is dumped into the steel hopper surmounting the dryer and passes down between the steam pipes and the vapor boxes. As the moisture in the sand is vaporized,



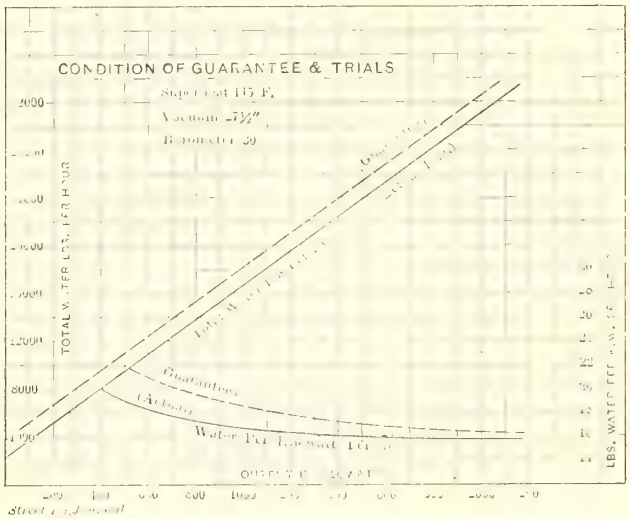
PART INTERIOR VIEW OF STEAM DRYER

it is drawn through numerous apertures into the vapor boxes and out of the body of hot sand through the main exhaust pipe, the dry sand falling through the adjustable openings in the bottom of the dryer. The important feature of this dryer lies, of course, in the vapor boxes, for as soon as the sand is heated the vapor is drawn into these boxes and out through the main exhaust pipe by the draft created by turning on the small steam blow cock shown. The dryers are made in two standard sizes, one for 5 and the other 10 tons daily capacity. They are substantially constructed and possess in their design a greater degree of refinement than is usually found in apparatus for this work; consequently they should last much longer than home-made devices and be more economical in steam consumption.

The blank report sent out by the Ohio State Railroad Commission, upon which steam, electric and street railroad companies are to make their annual reports, contains eighty-seven pages of questions, and is bound in board. All the details of operation, construction, maintenance, passenger and freight earnings and every item and feature that enter into the business are included. A description of the equipment is required and the officials are required to go minutely into all matters in question. The report must be in the hands of the commission by Sept. 15. The work of tabulating the information required by the commission will be something enormous, but there is no question as to the minute detail the members will have at hand, fresh and reliable every year.

STEAM TURBINES FOR SYDNEY, NEW SOUTH WALES

Willans & Robinson, Ltd., of Rugby, England, have recently completed two 2000-kw steam turbines built for the Sydney municipality, and for whom T. Rooke is electrical engineer. The entire contract was given to Dick, Kerr & Co., while the turbines and surface condensers were sublet to Willans & Robinson, Ltd. The interests of the



TEST CURVES ON A 2000-KW TURBO-ALTERNATOR

municipality of Sydney in England are in the hands of Preece & Cardew, who have witnessed the necessary tests on the plant prior to shipment.

The turbines are arranged to give an overload of 20 per cent for periods of two hours. To obtain the full load noncondensing the turbines are fitted with pass valves. The normal working pressure at the boilers is 150 lbs. per square inch, while the steam is superheated between the limits of 85 degs. F. and 145 degs. F. The turbines are arranged for a speed of 1500 r. p. m. and exhaust into a vacuum of 27½ ins.

The complete condensing plant is arranged to maintain a vacuum of 27½ ins. at the normal full load of the turbine, and a vacuum of 26 ins. at the overload, the temperature of the circulating water being 70 degs. F. The air pump is built on the Edwards principle and is of the three-throw type running at a speed of 108 r. p. m. It is driven through single reduction gearing by a three-phase, 22-hp motor running at 585 r. p. m. The circulating pump circulates 2950 gals. per minute when working against a head of 22 ft. It is driven by a three-phase, 35-bhp motor running at 580 r. p. m.

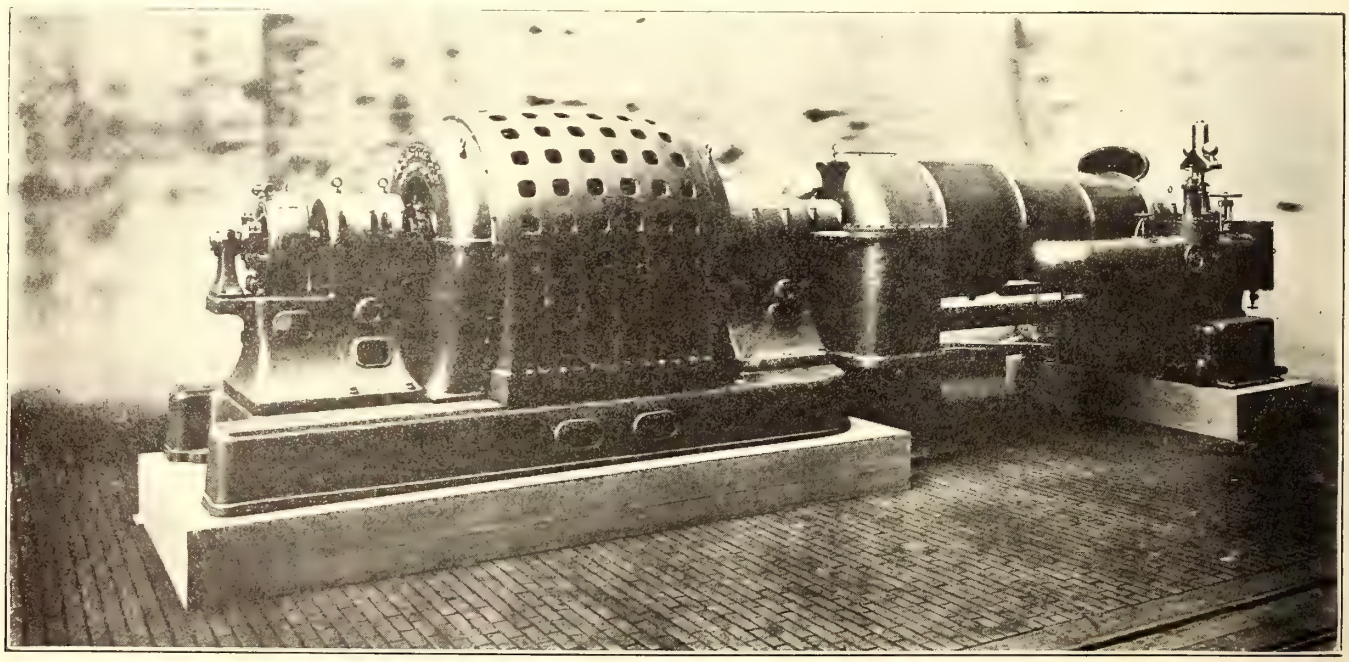
The alternators are of the Dick-Kerr three-phase type, arranged for 5200 volts and 50 cycles, and give an output of 2000 kw when working on 85 per cent power factor. Each alternator has a 100-volt exciter direct coupled on its shaft.

THE TURBINE

Although the Willans-Parsons turbine is now fairly generally known, attention might be drawn to the following points in which it differs from others manufactured under the same license.

It is arranged with two balance pistons in place of three. In the ordinary design of turbine the three balance pistons are placed on the high-pressure end of the turbine; in this it is considered an advantage to dispense with the third and large diameter balance piston on the steam end (which is essentially the small diameter end), and to utilize the low-pressure end of the turbine in place of the third balance piston. For this purpose steam is admitted through the interior of the rotor to the low-pressure end, which acts as a third balance piston. This arrangement allows the turbine to be made somewhat shorter and enables a more symmetrical casting to be used in view of the diameter of the low-pressure end being reduced.

The body of the turbine is built up in three sections instead of being cast in one piece. The advantage of this construction lies in the direction of being able to machine each section to a very much finer limit than would be possible if the complete case had to be machined in one length.



2000-KW STEAM TURBINE FOR SYDNEY, NEW SOUTH WALES, AUSTRALIA

The merits of the blading lie first in being able to build up the blades in half rings ready for assembly in the rotor and casing which permits the blading to be treated as a separately manufactured article completed and carried in stock ready for immediate use. The method of building up the blades in sections makes possible the use of the chan-

nel section shrouding. This shrouding, into which the ends of the blades are riveted, strengthens the blading and also makes possible larger clearances with the same resulting steam economy.

In the event of contact between the blading and the stationary portion the thin edges of the shrouding will wear down in preference to damaging the blades, because of the greater strength of the blading as a whole, and to the thin edges of the shrouding presenting less surface for contact than the section of a blade itself. That the latter point has been appreciated would seem to be borne out by other turbine makers having adopted the precaution of thinning down the tips of their blades. The channel section shrouding is also asserted to have economical advantages which result in a higher degree of economy being possible than with the ordinary method of blading.

In governing this turbine, oil and steam relays are omitted, and an ordinary centrifugal governor acts direct on to a throttle valve. The result of this is that the gear is very much simplified, while the governing is as perfect as it is possible to obtain with more complicated methods.

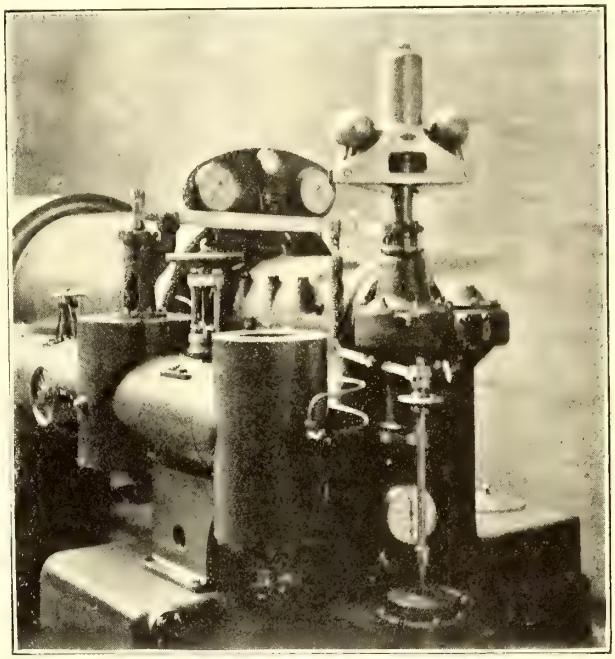
As to the general constructional arrangement of the turbine, it may be stated that in the smaller sizes the casing is hinged, so that the top can be opened up in the minimum possible time. An oil tank with the water circulating through it forms the end bearing pedestal, and contains the necessary oil for circulating through the different bearings. The rotary oil pump for circulating this oil is driven by a spindle actuated by worm gear from the main turbine spindle. The steam chest, with the necessary valves, etc., is arranged separately on one side of the turbine, and in no way tends to distort the casing of the turbine proper by being attached to it. The governor gear, etc., is mounted clear of the cover of the end bearing, and does not tend to obstruct access to the bearing proper. The rotor, after being machined to one-one-thousandth of an inch limits of accuracy both inside and outside, can be relied upon to be in perfect balance. The end shaft on the steam end of the rotor is forged solid in one piece with the rotor itself in all except the largest sizes of turbine. The usual practice is to force the end shaft into the rotor. The latter method is considered objectionable in view of the high temperature prevailing at the steam end, the difference in temperature between hot and cold tending to loosen the shaft in the rotor, and thus being likely to give trouble at the joint.

All the rotors and casings are "machined" after the blading is completed and in position, and it is a point of considerable advantage in favor of the shrouding that this should be possible.

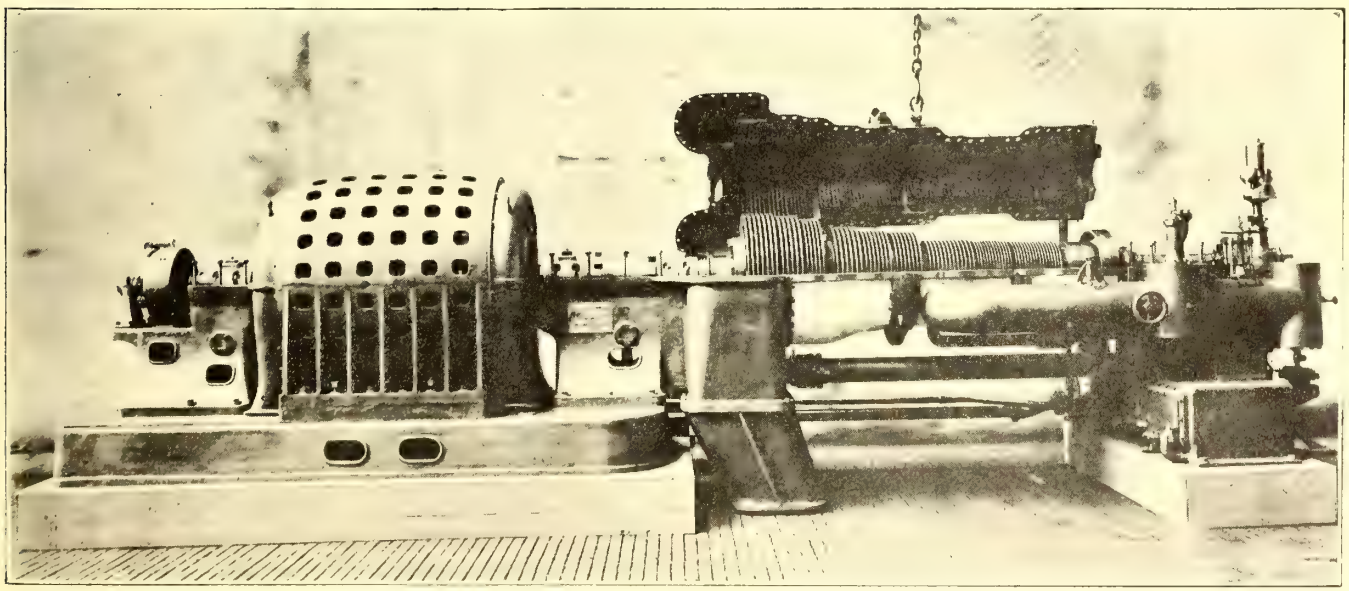
The result of being able to turn the blading in a lathe in the case of the rotors and in a horizontal boring machine in the case of the casings is that the desired clearances between the rotating and stationary portions are accurate. All parts, including the bladed rotors, are interchangeable.

THE ALTERNATOR

The main features of the Dick-Kerr turbo-alternator are fairly well known, but the most recent designs embody slight improvements which are worthy of note. As distinguished from other turbo-alternators of foreign origin, this is of the salient pole type, which is found to have a better inherent regulation owing to lower magnetic leakage in field and armatures. It enables machines to be designed with lower stator iron losses, and, in conjunction



VIEW OF GOVERNING MECHANISM



TURBINE OPENED TO SHOW ARRANGEMENT OF BLADING

with the possibility of using a larger amount of copper in the rotating field, increases the efficiency. All windings subject to heating are freely exposed to air currents, yet this result is obtained without the use of forced draft. A departure in the Sydney machine is the use of solid end shields to reduce the noise and prevent dirt being drawn into the machine.

The frame of the stator is made of strong cast iron and supports the stator laminations. The winding is embedded in slots and insulated by mica. Special ventilating ducts are provided in the frame, and laminations stiffening fingers on the outside of the laminations obviating danger of vibration. The feet of the alternator frame are bolted to a sole plate, so made that it is possible to slide the stator in a direction parallel to the shaft to uncover the rotor for easy inspection.

The rotor body is built up of a central solid steel casting cast under pressure with projecting poles. This central body is machined and bored out to a diameter larger than the shaft. Two cross-shaped pieces are built at each end of the central body and carry the rotor on the shaft. The pole tips are laminated and are dovetailed on the steel casting of the central body. Special end pieces dovetailed on the steel casting retain the laminated tips in position, and also act as checks against centrifugal force to keep the spools in position.

The field winding is of solid copper strip wound on edge, insulated between turns by paper and mica, and supported in a special copper spool with heavy insulated flanges. The copper winding of the fields bears flat on the insulation to avoid danger of cutting. The terminal leads of each spool are carried out on the bottom of the spool, and are composed of very thin and flexible copper strips. Special wedges are provided between the spools against the horizontal component of the centrifugal force, which tends to open the spools. The latter, after being assembled and connected up, are finished on the outside surface, where otherwise the copper would be bare, by an oil and waterproof varnish, presenting a very hard and glossy surface to make it easier to clean the machine. The shaft is of pressed steel.

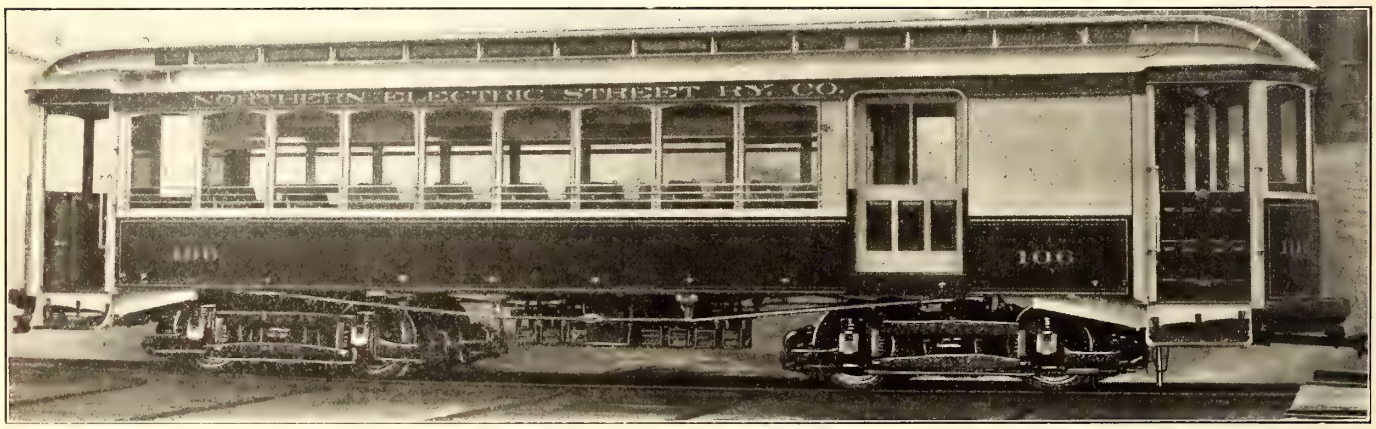
The collector rings are of cast iron, fixed over a solid steel sleeve, and of special construction as to make it impossible to be subject to deformation under working conditions, the collector rings being shrunk hot over special micanite rings built up directly on the steel shell of the collector ring. The leads from the field coils are carried to the collector rings and are protected by metallic caps fitted over the shaft and to the end of the rotor body. The connection of the leads to the collector rings is also protected by a cap, which is easily removable for inspection if necessary.

It may be added that the design of the machine embraces sizes from 500 up to 10,000 kw, and the variation in periodicity which obtains anywhere imposes no special difficulties in construction. Already machines have been supplied under extremely varying conditions of periodicity and voltage, in one case the conditions calling for single-phase machine at a periodicity of 100.

The brushes are of low-friction graphite, coefficient and high conductivity. The brushes belonging to one collector ring are kept separate from the brushes belonging to the other. Ample contact is provided on the brushes, and they may be adjusted and replaced, if necessary, while the machine is running.

EQUIPMENT FOR NEW LINE RUNNING OUT OF SCRANTON

The two types of cars of which illustrations are presented were built by the J. G. Brill Company for the North-



COMBINATION PASSENGER AND BAGGAGE CAR FOR THE NORTHERN ELECTRIC STREET RAILWAY COMPANY, SCRANTON, PA.

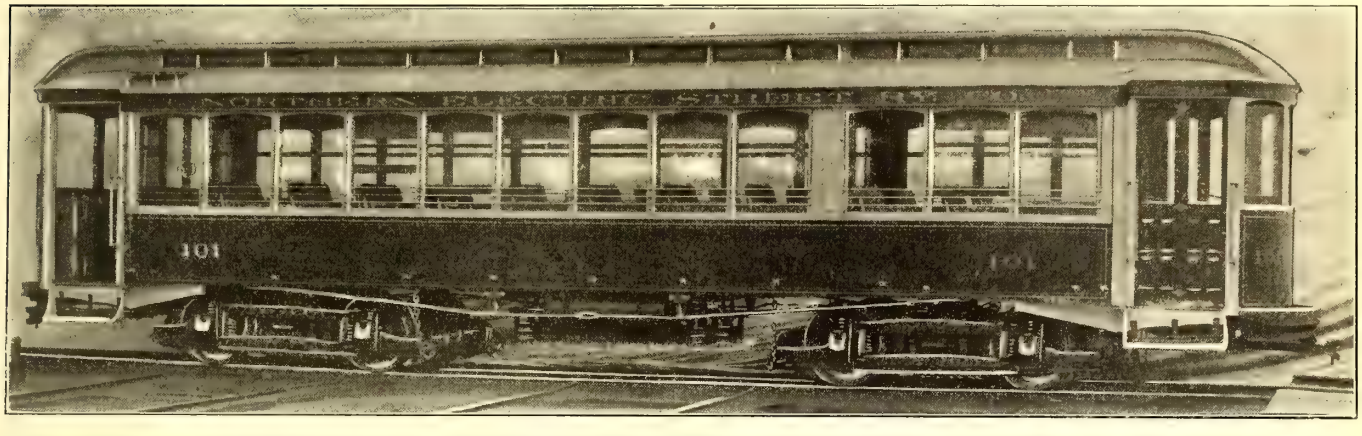
ern Electric Street Railway Company, and represent the present rolling stock of that company. There were five of the combination passenger and smoking cars in the order and one of the passenger and baggage type, both having the grooveless post, semi-convertible window system. The Northern Electric Railway is a new system, and, when completed, will connect Scranton with Chinchilla, Clark's Summit, Clark's Green, Glenburn, Waverly, Dalton, La Plume, Factoryville, Mill City and Lake Winola, the latter place being about 20 miles distant from Scranton. The proposed extensions (17 miles) will take in Tunkhannock, Hillside Home and Nicholson via Lake Sheridan. During the past year the road has been completed for more than one-half the distance, the power house and car house erected and the machinery installed. The electrical equipment for the power house and sub-station includes the following: Two-kw, 370-volt, three-phase, 25-cycle generators, 150 r. p. m.; two 17½-kw, 125-volt direct-current engine type exciters, 400 r. p, m.; four 200-kw, 600-volt, three-phase, 25-cycle, 750-r. p. m. rotary converters; three 200-kw, O. I. S. C. single-phase transformers, 16,500-406 volts; six 75-kw O. I. S. C. transformers, single-phase, 16,500-370-volt; one nine-panel main switchboard and one switchboard for sub-station; two of the rotary converters are for the sub-station. There are two 500-kw non-condensing engines arranged for direct

connection to generators, and three 300-hp boilers. The portion of the system now in operation connects La Plume borough with Lackawanna Avenue, Scranton, a distance of 12½ miles, and between these points a thirty-minute service is maintained.

Following is a description of one of the combination passenger and smoking cars, the dimensions of which are generally the same as the car having the baggage compartments; the equipment throughout of the two types is identical. Length over end panels, 34 ft. 4 ins.; over crown pieces, 43 ft. 9 ins.; width over sills, including sheathing, 8 ft. 6 ins.; size of side sills, 4 ins. x 7¾ ins.; end sills, 5¼ ins. x 6⅞ ins.; sill plates, 15 ins. x ⅜ in. The interiors, with their big windows, wide aisle space and extreme length of seat, due to the adoption of the grooveless post, semi-convertible window system, make the cars well suited for excursion service. The seats are of Brill make, those in the passenger compartment being of plush, while a leather cover-



BODY OF INTERURBAN CAR FOR THE EVERETT RAILWAY, LIGHT & WATER COMPANY



STANDARD PASSENGER CAR OF THE NORTHERN ELECTRIC STREET RAILWAY COMPANY



CITY CAR FOR EVERETT, WASH.

ing is used in the smoking compartment. The cherry-stained interior finish and Nile-green ceilings of poplar make a pleasing combination. Push buttons, arm rests and basket racks are among the accessories which add to the comfort of the passengers. The trucks, with 6-ft. wheel-base, are of the builders' 27-E1 type. The motors are of 45 hp capacity each. The car weighs without trucks, but with electrical equipment excepting the air brakes, 27,000 lbs.

CLOSED CARS FOR EVERETT, WASH.

Two good examples of cars having the drop-sash window arrangement are afforded in the cars shipped by the American Car Company last month to Everett, Wash., for operation on the lines of the Everett Railway, Light & Water Company. The larger of the two types is intended for interurban travel on the Northern Pacific branch line which is leased by the street railway company and electrified; the road connects Lowell and Snohomish, the latter place being the chief town of Snohomish County, one of the richest in the State in agricultural produce and in lumber and mining industries. Everett, with a population of about 21,000, is situated 35 miles north of Seattle on one of the best harbors of Puget Sound, and the interurban portion of the system is an important link in the chain of towns visited so much by tourists and excursionists.

The chief features of these new cars are brought out clearly in the illustrations. The interurbans measure 43 ft. over the end panels and 5 ft. over crown pieces; over bumpers, 58 ft.; width over sills, including sheathing, 8 ft. 6 ins.; centers of posts, 29½ ins.; height from floor to ceiling, 8 ft. 6 ins. The smaller cars (four in number) measure 28 ft. 8 ins. over the end panels and 41 ft. 8 ins. over crown pieces, and other dimensions are generally similar to the car described.

LONDON LETTER

(From Our Regular Correspondent.)

During the past month the Incorporated Municipal Electrical Association, of which S. E. Fedden, of Sheffield, is the president this year, held its annual convention at the Royal Victoria Hotel, Sheffield, After the presidential address was delivered, R. L. Acland, electrical engineer of Chesterfield, presented the following paper: "Extension of Electricity Supply to Outlying Districts.'" After luncheon special tram cars conveyed the members and visitors to the River Don Works of Messrs. Vickers, Sons & Maxim, which, by kind permission of Douglas Vickers, were opened for inspection by the visitors. In the evening a reception and dance was given by the Right Hon. the Lord Mayor at the Town Hall. The following day was devoted entirely to pleasure, a special train leaving Sheffield in the morning for an excursion to the Dukeries, members and their friends proceeding by this train to Worksop, from which place they proceeded to Welbeck Abbey, Cuckney and Budby Forest to Edwinstowe (a Saxon village), and so on to Ollerton, where luncheon was served. After luncheon they proceeded to the Normanton Inn, Clumber, Carburton, and back to Worksop for tea at the Town Hall, after which a return was made to Sheffield in the evening. The route followed by the delegates, so called the "Dukeries," because at one time as many as five Dukes resided in the neighborhood, lies in the immediate vicinity of Sherwood Forest and is probably one of the most beautiful parts of England. The following day was devoted to the annual general meeting, the afternoon being occupied by the reading and discussion of the following papers: 1. "Cheap Power Supply by Municipalities," by C. E. C. Shawfield, electrical engineer of Wolverhampton; and "The Costs of, or Charges for, Electricity Supply," by H. R. Burnett, electrical engineer of Barrow-in-Furness." 2. "Depreciation," by C. H. Yeaman, electrical engineer of Hanley. In the evening the annual association dinner was held at the Royal Victoria Hotel, which proved as successful as ever. On the last day of the meeting the following papers were read and discussed in the forenoon: "The Value of Photometry in Central Station Work," by R. McCourt, assistant electrical engineer of Harrogate, and "Alternating Current Distribution," by A. J. Cridge, assistant electrical engineer of Sheffield. In the afternoon a visit was made to the Kelham Island Tramway power station and to the Neepsend power house.

We published in a recent issue of the Street Railway Journal an article descriptive of the Johannesburg Tramways, so far as it related to the equipment of the overhead line, track construction and rolling stock. It may have seemed strange to some of our readers at that time that practically no reference was made to the power house, the equipment of which, as is well known, was to include a gas plant. It has also been a matter of general knowledge for some time that there was trouble in Johannesburg about this plant, and for the past year or so efforts have been made by the contractors to get the plant into running order. All kinds of trouble have arisen, however, and some accidents have occurred, and now it is no surprise to learn that the Town Council about a month ago held a special meeting to consider the situation, the whole of the gas portion of the plant having been shut down until further notice a day or two previously. The contractors have evidently come to the conclusion that nothing further can be done to put the plant into working order, and it is therefore to be abandoned, and the bond for the due performance of the contract, namely, £105,134, will now be demanded from the contractors, as also most likely the sums already paid, amounting to over £143,000. The whole situation is a deplorable one, and it is at present difficult to see just where the trouble lies. At the beginning criticism was aroused by the recommendation and adoption of gas engine plant for this particular installation. At the same time it is difficult to understand why the failure has been so complete, as certainly gas engines of equal size and of the same type are in most successful operation elsewhere. In the meantime a certain number of new steam engines and new electric generators have been ordered, and will be delivered as soon as practicable, so as not to stop the operation of the tramways any longer than is necessary. Temporary arrangements have also been made with the Rand Central Electric Works.

The question of fares on tramways is constantly cropping up on account of agitation on the part of the public. In Glasgow, for instance, there has been suggested that the distance of the halfpenny car fares be extended. Mr. Dalrymple, the manager, has just issued a long report, which makes it very clear that to extend that distance would be to court financial disaster. Glasgow is perhaps the strongest exponent of the halfpenny fare, but the only reason that it has been a success in that city is because the short distance, namely, about ½ mile, is rigidly adhered to. To lengthen this to three-quarters of a mile would be practically to transfer a large proportion of the penny passengers into halfpenny passengers. The matter has recently come before the committee, which have agreed with the manager that no change shall be made for the present. Arthur Ellis, of Cardiff, has also been making various experiments and changes relating to the fares in that city, as the revenue from these tramways has not been what it should be. Mr. Ellis has now instituted a system of transfer tickets for short distances, but has not introduced halfpenny fares. This transfer ticket would enable a passenger to travel over two ½-mile sections, so that he could either go and come on the same section or continue his journey over some other section for a short distance. The Hull City Council is also considering the fare question, and has started a six months experiment to use penny tickets, which enable passengers to travel over two sections for the price of one, which, in other words, is a transfer ticket system. The Hull Tramways, however, are making most satisfactory profits, and the agitation in this city has arisen on account of these profits, many believing that the best way to equalize things is by reducing the fares. R. R. Fairbairn, of Worcester, also proposes to make an experiment, with the object of popularizing the tramways. His intention is to give a double short journey for a penny, which is really equivalent to halfpenny fares for short sections, without having any single fare for which a halfpenny is valid. These tickets can also be used either as transfer tickets or double journey tickets. At Aberdeen a proposition had been made to the Council to establish a universal penny fare; that is, a fare of 1 penny, by which a passenger can travel any distance on any one car for that sum. The committee, however, has decided not to entertain this proposal, but has determined instead to adopt the system of a 1-penny fare from the center of the city to any terminus, a system which has been successful in other towns. Mr. Pilcher in a long report recommended this system, and though there would be losses on certain of the longer routes on which up to three pence had previously been charged, it was confidently expected that these would be more than made up by the increase of passengers in other directions. The question of fares is also a very acute one with the various electric railways in London, none of which is making as much money as necessary, and it is interesting to note that after long negotiations between the companies, the long-distance fares are to be raised sufficiently to assist the companies, but not to put any hardship on the public.

The Halifax Tramways are at present being operated at a loss, and F. Spencer, the manager, in a report which was recently given to the committee, has suggested that the recent accidents were largely responsible for the decrease in the traffic, a certain amount of timidity of the riding public having resulted. Though Halifax tramway cars are all equipped with slipper brakes, Mr. Spencer, in view of the recent accidents, has recommended an improved slipper brake. Most slipper brakes are operated by steel shafts parallel with the car axle. Mr. Spencer believes that there is too much elasticity in this shaft, and now proposes that it should be dispensed with, and the downward pressure taken by four bearings fixed on the truck side close to the axle-box. Halifax, as is well known, is one of the most hilly cities operating tramways, so that anything that will increase the safety of the passengers will undoubtedly help to build up traffic.

Last month the adjourned debate relating to the London County Council Electric Supply bill was resumed in the House of Commons, and after discussion by various members the bill was read a second time, and was then referred to a hybrid committee, which was instructed by Lloyd George that if power be conferred on the London County Council to transfer or lease to any company local authority, body, or person, any of the powers, duties, or liabilities entrusted to it by the bill, the conditions on which such power should be exercised should be embodied in the bill or in a subsequent bill. This special committee has now held several sittings, and it would appear that the present bill is based largely on the report of the parliamentary committee which considered the matter last year. The recommendation of the old committee that the Council lease the undertaking to a private company has been adopted by the new Council. The area now comprises 451 square miles, of which 117 are within the administrative county

and 334 in the surrounding districts. Powers were originally sought to acquire the undertakings of the local authorities, but the present Council thinks that it would not be right to allow the lessee to acquire these undertakings, and this clause has accordingly been struck out. Instead of seeking compulsory powers therefor, the present bill makes acquirement of the existing undertakings a matter of agreement. The chairman of the London County Council has also given a decided denial to the suggestion that the Council meant to reinstate the administrative county of London Company by making them the transferees of the powers sought under the bill, and stated that the intention of the Council was to invite tenders for those powers, and that so far as the Council was concerned there would be an open field and no favor. He also stated that the suggestion of the London County Council to cut up the area into various sections was untrue, and denied that there was any intention to repurchase from the lessee in two or three years' time. At the moment of writing, the committee has again adjourned, and at present it is difficult to foretell the actual fate of the bill.

A decision of importance to tramway companies and to local authorities and ratepayers has been given by the president of Local Government Board. Some time ago the Fleetwood Urban District Council constructed a road alongside the Blackpool & Fleetwood Tramroad Company's lines, beginning at a point where the tramways leave the street, and are fenced in with iron railings. The apportionment of cost was duly made, and a notice requiring payment of the cost of that portion of the road adjoining their lines was served upon the tramways company, as owners adjoining and abutting.

Mr. Burns, president of the Local Government Board, has now intimated that the decision of the board is that the tramroad company cannot be properly charged with the £1,588 3s. 2d. apportioned as the cost of that half of the road adjoining or abutting on the tram lines.

Sir F. Cory-Wright, chairman of the light railways committee of the Middlesex County Council, opened recently the new line of electric tramways from Wood Green to Palmer's Green. The line will eventually be carried as far as Enfield. Wood Green is now the center of direct communication with Tottenham, Muswell Hill, Finsbury Park, New Southgate and Palmer's Green.

Through running on the tramway systems between Bolton and Bury was recently formally inaugurated. The ceremony was performed on the Bolton borough boundary at Ainsworth, where cords were cut by Alderman Miles (chairman of the Bolton tramways committee) and Col. Hall (chairman of the Bury tramways committee). In the evening the members of the Bolton and Bury tramways committee and the Radcliffe Urban District Council met at dinner, and at night an illuminated car passed through Bolton, and left for Bury at 9 o'clock.

The sub-committee of the Leyton tramways committee recently decided that the practice of passes over the Council's tramways should be abolished, and all the officials pay their own fares, including the traffic manager and the electrical engineer, both of whom have frequently to go over the system in connection with their duties. The tramways committee has since reconsidered the matter, refused to confirm the sub-committee's recommendation, and decided that in future free passes should be provided to the traffic manager, the electrical engineer and two other officials.

The annual conference of the manager's section of the Municipal Tramways Asociation was held this month in Blackpool Town Hall, under the presidency of J. L. McElroy, of Manchester. The Mayor of Blackpool welcomed the delegates from all parts of the country, and the president, in acknowledgement, said every municipality that controlled a tram system was represented in the association. The proceedings were private.

The Ealing Corporation has addressed a letter to the district councils of Acton and Chiswick on the subject of the alleged nuisance occasioned by the noise of the electric cars of the London United Tramways Company, Ltd., and asking whether or not they would be willing to join in taking proceedings against the company to abate the nuisance complained of. The letter states that Ealing has already made representations to the Board of Trade on the subject, and that in their last communication on the subject the Board of Trade stated that the matter was one in respect of which they had no compulsory powers.

The negotiations between Dundee Town Council and the Harbor Board with regard to the site in the vicinity of the Fish Dock for the new electric station house have now been amicably settled at the price put forward by the Town Council, which has obtained a perpetual fee, so that for all time coming it cannot be disturbed by change of circumstances.

It is understood that the agreement for the running of through tram cars between Croydon, Penge and the Crystal Palace has been signed. It will take effect as soon as certain necessary arrangements are complete. The Croydon Corporation will provide the cars to run between Croydon and the Penge terminus, and the South Metropolitan Tramways Company will supply the cars for service between Croydon and the Crystal Palace.

Renfew County Council has now formulated its petition to the Scottish Secretary against the proposed extension of the Paisley District Tramway Company's system from Barhead to Thornliebank. In the petition the Council submits that there is no public necessity for the proposed tramways, and objects to powers being conferred on the company to construct tramways on the roads within their district.

The Board of Trade, in a letter to the Exeter tramways committee, announce that it has come to the conclusion that authorities operating tramways have rightly understood the desires of the people, and are not disposed hereafter to offer any objections to a reasonable number of people standing in electric cars. This will remove a great and unjust restriction of tramway managers, who, despite all they can do, cannot possibly provide cars enough to give every person a seat at the rush hours. Such restrictions were all right in the days of the horse car, but they had long become obsolete.

The last of the Yerkes Tubes, the one known as the Charing Cross, Euston and Hampstead Railway, was formally opened this June and has immediately sprung into popularity. This tube has its southern terminus under the Charing Cross station of the South Eastern and Chatham Railway, where it has connections with the District Railway, the Baker Street and Waterloo Railway and practically the whole system controlled by the Yerkes syndicate. From Charing Cross it proceeds northwards by way of Leicester Square, Oxford Street and Euston to Camden Town, at which point it branches into two, the one branch going in a northwesterly direction by way of Chalk Farm and Hampstead to Golders Green, where it comes to the surface, and the other branch going in a northerly direction by way of Kentish Town and Tufnell Park to Highgate. At Leicester Square it will be in connection with the Hammersmith, Brompton and Piccadilly tube; at Euston it will communicate with the main line of the London and North Railway, and be in the vicinity of the other important main line termini at St. Pancras and King's Cross. At Camden Town and Kentish Town it will also be in the vicinity of these main lines a little further out, and at Highgate will communicate with the tramways of the Metropolitan Railway Company which proceed still further north. On the day of the opening, the guests assembled at Charing Cross and were conveyed by a special train to Golders Green, where the ceremonies took place under the Hon. David Lloyd George, M. P., President of the Board of Trade. Luncheon was then served, and arrangements were made by which the company's guests were conveyed by special train from Paddington to Windsor. A brief description of the line is published elsewhere in this issue. A. C. S.

STONE & WEBSTER EXTENSION ON PUGET SOUND

The Puget Sound International Railway & Power Company has been incorporated in Washington to carry out the plans for the interurban electric railway extension proposed by Stone & Webster on Puget Sound. This announcement has been made in Seattle by C. D. Wyman, of Boston, member of the Stone & Webster executive committee. Mr. Wyman is vice-president of the Seattle Electric Company, vice-president of the Puget Sound Electric Railway Company and president of the Whatcom County Railway & Light Company. Mr. Wyman is quoted as follows: "Our interests are negotiating an affiliation with the Everett Street railway properties, which will give us control of them. The new company will immediately begin carrying out plans for the building of interurban roads from Bellingham to Seattle. It has always been our plan to afford the Puget Sound cities an interurban service eventually from the International boundary to Olympia and Chehalis, and perhaps finally to Portland and the Grays Harbor country. Our first step was the Puget Sound Electric Railway, between Seattle

and Tacoma. That has developed the valley through which it runs. Another region to the north, with Bellingham as the center, we shall develop with similar lines as rapidly as conditions permit, as the money is raised, the franchises and rights of way acquired, and other plans perfected. This, necessarily, can not be done in a day, especially when the construction including equipment costs from $40,000 to $50,000 a mile for single track road. The interurban project necessarily involved Everett's necessities and led to the negotiations which will give us the control of that system. The statement that we have bought the road there is not true, but the arrangement under way will give us the control. We shall build such extensions and connections as the conditions in that city seem to justify, giving it the advantage of a more elaborate interurban system. We shall put surveyors in the field with the idea of locating accurate and positive routes for lines through to Seattle. Our engineers have already made surveys 30 or 40 miles south of Bellingham and these will be continued in this direction. The Nooksack power plant will be used to operate the northern portion of the system, and will probably soon be increased in capacity. It is our policy to develop the interurban system from each center, until we shall have completed a through line from the boundary south. Thus we commenced from Seattle. We have already extended from Tacoma south to American Lake and will continue to Olympia. Our next step is the system from Bellingham, and we shall make plans for reaching out from Everett. We also expect to push the extension of our Puget Sound Electric Railway Company's system from Brookville to Puyallup, thence to Sumner, and finally to Orting and up that valley."

THE SAN FRANCISCO SITUATION

The condition in San Francisco continues to improve gradually in regard to the operation of street cars as well as in other industrial and in financial lines. The United Railroads is beginning to furnish complete service during the evenings, with the exception of the owl cars, on all the electric lines north of Market. This means a service until about 1.00 A. M.

The company now has 1,100 permanent men in its employ, and this the officials regard as a sufficient number to operate late cars on all the lines north of Market Street. More men are being employed in the East and are arriving in the city in small bodies every day. The men on the late cars are carrying arms openly. As the practice is general, it is presumed that it is with the consent of the company.

In regard to the company's attitude toward the old employees an official is quoting as saying: "The strikers doubtless believe that our men were hired for temporary service and that they will get their places back as soon as these men leave. They are mistaken. We have a thousand permanent men in our employ, and not one of them will be discharged to make room for a striker. Moreover, the new men have been given the choice of runs, and the strikers, when they return, will have to take such runs as are left. Very soon, though, there will be no runs whatever left, as we are employing men at the rate of 30 or 40 a day, and it will not take long to fill all the places of the strikers."

The effort on the part of the leaders of the strike to discourage riding on the cars by placing pickets along the lines is not meeting with much success.

The United Railroads has placed its Eighth and Eighteenth Streets line to Sixteenth, South and Railroad Avenues in operation as well as the Sixteenth and South Street line. Work is being hastened on the track and overhead trolley of the Kentucky Street line, and as soon as it is finished the line will be operated from Twenty-third Avenue South to Fifth and Market Streets, via Brannan Street.

The California Street Cable Railroad Company has placed its Hyde and O'Farrell Streets cable line in operation, and its California Street road will be placed in service in a very few days. In regard to its employees President Stetson says: "We are going to establish the open shop on the California Street line. We have had some men in our employ for a long time and we would prefer to have them run the cars for us again. But we will deal with them individually only. If they are not willing to come back on that basis we will have to fill their places. We cannot afford to pay more than the old rate, which was established by arbitration at 30, 31 and 32 cents, but will pay new men 25 cents an hour. We should have started the line sooner if it had not been necessary to do certain repair work, but as soon as this is completed we will begin immediately. We will have nothing further to do with the carmen's union. The men individually are good men, and we should prefer to have them in our employ again. But we will not deal with them as an organization. I want that to be made perfectly plain. Some of our men have promised to return and, as a matter of fact, most of them would like to go to work again. We will have no trouble in getting all the men we need."

LEGISLATION IN CONNECTICUT

The Connecticut Legislature, on July 2, passed the Consolidated Railway Company's general charter amendment bill, but it was amended at the instance of Representative Gunn so that the franchises for undeveloped road, which it was said aggregate over 800 miles, must be utilized before Oct. 31, 1908, or they lapse. No further action was taken on the East Haven & Morris Cove charter, which is being advocated by Representative Griswold, of Guilford, in opposition to the Consolidated.

CLEVELAND TRACTION MATTERS

Notwithstanding all overtures made to him the past week, City Clerk Peter Witt persistently refused to allow representatives of the Cleveland Electric Railway Company to see and examine the consents of property owners at Quincy Street and Central Avenue for the new companies. Mayor Johnson urged him to accede to the request of the officials of the old company, saying they had a right under the law to examine and copy them, but Mr. Witt would not listen, seemingly inviting a suit. After another trial Friday morning, the attorneys for the company filed mandamus proceedings in Judge Ford's court and an order was issued at once. On Saturday when Attorney Harry J. Crawford and Robert B. Rifenberick, representing the Cleveland Electric Railway Company, called upon Mr. Witt with the order, he at once turned the consents over to them for examination. This is only another peculiar act on the part of a city official in the fight that is being made for consents.

The City Council has passed the ordinance providing for compensation to the Cleveland Electric by the Low Fare Railway Company for the use of its tracks. When the ordinance becomes operative it is expected that an injunction suit will be brought to test the right of the Council to prescribe the compensation.

The portion of the value fixed for the Low Fare Railway Company to pay on each section of the track are as follows: Euclid Ave., from East Fourteenth St. to Ontario St., $19,000; through Public Square to Superior Ave., $2,650; four tracks on Superior St., from Ontario St. to the viaduct, $21,500; overhead wires over the viaduct and the tracks on West 25th St. and from the viaduct to Detroit St., $5,500; circling the Public Square, $9,000.

The council is fixing the valuation, following the refusal of the Cleveland Electric to treat with the Low Fare Company as to compensation for joint use of its tracks in what is called free territory. The company claims that the city council has no authority to fix the compensation. Under this claim, it is probable that the company will resist any attempt to operate cars over these tracks, other than the ones now being used on Superior St. in consequence of the injunction having not been enforced by the Cleveland Electric since the suspension of hostilities some months ago.

BOND ISSUE AT BIRMINGHAM

The amount of the bond issue authorized at the recent meeting of the stockholders of the Birmingham Railway, Light & Power Company, of Birmingham, Ala., is $25,000,000, not $35,000,000, as stated in the issue of June 22. Among other improvements made possible by this issue are a new power station and a number of new cars for interurban service.

PERSONNEL OF THE NEW YORK PUBLIC UTILITIES COMMISSION—OTHER MATTERS

In the STREET RAILWAY JOURNAL of June 29 brief mention was made of the two commissions which Governor Hughes, of New York, has appointed in accordance with the provisions of the Public Utilities Bill. In view of the wide scope of the powers conferred by this bill it may be of interest to present the following brief sketches of the gentlemen who have been selected to carry out the work.

The bill provides for ten commissioners, five of whom will take care of the public service interests in what will be known as the First District, composed of New York, Kings, Queens and Richmond Counties, while the Second District, made up of the remaining counties, will have a separate commission of five. The commissioners of the First District are the following: W. R. Wilcox, Wm. McCarroll, Edward M. Bassett, Milo R. Maltbie and John E. Eustis: For the Second District, Frank W. Stevens, Charles H. Keep, Thomas M. Osborne, James E. Sague and Martin S. Decker.

William R. Wilcox, chairman of the commission for the first district, was until his appointment postmaster of the City of New York. In Mayor Low's administration he was appointed a park commissioner, and in that position established many public playgrounds and gymnasiums. On January 1, 1905, President Roosevelt appointed him postmaster of New York City. Mr. Wilcox was born in Smyrna, N. Y., in 1863, and was educated at Rochester University and the Columbia Law School.

William McCarroll was born in Belfast, Ireland, in 1851, where he also received an academic education. In 1869 he emigrated to New York to enter the leather trade and continued in this line of business, becoming in 1902 president of the American Leather Company. He is a resident of Brooklyn.

Edward M. Bassett was born in Brooklyn in 1863, and educated in the public schools of that city until his family moved to Watertown, N. Y., where he graduated from the high school. Later he went to Hamilton College and Amherst, graduating from the latter in 1884, after which he spent two years at the Columbia Law School, from which he graduated and was made a member of the New York bar. After his graduation he took care of the legal work of a Buffalo contracting firm, but returned to New York in 1892 to take up the general practice of law. Mr. Bassett has been a member of the local board of education and other educational bodies.

Milo Roy Maltbie, of New York, has been a prominent figure in recent years, owing to the work he has done in behalf of civic bodies with reference to the relation between public service corporations and municipalities. He investigated the street railway franchises of Chicago for the Civic Federation of that city, the Ramapo water contract for the Merchants' Association of New York and municipal questions in Great Britain for the United States Bureau of Labor. He was also a member of the commission recently sent by the National Civic Federation to study municipal ownership in Great Britain. Mr. Maltbie was born in 1871, and studied in several American universities. He was professor of mechanics and mathematics in Mt. Morris College from 1893 to 1895 and a fellow in administrative law in Columbia University from 1895 to 1897. He served as secretary of the Reform Clubs committee on city affairs from 1897 to 1902.

Charles Edwin Eustis is a resident of the Bronx or northern section of New York City. He is a lawyer and for many years has been deeply interested in transportation problems. Mr. Eustis was born in Limerick, N. Y., and attended the public schools of Hammond in the same State. Later he enlisted in the New York cavalry and served two years, but on retirement from military service took a scientific course at Wesleyan University at Middletown, Conn. He graduated in 1874 and was appointed city surveyor of New York. In 1875 he entered the Dwight Law School, graduating in 1877.

Frank W. Stevens, who is chairman of the commission for the Second District, is a resident of Jamestown, N. Y., and is known as one of the foremost public spirited lawyers in western New York. He was born in Leon, Cataraugus County, in 1847, and after receiving a common school education entered the Harvard Law School. He has been practicing since 1872. He was assitant district attorney of Cattaraaugus County from 1876 to 1883, a member of the Jamestown Board of Education from 1891 to 1897, and now holds that office for the second time. He has been a member of the board of water commissioners of Jamestown since 1903.

Charles Hallam Keep, of Buffalo, was until his present appointment Superintendent of Banks, to which position Governor Hughes had appointed him to succeed F. D. Kilburn. Mr. Keep was born in Lockport, N. Y., in 1861, graduated from Harvard in 1882 and from the Harvard Law School in 1885. He practiced law in Buffalo until 1903, when he was appointed assistant secretary of the treasury of the United States. He has always taken a prominent part in business and civic activities in Buffalo, having been secretary of the Buffalo Chamber of Commerce and the Lake Carriers' Association.

Thomas Motts Osborn, of Auburn, N. Y., was born in that city in 1859. He was educated in the schools of his home town and later in Adams Academy, at Quincy, Mass., and also at Harvard, from which he graduated in 1884. After his graduation Mr. Osborn became a clerk in his father's farm tool factory and later became president of the company. He has always taken considerable interest in civic affairs and was Mayor of Auburn from 1902 to 1905.

James E. Sague, of New Hamburg, N. Y., is a well known steam railroad man. He was born in 1862 and graduated as a mechanical engineer from Stevens Institute in 1883, immediately entering the service of the Chicago, Burlington & Quincy Railroad, where he remained ten years. He spent four years with the Erie Railroad, two years with the Jamaican Railroad in the West Indies and ten years with the Schenectady Locomotive Works. He served as chief mechanical engineer for six years in the American Locomotive Company's works at Schenectady, becoming assistant vice-president and then first vice- president in charge of engineering and manufacturing. He resigned this position last March.

Martin S. Decker, of New Paltz, N. Y., is at present the assistant secretary of the Interstate Commerce Commission in Washington, having held that position since the organization of the commission in 1887. He is therefore very familiar with the federal law and has frequently sat as a deputy commissioner for taking evidence. He is a lawyer and was born in Rosendale, Ulster County, in 1858, where he received a public school education and began life as a telegrapher. During the American occupation of Cuba Mr. Decker assisted in drafting the Cuban railway law.

The members for the first district met on July 2 in the offices of the old Rapid Transit Commission and elected Travis H. Whitney secretary. The announcement was made that the office of the Commission will be open from 8 a. m. to 11 p. m. every day in the year.

The new secretary was born in Gentryville, Ind., thirty-two years ago. He attended Baker University and was graduated from the Harvard Law School in 1903. Immediately thereafter he became connected with the New York Citizens' Union as secretary. Chief Engineer Rice of the old board has been retained, temporarily at least.

The new board was notified that it had inherited $400,000 from the Rapid Transit Commission, which had not expended quite half of its allowance for the year.

The Commission received on July 2 its first application for a franchise from Edward Dixon, on behalf of F. H. Behr, the mono-rail man, who wants to build a line in Brooklyn from the East River to Coney Island. The application referred to the records of the old board and asked speedy action.

The first active steps toward perfecting the organization of the Public Service Commission for the second district were taken in Albany July 2, when several expert attachés of the old State Board of Railroad Commissioners were designated to places and sub-committees of the board were assigned to look after certain details of the work.

Commissioner Decker was named as chairman of a committee to confer with the freight agents of the railroads regarding the form to be used for tariff schedules. Commissioner Sague was named as chairman of the committee on instructions for the expert attachés of the office. Commissioner Keep is to head the committee on arrangement of quarters. Chairman Stevens is the second member of each of these sub-committees. Chairman Stevens announced later that these assignments of old attachés of the Railroad Commission had been made: Steam railroad inspector, J. D. Schultz; electrical expert, Charles D. Barnes; expert inspector of accidents, E. F. Van Hoesen; inspector of locomotive boilers, G. P. Robinson; superintendent of grade crossings, Arnold H. Sutermeister; inspector of grade crossings, James E. Brazee. These men are to serve at their present salaries for the present.

THE PHILADELPHIA TRACTION ORDINANCE SIGNED

Mayor Reyburn signed at noon on July 1, the ordinance whereby Philadelphia becomes a partner in the management of the Philadelphia Rapid Transit Company, and in fifty years may become sole owner of the entire traction system. Subsequently, City Councils elected Clarence Wolf and William H. Carpenter as the city's representatives on the Board of Directors of the Transit Company. The Mayor is also a member of the board.

Under the ordinance the city is to have half of all the company's dividends over 6 per cent. The company must establish a sinking fund to extinguish its capital of $30,000,000 at the end of fifty years. When this sinking fund reaches $5,000,000 it is to be paid to the city, when it becomes the property of the city. The company is required to call in all unpaid capital and expend the whole amount in improvements. The city will have a right on any July 1, after July 1, 1957, to take over the whole property, subject to all indebtedness now existing or hereafter lawfully created, upon six months' notice. This right is assignable.

The ordinance to regulate passenger railways approved July 7, 1857, together with all other ordinances on this subject are repealed, but the city retains the right to make all rules and regulations relating to the operation and management of the company's lines necessary for public health and safety.

For paving of streets and car licenses the company will pay an annual charge running from $500,000 in the beginning to $700,000 in the last ten years of the contract. Other fixed payments are provided. The company cannot assume further leases or obligations or part with its property without the consent of the city, or issue stock or bonds without consent.

Councils may determine upon routes of new surface, elevated or subway lines, and if the company fails to accept the same within ninety days the city may offer the franchises to those who will undertake them. As a means of assuring payment of part earnings to the city, the Controller is to have access to the company's books, accounts and vouchers to verify its financial statements by examination and report the result to the Councils.

A special meeting of the stockholders of the Philadelphia Rapid Transit Company has been called for July 18 to ratify this ordinance.

CLEVELAND, SOUTHWESTERN & COLUMBUS TO CONTROL MANSFIELD RAILWAY & LIGHT COMPANY

The directors of the Cleveland, Southwestern & Columbus Railway Company have approved the plan to purchase a controlling interest in the Mansfield Railway Light & Power Company of Mansfield from F. L. Fuller, who secured control of the company some time ago. It is understood that Mr. Fuller represented the company in the purchase of this property at the time, but nothing of the kind was made public then. There are 10,000 shares of common and preferred stock outstanding and the Cleveland, Southwestern & Columbus secured 5050 of them.

At this time it is not the intention to merge this property with the others, but, the ownership being the same, they will be operated as one system when the Cleveland, Ashland & Mansfield line is completed. Besides eight miles of track in Mansfield, the company operates a line between that place and Shelby, a distance of twelve miles. The Central Ohio traction lines, owned by the Cleveland, Southwestern & Columbus, extend from Mansfield to Galion and Bucyrus, to which point the Webb line from Columbus is being built.

This company operates the lighting plant at Mansfield also, and its acquisition will place the Cleveland, Southwestern & Columbus in control of the greater part of the lighting business within the territory covered by its roads.

In all the company has $350,000 preferred stock and $650,000 common stock, with $942,000 in 5 per cent bonds outstanding. Its business is in excellent condition and will, no doubt, be of much benefit to the larger company in many ways. It is said the gross earnings this year will be $207,000.

DENVER TRAMWAY'S CHANGES HANDS

Control of the Denver City Tramway Company has passed to the East by the sale of the holdings of David H. Moffatt, president of the First National Bank of Denver. It is reported that about 68 per cent of the stock is now held by D. C. Clark and W. L. Bull, of New York, and Marsden J. Perry, Benjamin A. Jackson and Samuel M. Colt, of Providence, R. I.

PERTINENT REMARKS BY PRESIDENT OF A NEW YORK AND PENNSYLVANIA TRACTION COMPANY

W. A. Page, president of the Western New York & Pennsylvania Traction Company, addressed the Board of Trade at Bradford, Pa., last week by special invitation of that body, which is seeking the extension of the company's system to various points in that territory. Mr. Page gave it as his judgment that street railways in cities of less than 50,000 population were operated at a loss. He informed his auditors that his company intends to improve and extend the system, and contemplates building several extensions, notably from Bradford to Carrollton via Limestone and Clarkdale, the contract for which has been let to the James A. Hart Company, of New York City. Work on this extension has begun at Clarkdale. The company also contemplates a line from Eldred to State Line, which will be an extension of the Rock City line, and is now building a large sub-station at East Bradford. The lines on all paved streets in Bradford and the Lewis Run line will be reconstructed. The latter line will also be extended, just how far has not been definitely determined.

Mr. Page stated that one difficulty his company had encountered in raising funds for improvements and extensions was the fact that the Bradford franchise has a life of but thirty-seven more years, whereas the bonds are for a term of fifty years. He objected to the car tax in Bradford as wrong in principle, saying that it has a tendency to limit the number of cars operated. Mr. Page pointed out the great advantage accruing to any city possessing an interurban electric railway system, and argued that Bradford should show its appreciation by voting the company an unlimited franchise. The attention of Mr. Page was called to the desirability of building a line from Bradford to Mt. Jewett and Smethport via Kane and Hazlehurst. The Board passed a resolution of thanks for the presence and address of Mr. Page, and decided to refer to City Council with a favorable recommendation.

PERSONAL MENTION

MESSRS. A. F. BENTLEY AND P. L. DOWNS have been elected first and second vice-presidents, respectively, of the Belton Temple Traction Company, of Temple, Tex., and Lewistown, Pa.

MR. HENRY G. BRADLEE was elected on June 30 a partner in the firm of Stone & Webster. The firm now consists of Messrs. Charles A. Stone, Edwin S. Webster, Russell Robb and Henry G. Bradlee.

MR. A. V. SCHROEDER has resigned as general superintendent of the Springfield Railway & Light Company of Springfield, Mo., to become general manager of the Winona Railway & Light Company of Winona, Minn.

MR. WILLIAM H. FORSE, JR., heretofore assistant treasurer of Indiana Union Traction Company, has been appointed secretary and treasurer of the company, succeeding Mr. William C. Sampson, secretary, and Mr. John J. Collier, treasurer.

MR. RALPH L. CRUMP has been appointed resident engineer of Ford, Bacon & Davis, in charge of their work at Pine Bluff, Ark., where a contract has been taken by the firm for the enlargement and rehabilitation of the gas, water and light plants in that city.

MR. WARREN BICKNELL, formerly president of the Lake Shore Electric Railway here, was elected president of the Havana Electric Railway Company, the largest electric railway company in Cuba. Six months ago he became identified with the New York interests which backed the reorganization of the old lines in the Cuban city.

MR. PERRY A. RANDALL, of Ft. Wayne, Ind., has been elected president of the Ft. Wayne & South Bend Railway Company of Ft. Wayne, Ind., to succeed Mr. G. A. Wulkup. Mr. J. H. Grisamer, of Churubusco, Ind., was elected temporary secretary to succeed Mr. Wm. F. Dinnen.

MR. SAMUEL McROBERTS, president of the Sioux City Traction Company, has been elected president of the Illinois Tunnel Company of Chicago, to succeed Mr. A. G. Wheeler, resigned. Mr. W. J. Kenyon has been elected general manager and Mr. J. O. Armour has become a director.

MR. H. M. BEUGLER, formerly superintendent of railways for Ford Bacon & Davis' Operating Department, operating the Newman properties in Houston, Texas, Memphis, Little Rock,

Birmingham, Nashville, Knoxville, has taken a position with the firm of Dodge & Day, the well-known engineers and constructors of Philadelphia and New York.

MR. HOWARD E. HUNTINGTON, son of Henry E. Huntington, and H. O. Pratt, general land agent for the Huntington electric railway systems, have been appointed to the directorate of the San Bernardino Valley Traction Company in place of J. S. Wood and W. D. Brookings, resigned. These appointments remove all doubt as to the Huntington control of this property.

MR. E. C. RUTHERFORD, who was recently connected with the National Brake Company of Buffalo, has been appointed sales manager of the Magann Air Brake Company, of Detroit and Toronto. Before his connection with the National Brake Company, Mr. Rutherford was associated with the Magann Company, which was the pioneer manufacturer in the storage air brake field.

MR. S. N. FORD has been elected president of the Mansfield Railway, Light & Power Company of Mansfield, Ohio, to succeed Mr. Leopold Kleyboldt of Cincinnati. Mr. C. F. Ackerman of Mansfield succeeds Mr. A. S. Huey of Chicago as vice-president, and Mr. S. A. Foltz of Mansfield now is the secretary as well as manager of the company, succeeding Mr. G. H. Koehler in the first-named position.

MR. F. J. J. SLOAT, general manager of the Cincinnati Northern Traction Company, while retaining his present position, has been made division manager of the Indiana, Columbus & Eastern, with headquarters at Dayton, instead of Hamilton. He will have charge of the division between Dayton and Union City, Ind., and the Dayton & Western. Superintendent C. E. Palmer will have charge of the Hamilton offices.

MR. ARTHUR B. SHEPARD has resigned as manager of the General Electric Company's Cleveland office to spend most of his time looking after his own properties. He is president of the Toledo & Chicago (single-phase) Interurban Railway, operating from Ft. Wayne to Garrett, Kendallville, Auburn and Waterloo, and which will later be extended to Goshen. Mr. Shepard will retain connection with the General Electric Company in a consulting capacity.

MR. H. A. HILDEBRANDT, after three years' service in the mechanical and electrical testing departments of the Brooklyn Rapid Transit Company, has resigned to become superintendent and chief engineer of the department of electric light and water works of St. Peter, Minn. During his stay in Brooklyn Mr. Hildebrandt has the opportunity of carrying out tests on a wide line of electrical apparatus, particularly on motors and in connection with cable installation and maintenance.

MR. J. M. BRAMLETTE, who as previously noted in the STREET RAILWAY JOURNAL has been appointed general manager of the Michigan United Railways Company, has held the position of general superintendent of the company for more than a year past and the appointment is a well merited recognition of his efficient services. Mr. Bramlette's headquarters will continue to be in Kalamazoo, the western terminus of the system. The office of general superintendent has been abolished.

MR. GEORGE B. DUSINBERRE has resigned as Cleveland manager of the Westinghouse Electric & Manufacturing Company, to become a consulting engineer in power and railway work. Mr. Dusinberre worked his way up through the company from wireman to the position he has just relinquished. He is a graduate of Cornell University with the degree of mechanical engineer. Mr. Dusinberre's successor is Mr. G. E. Miller, now assistant to the manager of the railway and lighting department at the Pittsburg works of the Westinghouse Company.

MR. E. F. DAVIS, who as recently noted in the STREET RAILWAY JOURNAL has resigned as superintendent of the southern district of the Brooklyn Rapid Transit Company, was tendered a farewell dinner on Wednesday evening, June 26, at Feltman's Coney Island, by a party comprising the depot organizations of the southern district of company. Mr. H. Bongard, assistant superintendent of the Ninth Avenue and Fifty-Eighth Street car houses acted as toastmaster. Mr. J. J. Riley, who succeeds Mr. Davis as district superintendent, and the representatives of each depot made speeches, followed by Mr. Davis, who expressed regret at severing his connection with the company. Mr. and Mrs. Davis plan to leave for Minneapolis about June 1.

MR. S. B. STORER, of the Niagara, Lockport & Ontario Power Company, has resigned from that corporation to establish an office as consulting electrical engineer at Syracuse. Mr Storer has taken an active part in the development of high-tension power distribution in New York State during the last few years, as manager of the sales department of the Niagara Falls, Lockport & Ontario Power Company, and his several papers on this subject before the New York State association have attracted wide attention. Mr. Storer is a graduate of Ohio State University, in the class of 1893. Soon after graduation he became connected with the Niagara Falls Power Company, from which he resigned to become associated with the power transmission department of the Westinghouse Electric & Manufacturing Company. He resigned from this company to join the Ontario Power Company.

PRESIDENT ROBERT JEMISON, of the Birmingham Railway, Light & Power Company, has resigned the presidency of the company, after six years in that position, to become the chairman of the executive board. The new position gives him greater powers but relieves him of the active duties of directing the actual workings of the local system. The resignation will take effect September 1, at which time President Jemison will be succeeded as president by Mr. A. H. Ford, who is now president of the American Cities Railways Company, with headquarters in New York. For twenty years President Jemison has been connected in an official capacity with the street railway system of Birmingham and has been closely identified with the development of the system from a few important lines to the present splendid system of local and interurban lines.

MR. BENAGE S. JOSSELYN has resigned as vice-president and general manager of the Baltimore Electric and Maryland Telephone Companies to become president of the Portland Railway, Light and Power Company of Portland, Ore. The Portland Company is controlled principally by E. W. Clark & Company of Philadelphia, J. W. Seligman and Pratt & Company of New York, and the properties it owns represent an investment of about $40,000,000. Mr. Josselyn will succeed Mr. H. W. Goode, who died last April. Mr. Josselyn went to Baltimore about two years ago to become assistant to the president of the Maryland Telephone Company, and two months later was elected vice-president. Mr. Josselyn is a native of Illinois and has had an extensive experience in the management of steam and electric railways, electric light and telephone enterprises. He is known to many Baltimoreans through his connection with the Union Terminal at Sioux City, Iowa, which he succeeded in disposing of to the benfit of those financially interested.

MR. WILLIAM L. DERR has just been appointed general superintendent of the New York City Railway Company, an office which has been created for him. Mr. Derr's headquarters will be at the car house of the company at 761 Seventh Avenue. As general superintendent of the company he will receive reports from the superintendent of transportation, the general master mechanic, the engineer of maintenance of way, the superintendent of buildings, the superintendent of electrical car houses and the master mechanic of the One Hundred and Forty-Sixth Street shop. He will report to the vice-president and general manager of the company, Mr. Oren Root, Jr. Mr. Derr has had an extended experience in railroad affairs, although for the most part with steam operation. He was educated in private and public schools at Havre-de-Grace, Md., and at the Polytechnic College of the State of Pennsylvania at Philadelphia. He entered in railway service in 1876 and has been continuously in it ever since. Briefly, Mr. Derr's railway connections may be summed up as follows: 1876 to 1878, assistant engineer Susquehanna Bridge, Philadelphia, Wilmington & Baltimore Railroad; 1878 to 1880, in maintenance of way department Pittsburg, Cincinnati & St. Louis Railway; 1880 to 1883, assistant engineer maintenance of way New York & New England Railroad in charge of relocation of the line between Boston and Newburgh; 1883 to 1884, roadmaster Woonsocket & Valley Falls division and 1884 to 1886, assistant superintendent Woonsocket division same road; 1886, roadmaster Buffalo division New York, Lake Erie & Western Railroad; 1886 to 1888, roadmaster Delaware division same road; 1888 to 1889, assistant superintendent Susquehanna division; 1889 to 1890, superintendent Jefferson division, and 1890 to March 1899, superintendent of the Delaware division of the Erie Railroad at Port Jervis, N. Y.; March, 1899, to August, 1901, superintendent of the Susquehanna division at Elmira, N. Y.; August, 1901, to May, 1903, superintendent of the New York division; May, 1903, to March, 1905, chief engineer of the same road; March, 1905, to February 15, 1907, superintendent of the Hartford division New York, New Haven & Hartford Railroad at Hartford, Conn.; February 15, 1907 to June 30, 1907, superintendent of the Chicago & Alton Railroad Company at Bloomington, Ill. His experience, as outlined, has included both engineering and operation and has been with such important corporations as the Erie and New Haven roads.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement, "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. ‡ Including Rapid Railway system, Sandwich, Windsor & Amherstburg Railway, and Detroit, Monroe & Toledo Short Line Railway.

Company.	Period.	Total Gross Earnings.	Operating Expenses.	Net Earnings.	Deductions From Income.	Net Income, Amount Available for Dividends.
AKRON, O. Northern Ohio Tr. & Light Co.	1 m., May '07	158,288	94,202	64,087	42,754	21,333
	1 " " '06	140,233	85,363	54,870	39,947	14,923
	5 " " '07	667,015	412,598	254,418	209,185	45,232
	5 " " '06	592,208	387,936	204,272	199,735	4,537
BINGHAMTON, N. Y. Binghamton Railway Co.	1 m., Apr., '07	20,240	13,377	6,844	8,128	†1,284
	1 " " '06	22,012	12,461	9,550	7,363	2,188
	10 " " '07	248,989	137,249	111,740	78,596	33,145
	10 " " '06	236,951	124,312	112,638	72,936	39,703
CHAMPAIGN, ILL. Illinois Traction Co.	1 m., May '07	293,875	*168,755	125,120		
	1 " " '06	229,497	*130,057	99,440		
	5 " " '07	1,399,198	*798,774	600,424		
	5 " " '06	1,122,882	*641,046	481,836		
CHARLESTON, S. C. Charleston Consolidated Ry., Gas & Elec. Co.	1 m., May '07	61,399	37,638	23,761	12,516	10,245
	1 " " '06	52,879	32,649	20,230	12,967	7,263
	3 " " '07	172,858	109,858	63,000	40,550	22,450
	3 " " '06	154,875	96,000	58,875	38,901	19,974
CHICAGO, ILL. Aurora Elgin & Chicago Ry. Co.	1 m., May '07	116,415	61,872	54,543	26,414	28,129
	1 " " '06	102,533	55,730	46,803	24,939	21,864
	11 " " '07	1,196,047	651,826	544,221	291,311	252,910
	11 " " '06	1,062,666	585,350	477,317	269,079	208,238
Chicago & Milwaukee Elec. R.R. Co.	1 m., May '07	89,283	33,259	56,024		
	1 " " '06	69,813	26,445	43,368		
	5 " " '07	337,517	160,528	176,989		
	5 " " '06	247,318	116,538	130,779		
CLEVELAND, O. Cleveland, Painesville & Eastern R.R. Co.	1 m., May '07	19,470	*11,349	8,121	7,213	908
	1 " " '06	18,202	*12,118	6,084	6,789	†705
	5 " " '07	71,543	*41,489	30,053	28,851	1,203
	5 " " '06	63,440	*39,703	23,737	26,989	†3,251
Cleveland, Southwestern & Columbus Ry. Co. (Incl. Ohio Central)	1 m., May '07	66,993	38,819	28,174		
	1 " " '06	54,219	30,202	24,017		
	5 " " '07	270,721	164,917	105,804		
	5 " " '06	230,219	141,383	88,837		
COLUMBUS, GA. Columbus Elec. Co.	1 m., Apr., '07	28,030	*17,328	10,702	10,083	619
	1 " " '06	23,489	*12,800	10,689	8,762	1,927
	12 " " '07	324,111	*177,284	146,827	109,852	36,975
DALLAS, TEX. Dallas Elec. Corp'n	1 m., Apr., '07	84,171	*64,821	19,350	17,747	1,603
	1 " " '06	81,502	*51,383	30,119	15,660	14,459
	12 " " '07	1,052,788	*758,161	294,628	192,544	102,084
	12 " " '06	985,532	*608,380	377,152	183,095	194,057
DETROIT, MICH. Detroit, Jackson & Chicago Ry.	1 m., Apr., '07	32,133	*27,047	5,086	15,012	†9,926
	1 " May '07	36,343	*29,570	6,773	15,012	†8,239
	4 " " '07	128,950	*104,582	24,368	60,050	†35,682
‡Detroit United Ry. Co.	1 m., May '07	556,305	*338,179	218,126	113,897	104,229
	1 " " '06	506,055	*314,373	191,682	105,478	86,204
	5 " " '07	2,519,101	*1,601,714	917,387	562,035	355,352
	5 " " '06	2,222,940	*1,354,612	868,328	499,447	368,881
DULUTH, MINN. Duluth St. Ry. Co.	1 m., Apr., '07	67,291	33,523	33,768	17,645	16,123
	1 " " '06	62,181	31,841	30,339	17,524	12,815
	4 " " '07	243,989	131,322	112,667	70,366	42,301
	4 " " '06	225,355	129,190	96,165	70,007	26,158
EAST ST. LOUIS, ILL. East St. Louis & Suburban Co.	1 m., May '07	178,988	95,535	83,453		
	1 " " '06	159,183	79,022	80,161		
	5 " " '07	814,750	449,198	365,552		
	5 " " '06	733,138	375,868	357,270		
EL PASO TEX. E Paso Cos.	1 m., Apr., '07	37,966	*31,303	6,664	4,816	1,848
	1 " " '06	31,449	*20,092	11,357	3,809	7,548
	12 " " '07	426,789	*319,787	107,002	50,641	56,361
	12 " " '06	314,690	*211,946	102,744	44,758	57,985
FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co.	1 m., Apr., '07	93,940	58,282	35,658		
	1 " " '06	79,543	50,947	28,595		
	4 " " '07	360,958	224,192	136,767		
	4 " " '06	311,631	194,680	116,951		
FT. WORTH, TEX. Northern Texas Tr. Co.	1 m., Apr., '07	79,052	*49,981	29,071	10,313	18,758
	1 " " '06	64,925	*39,633	25,292	9,942	15,350
	12 " " '07	934,426	*590,369	344,057	120,878	223,179
	12 " " '06	706,147	*428,530	277,617	120,044	157,573
GALVESTON, TEX. Galveston Elec. Co.	1 m., Apr., '07	26,267	*17,227	9,040	4,167	4,873
	1 " " '06	22,618	*15,111	7,507	4,167	3,340
	12 " " '07	337,877	*199,931	137,946	50,000	87,946
	12 " " '06	274,173	*175,011	99,163	50,000	49,163
HOUGHTON, MICH. Houghton County St. Ry. Co.	1 m., Apr., '07	19,387	*12,163	7,224	3,946	3,278
	1 " " '06	17,966	*11,647	6,318	3,937	2,382
	12 " " '07	238,472	*151,193	87,278	47,133	40,146
	12 " " '06	198,460	*144,527	53,933	45,303	8,630
HOUSTON, TEX. Houston Electric Co.	1 m., Apr., '07	53,541	*35,285	18,256	8,351	9,905
	1 " " '06	47,173	*30,811	16,362	7,692	8,670
	12 " " '07	621,643	*395,643	226,000	94,460	131,540
	12 " " '06	546,457	*339,441	207,016	102,547	104,469
KANSAS CITY, MO. Kansas City Ry. & Lt. Co.	1 m., Apr., '07	472,666	245,720	226,946	149,826	77,120
	1 " " '06	435,908	220,589	215,319	138,446	76,873
	11 " " '07	5,226,289	2,631,668	2,594,614	1,613,890	980,724
	11 " " '06	4,701,659	2,345,742	2,357,916	1,503,508	854,409
LEXINGTON, KY. Lexington & Interurban Rys. Co.	1 m., Apr., '07	40,853	27,922	12,930		
	1 " " '06	40,049	29,478	10,571		
	4 " " '07	157,572	107,749	49,823		
	4 " " '06	137,557	102,391	35,166		
MILWAUKEE, WIS. Milwaukee Elec. Ry. & Lt. Co.	1 m., May '07	321,402	158,689	162,713	92,424	70,290
	1 " " '06	284,499	153,428	131,070	89,719	41,351
	5 " " '07	1,529,734	780,506	749,228	468,165	281,064
	5 " " '06	1,370,866	693,811	677,055	437,411	239,645
Milwaukee Lt. Ht. & Tr. Co.	1 m., May '07	58,009	25,741	32,269	32,656	†388
	1 " " '06	50,167	22,068	28,099	25,454	2,645
	5 " " '07	266,705	128,347	138,358	153,227	†14,869
	5 " " '06	227,490	98,585	128,905	117,954	10,951
MINNEAPOLIS, MINN. Twin City R. T. Co.	1 m., Apr., '07	465,221	218,089	247,132	115,258	131,873
	1 " " '06	415,414	197,157	218,257	109,708	108,548
	4 " " '07	1,821,162	912,386	908,776	461,033	447,743
	4 " " '06	1,621,914	789,575	832,339	438,833	393,506
MONTREAL, CAN. Montreal St. Ry. Co.	1 m., May '07	295,952	170,496	125,456	49,633	75,824
	1 " " '06	264,252	149,074	115,178	47,236	67,942
	9 " " '07	2,169,636	1,410,568	759,068	333,829	425,239
	9 " " '06	1,906,190	1,214,359	691,832	266,975	424,857
NEW ORLEANS, LA. New Orleans Ry. & Lt. Co.	1 m., Apr., '07	482,128	253,266	228,862	167,261	61,601
	1 " " '06	490,578	252,342	238,235	152,297	85,938
	4 " " '07	2,077,841	1,020,561	1,057,281	666,703	390,578
	4 " " '06	1,981,909	1,018,102	963,808	608,297	355,511
NORFOLK, VA. Norfolk & Portsmouth Tr. Co.	1 m., Apr., '07	187,097	117,192	69,905		
	1 " " '06	128,606	84,095	44,511		
	4 " " '07	629,014	411,163	217,851		
	4 " " '06	495,379	321,499	173,879		
PEEKSKILL, N. Y. Peekskill Lt. & R. R. Co	1 m., May '07	12,424	7,561	4,863		
	1 " " '06	11,023	6,225	4,798		
	5 " " '07	59,311	35,724	23,587		
	5 " " '06	50,757	28,919	21,838		
PHILADELPHIA, PA. American Rys. Co.	1 m., May '07	249,155				
	1 " " '06	225,687				
	11 " " '07	2,593,903				
	11 " " '06	2,363,219				
PLYMOUTH, MASS. Brockton & Plymouth St. Ry. Co.	1 m., Apr., '07	7,815	*6,398	1,417	1,811	†394
	1 " " '06	7,248	*5,571	1,677	1,851	†174
	12 " " '07	113,890	*72,367	41,522	21,692	19,831
	12 " " '06	103,389	*71,908	31,480	21,376	10,104
ST. LOUIS, MO. United Railways Co. of St. Louis	1 m., May '07	947,337	*622,048	325,289	230,831	94,458
	1 " " '06	911,673	*558,504	353,169	231,842	121,327
	5 " " '07	4,326,422	*2,927,682	1,398,740	1,155,458	243,282
	5 " " '06	4,050,558	*2,566,548	1,484,010	1,159,068	324,942
SAVANNAH, GA. Savannah Electric Co.	1 m., Apr., '07	46,913	*30,752	16,161	11,828	4,333
	1 " " '06	49,872	*29,982	19,891	10,978	8,913
	12 " " '07	602,072	*377,800	224,272	137,396	86,876
	12 " " '06	607,130	*366,706	240,424	129,169	111,256
SYRACUSE, N. Y. Syracuse R. T. Co.	1 m., May '07	103,072	60,609	42,463	25,201	17,262
	1 " " '06	87,628	50,609	37,019	23,257	13,762
	5 " " '07	490,98	277,866	213,116	125,577	87,539
	5 " " '06	428,125	244,199	183,926	112,401	71,525
TACOMA, WASH. Puget Sound El. Ry. Co.	1 m., Apr., '07	134,516	*86,831	47,685	29,841	17,844
	1 " " '06	105,133	*69,828	35,305	24,371	10,934
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., May '07	173,990	*106,632	67,358	47,397	19,961
	1 " " '06	167,847	*93,855	73,992	42,243	31,749
	5 " " '07	834,881	*490,132	344,749	229,111	115,638
	5 " " '06	784,391	*420,494	363,897	211,451	152,446

Street Railway Journal

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BACK COPIES.—No copies of issues prior to September, 1904, are kept on sale, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1907 *to date* 230,350 *copies, an average of* 8226 *copies per week.*

Galvanizing Line Material

The preservation of the metal ware used in pole line construction is a desirable practice in very high-grade work, and it is surprising what a large number of bolts, coach screws, washers, cross-arm braces, anchor and guard rods lend themselves to galvanizing in cases where a company can afford to reduce its long-run line depreciation by taking measures to prevent rusting when the line is first built. In such cases the question generally comes up as to which is the better process, the electrolytic or the dipping method.

There is no question but the dipping or hot galvanizing process gives a heavier coating than the electrolytic, as the latter deposits a thickness of metal measured only by a few thousandths of an inch. The former process is, therefore, more suited to anchor rods. cross braces, washers and the heavier pole line hardware, even though the coating is not as clean and smooth as the electrolytic. The latter gives a better coating for nuts, bolts, lag screws and turnbuckles, where a snug fit by thread is required, though care should be taken to see that the electrolytic process does not leave pin holes and defects exposed, which soon are attacked by moisture and rust. The hot dipping process tends to leave shreds of metal on the threads, which must either be cleaned off by a die or tap before assembly, with the resulting stripping of some of the galvanized coating. The electrical method will not stand as severe an immersion test in acid as the dipping method, but that is not a serious drawback after the work is carefully installed.

Protection of Alternators from Overloads

One of the most valuable characteristics of a well-designed alternator is its ability to withstand very severe overloads of momentary duration. It is often claimed that even on short circuit a first-class alternator cannot give sufficient current to cause it to burn out within a limited time, and it is without doubt true that the reactive drop in potential on full short circuit is so great that the current cannot under most conditions rise to a destructive value as instantaneously harmful to the windings as would be the case with a direct-current constant potential generator. At the same time, short circuits are greatly to be feared in alternating-current plants, for the derangement of the system tends to upset the balancing of loads and distribution of potential to a serious extent which may easily interrupt the service if continued for any length of time.

Modern switchboard practice tends to exclude every kind of automatic circuit-opening device between alternators and bus-bars. There is little doubt that this is wise, for experience in the last few years has definitely shown that the best place to protect a group of alternators is on the individual feeder or transmission circuits. A prominent New England engineer recently stated that in ten years' experience in several power plants with apparatus and switchboards he had never seen a case wherein an automatic device between generators and bus-bars would have been of any value, but, if used, would have been detrimental to the successful operation of the plants. The best practice locates the automatic switches in the feeder lines, so that a local short circuit will not trip alternator switches, for when several alternators are operated in parallel tripping a cir-

cuit breaker on one tends to throw more load on the other machines than they can readily carry instantly with good regulation, perhaps shutting down the whole station.

If the leads from the generators to the switchboard are carefully inspected and tested before installation and run in conduit there need be practically no apprehension of trouble in this short distance. Probably 99 per cent of the electrical troubles in alternating-current systems occur in the transmission or distributing equipment, and it is a great advantage to be able to confine the fault to the local circuit upon which it occurs, either burning out the flow by the station capacity available or shutting down a single line while repairs are made. Careful operation of a station includes regular watching of the machine ammeters to see that the alternators are not continuously overloaded. Bus-bar short circuits are, of course, not guarded against by open circuiting devices in the outgoing lines, but these are of such rare occurrence that it would not pay to install automatic switches in anticipation of an overload from such a cause. There is no question that in an alternating plant it is better insurance to put the money which would otherwise be spent in expensive automatic oil switches and auxiliary wiring in the generator leads into increased generating capacity.

Non-Competitive Interurban Service

The conviction that fast electric interurban service occupies a field of its own in relation to other transportation facilities in the same territory has been gaining ground for some little time, and corroborative evidence of this fact is always of special interest. When a high-speed electric line is built parallel to a steam road it is almost always the case that at first the latter feels the effects of the new service by reduced receipts at certain points and decreased traffic between others. If the electric line has been built on sound financial analysis, however, the chances are that in a comparatively short time the steam road will be earning a larger total than ever before. New facilities, such as electricity alone can offer, stimulate traffic in the existing tributary population and create new business. Population tends to increase in the territory and both passenger and freight traffic take a new lease of life.

In the Boston & Eastern hearings which are summarized on another page of this issue, eloquent testimony of the beneficial effect of an existing interurban line upon a long established steam system parallel with it is presented. Actual figures are not available, but one of the high officials of the Boston & Albany Railroad has confirmed the impression which we have had for some time that the Boston & Worcester Street Railway Company's electric service between the two principal cities of Massachusetts has really stimulated and created traffic in the territory which the two roads occupy. A slight falling off in certain local steam railroad receipts was noted during the first two or three months after the electric line began operation, but in the recent years of separate service in the same general territory the steam road has been materially benefited by the enlarged facilities for travel. Even the lower fares of the electric line have not sufficed to injure the business of the Albany road.

Again, a number of representative merchants in Beverly and Danvers, Mass., are assured that local business increases with increased trolley service, even though 5-cent connections with larger centers are furnished. Experience has proved in these communities that the small store keeper has nothing to fear from the trolley leading to the city. Readjustments may take place, but they are both centrifugal and centripetal as regards the distribution of travel. The net result is in favor of new methods of getting about, so long as the traffic warrants the building of the lines. The idea is about exploded that a place of good size provided with through facilities and connections is worse off than one in which dead-ended infrequent branch line service is the only means of transportation into and out of town. Of course, the effect of through high-speed electric lines on local electric systems is not quite as clear to determine, but if all the facilities are operated with a broad spirit of common interchange of interests and fitting together of intersecting services, it is scarcely open to denial that in a territory densely populated the through and local lines may help one another to their mutual profit and to the general welfare of the traveling public.

Motor-Driven Auxiliaries

The value of motor as compared with steam-driven power plant auxiliaries is one of the questions which has long been unsettled in the field of original design and station extension. Opinions differ as to the wisdom of applying the electric drive to feed-pumps, stokers, circulating and air pumps on account of the dangers of an interrupted power supply in case anything happens to the electric circuits; but in the operation of coal conveyors, crushers, hoisting buckets, sump pumps and equipment which is incidental rather than vital to the power production process, there is a more general agreement that the compactness, simplicity and efficiency of the motor drive recommend its adoption in the place of less efficient steam machinery.

Economy and reliability of operation are the two points of greatest importance in determining this matter of auxiliary power. If the exhaust steam from the auxiliaries can all be utilized in heating the boiler feed-water, the greater efficiency of the electric drive ceases to be important, and the question becomes one of relative service reliability. It has been clearly shown in the past few years that electric motors are capable of giving as regular service without breakdown as steam engines, and when the motor is of the simplicity of the induction type, without contact rings or commutator, the need of repairs in many months of work becomes almost nominal. In Europe the driving of auxiliaries electrically is widely practiced, and there is a marked tendency in this country to employ motors, in turbine plants particularly.

The crux of the whole problem may be stated to be the amount of exhaust steam needed by the feed-water. In a plant equipped with an economizer fewer of the auxiliaries need to be operated by steam, for the waste heat of the boilers in such cases raises the feed-water temperature through a large part of the range. The requirements of higher vacuum in turbine plants than in engine-driven installations increase the number of auxiliaries somewhat, so that in such cases there is generally enough steam dis-

charged from the boiler pumps, stoker engines and possibly from one exciter engine to take care of the feed-water heating. The boiler feed pumps are the least desirable of all auxiliaries for motor driving, because their exhaust is almost invariably all needed in the heaters and they must always be self-starting without dependence upon the condition of the bus-bars. One exciter in every alternating-current plant should be steam driven, unless the installation includes an exciter battery, which is a valuable though somewhat costly species of insurance. The main point is to deliver enough heat units to the boiler feed-water, to make sure that enough steam-driven auxiliaries are provided to enable the plant to start, and then to make a judicious use of motors in the remaining equipment. It is undeniably a fact that the steam equipment of modern power plants claims by far the greatest share of repair work, and the absence of leaks in wiring and motors as compared with the results of wear and tear in valves, pump packing, cylinders and pipe joints is well worth securing. Non-condensing auxiliary steam cylinders, even when compounded, consume steam at a heavy rate, and the high economy of motors demands their careful consideration in all commercial installations.

Atavism In Republics

The commonwealth of New York State is embarking on a very novel departure in government, and one which is bound to attract the widest attention at home and abroad among students of political science. The founders of the republican government in this country, both National and State, were imbued with the theory that one of the principal objects to be sought in political communities was the freedom of the individual from tyranny on the part of a majority or of a minority. To this end the National and all the various State constitutions include definitions of the rights possessed by the citizens and provide that the courts shall act as an interpreter of these rights. In other words, the judiciary was intended as the ultimate bulwark of the freedom of the citizen from the assaults of either a victorious democracy or a triumphant aristocracy or plutocracy. The establishment of the present Public Utilities Commission, however, marks an abrupt departure from the principles which heretofore have, theoretically at least, directed governmental policy in this country. It is, in fact, based, so far as the law will permit, upon those primitive methods of government in which the suzerain exercises absolute dominion over the life and property of his subjects. To be sure, the constitutional privilege of court review cannot be entirely abrogated, but it has been nullified so far as has been possible by giving immediate force to the rulings of the Commission and imposing cumulative penalties in case of disobedience until the rulings of the Commission have been declared non-constitutional through the tedious process of law.

We have already discussed the possibilities for both good and evil of the experiment in popular government now being tried in New York State, and need not traverse the ground again. It is enough to say that the methods formerly in vogue were far from satisfactory in every particular and were especially inadequate in securing quick relief from arduous conditions, when desired by both the public and the corporations which served them. Circumlocution in certain offices and inaction in others have often prevented the construction of necessary extensions to existing transportation systems, so that a board with autocratic powers to grant franchises can exercise a tremendous amount of good in the State and particularly in the city of New York. The rumor that the City Commission will immediately authorize the construction of a third track on the Second and Third Avenue elevated railways in New York City is a case in point. The value of such an extension in relieving the traffic congestion of the city has been recognized by transportation experts for many years. Relief almost equally important can be granted in many other sections of the State.

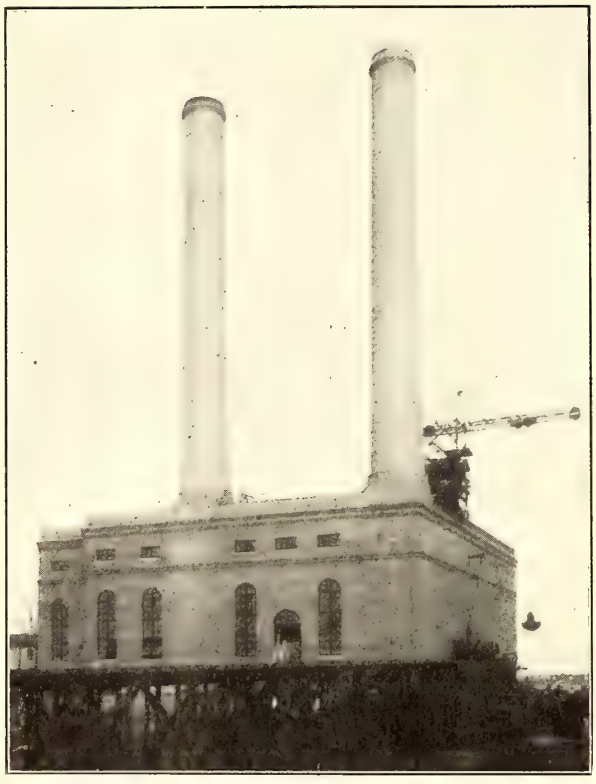
We trust, however, that the Commission, in any work of this kind which it authorizes—or "orders" might be a more exact expression—will recognize the changes which have occurred in the transportation industry during the past few years. There has been a tremendous increase in the cost of practically every item which enters into operating expenses. Wages, fuel and material of all kinds have risen greatly in price. Finally, and perhaps more important than any other factor, the existing franchise laws impose taxes which eliminate most, if not all, of the profit to the operating company in transportation undertakings in this State. In other words, the day in which electric railway companies could pay large prices for the privilege of increasing their facilities and of giving passengers longer rides for the same fare have passed away. Any new public service enterprise is automatically subjected upon its establishment to an impost which is practically proportional to the business done. For this reason the excess earnings left for capital are extremely slight.

We earnestly trust and believe that both of the Public Utilities Commissions appointed in this State realize these facts and that they will administer their office in a broad-minded way; that they will not be misled by fantastic ideas of the profits of public utilities companies derived from the days when there was no franchise tax law, and that they will set the welfare and convenience of the whole people above a narrow desire to secure temporary popularity among those who affect to believe that the business of transportation offers an unlimited mine of wealth.

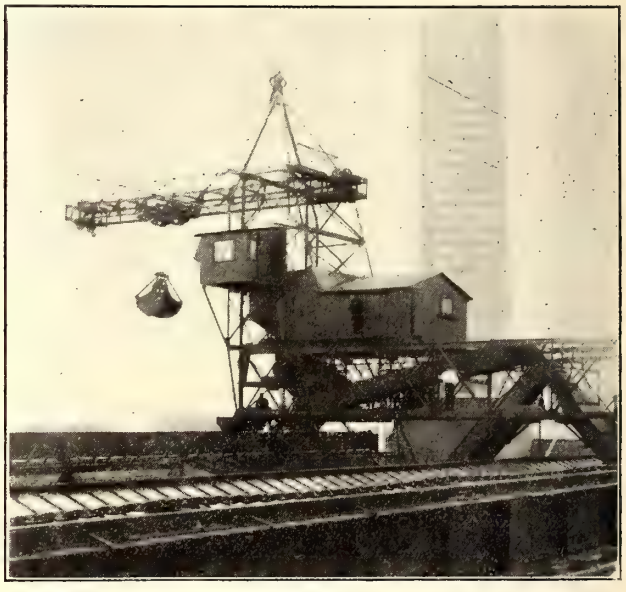
We hear a great deal at the present time about the "unwritten law," but no more striking example exists of this system of jurisprudence to-day than in New York State. The Public Utilities Commissions are bound by no precedents, and the revelation of the unwritten law governing transportation and lighting companies, as shown by the decisions of the commissions in different cases, will be of great interest to the public service corporations of the State. For this reason the suggestion made at the last meeting of the Empire State Gas and Electric Association that the members of that association and of the New York State Street Railway Association codify the new law by keeping their respective secretaries informed of all actions taken by the commissions in matters in which these companies are interested, the information to be supplied to all the members, is worthy of adoption.

THE POWER PLANT OF THE NORFOLK & PORTSMOUTH TRACTION COMPANY

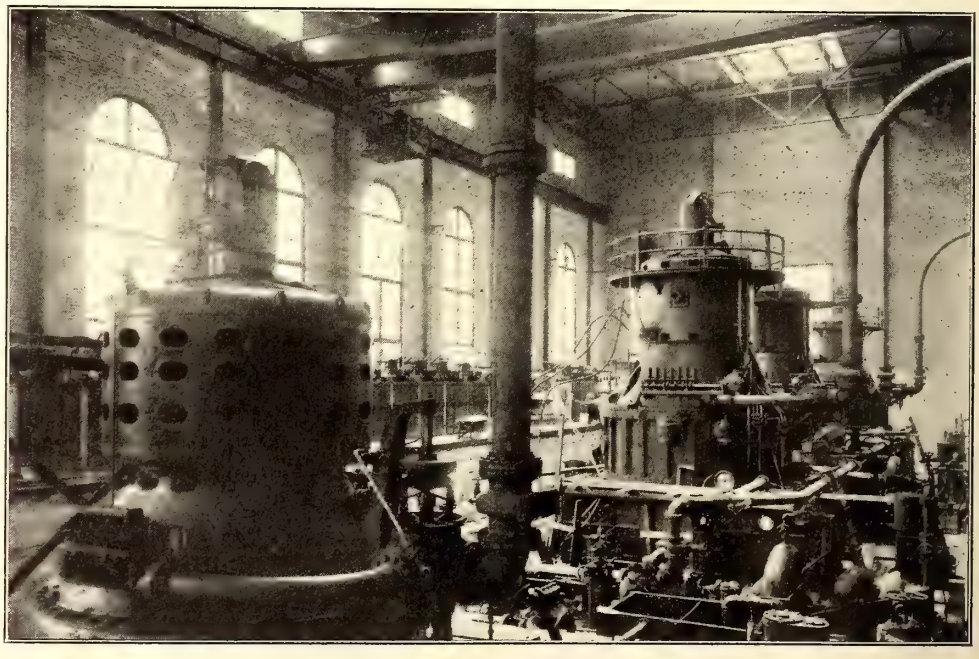
The new generating station of the Norfolk & Portsmouth Traction Company at Norfolk, Va., with a capacity of 10,500 kw, made up of a 1500-kw and three 3000-kw turbo-generator units, is thoroughly modern in all the details of its design. This station furnishes power to operate the railways in Norfolk and Portsmouth and a number of lines from those cities to resorts along the shore of the Atlantic Ocean and arms of the latter; the traffic between the Jamestown Exposition grounds and Norfolk is handled entirely by electric lines supplied with power from this station. The latter also furnishes power for electric lighting in Norfolk and the adjacent cities and for the brilliant electrical display at the Jamestown Exposition.



EXTERIOR VIEW OF THE NORFOLK PLANT



COAL-HANDLING APPARATUS AT THE NORFOLK POWER STATION



TURBINE INSTALLATION IN THE NORFOLK POWER STATION

The station occupies a rather prominent site in Norfolk on the bank of the Elizabeth River, a broad tidal stream connecting with Hampton Roads and the ocean. The exterior is designed in keeping with the surroundings. The footings and substructure of the building are of concrete built on piles driven into the sandy soil of the site. The walls are of red brick surmounted by a concrete roof supported by steel trusses carried by columns in them. The building is 148 ft. by 154 ft. 3 ins. in plan, a brick wall dividing it into a boiler room 87 ft. 5 ins. wide, and a turbine room 66 ft. 10 ins. wide, both of which extend the full length of the building.

The boiler room is along the river side of the building and contains fourteen 500-hp Babcock & Wilcox double-drum water-tube boilers. These boilers are set in batteries of two each, the batteries being in two rows, with six boilers in one row and eight in the second. The two rows face on a firing floor having a clear width of 15 ft. at the level of the boiler room floor, the fronts of the boilers in the two rows being 27 ft. apart. The space over the firing room floor is open and is surmounted by a monitor in the roof having side windows and skylights; a monitor with side windows and skylights also extends the length of the building along both sides of the roof over the boiler room. This arrangement of monitors produces good light and secures ventilation for all parts of the boiler room.

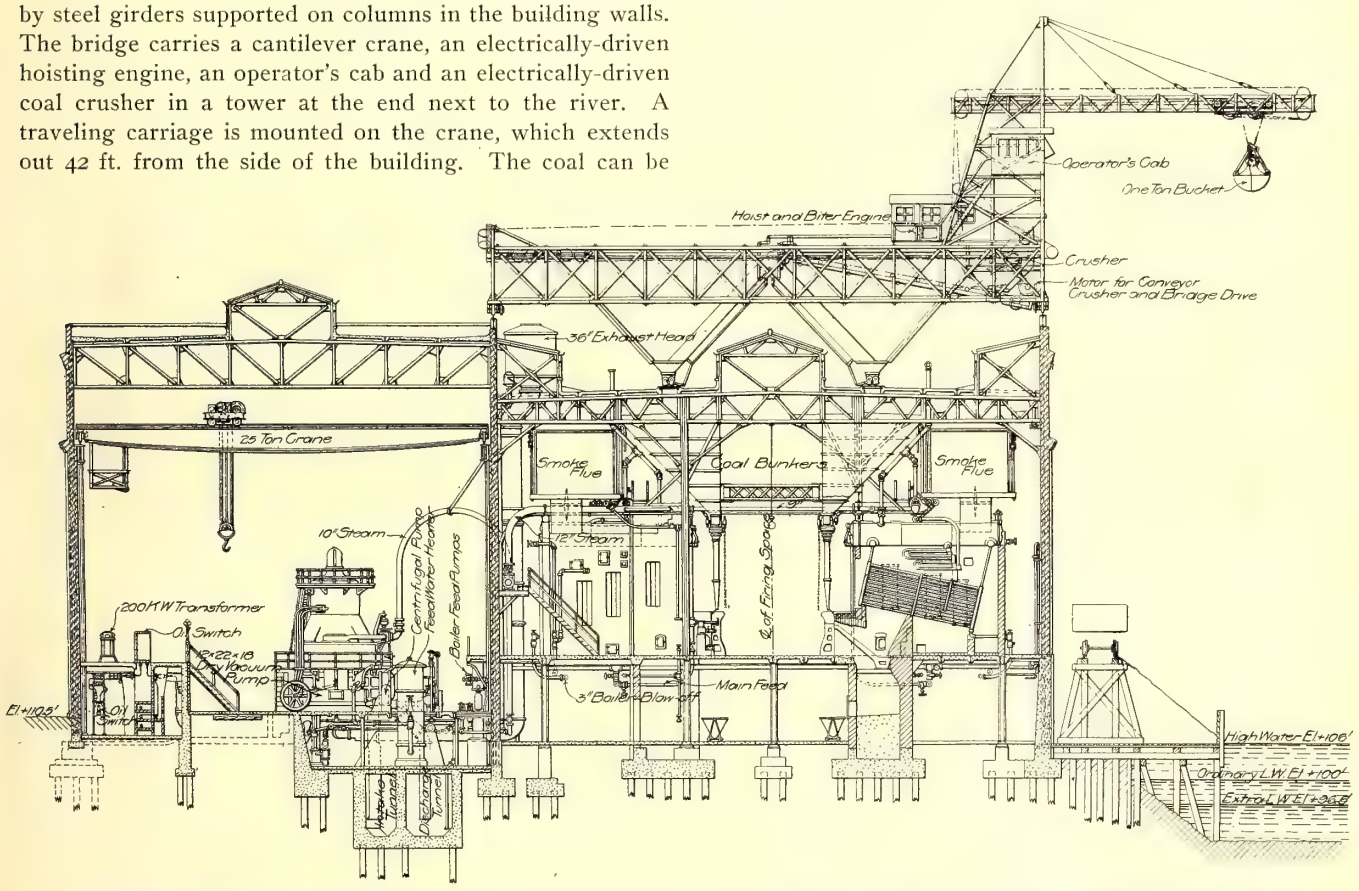
The coal supply for the boilers can be delivered in cars

on a switch track on a trestle along the river side of the building, or by vessels in the river. An open storage bin, 26 ft. wide and with its outer side 5.5 ft. high, is built on piles directly under the trestle. This bin is against the side of the building, extending the full length of that side and along one end of the latter. The floor of the bin is at the extreme high-water level in the river, while the base of rail on the trestle is 14 ft. above that level, so the bin has a large storage capacity. The coal is dumped from the cars directly into the bin, or can be unloaded from vessels into the latter.

The coal is handled from the storage bin, the cars or the vessels to bunkers over the boilers by hoisting and conveying apparatus mounted on a traveling bridge on the roof of the boiler room. This bridge has a clear span of 88 ft. and runs the full length of the building on rails carried by steel girders supported on columns in the building walls. The bridge carries a cantilever crane, an electrically-driven hoisting engine, an operator's cab and an electrically-driven coal crusher in a tower at the end next to the river. A traveling carriage is mounted on the crane, which extends out 42 ft. from the side of the building. The coal can be elevated from the cars on the trestle, from the storage bin, or from vessels moored along the dock on which the bin stands by a 1-ton clam-shell bucket swung by a hoisting cable from the traveling carriage.

The clam-shell bucket dumps into a hopper at the inner end of the crane. A chute leads from this hopper to the coal crusher immediately under it, the crusher discharging on a belt conveyor inclined upward toward the top of the traveling bridge and extending to the middle of the latter; the crusher may be by-passed and coal discharged from the hopper directly to the conveyor. Gates are arranged at the end of the conveyor so the latter will discharge at the middle of the bridge into either or both of two inclined chutes leading down to openings in the roof of the boiler room. These chutes are each fitted at the lower end with an undercut gate controlled from the operator's cab. Coal is supplied by these chutes to two rows of bunkers over the fronts of the boilers, each boiler having a separate bunker with a capacity of 95 tons. An opening in the roof, normally covered with a tight hatch, is provided over each of the bunkers, which are fed through these openings by the chutes on the traveling bridge. The bunkers are carried by steel columns in the fronts of the boiler settings and by the roof trusses. A vertical chute controlled at the top by a gate operated from the firing room floor feeds coal from each bunker to the charging hopper of the stoker immediately under it.

The ashes from each stoker are discharged into a tight chamber directly under the front of the boiler setting. A chute also leads into this chamber from back of the furnace bridge, which is provided for conducting into the ash chamber the soot and fine ashes that collect back of the bridge. Two 24-in. gage tracks are laid the length of the floor of the basement under the firing floor in the boiler room, one track in front of the ash chambers under each row of the boilers. The ashes are drawn out of these chambers through doors directly into 1-yd. dump cars running on these tracks. These cars are pushed out of the building by hand to low ground around the station on which the ashes will be dumped for filling.

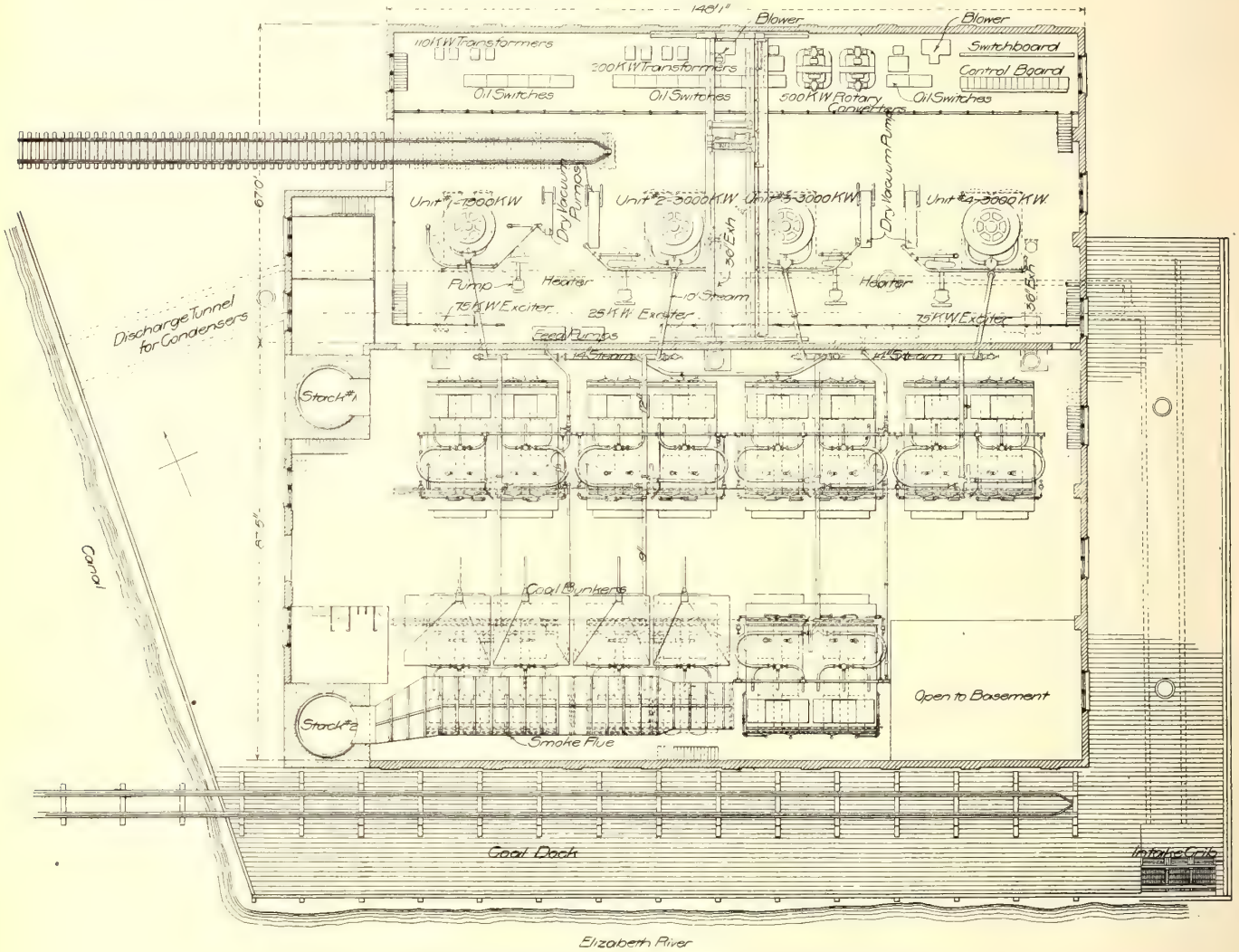


CROSS-SECTION OF THE NORFOLK POWER STATION OF THE NORFOLK & PORTSMOUTH TRACTION COMPANY

The setting and arrangement of the boilers do not involve any unusual features. The boilers are designed to operate at 195 lbs. pressure and are each equipped with superheaters capable of raising the temperature of the steam to 150 degs. F. above the temperature of saturated steam. Two brick stacks, 12.5 ft. in diameter and 200 ft. high above the boiler room floor, are built on separate concrete footings at one end of the building, each stack serving one row of boilers. A smoke flue built of steel plates extends the length of the boiler room from each stack and is swung over the rear of the boiler settings from the steel roof trusses. Each of the boilers is con-

nected to one of the flues by a short vertical breeching.

Two pairs of 18-in. x 12 in. x 24- in. Atlantic type upright Dean Bros. feed-water pumps and two Alberger feed-water heaters, with 2500 sq. ft. of heating surface each, are installed in the turbine room, one pair of pumps and one heater forming a set. The four main units in the turbine room are all operated condensing. A separate hot-well is provided to receive the discharge from the condenser of each unit, an 8-in. x 12-in. x 12-in. Alberger vertical pump being installed at each of these wells to deliver the condensed steam to the feed-water heaters; these pumps may also discharge into the tunnel under the turbine room



GENERAL PLAN OF GENERATING EQUIPMENT, STEAM PIPING, ETC.

basement. Make-up water is supplied to the heaters from a connection with the city mains, and a second connection with those mains is provided so the heaters may be supplied entirely with cold water, if necessary. The steam-consuming units of the auxiliary equipment in the station discharge their exhaust steam into the feed-water heaters.

The boiler-feed pumps can draw either from the feed-water heaters, from a condenser discharge tunnel under the engine room, or from the city mains. Each pair of pumps supplies a separate system of feed-water piping for the boilers, the two systems being interconnected so any pump can supply either row of boilers. A 4-in. main feed-water header, hung from the ceiling of the basement under the boiler room, is provided for each row of boilers. These headers are supplied through a connection from both sets of pumps, each boiler having a connection with the header under its row. An auxiliary header is extended over each row of boilers, these two headers being interconnected and supplied independently from the feed-pumps.

A 14-in. steam header in two sections is supported on the wall between the engine room and boiler room, the two sections being connected by an 8-in. loop. Two 12-in. branches are extended from each section of the steam header to connections with the first row of boilers and are then continued as 9-in. lines to the second row of boilers. The two drums of each boiler have a 6-in. connection with one of these branches, the connections each having a check and stop valve and an angle valve at the boiler, and a gate valve at the header.

Two of the main units in the turbine room are supplied from each of the two sections of the header, the latter having a valve at the middle by which either half of it may be operated independently. A line is extended into the turbine room basement from both ends of each section of the header to supply the auxiliaries in the turbine room, all of which are steam driven.

Hydraulically-operated Crane gate valves are used on the steam headers and on the main connections from them. They are arranged for operation from the basement of the boiler room. Water under pressure for operating the valves is obtained from connections to the supply lines leading from the feed-water pumps to the boilers, auxiliary connections also being provided. These connections are

each controlled by a four-way cock, the controlling cocks being brought together in two groups on the wall of the boiler room basement so the operator may close all of the valves on one section of the steam header and on the branches of the latter leading to the main units in the turbine room, without moving from the group of controlling valves. All the fittings and valve bodies on the main live steam connections are of cast steel.

The four main units in the turbine room are in a single row, the 1500-kw unit being at the front end of the station. Between this unit and the first 3000-kw unit are the condenser equipments for these two units, one feed-water heater and a pair of feed pumps. The third and fourth units are arranged in a similar pair with their auxiliaries between them. The plans for the station contemplate that the building will be extended from the end which the fourth unit occupies.

The four main units have three-phase, 60-cycle, 11,000-volt, 10-pole alternating-current General Electric generators, which are each direct connected to a Curtis turbine, and are operated at 720 r. p. m. The steam supply to these turbines is automatically controlled by an oil-operated governor in each case. The turbines all have base-condensers of the Alberger type, those on the 3000-kw units having 12,000 sq. ft. of surface, and the one on the 1500-kw unit having 6000 sq. ft. of surface. Cooling water for these condensers is obtained from a large tunnel which connects with the river and extends the length of the building under the floor of turbine room basement. Three 20-in. Alberger volute centrifugal pumps, each direct connected to a steam engine, are placed on the turbine room floor, one close to each of the large units, which delivers the water from the intake tunnel to the condensers. A 16-in. volute centrifugal pump performs the same service for the condenser of the 1500-kw unit. After the circulating water has passed through the condensers it is discharged into a second tunnel, which parallels the intake tunnel and is also connected with the river, the two tunnel connections being at nearly diagonally opposite corners of the station site.

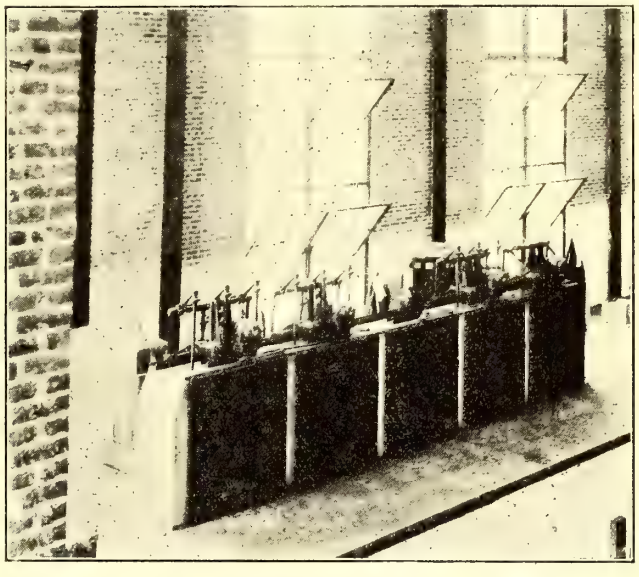
A 12-in. x 22-in. x 18-in. Alberger dry vacuum pump is used in connection with the condenser of each of the large units and an 8-in. x 20-in. x 12-in. dry vacuum pump serves the condenser of the 1500-kw unit. These pumps are on the floor of the turbine room, close to their respective units. Each condenser has an exhaust to the atmosphere through a riser extending above the roof of the boiler room. Each free exhaust outlet is fitted with a bronze mounted Davis turbine relief-valve, a 24-in. size for the 3000-kw and an 18-in. size for the 1500-kw unit.

The oil for the lubrication of the turbines and for the governors is supplied by four 9-in. x 5⅛-in. x 3⅛ in. x 10-in. duplex, center-packed plunger Blake pumps of the differential type, one pair of these pumps supplying two turbines. These pumps take suction from a pipe supplied from the storage chamber of an oil filter in the basement, to which the oil from the bearings of the turbines is returned by gravity. The connections between the pumps and the bearings are arranged so either pump of a set may supply either turbine in each pair.

A 25-kw and two 75-kw, 4-pole, 125-volt direct-current General Electric generators furnish excitation for the main generators. These exciters are each direct connected to a horizontal Curtis steam turbine and operate at 2400 r. p. m.

A part of the output of the alternating-current generators is transformed by two 500-kw General Electric rotary converters in the engine room to direct current at 550 volts and is transmitted at that voltage for use on the street railway lines in the immediate vicinity. A large part of the remainder of the output is transmitted at 11,000 volts to sub-stations where it is transformed by rotary converters to direct current at 600 volts. The balance is stepped-down to 2300 volts alternating current and is used to supply lighting circuits.

The transformers, converters, control board, switchboard, and so forth, are mounted on a concrete platform, 17 ft. 8 ins. wide, which extends the length of the engine room, 8 ft. above the level of the floor of that room. The three cable leads from each main generator are carried under the engine floor in conduits to current transformers under the platform and then to motor-operated automatic 11,000-volt General Electric oil switches mounted on the platform. These switches are connected through disconnecting switches to three-phase buses in a brick compartment under the space enclosed by the platform and the wall in front of the latter. Each bus is in a separate section in this brick compartment. The buses are sectionalized at the middle by a 11,000-volt, motor-operated oil switch, two generators



OIL SWITCHES MOUNTED ON PLATFORM

being on each section. Three 11,000-volt feeder lines lead out of the station from each section of the bus-bars. Leads also extend from one section of the buses through disconnecting and oil switches to the primaries of two 550-kw, three-phase G. E. air-blast transformers mounted on the platform. The 11,000-volt current is stepped-down to 420 volts by these transformers which deliver it to the rotary converters. The current used for lighting is stepped-down to 2300 volts by three 200-kw and three 100-kw single-phase, delta-connected transformers, motor-operated oil switches and disconnecting switches being provided between the 11,000-volt buses and the transformers, and solenoid-operated oil switches and disconnecting switches between the transformers and the 2300-volt buses.

The oil switches, rheostats, field switches and the governors of the main generators and the switches for the 11,000-volt lines are operated by remote control switches on a switchboard having 110 volts at the latter. This board has a panel for each generator, a tie panel for the 11,000-volt buses, a panel for each of the rotary converters, two transformer panels and six outgoing line panels.

The regulation of the auxiliary equipment, the direct-current side of the rotary transformers and 600-volt feeders,

the local power and lighting circuits, and so forth, are controlled from a second switchboard. This board has two panels for Tirrill voltage regulators, a panel for each of three exciter units, a station lighting panel, four panels for 600-volt, direct-current feeder lines, two panels for the positive of the direct-current side of three rotary converters, a 600-volt panel for power supply around the station and three 2300-volt feeder panels.

A switch track is extended into the engine room for a car length to expedite the delivery of heavy machinery. A 25-ton Niles-Bement-Pond traveling crane operated by three electric motors spans the turbine room and serves all parts of the latter.

The station was designed and built under the direction of Sargent & Lundy, consulting mechanical and electrical engineers, of Chicago. J. B. McAfee, C. O. Emmons and E. C. Hathaway formed the engineering committee in charge of the design and construction of the station for the Norfolk & Portsmouth Traction Company. The electrical equipment of the turbine room was furnished and installed by the General Electric Company.

DUTIES OF THE INDIANA RAILROAD INSPECTORS

To make railroad traveling safer, the Indiana Railroad Commission has issued a circular setting out in detail the duties of the inspectors who will be sent out over the State, beginning July 1. The inspectors are required to make daily report of their work; must carefully examine all main tracks, side tracks, connections, culverts, bridges, trestles and terminals; examine the officers and men employed as to the efficiency of the service and management; see whether the company furnishes printed rules of operation, as provided by law; whether they instruct the men in these rules, whether the men obey them, and if not, why; whether any officer or employee is intoxicated while on duty or for any other reason incompetent to perform his work; whether full-train crews are provided; whether men are worked continuously exceeding sixteen hours; whether train dispatching, including the work of the operators, is properly conducted; whether agents and officers and employees are courteous and accommodating in their treatment of the public. If rolling stock is found to be defective or dangerous it must be condemned by the inspector and put out of commission until repaired.

WORK ON PHILADELPHIA SUBWAY-ELEVATED LINES

The Philadelphia Rapid Transit Company has begun construction of the Delaware Avenue elevated railway comprising section No. 11 of the combined subway and elevated railway system outlined in the Street Railway Journal of Sept. 23, 1905, and of which the Market Street line forms the beginning. This section extends for about a mile over the steam railroad tracks paralleling the Delaware River, and eventually will join the Market Street line when the latter is continued on section No. 6, through Water Street to Arch Street and Delaware Avenue. All of the piers on Delaware Avenue are now in place and the line is planned for completion by Jan. 1, 1908. The structural features of this line were described in the Street Railway Journal of Feb. 16, 1907. Section No 5, comprising the subway loop around the City Hall, is also under way, as shown in one of the accompanying illustrations.



AT WORK ON THE LOOP AROUND THE CITY HALL

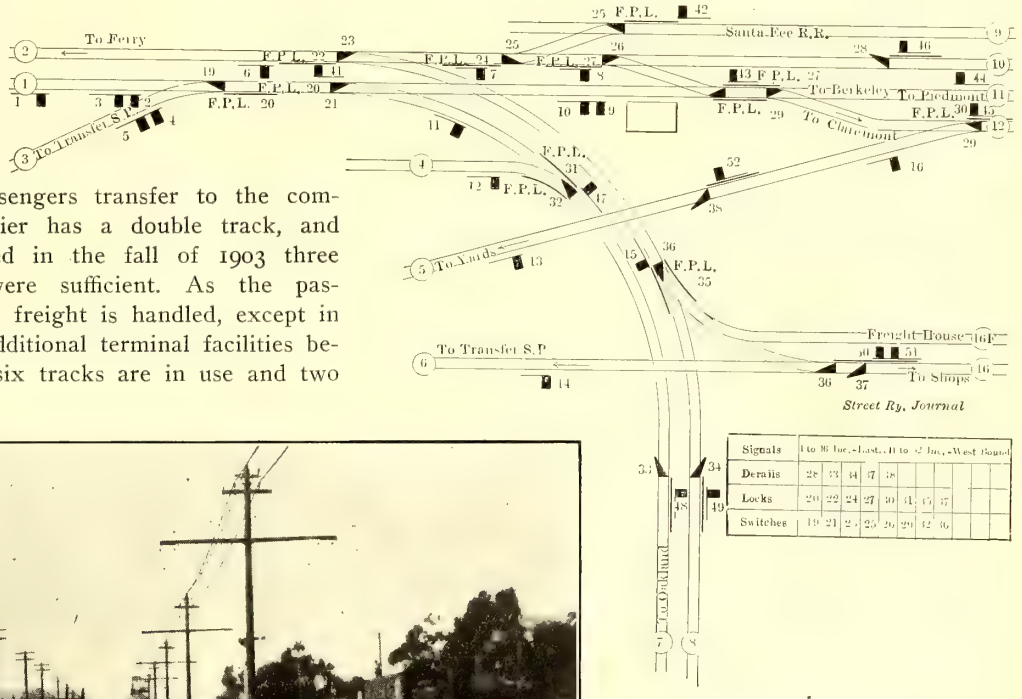


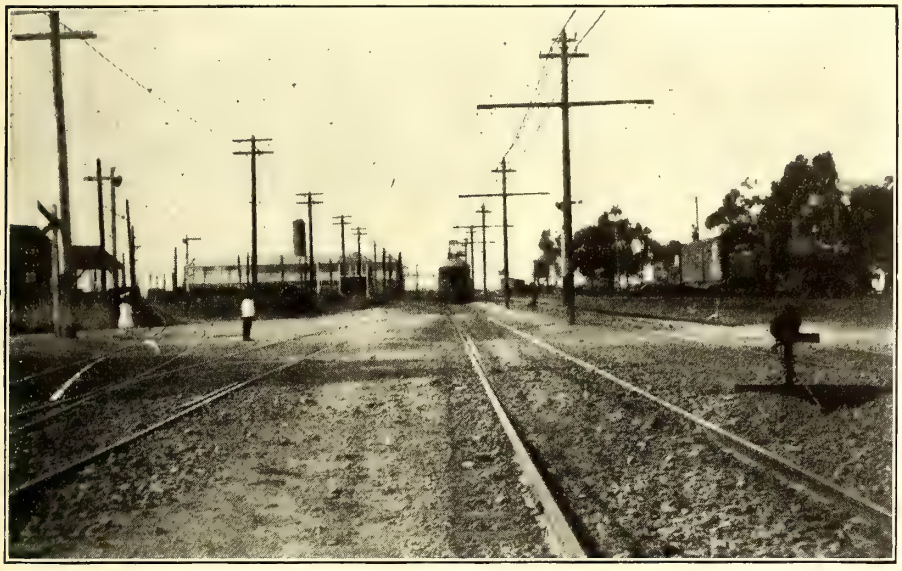


TWO VIEWS ALONG DELAWARE AVENUE, PHILADELPHIA, SHOWING THE FOUNDATIONS OF ELEVATED PILLARS

KEY ROUTE INTERLOCKING PLANTS

The San Francisco, Oakland & San Jose Railroad has installed two interlocking plants on its Key Route system for facilitating the handling of its electric train service on the Oakland side of San Francisco Bay. Station No. 1 is located at the end of the 17,000-ft pier, where the trains run into a large train shed and where passengers transfer to the company's ferry boats. The pier has a double track, and when the road was opened in the fall of 1903 three tracks at the terminal were sufficient. As the passenger traffic increased (no freight is handled, except in small quantity at night), additional terminal facilities became necessary, and now six tracks are in use and two more are soon to be added.





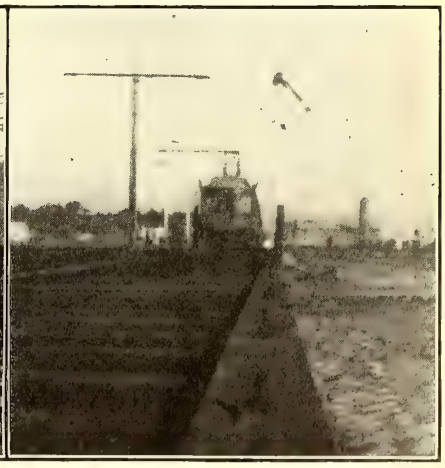
THE APPROACH TO THE STATION AT YERBA BUENA AVENUE

This first interlocking plant was installed about two years ago, a tower being built at one side of the pier so that the operator can command a view of the entire terminal, as well as the long pier. It is equipped with a twenty-four-lever machine for hand manipulation, and twenty-one working levers are at present in use. Standard track semaphores are installed.

Station No. 2 is located on Yerba Buena Avenue near the end of the pier and between the company's power house and its shops. It controls the trains on the main line going to Berkeley and Piedmont, the Oakland branch turning to the south, and the new Claremont branch, which parallels the main line for several blocks. It also controls the switch and service tracks connecting with the Santa Fe and Southern Pacific Railroads, and the shops, yards, freight house and power house. The tower is centrally situated and the interlocking system operates switch and signal points up to 2565 ft. west of the tower, 720 ft. east and 525 ft. south. A fifty-two-lever machine is installed in the tower with forty-eight working levers. The tower is large enough for seventy-six levers. The system installed is the standard type of the Union Switch & Signal Company with wooden signal towers, Hayes derails, etc. Red signals are used to indicate danger and green to clear. At No. 1 signal on the end of the pier yellow is used as a caution and clearing signal.



THE LOCATION OF THE 48-LEVER TOWER



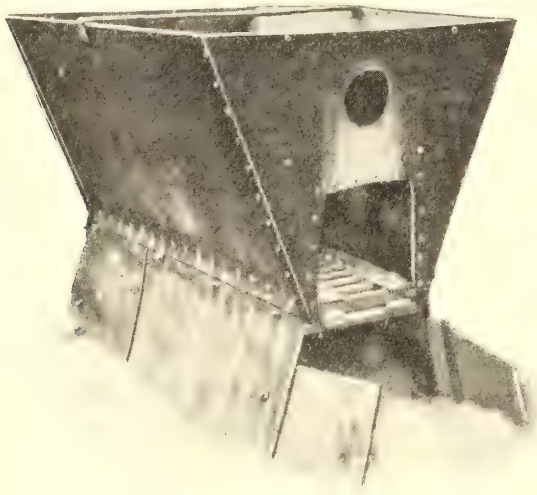
BLOCKS ON THE PIER

SAN ANTONIO SHOP NOTES

Several unique devices are in use in the shops of the San Antonio Traction Company. Through the courtesy of T. C. Brown, superintendent of transportation, an account of some of them is given.

SAND DRIER

A sand drier built by Mr. Brown is shown in an accompanying reproduction. It consists of a hopper-shaped bin

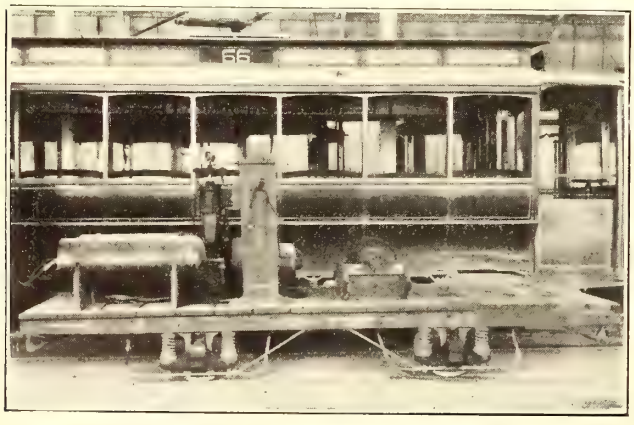


SAN ANTONIO HOME-MADE SAND DRIER

with a U-shaped furnace built inside. The dry sand falls through 1-in. holes, at the bottom on each side of the furnace. The bin is about 6 ft. long and 4 ft. wide at the top. The hopper is usually kept full of sand and enough is dried by simply burning the trash that accumulates about the shop in the furnace.

SHOP UTILITY CAR

A general utility car in use about the shops has mounted upon it an air compressor and storage tanks. The car is hitched to a motor car and is utilized to convey armatures and heavy parts about the shops. The air equipment is used for blowing out controllers and motors. These are

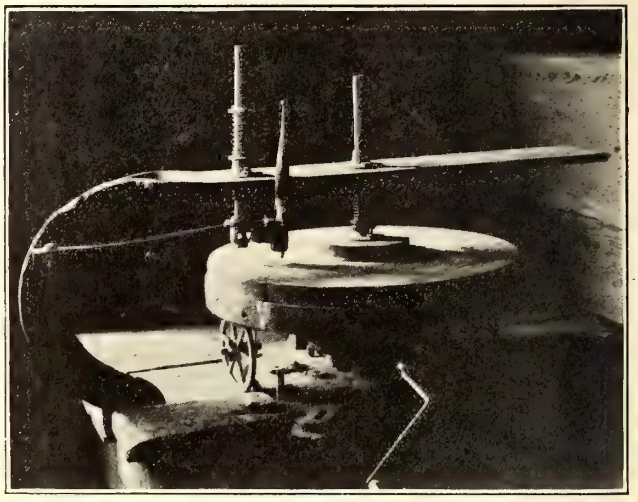


GENERAL UTILITY AND AIR COMPRESSOR CAR IN SAN ANTONIO

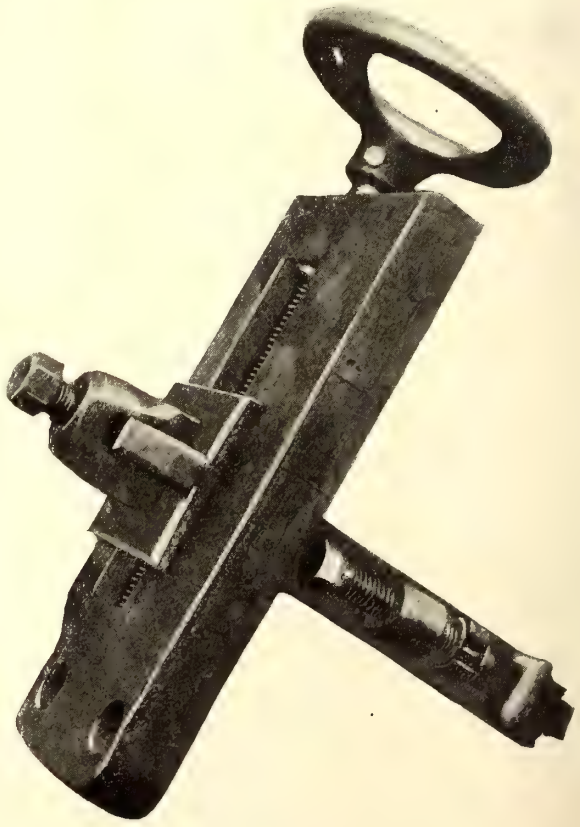
blown out each day, and since the practice has been inaugurated there has been a noticeable decrease in controller troubles. On the car is mounted an old-style vertical compressor and two 16-in. x 48-in. tanks.

DEVICE FOR CLEANING RAIL GROOVES

The company is experimenting with a device for cleaning the rail grooves in paved streets. Formerly these were cleaned by hand, and one man's time was required about one and one-half days per week to keep the track in condition. With the device all the tracks can be gone over in about two hours. It consists of a frame attached to the rear end of the car truck and which has several downward projecting teeth to gouge the dirt out of the groove. These teeth are so held in place by springs that when rigid obstructions are met, as at switches, the teeth are pulled back so that they slide over the obstruction. The device is raised



HEADLIGHT GLASS CUTTER IN SAN ANTONIO SHOPS



COMMUTATOR-TURNING DEVICE

by a lever on the platform above. The device was gotten up and patented by C. H. Frick, shop machinist, who has also devised a method for turning commutators without removing the armatures from the motor.

COMMUTATOR-TURNING DEVICE

The device just mentioned, which is shown in an accompanying reproduction, is used on G. E. 52, 54, 62 or 67 mo-

tor. It is bolted over the opening over the commutator by extra long bolts, substituted for those holding the brush holder yoke in place. The tool held in the downward projecting arm is adjusted by the cap screw to the diameter of the commutator. The motor being worked on is then cut out and the car is operated by the other motor. As the armature revolves the tool is shifted laterally by the hand wheel, which projects beyond the motor casing.

HEADLIGHT GLASS CUTTER

Considerable time is saved in the shop by the use of a device for cutting headlight glass. The device was made largely from the mechanism of a discarded Lewis & Fowler register. It consists essentially of a revolving table on which the glass is placed and a glass cutter held stationary in a spring support over the table. The table is turned by a crank which has been attached to the shaft formerly used to turn the register back to zero reading.

WRECK CAR

An old eight-bench open car is used as a wreck car. The four posts adjacent to the corner posts have been sawn out and the central portion of the car has been enclosed. The car is kept in a portion of the yard where it can be gotten out quickly, and is well supplied with wrecking tools. Included in these is a horse with chain blocks for raising trucks and a truck used in bringing in cars with broken axles. This latter is a four-wheel truck built with a swivel bolster. The disabled end of the car is raised up so that the wheels clear the track and then the truck is run under the elevated end. The car is then returned to the shop with one motor. With this truck a crew has received word over telephone of a breakdown, gone one and one-half miles and returned to the shop with the disabled car in 40 minutes.

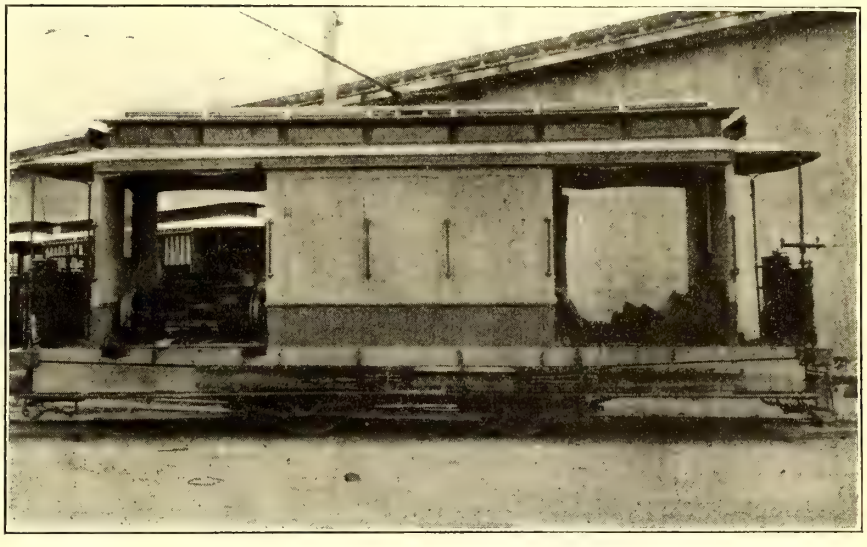
A close record is kept of all trips made by the wreck car. Information concerning these is furnished to the superintendent of transportation on special blanks, which indicate the time the car was out and the nature of the wreck. A few years ago the track was in very bad condition and the wreck car was kept busy getting cars back on the track. However, in the last three years the tracks have been almost entirely rebuilt with the result that the wreck car is very seldom required to go out.

The Montreal Street Railway Company has issued a trolley folder addressed to visitors in the city of Montreal who would see the many beauty spots in the suburbs comfortably and cheaply. The cover is an artistic reproduction in colors of a city view in Montreal, showing the highlands in the distance. The booklet proper is well illustrated with typical scenes in and around the city. It also contains a map of the Montreal Street Railway Company's local and suburban lines. A feature of special interest to the trolley traveler is the schedule of time, rates of fare, etc., to such points as Lachine, Sault-au-Recollet, St. Laurent, Cartierville, Pointe aux Trembles and Bout de l'Ile. There is also a bird's-eye view of the city of Montreal, made into a headpiece to precede the reading matter.

CALIFORNIA MIDLAND RAILROAD

The California Midland Railway is one of the several electric railway projects under construction in the central part of California, which will greatly improve the transportation facilities of that section of the State. The road is intended to connect Marysville with the mines of Nevada and Placer Counties. Its main line will extend 34 miles east from Marysville to Limekiln Junction, with a branch 17 miles south to Auburn on the main line of the Southern Pacific. Other branches will extend 12 miles northeast to Grass Valley, which is now connected to Nevada City by an electric railway, and 1½ miles to Hammond, the center of the gold-dredging industry on the Yuba River. In all, there will be about 70 miles of track, and, as the route runs through the Sierra Nevada foot hills, it will be a picturesque one. The maximum grade will be 3 per cent for a stretch of 7 miles. In addition to several large bridges and fills, the road will cross the Yuba River and marsh near Marysville over a 9000-ft. trestle.

The road will be operated by 1200-volt direct current supplied from four reinforced concrete sub-stations by a third rail of the under-running type. Power, which will be purchased from the California Gas & Electric Corporation, will be stepped-down from 60,000 volts at the sub-stations and converted into 1200 volts direct current by 400-kw motor-generators. The sub-station will be located at Marygold, Limekiln, north of Auburn, and midway between Marygold and Limekiln.



SAN ANTONIO WRECK CAR, SHOWING TRUCK USED IN BRINGING IN CARS WITH BROKEN AXLES

For the contact rail the company plans to use a special low-carbon steel rail of inverted T section, weighing 22.4 lbs. per yard. The rail will be keyed at the web to wrought iron stirrups, which will hang from porcelain insulators supported on channel-iron brackets spiked to the ties. These supports will be spaced every 15 ft., and with the light section of rail each support will carry but a little over 100 lbs. weight. The rail will be arranged to carry four No. 0000 auxiliary copper feeders if necessary. The rail will have a conductivity of 345,000 cm, with a resistance, including bonds, of 0.16 ohm per mile.

Fifty-two-foot passenger cars will be used, each equipped with four 75-hp, 600-volt motors connected two in series for 1200-volt operation. Across the motor terminals will be shunted potential relays to eliminate the possibility of

trouble from the loss of one motor of a pair. The cars will be supplied with pantograph trolleys for supplying the motors in towns equipped with overhead conductors, but in the country the current will be taken up by four under-running collector shoes. The brakes will be operated by compressed air, which will also control the changing from the third rail to the trolley. The track will be protected by a block-signal system. John Martin, of San Francisco, is president of the California Midland Railway Company, and C. C. Manker, electrical engineer, had charge of designing the electrical details.

TURBINES IN PHILADELPHIA

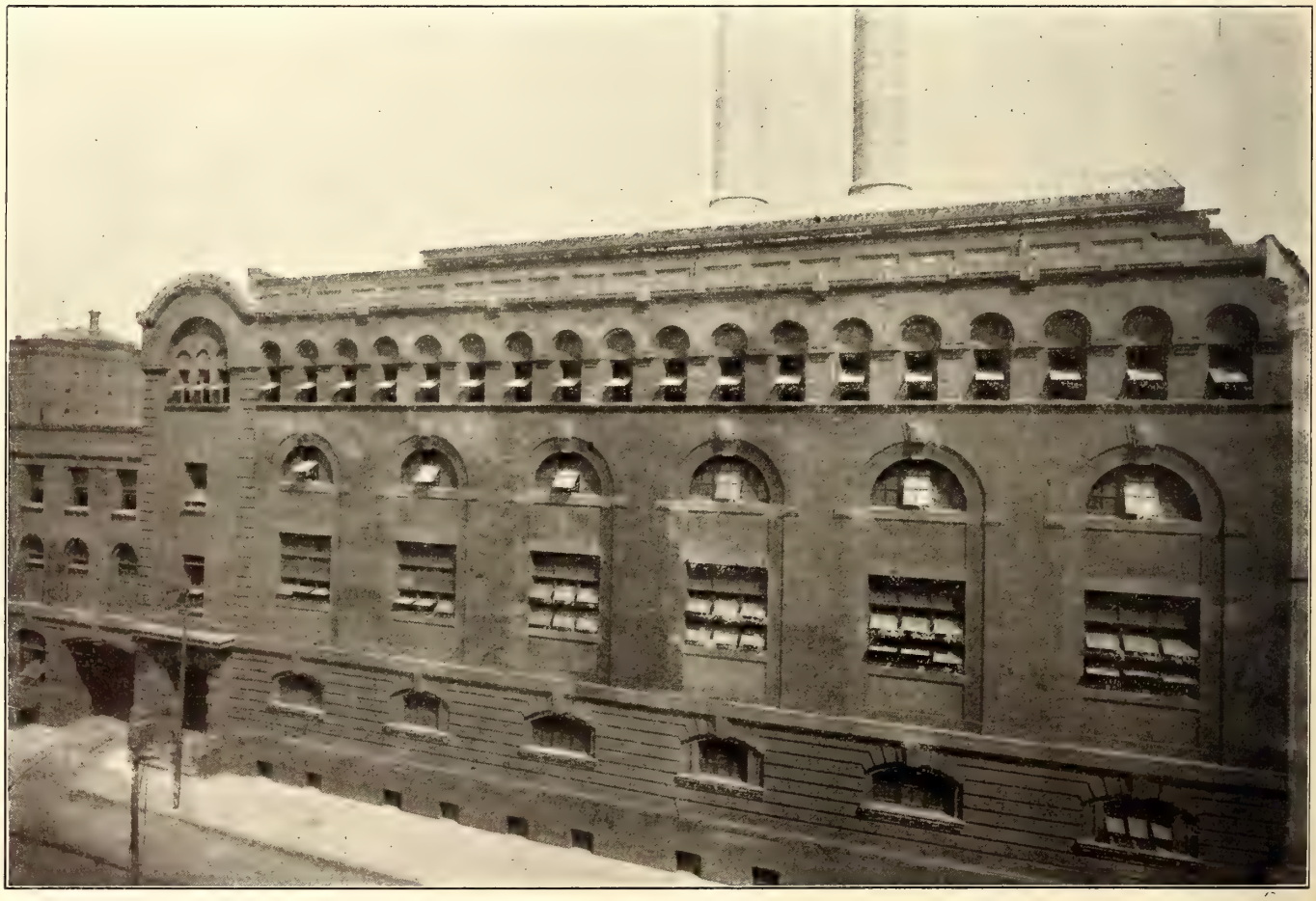
The Philadelphia Rapid Transit Company is now putting the finishing touches on the Delaware Avenue power station, of which a preliminary description was published in the Street Railway Journal of Sept. 23, 1905. At present this station contains two 6000-kw Westinghouse turbines, the first of which was started Feb. 22 and the second a month later. The third and last unit will be started in about a month.

Thus far no tests have been made of any of these turbines, as they are using hard coal temporarily, but later this summer when the boilers can be fed with soft coal, complete tests will be made on all machines before their final acceptance. It might be noted that one reason for delaying tests on the Delaware Avenue turbines is the fact that this station is used intermittently at present and will not give continuous service until the fall. In addition to these turbines, the old Delaware Avenue station contains a 2000-kw Curtis unit which has been running for twenty months.

There are also six 1500-kw Westinghouse turbines in the Wyoming Avenue station which have been running for over two years. At present one-third of the power from this station is generated by turbines. In general, these machines are giving satisfactory service, but there are still a number of points about them, such as the best method of lubrication and detection of internal troubles, that can only be settled by further experience with this type of prime mover.



INTERIOR VIEW OF THE DELAWARE AVENUE STATION



EXTERIOR VIEW OF THE DELAWARE AVENUE TURBINE STATION OF THE PHILADELPHIA RAPID TRANSIT CO.

THE DEFORMATION OF RAILS AND WHEELS

At the engineering conference of the (British) Institution of Civil Engineers in London, a paper was presented June 20 in the railway section by H. R. A. Mallock, on "The Action Between Wheel and Rail." It was based on observations by the author on the rails of the tube railways in London, which become rapidly worn, especially just after they are laid. An abstract follows:

I assume that the wheel and the rail are made of the same steel, and that such steel will bear a load of 20 tons per square inch on its surface before deforming. Hence, if each wheel carries a load of 4 tons, there must, at any rate, be more than 1/5 sq. in. of contact between the rail and the wheel, for 1/5 sq. in. would be required if the pressure was uniformly distributed over the whole area; but in the actual case the pressure is greatest at the middle of the contact area, and it can be shown that the maximum pressure is half as large again as the mean.

The next question is, if a steel cylinder of a certain radius and width rests on a flat steel rail of the same width, and carries a definite load, how much will the cylinder depress the rail and how much will the rail flatten the cylinder?

It appears that over the area in which they come in contact the profile of the rail and wheel are both arcs of the same circle, and that the radius of this circle is twice the radius of the wheel. It appears also that the depression produced at the mid point of contact is about $\frac{1}{24{,}000}$ of the square root of the area of contact per ton per square inch, it being assumed that the square root of the area of contact is small compared with the depth of the rail. If, therefore, the maximum permissible load is 20 tons per square inch, the greatest allowable indentation is $\frac{20}{24{,}000} \times$ (square root of the area of contact).

Now the area of contact is the width of the effective tread multiplied by the length of the arc of contact, and this latter varies as the square root of the radius of the wheel for a constant depth of indentation.* If, therefore, the area in contact is to be constant, the width of the tread must vary inversely as the square root of the radius.

It can be shown that the total elastic reaction between a cylinder and a surface originally plane is two-thirds of the maximum pressure between them multiplied by the area of contact. Hence if the total load on the rail is 4 tons, and the maximum pressure the steel will bear without permanent deformation is 20 tons per square inch, the area of contact must be not less than $4/20 \times 3/2$, or 0.3 sq. in. The square root of 0.3 is 0.53; therefore, the indentation at mid-contact must not exceed $0.53 \times \frac{20}{24{,}000}$ in., or $\frac{1}{2250}$ in.; and I find that, in order to get the required area and not exceed this indentation, the diameter of the wheel must be not less than 5 ft. if the tread is 1 in. wide. Any wheel of less diameter, unless the tread was wider than 1 in., would cause a permanent flattening of the rail.

Most of the wheels now in use on railways are less than 5 ft. in diameter, and when both wheel and rail are new, they certainly do not have a bearing surface an inch wide. I conclude, therefore, that there is some permanent flattening down of the rail each time a wheel passes over it.

I can make some estimate of what the flattening is in the case of a wheel whose diameter is given, by finding in the first place what load that wheel would carry by purely elastic reaction, and then finding how much deeper the wheel would have to sink into the rail to carry the extra load, taking the reaction over that part of the depression which exceeds the elastic limit to be constant and equal to 20 tons per square inch. As an example, take a wheel of 40 ins. diameter; such a wheel, on the supposition above made, would carry elastically 3.2 tons. This leaves 0.8 ton to be made up by deformation, which is in part permanent, and I find that the permanent part of the deformation is about .0,000,005 in. On the supposition that the width of the tread was 1.38 in. instead of 1 in., the 40-in. wheel would carry the 4-ton load by elastic deformation only.

Five millionths of an inch does not seem a very large quantity; but if we take the case of a railway on which there is a two-minute service of trains for twelve hours a day, and suppose each train made up of six eight-wheel carriages, it will be seen that this wear is $\frac{4 \times 5 \times 360 \times 365}{1{,}000{,}000}$ = 2.60 ins. per year, for a 40-in. wheel with a 1-in. tread, whereas with a tread of about 1.4 in. there would be no wear at all, the load in like cases being 4 tons. Without attaching much importance to the actual figures, this example, and the formula in the foot-note, show how much the width of the tread affects the flattening, and that it is to be expected that wear will be very rapid at first, and will almost cease when the wheels and rails have adapted themselves to one another. It seems possible, therefore, that if the rails were rolled with a slightly different cross section, a considerable part of the initial wear might be avoided.

In all these remarks I have considered only the wear which would occur on a straight railway, and where there is no slipping between the rail and wheel.

On a curve there is necessarily slipping on one or both rails, and slipping must occur even on the straight, unless the diameter of the wheels on the same axis is identical. The wear due to slipping is quite distinct from the flattening or crushing which I have considered hitherto; but it is to the slipping we must look, I think, for the origin of the ripple-like marks which are often to be noticed on rails over which small wheels are run. The length of each of these ripples is 2½ ins. to 3 ins., and they often extend over a considerable length of line. The question arises, What settles the wave-length? Is it something which depends only on the distance the wheel travels and not on the velocity (as would be the case if it was the result of the toothed gear wheels of the motors), or is it a real period, e. g., something which recurs in a constant time? I think the latter is the true explanation, and the only period likely to give rise to these marks is the period of the torsional vibration of the wheels on their axles. Such torsional vibrations are sure to be set up at certain speeds if the wheels slip on the rails, and may be compared with the vibrations of a bowed string, or more closely with chattering a wheel or disc when mounted on a slender axis and turned in a lathe.

* The general formulas connecting the radius of the wheel (r), the length of arc (a) in contact with the rail, the width of the tread (b), and the total elastic supporting force of the rail (F), are

$$a = c_1 r^{2/3} b^{1/3}$$
$$F = c_2 r^{2/3} b^{4/3}$$

If the units are tons and inches, and assuming that 20 tons per square inch is the greatest load which can be laid on a plane of the material without causing permanent set, and that the compression produced by a pressure of 1 ton per square inch is

$$\frac{1}{24{,}000}$$

of the square root of the area over which it is applied, $c_1 = 0.0165$ and $c_2 = 0.46$.

THE PLANS OF THE BOSTON & EASTERN ELECTRIC RAILROAD

During the last few months plans have been developing in Massachusetts for the building of a high-speed interurban railroad between Sullivan Square, Charlestown, at the terminal of the Boston Elevated Railway Company, and the cities of Lynn and Salem as a major route, with extensions to Revere Beach, Beverly, Peabody and Danvers. A company has been formed for the purpose of building and operating the line in case the necessary certificate of public convenience and necessity is granted by the Massachusetts Railroad Commission, the corporate name being the Boston & Eastern Electric Railroad, and the chief engineer, John H. Bickford, of Boston. A number of hearings have been given to the parties interested by the commission, at which the plans of the company were submitted in great detail. As they are the most elaborate ever submitted to the commission, an abstract of them may be of interest to many.

The proposed route is shown in Fig. 1. From Sullivan Square, Charlestown, the line crosses the Mystic River into Everett, and traverses the edge of Chelsea and Revere to Lynn. About a mile of the run in the latter city is planned as semi-subway, a typical section of the latter being shown in Fig. 2. From Lynn the line swings to the north through Peabody to Salem, Beverly and Danvers. The territory traversed is more densely populated than any other equal area in New England. Exclusive of Boston, five cities and three towns are directly tributary to the line. The territory is naturally divided into three zones separated from one another by two undeveloped areas. Zone 1 comprises Salem, Beverly, Peabody and Danvers, with a combined population of over 80,000 and an average distance of 17 miles from Boston. Zone 2 comprises Lynn, 11 miles from Boston, population 90,000. Zone 3 comprises Chelsea, Everett and Revere, averaging 4 miles from Boston, with a population of 81,000. It is expected that the entire territory, of which Sullivan Square is the terminal, will furnish more or less traffic to the road. The population density is 2855 per square mile in the territory, according to the State census of 1905. Between 1900 and 1905 the percentage growth was 63 per cent greater than the State as a whole. Boston proper has a population of 600,000.

It is urged by the company that a special field of service exists in the territory which neither the present steam nor street railway facilities can meet. The plans for the Boston & Eastern line specify a private right of way without grade crossings throughout the entire run, the principal running times, fares and distances having been figured as follows:

TABLE I.

	Fare.	Distance.	Running Time.	
			Express.	Local.
	Cents.	Miles.	Minutes.	Minutes.
(Boston) Sullivan Sq.—Lynn.....	10	9.0	10–11	14
" " " —Salem.....	15	14.5	17–18	25
" " " —Beverly.....	20	16.5	21–22	28
" " " —Danvers.. .	20	17.	26	

Table II. shows the present trolley schedules between Scolly Square, Boston, and the above points. About ten minutes are required between Sullivan and Scolly Squares.

TABLE II.

	Distance, Miles.	Time, Minutes.	Fare, Cents.	Car Changes.
(Boston) Scolly Sq.—Lynn.....	10.5	60	10	0
" " " —Salem.....	15.	75	20	0
" " " —Beverly.....	17.	93	20	1
" " " —Danvers.....	19.25	101	25	1

Table III. shows the increase and decrease of suburban service in relation to population on the Boston & Maine Railroad between 1893 and 1906 in the territory of the Boston & Eastern route. During this period the Boston & Maine has not extended any of its four divisions within 25 miles of Boston, but the passenger mileage increased 17.2 per cent and the freight mileage 63.8 per cent in this time. Out of sixteen stations tabulated only four show an increase in train service, two have remained the same and ten have decreased from 13.8 per cent to 100 per cent. At Lynn, the most important station on the list, the population has increased 35.7 per cent, while the number of trains at the central station has increased but 15.4 per cent. The city as a whole has 135 per cent less trains than it had thirteen years ago. In Revere the population has increased 103.8 per cent and the number of trains decreased 28.6 per cent.

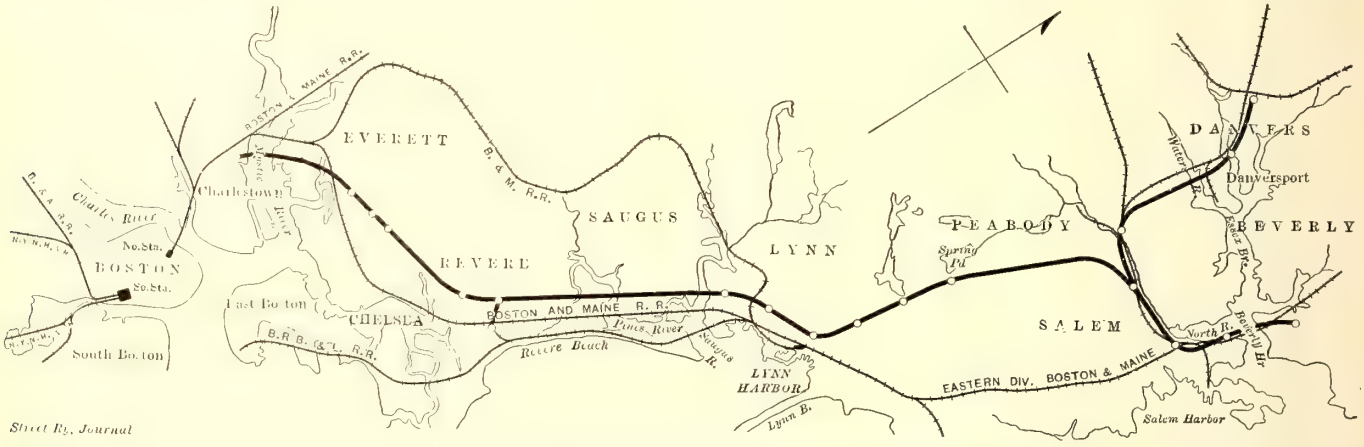


FIG. 1.—LOCATION MAP OF THE BOSTON & EASTERN ELECTRIC RAILROAD

The company states that the average speed of its express trains is to be 47 miles per hour, locals 30, excluding layovers. Between Beverly and Boston the schedule speed is to be 45 miles per hour with a 50-ton car, 16 hp per ton, a maximum speed of from 63 to 67 miles per hour and limiting curvature of 1.5 degs. The Aurora, Elgin & Chicago's schedule speed is 43.5 m. p. h., cars 41 tons, 12 hp per ton, maximum speed about 60 m. p. h., and 2 degs. curves. The Lake Shore Electric lines have a schedule speed of 52 m. p. h., with 41-ton cars, 4 hp per ton, 50-60 m. p. h. maximum and 4-deg. curves. The average train on the Boston &

Eastern is figured at 2.5 cars. Each car as figured is a 50-ton steel car, 60 ft. long over all, with a seating capacity of fifty-two, four 200-hp motors with multiple-unit control, air brakes and four pneumatic doors. The car weight is estimated as: Body, 37,000 lbs.; one pair trucks, 22,000 lbs.; equipment, 34,000 lbs.; passengers, 7000 lbs.

The maximum curvature on the main line does not exceed 2 degs., except at Salem and Lynn central stations,

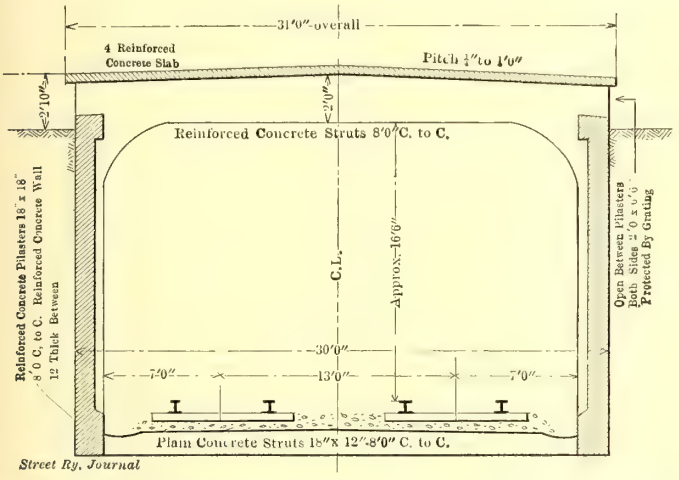


FIG. 2.—CROSS-SECTION OF SEMI-SUBWAY CONSTRUCTION

and the maximum grade is 3¼ per cent. Four tunnels will be required, all on tangent track, aggregating 4800 lineal feet. The semi-subway at Lynn is to be built wholly on private land and of reinforced concrete with a roof projecting less than 3 ft. above grade. Bridges over streets

TABLE III.—SERVICE IN BOSTON & MAINE R. R

Station.	Population.		No. of Trains Per Day.		Per Cent Increase.		Remarks.
	1893.	1906.	1893	1906	Population.	No. of Trains	
Beverly	11,322	16,000	43	61	41.2	41.9	
Danvers	7,890	10,000	29	25	26.8	13.8	Eastern Div. only.
Peabody	10,368	14,000	29	25	35.0	13.8	Eastern Div. only.
Salem	33,004	38,200	73	82	15.7	12.3	Eastern Div. only.
Swampscott	3,234	5,260	51	49	62.7	3.9	Main Line only.
East Lynn	....	....	34	34	....	0.	Main Line only.
Lynn	59,703	81,000	78	90	35.7	15.4	Main Line only.
Market street	....	....	23	0	....	100.0	Main Line only.
West Lynn	....	....	43	30	....	30.3	Main Line only.
Revere	6,721	13,700	42	30	103.8	28.6	Main Line only.
Forbes	....	....	11	12	....	9.1	
Vila street	....	....	14	0	....	100.0	
Chelsea	29,924	38,700	63	49	29.3	22.2	
East Everett	....	....	19	19	....	0.	
Everett	15,571	30,250	42	35	94.3	16.7	
East Somerville	47,381	70,798	99	64	49.5	35.4	Main L. & Saugus Br.

NOTE.—Population figured at uniform rate of increase. Number of trains is sum of both directions, to and from Boston. Figures in black indicate decrease. Population as given for East Somerville is for all of Somerville.

and ways are to be principally reinforced concrete arches. The road is planned to be ballasted with crushed rock, and rails of not less than 90 lbs. are figured for the track. Block signals and automatic stops are also planned.

The estimated cost of construction was figured and submitted to the Board in minute detail. In toto it is as follows:

Real estate		$1,328,480
Grading, surfacing, tunneling, etc.	$1,393,740	
Side and retaining walls, waterproofing	655,150	
Ballasting with stone	191,000	
Eleven crossings over other railroads	251,900	
Crossings at streets and ways, 102 buildings, etc.	983,630	
Crossings over waterways	206,700	
Track and track equipment	315,970	
Signal system	100,000	
Stations, 19	130,000	
Seeding, sodding and fencing	32,750	
Generating station	800,000	
Power distributing system, high and low tension	328,140	
Three sub-stations	300,000	
Cars and car equipment	842,500	
Engineering	225,000	
Interest during construction	250,000	
Miscellaneous expenses, allowances for abnormal items	300,000	
Total construction		7,426,480
Total cost of road		$8,754,960

The power house is planned at Lynn on tide water, and the capacity calculated is 8000 kw, the units being four 2000-kw, 13,000-volt, three-phase turbo-alternators without set-up transformers. Three sub-stations are planned, one at Lynn separate from the power house, one near Peabody Junction and one in Chelsea or Revere. The estimated number of employees required is:

30 General officers and clerks.
72 Maintenance of way and bridges.
24 Superintendence of transportation.
79 Train service.
114 Passenger station service.
45 Power and sub-station men.
68 Car repair men.

432 Total employees.

The watt-hours per ton-mile at the cars vary from 70.4 in express service to 135.2 in local runs, averaging 97.2 at the car, not including heating. At the power station, including all the sources of energy consumption, the figure reaches 140 watt-hours per ton-mile, average.

The estimated operating expenses were made up in minute detail, the totals coming to:

General expenses	$84,000
Maintenance of way and structures	131,400
Maintenance of equipment	91,700
Conducting transportation	489,700
Total	$796,000

This figures 57 per cent of the gross earnings as estimated, no operating ratio having been assumed originally.

An exhaustive study was made by the company's engineers as to the probable earnings of the line and the influence of its service upon existing methods of transportation. It is estimated that in 1910 the tributary population will be 210,000, exclusive of Boston, taking half of Everett and Chelsea and not including Marblehead, Valiant, Lynnfield and Saugus. This is a density of 3110 per square mile. The length of the road is 20.5 miles, the population per mile being 10,800. It is expected that in large measure the road will create its own traffic, stimulate the traffic of parallel steam railroad lines and the short-haul traffic of street railways operating in the same general territory. Reduction of the single fare from that of the steam railroad, together with the rapid service and frequency of trains, induces travel. This is instanced by the increase in local traffic, gross and net income noted by the New York, New Haven & Hartford Railroad since a 2-cents-per-mile local rate was established. In Massachusetts from 1885 to 1895 the increase in traffic on the street railways was 450 per cent, a rate eight times the increase in population, which was but 55 per cent. During this period steam railroad traffic increased 50 per cent.

The present interurban travel in the territory was studied by means of a very large number of passenger counts, checked, as far as possible, by the returns of the several companies to the Board. For the Boston & Maine suburban system the earnings were found to be about 94 cents per train-mile, which was considered conservative in comparison with the average revenue of the whole system, which is $1.13. This territory is considered much above the average. On the Boston & Northern competing trolley lines the earnings per car-mile were obtained in this territory from counts as 24.6 cents, a conservative figure in com-

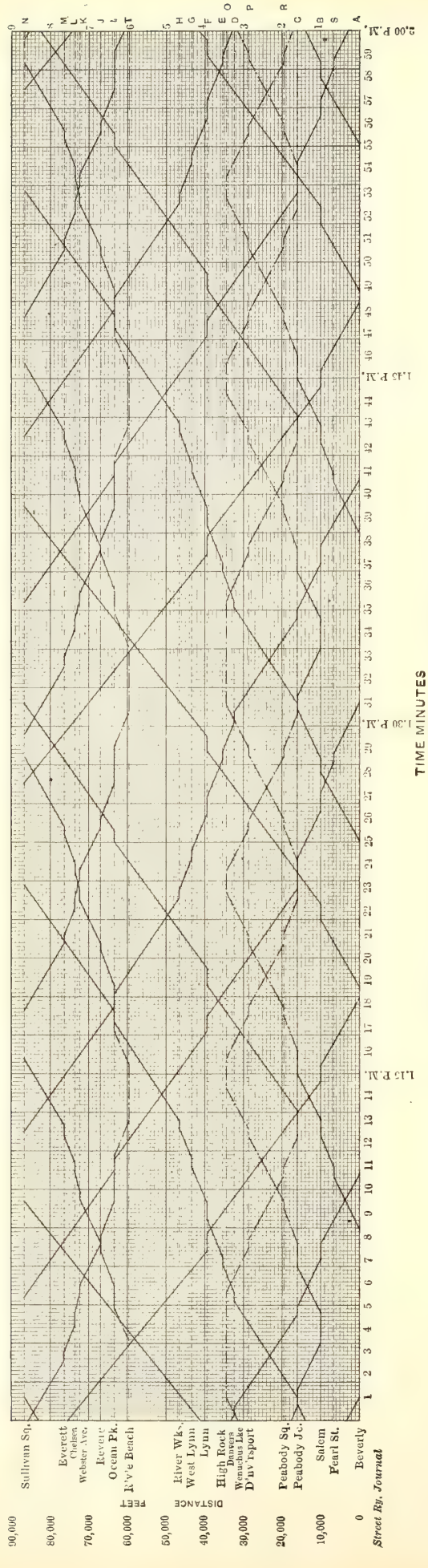


FIG. 3.—PROPOSED SCHEDULE OF THE BOSTON & EASTERN RAILROAD

parison with the rate on the whole system of 26.6 cents for the year 1905-6. Traffic results on the Boston, Revere Beach & Lynn Railroad were also studied.

The summary of earnings and prospective earnings estimated as competitive in this territory is:

Year 1906–7.	
Boston & Maine Railroad	$585,000
Boston & Northern Street Railway	1,010,000
Boston, Revere Beach & Lynn Railroad, 10c. fare	306,000
Boston, Revere Beach & Lynn Railroad, 5c. fare	48,000
Total	$1,949,000
Year 1910–11.	
Boston & Maine Railroad	$738,000
Boston & Northern Street Railway	1,303,000
Boston, Revere Beach & Lynn Railroad, 10c. fare	521,000
Boston, Revere Beach & Lynn Railroad, 5c. fare	71,500
Total	$2,633,500

According to the Boston & Eastern estimates, these lines will be overcrowded with business in this latter year. In two years the Boston & Worcester line in the same general neighborhood created a business of over $400,000. A high official of the Boston & Albany stated to Mr. Bickford that at the same time the train-mile earnings of this competing steam line between the points served by both roads increased several per cent. The density of tributary population to the Boston & Eastern, omitting Boston, is three or four times as great as that of the Boston & Worcester or the Lackawanna & Wyoming Valley line. The induced traffic is, therefore, estimated at the rate of 25 to 33 per cent of the competitive traffic of the present roads in 1910-11, giving a total competitive traffic on all four roads of not less than $800,000 plus $2,640,000, or $3,400,000. It is considered that the local trolley lines will feel the effect of competition in long-haul business parallel to the new line, whether doing a short or a long-haul business, and the purely local trolley lines should each do a larger business to the fifteen points of intersection with the new line, each of which is provided with a station. It is figured that what the trolley lines will lose in competitive business will be more than gained in the short-haul business, which is the most profitable. Mr. Bickford strongly urged that in no event would the financial stability of the existing trolley lines be affected through the advent of the proposed road. The Boston & Maine will feel the competition on its purely suburban lines, but its through passenger, through and local freight business will materially increase on account of the greater increase of population in the territory. It is expected that the Boston, Revere Beach & Lynn Railroad will not be vitally affected.

At the end of two years of operation the earnings of the proposed road, including summer traffic to Revere Beach, are estimated at between $1,350,000 and $1,450,000. This is between 15 and 16 per cent of the total cost of construction, or $6.50 per capita. The Boston, Revere Beach & Lynn earnings were about $9 per capita last year, total gross $729,000. These are increasing at the rate of 11.66 per cent yearly, and are likely to reach $13 per capita by 1910-11. The Boston & Eastern has an estimated tributary population nearly twenty-five times as great. At the present rate of increase the Boston, Revere Beach & Lynn should be $88,700 per mile in 1910-11, and the Boston & Eastern $70,000.

Expert testimony in favor of the construction of the road, its schedules, estimated earnings and expenses has been given by a number of consulting engineers at these hearings, including J. R. Worcester, of Boston; John Balch Blood, of

Boston; H. M. Brinckerhoff, of New York, associated with William Barclay Parsons, and others.

At a continued hearing on the proposition before the Massachusetts Railroad Commission on June 20 cross examination of John H. Bickford, chief engineer, was begun. Supplementing his previous statements, Mr. Bickford said that forty-one out of forty-five Salem merchants whom he had interviewed signed a petition in favor of the new road, and were agreed that the establishment of fast service between Salem and Boston would benefit rather than injure local trade. In Beverly twenty-two out of twenty-five merchants were of the same opinion. Twenty merchants in Danvers were practically all in favor of the line and held no doubts as to the effect on local trade. Trade has been better in both Danvers and Beverly since a 5-cent car service was inaugurated between them and Salem, which is the larger center of population. The increase in population due to trolley facilities is accounted responsible for these improved trade conditions.

In reply to questions by the City Solicitor of Lynn regarding proposed changes in sewers and street grades, Mr. Bickford pointed out that these would be taken care of as an engineering problem; that in one or two cases the grade of the street would be raised 2 ft. or 3 ft., and that under the semi-subway the inverted siphon method of construction would be practiced. The lower portion of the semi-subway would be waterproofed, as its grade is below tide-water, and a drainage scheme with sump pits and automatic electrically operated pumps would take care of surface water. A long list of questions was then asked by Bentley W. Warren, counsel for the Boston & Northern Street Railway Company, in regard to the details of the proposed plans and estimates. The main points brought out were, in brief, as follows:

An original estimate of the cost of the road drawn up in August, 1906, gave a total of about $7,970,000. A second estimate filed in May, 1907, gave a total of about $8,750,000. This increase is due largely to a change of location, and the provision of a service to Revere Beach, the latter not having been included in the first estimate. The beach service increased the investment in car equipment by ten cars, and 200 hp instead of 160-hp motors were figured in the second estimate. Fifty cars were also required against forty originally. The additional rolling stock cost is $137,000.

The real estate estimate was based partly on the results of consultations with real estate men and partly on the assessed valuation of property along the route. The actual figures ran well above the assessments. The reduction of the real estate investment from $2,300,000 in the first estimate to $1,328,480 in the second was due to a narrowing of the right of way 2½ ft. in Lynn, the avoidance of Powder Horn Hill in Chelsea and slight changes in Salem. Increase in cost of waterway crossings was due to the design of draws originally contemplated. Draws will be located at Beverly, Saugus and Mystic River, all being pile bridges with steel draws. All concrete and steel construction was found to be too expensive.

Thus far no traffic arrangements have been made with the Boston Elevated Railway Company for the handling of passengers at the Boston end of the line. The company hopes to secure 8-cent check privileges in zone 3, which includes Revere, Chelsea and Everett. The Boston Elevated Railway Company has not opposed the plans of the Boston & Eastern at any of the hearings. At this point Chairman Jackson, of the commission, remarked that the attitude of the Boston Elevated as a metropolitan receiving and distributing system would not settle the question of public exigency of such a road as the Boston & Eastern, though the board desires to be fair in its treatment of all parties concerned. The public need, or absence of need, of facilities of this type does not depend upon the terminal system, and it is reasonable to suppose that if a line of this character is demanded by public convenience and necessity—which is the point at issue—some working agreement can be arranged between it and the receiving company.

The present suggestions provide for a terminal station in Alford Street, Charlestown, parallel with the Sullivan Square terminal of the Boston Elevated Railway Company. Physical connections between the two stations are as yet unsettled, but they are doubtless possible if the conditions demand them. The approach to the station in Alford Street would be by about 1200 ft. of elevated structure. An incline of about 1 per cent would be required.

An extended discussion of the tributary population estimates was then held, with explanations of the limitations assumed in various cases. In general, easy walking distance was taken as the criterion, and passengers brought to the road by intersecting street railway lines were not included. Mr. Bickford again emphasized the fact that a high official of the Boston & Albany Railroad had shown him his train records and demonstrated that the Boston & Worcester line had helped business on this competing steam road because of the new class of service it had inaugurated. Mr. Bickford estimated that the Boston & Worcester has easily induced $700,000 worth of additional traffic on the Boston & Albany, the Boston Elevated and the Worcester Consolidated systems.

The operating ratio of 56 per cent was reached by estimating the amount of each expense and not by assuming this as a percentage of gross earnings common to well-operated interurban electric railways. The wages of employees in conducting transportation were taken at 30 cents per hour for motormen, $3 per day for spare men and 25 cents per hour for guards. Conductors would be required on trains, and there would be station agents.

Maintenance of way was figured in total as $3,370 per mile of single track per year, including bridges and buildings. The plans allow for the careful inspection of every foot of the line at least every two hours. The maintenance of equipment charge came to $1,842 per car per annum, or $5.05 per car per day. The maintenance of power station, sub-stations and overhead lines was figured at 0.16 cent per kw-hour output, or a total of $61,500 per year. The total number of employees would be 432, of which 114 ticket sellers and guards in station service would be required at an average rate of $2.50 per day each.

In regard to damages, injuries to persons and property were not figured in the operating expenses, as there is a surplus of $73,000 in excess of dividends which could easily care for this item. Taxes come to about $80,000. The company would have no excise tax except the slight tax on 1200 ft. of elevated structure in Charlestown. The cost of removing snow and ice was figured in connection with the work of five gangs, consisting of eight laborers and one foreman each, at $910 per mile per year. This would come, all told, to possibly $35,000 per year.

General expenses, $84,000, were figured as 6 per cent of the gross receipts, or 1.5 cents per car-mile. Maintenance of way and structures, or $131,400, came to 2.5 cents per car-mile. Maintenance of equipment was figured at $91,700, and the cost of conducting transportation was figured at $489,700, or 8.98 cents per car-mile.

The final hearing of the Boston & Eastern Electric Railroad project was held by the Massachusetts Railroad Commission at Boston on July 2. At the morning session W. H. Coolidge, counsel for the Boston & Maine Railroad, submitted exhaustive figures showing the number of trains per day between various large centers and their suburbs, including Saturday extras and Sundays. Between Boston and Lynn there are 339 daily trains both ways, 244 on Sundays and 33 more on Saturdays, counting the services of two railroads. Newark, N. J., several times the size of Lynn, is served by five railroads, and it has 406 trains per day, 255 on Sundays and 14 extra on Saturdays. Evanston, outside Chicago, served by two roads, has 117 trains daily, 67 Sundays and 9 Saturday extras; Yonkers, N. Y., 119 daily, 115 Sundays, 2 extras Saturdays; Port Chester, N. Y., 66 daily, 38 Sundays and 6 extras; Braintree, Mass., 141 daily, 59 Sundays, 2 extras, and Newton, Mass., 94 dailys, 35 Sundays and no extras.

He stated that in Nov., 1906, out of 5401 trains run between Lynn and Boston, 2329 were on time. The average lateness of the 1072 others was 5.7 minutes, and only 385 were over 4 minutes late. Mr Coolidge said that the main line of the Boston & Maine Railroad between Boston and Beverly, 18.53 miles, is built on an 82.5-ft. right of way most of the distance, leaving plenty of room for four-tracking, with the exception of 4 miles. Last year the passenger earnings between Boston and Beverly and intermediate stations were $618,327. The estimated cost of adding two more tracks to this line, including Danvers, eliminating the Salem tunnel and all the grade crossings and electrifying the two new tracks is figured at $7,284,000. The fare from Lynn to Boston is 20 cents, but on a twenty-five-ride ticket it is 12 cents. The fastest schedule time between the two cities is 17 minutes and the slowest 32 minutes. Mr. Coolidge closed his remarks in opposition with a general argument against the disturbance of existing real estate and other conditions between Boston and Beverly. He claimed, on the strength of a remark by Mr. Bickford, that the territory is served better than any other of the same character in the country. He argued that it would be unfair for the stockholders of his road to be obliged to pay some $150 per share for these sweeping improvements against $100 per share by the Boston & Eastern stockholders. If the board thinks further facilities are needed, the Boston & Maine stands ready to grant them.

Col. Melvin O. Adams, president of the Boston, Revere Beach & Lynn Railroad, was the next speaker in opposition. He gave a long history of the development of this line, which is a narrow gage road. As late as 1903 there were but forty-five daily trains out of Lynn on his line; now there are one hundred each way. An all-night service is given. Since 1897 the fares have increased from 2,360,000 to 11,000,000. The winter traffic runs now from 600,000 to 700,000 fares per month, and the summer traffic last August reached 1,645,000 fares. The company had nine locomotives and forty-four nondescript cars in 1890; it now has twenty-one locomotives and one hundred cars. The locomotives weigh 40 tons each, and the cars are light, carrying sixty-eight passengers, seated, each. About $2,000,000 is devoted to the enterprise, which includes a frequent ferry-boat service in connection with the trains. The company can deliver 6000 to 7000 passengers an hour at Crescent Beach and Bath House and still have a nine-car train at each end of the line as a reserve. H. M. Brinckerhoff, of New York, stated that electrification would increase the traffic capacity of the Boston, Revere Beach & Lynn from 30 to 50 per cent. Col. Adams criticised the proposed Revere Beach loop as an enterprise of temporary character.

Bentley W. Warren, Esq., counsel for the Boston & Northern Street Railway Company, began his argument in opposition to the Boston & Eastern road by referring to the influence of the Salem short line of trolley service upon the Loring Avenue electric lines which parallels it. During the first four months there was no loss of earnings on Loring Avenue, nor was there any increase, but in the first year of operation the earnings of the older line fell off 3.88 per cent, or $8,390. The Lynn division in general showed a gain of 4.43 per cent in gross receipts.

Mr. Warren summarized the car service between various points in the territory as follows: On the Salem division between Beverly and Danvers, 34 round trips daily, running time 30 minutes; Salem and Beverly, 89 round trips, 20 minutes; Salem and Danvers, 66 round trips, 26 minutes; Salem and Peabody, 48 round trips, 13 minutes; Salem and Boston, 33 round trips, 1 hour 15 minutes. On the Lynn division, between Salem and Lynn, 55 round trips, 43 minutes via Loring Avenue; Salem and Peabody, 46 round trips, 40 minutes; Lynn and Boston via Central Square, 68 round trips, 1 hour; Lynn and Boston via Market Street and to Scollay Square, 101 round trips, 45 minutes; Revere and Boston, 746 trips, 30 minutes; Chelsea division, Chelsea Square to Boston, 1294 trips, 18 minutes. From the station records at Town House Square, Salem, 103 trips between Boston and Salem showed a total delay of 235 minutes, and 55 trips 148 minutes delay. There was an average delay of 2.5 minutes. Last October President Sullivan, of the Boston & Northern, wrote to Vice-President C. S. Sergeant, of the Boston Elevated Railway Company, to ascertain if arrangements could not be made to run the Lynn and Salem cars into Boston via the East Boston tunnel. Mr. Sergeant replied that he saw no objection as soon as the completion of the Washington Street tunnel enlarges the terminal facilities at Court Street. Mr. Warren's final arguments were reserved until the afternoon session. The last speaker of the forenoon session was F. D. Allen, counsel for various citizens of Lynn. He voiced objections to the proposed route, but urged that better freight and passenger facilities are needed than now exist. He also criticised terminating the new line at Sullivan Square.

Bentley W. Warren continued for the Boston & Northern at the opening of the afternoon session. He emphasized the degree to which the territory is gridironed by existing tracks of the steam and electric lines now in operation, and urged that these companies be asked to extend their facilities by the board in case it deems the extended facilities necessary. The Boston & Maine could double-track the present line which it owns between East Boston and Lynn, if necessary, giving, in all, four tracks to Lynn, and at a cost of about $3,000,000 the Boston & Maine and Boston, Revere Beach & Lynn could build a joint tunnel under the harbor. The narrow gage line could be extended to Salem, Beverly and Danvers as easily as the Boston & Eastern, including the semi-subway. The prospective use of the East Boston tunnel and the possible results of a merger between the Boston & Maine and the New Haven roads should all be considered by the board. Mr. Warren argued that the Boston & Eastern should terminate not at Sullivan Square, which is on the edge of Somerville, but in the heart of Boston. All the time and fares given have been to Sullivan Square. The Boston, Revere Beach and Lynn requires no

more transfers and lands its passengers in Boston proper for 10 cents, against 15 cents on the new line. The Boston & Northern has asked for new locations in Salem to enable its service to be improved, but thus far the local authorities have held back. During the last seven years the road has expended $6,478,862 in new construction and $1,695,912 in reconstruction, making a total of $8,174,774. Within two years over $500,000 has been expended between Salem and Lynn on the new short line. Mr. Warren concluded with the plea that the Boston & Eastern figures gross earnings equal to the sum of the Boston & Maine and the Boston & Northern in the same territory, and that this, in his opinion, must cut heavily into the receipts of the latter roads. He urged that existing facilities be given the chance to expand rather than that a new company should be allowed to enter the field and injure the present organizations by its aggressive policies.

The last argument was presented by Moorfield Story, counsel for the petitioners. He quoted from recent reports of the Commission which emphasized the need of high-speed interurban construction. New England highways are crooked and hilly, and private rights of way are essential to fast time. There are now no large centers in Massachusetts not connected by steam and electric railways. The proposed line traverses the most thickly settled and rapidly growing territory in the State. Mr. Story claimed that the southern side of Boston is far better served by transportation facilities than the north side of the city. It will soon have elevated service to Forest Hills, and, on the west, the Cambridge subway will provide real rapid transit. The needed facilities cannot be supplied by surface tracks. The ordinary trolley lines are limited to house-to-house distribution. The growth of population along the Boston, Revere Beach & Lynn was emphasized, and the Boston & Maine's practice of sacrificing the local to the through train service scored. Mr. Story quoted the celebrated letter of President Tuttle, of the Boston & Maine, in which he deprecated the handling of suburban traffic even when electrified by steam railroads, and doubted its financial profit. He pointed out that no move had been made by the present steam lines north of Boston toward these great improvements which counsel suggested as so readily possible, and stated that the Boston & Maine has now reached the limit of double-track capacity. It has thrown a large share of suburban travel to the trolleys, and has largely reduced its train service in the face of a growing population.

Mr. Story urged that a surface railroad cannot furnish rapid transit without endangering the lives and property of all other users of the street. He claimed that the experience of other roads shows that the Boston & Northern traffic will in the long run be benefited by the establishment of the fast service. Real estate will be increased in value two or three times in Beverly and Salem if the road is built. He emphasized the absence of opposition from the Boston Elevated Railway Company and the citizens of Danvers, Peabody, Salem, Beverly and Revere; urged that the statistics presented with such care have not been attacked, and pointed out that 416 acres of new land within the corporate limits of Lynn and 1000 acres in Danvers will be opened up by the new line. The hearing concluded with a statement from Chairman Jackson that the various interurban matters before the board would now be taken up and decisions reached as early as practicable.

The following is a detailed statement of the estimated cost of the Boston & Eastern Railroad:

BOSTON & EASTERN ELECTRIC RAILROAD ESTIMATE OF COST IN DETAIL

GRADING, SURFACING, TUNNELING, ETC.

Cut east of High Rock	705,760	cubic yards at	$0 50	$352,880
Cut west of High Rock in Lynn	140,400	cubic yards at	1.20	168,480
Cut west of Lynn	294,900	cubic yards at	1 00	294,900
Borrow west of High Rock	54,000	cubic yards at	0 50	27,000
Rip-rap slope	40,180	square yards at	0 50	20,090
Tunnel rock	84,800	cubic yards at	4.00	339,200
Tunnel lining	30,000	square yards at	1.00	30,000
Open rock cut	157,910	cubic yards at	1.75	276,342
Tunnel portals	3,080	cubic yards at	7 00	21,560
Culverts				10,000
Earth tunnels in Revere	480	feet at	$2 00	96,000
				$1,636,452
Credit 242,710 cubic yards of rock at $1.00				242,710
				$1,393,742

East of High Rock there is a total excess of cut over fill of 60,000 cu. yds. West of High Rock there is a borrow pit of 54,000 cu. yds., which will probably be obtained in the neighborhood, or which may be hauled from the Peabody Hills. The cut through Lynn will be done by digging two trenches 3 ft. each at an estimated cost of $2.00 per cubic yard, laying the concrete side walls and then removing the core at $1.00 per cubic yard, the cost averaging $1.20 per cubic yard for the whole job. The slopes are figured to be 1.5 to 1, with a standard width of roadway nearly 30 ft. on a fill and 36 ft. in a cut. Rip-rap slopes come at points where the embankment is subject to the action of tide-water or streams, a large part being on the Saugus marshes. The price of rock work is the cost of excavating, trimming and a reasonable haulage. There is a salvage of $1.00 per cubic yard for the rock, utilizing it as ballast and concrete. The tunnel lining includes a ½-inch coat of pitch and concrete to keep it in place. The tunnel under Mack Park and possibly the tunnel in Peabody may not require this lining, but it is included in both cases.

The item "culverts" is assumed. A horseshoe culvert, 6 ft. wide and made of reinforced concrete, will cost from $8.00 to $9.00 per foot of length, or an average of about $500 apiece. This allows for twenty culverts, which is a larger number than are expected necessary. The earth tunnel in Revere comes just west of Boadway. An excavation charge of $25 per lineal ft. is already included under the heading, "cut west of Lynn," so that the total estimated cost of the tunnel is $225 per lineal foot.

SIDE AND RETAINING WALLS, WATERPROOFING.

The chief items included under this are:

Lynn semi-subway	$312,980
Chelsea under Parkway	51,200
Everett under Parkway	130,400
Miscellaneous side and retaining walls	93,570
Sumps and sewers	67,000
	$655,150

The first three items are exclusive of excavations and bridges at streets. The item "miscellaneous side and retaining walls' covers walls located at different points along the line, notably in Salem, Peabody, Revere, Chelsea and Everett. The item "sumps and sewers" will include three sumps, one each in Lynn, Revere and Everett, and will take care of the sewers in the streets where the tracks are depressed.

BALLASTING WITH STONE

The length of the double track is 17.0 miles, and of the single track 3.5 miles. From this must be subtracted the wooden trestles, the steel viaducts and steel bridges, making 14.87 miles of double-track road to be ballasted, and single track 3.21 miles; allow a mile of single track for sidings, etc.

14.87 miles double track times 5,800 cubic yards	86,200 cubic yards.
4.26 miles single track times 2,200 cubic yards	9,300 cubic yards.
	95,500 cubic yards.

Allow a price of $1.00 for the stone (credited to the rock work) and $1.00 for the crushing and laying:

95,500 cubic yards at $2.00	$191,000

CROSSING OVER OTHER RAILROADS

This item includes 8 steel double-track bridges, 1 steel single-track bridge, 1 reinforced concrete double-track bridge, 1 reinforced concrete single-track bridge, and 13 reinforced concrete abutments. The sum of the spans is 2760 ft., and this divided into the total cost gives an average price of $91.50 per foot.

Examples:

1. Beverly crossing, 270-ft. span, 1 span through steel bridge, cost $27,250 exclusive of abutment.

2. Salem, Skenry Street crossing, 325-ft. span, double span through bridge cross bent over tracks, cost $30,550 exclusive of abutments.

CROSSINGS AT STREETS AND WAYS.

This item includes 102 bridges and several steel and concrete viaducts.

Examples:

1. North St., Salem	90-foot span, 1,290 cubic yards of concrete cost	$15,480
2. Market St., Lynn	65-foot span, 460 cubic yards of concrete cost	6,900
3. Boston St., Salem	200-foot span, 1,360 cubic yards of concrete cost	20,400
4. Mystic Ave., Lynn	55-foot span, 530 cubic yards of concrete cost	6,360

CROSSINGS OVER WATERWAYS

This includes 6 pile bridges, 1 reinforced concrete arch and 3 steel drawbridges. The pile bridges are listed at $20 per lineal foot for the ordinary double-track trestle, and at $30 per foot for the two-track or single-track trestle, when the elevation of the rail is more than 30 ft. above mean low water. The draws are listed at $25,000 each for Beverly and Saugus River, and $50,000 for Mystic River.

TRACK AND TRACK EQUIPMENT

There are altogether 17.25 miles of double track and 3.5 miles of single track, or a total of 38 miles of single track exclusive of sidings, etc. For sidings were allowed two of 1000 ft. each between Peabody Square and Danvers, and 13 sidings of 250 ft. each located at various points. Total, 5250 ft. Total, 39 miles of single track:

90-pound rail, 39 x 141.43 at	$33 00	$182,200
Joints every 45 feet, 9,150 at	1.25	11,420
Spikes, 39, at	1.50	5,850
Ties, 16 ins. 33 ft., 100,000 at	0.65	65,000
Special work		10,350
Labor, 39 x 5,280 at	0.20	41,150
		$315,970

This amounts to $8,100 per mile of single track, excluding ballast. Including ballast it amounts to $13,000 per mile of single track.

SIGNALING SYSTEM

A block signal system with interlocking switches and automatic stops is assumed. There must be a tower at Revere Street and Peabody Junction, and also interlocking switches at Beverly and Sullivan Square terminals. The item also covers a telephone system connecting the passenger stations, towers and general offices.

STATIONS

1 station (Sullivan Square)	$28,000
1 station (Salem)	15,000
1 station (Revere Beach)	12,000
1 station (Lynn)	10,000
1 station (Beverly)	8,000
2 stations at $5,000 each	10,000
11 stations at $4,000 each	44,000
1 station at $3,000	3,000
	$130,000

SEEDING, SODDING AND FENCING

The length of road to be fenced, subtracting the timber trestles, steel viaduct, bridges, tunnels, etc., amounts to 15 miles. This calls for 30 miles of fence, which at $1,000 a mile amounts to $30,000. With the elimination of the fill in Lynn, Chelsea, etc., the item of sodding will be much reduced. Allowance for seeding, etc., $2,750.

GENERATING STATION

A station of 8000 kw is required, costing $100 per kilowatt exclusive of interest on construction and engineering but including land. These items are as follows:

	Per Kw.	Total.
1. Land, wharf, etc	$4 00	$32,000
2. Building foundations, stock, intake, sewers, fixtures, etc	20 00	160,000
3. Steam equipment, boilers, stokers, coal handling, piping, engines, generators and auxiliaries	62 00	496,000
4. Electrical equipment (except generators)	4 00	32,000
5. Miscellaneous 10 per cent	10.00	80,000
	$100 00	$800,000

POWER DISTRIBUTING SYSTEM

Third rail installed	39 miles at	$4.700	$183,300
Bonding track	39 miles at	500	19,500
Transmission cable	7 miles at	7,920	55,340
Transmission line	16 miles at	4,000	64,000
Terminal houses	2 at	3,000	6,000
			$328,140

The item third rail includes also carbon rail installed with wooden protection; cable listed at $1.50 per lineal foot installed.

SUB-STATIONS

Peabody Junction, 3000 kw; Lynn, 3000 kw; Revere or Chelsea, 4000 kw. Total, 10,000 kw. At $30 per kilowatt for machinery and building this comes to $300,000. It is planned to locate the sub-stations in the passenger stations.

CARS AND CAR EQUIPMENTS.

Car bodies and trucks	$5,500
4—200 hp. motor equipments	10,725
Air brakes	500
Miscellaneous	125
	$16,850
50 cars at $16,850	842,500

CAR HOUSES AND REPAIR SHOPS.

Land	$15,000
Shops for 60 cars at $1 000	60,000
Equipment	20,000
Service cars	25,000
	$120,000

ENGINEERING

This is 3.5 per cent of the total construction cost.

INTEREST ON CAPITAL DURING CONSTRUCTION.

A period of about 2 or 3 years is assumed.

Real estate	$500,000
Grading and side walls	1,100,000
Ballast, $200,000 for 6 months	100,000
Bridges	800,000
Track, $300,000 for 6 months	75,000
Signals, $100,000 for 6 months	25,000
Generating station	600,000
Power distribution, $300,000 for 6 months	150,000
Sub-stations	200,000
Cars, etc., $850,000 for 4 months	283,000
Car houses, $120,000 for 4 months	40,000
Engineering	150,000
Miscellaneous	200,000
	$4,223,000
$4,200,000 at 6 per cent for 1 year	250,000

Miscellaneous expenses 10 per cent of all doubtful items.

ACCIDENT DAMAGES IN RIGHT-OF-WAY CASE

An interesting decision was handed down by the local courts at Coatesville, Pa., in a suit brought by Clarence B. Hope, of Valley Township, against the Philadelphia, Coatesville & Lancaster Electric Railway Company to recover damages for the killing of a cow. The defendant company denied liability on the ground that the cow was a trespasser, but it appears that the plaintiff had an agreement with the company in which the latter assumed liability for damages to personal or other property in connection with the right of way secured through Hope's land. The damages were assessed at $60 in the cow case, and Justice Paxson handed down a verdict for this amount. It is not yet known whether an appeal will be taken.

RICHMOND COMPANY'S TOURIST GUIDE

The Virginia Passenger & Power Company has published a fine folder on the many interesting places that the tourist can reach by way of its electric lines. The territory around Richmond is very attractive through its many natural beauties, but even more so on account of its historical associations. Here were fought many of the important battles of the Civil War, and there are also many interesting reminders of the ante-bellum days when Virginia was famed as the "Mother of Presidents." The folder contains a number of typical half-tone illustrations, descriptive data about Richmond and environs and seven maps, the largest of which is 23 ins. x 8¼ ins., and shows the country around Richmond and Petersburg, with all lines of communication and points of historical interest. The latter include colored lines indicating the old Federal and Confederate fortifications.

General William J. Palmer has given the Engineering School of Colorado College, Colorado Springs, the sum of $12,000, to be expended immediately upon additional equipment of the engineering laboratories for senior work.

EMBANKMENT SUBWAY FOR BOSTON

The signing of the embankment subway bill by Governor Guild, of Massachusetts, marks an important forward step in the rapid transit development of Greater Boston, and assures the establishment of a greatly needed high-speed service between the city proper and its western residential suburbs. For several years past the conditions of traffic in the Back Bay district leading to the Park Street loop of the Fremont Street subway have been unfavorable to fast service, and in morning and afternoon rush hours the congestion has probably been greater than on any similar stretch of double-track lines in the city. Business in Boston is moving westward along Boylston Street to a remarkable degree, and the population of the suburban districts of Allston, Brookline, Brighton, Chestnut Hill, the Newtons and adjoining cities and towns constantly tends to increase and pour an added burden of traffic into the Park Street terminus.

The building of a subway beneath Beacon Hill and under the embankment of the Charles River basin comes at a particularly opportune time, considering the plans for the beautifying of the river front by the Charles River Basin Commission. Connecting Park Street with the vicinity of the Charlesgate thoroughfares beyond Harvard Bridge, the embankment subway can certainly be built at a much lower cost per mile than the subways and tunnels previously constructed in Boston, and in such manner as not to interfere with the general scheme of improvement which the basin of the Charles River is undergoing. The elimination of delays caused by vehicular and pedestrian traffic will be a great boon to the Back Bay and western suburbs, and will shorten the running time of surface cars to the center of the city by from eight to ten minutes on a conservative estimate. What this means to the aggregate number of passengers traveling yearly over the routes to the west cannot be easily exaggerated.

OPENING OF THE SARATOGA-SCHENECTADY THROUGH ELECTRIC LINE

The Delaware & Hudson Company's electrified division between Ballston and Saratoga, N. Y., which will be used by the Schenectady Railway Company to make a through line from that city to Saratoga, was formally opened on Wednesday, July 3, by an inspection party arranged by General Manager E. F. Peck, of the Schenectady Railway Company. Special cars were run from Troy and Albany, as well as Schenectady, and a large party of railway officials, prominent local business men, etc., was entertained at luncheon at the Grand Union Hotel, Saratoga. After luncheon, through the courtesy of the management, the guests made a tour of Congress Park, which has recently been turned into an amusement resort, with carousels, theater and other summer park attractions.

Among the representatives of trolley and steam roads present were F. A. Harrington, president of the Schenectady Railway Company, and superintendent of the Mohawk Division of the New York Central; T. H. Barrett, president of the Eastern New York Railroad; E. S. Fassett, general manager of the United Traction Company and the Hudson Valley Company; William Darbee, general manager of the Albany & Hudson Railway; Axel Ekstrom, consulting electrical engineer of the Delaware & Hudson; T. McCoy, assistant superintendent of the Mohawk Division of the New York Central; Chas. H. Armatage, general traffic manager of the United Traction Company and Hudson Valley Company; W. B. Elmsdorf, general agent of the Albany Day Line, and General Manager Peck, Superintendent Ryon, Assistant Superintendent Hamilton, Chief Engineer Penoyer and Master Mechanic Doyle, of the Schenectady Railway Company.

The cars used on the through line between Schenectady and Saratoga will be the same type as those formerly running between Schenectady and Ballston. These cars weigh approximately 40 tons each and are equipped with four 125-hp General Electric motors, making 500 hp per car, and the motors are geared so as to be capable of developing a speed of 50 m. p. h. with normal voltage and level track. They are equipped with air brakes and Sprague-General Electric type M control.

It is intended to run limited cars every hour with a schedule speed of 55 minutes between Schenectady and Saratoga. The time table calls for a single car service under 20-minute headway and a regular running time of 1 hour 15 minutes for all cars except the limiteds.

The roadbed and track construction between Ballston and Saratoga are new and parallel the old D. & H. tracks. The overhead trolley system is used, supported by central poles between the two electric railway tracks. The poles are placed 100 ft. apart and are embedded in cement, which extends above the ground for a foot or more, preventing wet and dry rot at the surface of the earth. The copper trolley wire, which is No. 0000 gage, is held in position by the catenary suspension. A 3/8-in. double galvanized, seven-strand messenger cable is used with galvanized iron supporting hooks and clamps every 33 ft. The d. c. feeder is a bare copper 500,000-circ. mil stranded cable, and a return feeder of the same size is connected to the track at about every tenth pole.

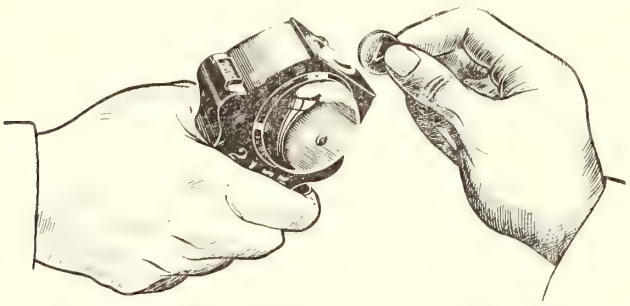
MICHIGAN ELECTRIC LINES SEEK STEAM FREIGHT CONNECTIONS

Western Michigan interurban electric roads have been fighting to secure an interchange of freight with steam roads. The Grand Rapids, Holland & Chicago Railway, which pro rates with the Graham & Morton Transportation Company, a boat line to Chicago, has appealed to the Interstate Commerce Commission for relief, all roads out of Chicago, save the Chicago & Great Western, having refused to pro rate with the trolley road and boat combination. Pending a decision of the commission, the interurban will accept freight for points out of Chicago at steam road rates. This means dead-heading business in many cases. There will be an arrangement with the boat line for a pro rata distribution of the differentials against Chicago in such cases.

Under the care of Superintendent John B. Crawford, of the Fort Wayne & Wabash Valley Traction Company, the Logansport-Lafayette extension of this system was opened on July 2. A three-hour service will be maintained on the extension until the roadbed is in shape to establish through service from Fort Wayne. At present every other car on the extension makes connections at Logansport with the cars for Fort Wayne. Mr. Crawford states that people along the route of the new road are already urging the company to establish an amusement park. Falling Springs, 1½ miles east of Delphi, is urged as a site.

THE ROOKE AUTOMATIC SYSTEM OF FARE COLLECTION AND REGISTRATION IN PROVIDENCE

On April 24 of this year the Rhode Island Company, of Providence, R. I., after a careful investigation of the basic merits of the Rooke automatic system of fare collection and registration, began the gradual use of this system, which, it is claimed, will go far toward fulfilling the ideal of every electrical railway manager, namely, the absolute

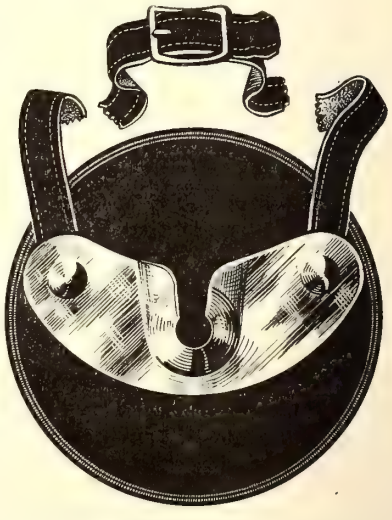


PRESENTING THE REGISTER FOR THE FARE

registration and turning in of every fare paid. The register used is the mechanical embodiment of a new collection idea, and the system operating around it has most interesting and seemingly practical features. It appears to be an ingenious blending of the good points of the American fare register and the Canadian cash box systems, for the counter and receiver are combined in one machine. As in the Canadian practice, the passenger inserts the fare himself, but with this vitally important difference—the fare is automatically registered and the coin released to the conductor's immediate possession. In accomplishing all this no perceptible time elapses and the company's record is secured without regard to the disposition of either the passenger or conductor. The general appearance and size of the register is apparent from the accompanying sketch, which also shows how it is handled in collecting fares. In size, the register may be easily covered by the conductor's open palm. It weighs scarcely over 1 lb., it offers no burden to the conductor and does not impede his progress through the car or his ability to use both hands in moving about on the running board. When not in use the register is suspended from a leather bracket or carried in the conductor's pocket. In making change it is dropped on the palm much the same as the ordinary punch. The slot into which the nickel is inserted is in the center of the metal top plate or trough, the coin finding its entrance into the register without foolish aiming or pushing on the part of the passenger. It is from the grip of the passenger to the mechanical grip, which seems to possess the human function of pulling the coin from the passenger's hand the instant it is but partially inserted in the slot. The register, therefore, may be presented for fare at any angle or in any position which a crowded car or a long reach would impose on the conductor. The tug on the coin is so positive that it excites wonderment, and the general knowledge of this mechanical feature, together with the positive knowledge that this small mechanism accomplishes also the registration of the fare, has done much to win the friendliness of the riding public to its use. Reasons of self-respect on the part of the conductor have frequently been urged against various schemes of portable registers which have all served as bulky containers for fares. These reasons do not apply as against the Rooke register.

The machine is provided with two totalizers plainly visible on the side of the register, and while but one of these is used in the Providence system, it may be stated that the other totalizer is used in connection with the insertion of coins or other metal tokens which may be required by other street railway companies. As soon as the nickel is inserted it is automatically registered, a bell rings, the entrance to the coin slot is automatically closed and the coin is deposited in the conductor's hand instantly. As stated, all this is seemingly accomplished merely by utilizing the unconscious physical act which the passenger has always resorted to in paying his fare. The lever shown at the bottom of the register is pulled by the conductor's index finger to open the entrance to the coin channel for the receipt of each fare. Once the coin is inserted in the register it rests in an open tube at the bottom, in which the conductor may accumulate several coins, if he desires, before removing same to his pocket. The money is in plain sight all the time.

Reduced to its simplest terms, this fare collection process is one that interposes a small, positive registering device between the hands of the passenger and the conductor. Its merits do not rest entirely on the fact that it seems to stop the leak which has always existed between the passenger and the treasury of the street railway company. It seems to solve also the vexatious question regarding the registering or non-registration of transfers. With the registration of the nickel always secured, and under a system which makes it impossible to win back money once registered by the manipulation of either the register or transfers which has had a par value with cash, the opportunity for fraud in the substitution of paper for cash in the conductor's accounting is obviated. This feature is very forcibly enlarged on by those familiar with this register system. The register is so compact that after a little practice the conductor can make change almost as easily as if he had nothing to carry. Less change making is necessary. Its use during the past two months has shown that many more nickels are tendered under this system. It is stated that on the second day of its use on the Auburn and Eden Park cars, out of a "standing freight" of eighty passengers one conductor secured seventy-five nickels, making change but five times in going through the car. If this system can in any way discourage the change - demanding habit on the part of the riding public, a great saving of time will be accomplished.



CONDUCTOR'S STRAP AND BRACKET FOR HOLDING REGISTER WHEN NOT IN USE

Of course, the Rhode Island Company realized that an innovation of this kind could not receive a fair trial unless thoroughly understood by both the public and conductors. The experiment was begun with a few cars on the Riverpoint line, which is one of the heaviest and most vexatious routes on the company's system. The cars had been furnished with explanatory posters like that shown in the accompanying illustration. The conductors to use the register

were instructed regarding its workings, and, among other instructions given, the following might be mentioned:

1.—Do not permit the examination or handling of register by passenger.

2.—When not in active use on the car, the register must be suspended from bracket and carried on conductor's person. It should never be left on car seat, vestibule window or in any other manner leave conductor's personal possession.

3.—Observe strictly and insist on passenger observing the rules posted in the car under the head of "Notice to Passengers."

4.—If the passenger is blind or physically incapacitated, conductor may collect and insert fare himself.

5.—Conductor should call out "Nickels, please," or "Get your nickels ready," before starting to collect.

6.—Conductors assigned to regular runs will retain the same register all day, excepting conductors who have late runs and have more than three hours layoff during the afternoon, in which case they will turn their registers in at the completion of their noon period. Conductors who are assigned to trippers, or single trips on regular cars, will also turn in their registers when completing such trips.

7.—Transfers and tickets will not be registered when collected, but must be entered in the day cards and turned in as heretofore. Records for each half-trip will be kept on the day cards as at present and five cents turned in for each fare registered.

8.—The number of each automatic collector will be charged against collector and unnecessary injury to same through improper handling will also be charged. If lost, the sum of..... will be charged against conductor.

9.—Use the word "Insert" as "Insert your fares, please," when addressing passenger. Never use the word "Drop."

10.—Hold the automatic collector in an inclined position when presenting same for receipt of fare and in the position best suited to passenger's convenience.

NOTICE TO PASSENGERS

INSERT NICKELS ONLY
into the Automatic Collector---
ONE NICKEL FOR EACH FARE TO BE PAID.
Conductor returns FULL CHANCE when passenger lacks the NICKEL.
CONDUCTOR IS NOT PERMITTED TO RECEIVE FARE IN HIS HAND OR INSERT FARE FOR PASSENGER.
Try to have the EXACT FARE---A NICKEL.
THE RHODE ISLAND COMPANY.

POSTER PLACED IN CARS USING HAND REGISTERS

11.—Never pull the lever opening entrance to coin channel until just before fare is to be inserted. This gives conductor full control of coin slot, preventing insertion of wrong coins and also permits conductor to see the coin to be inserted.

12.—Conductors should never permit more than five nickels to accumulate in register tube before removing same to his pocket.

13.—In returning full change for money of larger denomination than a nickel, conductor should always return a sufficient number of nickels to cover all fares passenger may wish to pay.

14.—Should the automatic collector meet with accident or fail to operate, conductor will immediately notify his carhouse foreman and proceed to collect fares as instructed under rule.

15.—Should passenger refuse to insert fare, conductor will refer to printed rules posted in car and insist on compliance with same. If proper payment is still resisted, conductor will refuse to accept fare in any other way than through the automatic collector, and will take passenger's name and address (if possible) and report the occurrence to the superintendent of transportation. Conductor may ask any other party to insert fare for this objecting passenger.

16.—If passenger wishes to pay more than one fare, he must pay each fare in the same manner as he would his own. If passenger refuses, conductor will proceed to collect single fares from each of the parties.

From the start the automatic collector attracted a great deal of attention and comment, much of this comment being, of course, based on but slender information, either regarding the register itself or the benefits it was supposed to accomplish from the standpoint of both the passenger, the conductor or the company. It soon became apparent that no trouble was to be had with the public, as complaining passengers were few in number. While few passengers were inclined to be captious, some good-natured bantering with the conductor was engaged in and much questioning added to the conductor's troubles during the first few days. It has been demonstrated, however, that the riding public is not unfriendly to the new system or unwilling to co-operate with the conductor. The conductors themselves, as they have become better acquainted with the system and have grown accustomed to the handling of the register, seem to realize and speak of its advantages and its protection. They find that under this new system they are free from the suspicion of being dishonest, the opportunity for dishonesty being eliminated. Regardless of the question of personal integrity, they also realize that under this system an honest error does not count against them or bring them unjust suspicion.

The success of the pioneer cars led to the equipment of others, and to-day there are some fifty registers in service on the Riverpoint lines, including the Pawtuxet Valley and Rocky Point systems; thirty on the Apponaug and East Greenwich lines, which carry heavy local traffic and also the crowds to Narragansett Pier, and a large number also on the Auburn & Eden Park line, which is also a heavy riding city line. In general, these lines carry much traffic, due to morning and evening rush hours, caused by the transportation of mill hands and considerable pleasure riding. A further complication is introduced by zone fares on these lines, yet no trouble has been experienced. All collections are being made and no fares lost owing to the question of speed as between this system and the old one. The newness of it all brings some delays incident to the handling of those passengers unfamiliar to the system. It is an old story, however, on some of the lines and excites no comment. The developments of the last week have been very satisfactory. Aside from the dropping and slight injury to one register by a conductor who had never handled the register until that day, the registers gave unfailing good service all day long on the Fourth of July, and the riding was very heavy. Loads of 130 up to 140 or more on thirteen-bench open cars were a regular thing, and no fares were lost owing to the system of collection employed.

The conductors appreciate the fact of having the same registers intrusted to them for the entire day and that under this system there are no errors or disputes caused by the signing off between conductors. They find the registration of the register accurate, and seem satisfied with the fact that there is now less likelihood of finding themselves either over or lacking in funds at the conclusion of the day's work. The company also realizes that now conductors who lose their money through incorrect change-making or any other way are unable to charge their own carelessness to the company, thus shifting the loss occasioned by their own errors to their employer. Under this system the conductors are charged with no mental accounting during the day and the opportunity to forget to "ring up" or the chance of having some passenger ring up for them through error does not involve them in suspicions or mistakes. Aside from the few conductors who might be disposed to oppose this system, no troubles have been

noted. One conductor guilty of blocking the register with a bent nickel was discharged, and the wise use of a little discipline is having the desired effect. The register is proof against manipulation by the conductor and gives no encouragement to one who would attempt the use of a "dummy." Unlike other fare registers where the ringing of a bell or the mere display of a register of some sort has been the only protection, this register depends for its effectiveness upon the co-operation of the passengers. The latter are keenly alive to the mechanical functions which attach themselves to the register mechanism and which they experience in paying their fare.

It would seem that this system would also tend to simplify the work of the accounting department of the street railway company, as under the old system the record of the registers have to be traced through the hands of the different conductors who use the register during the day.

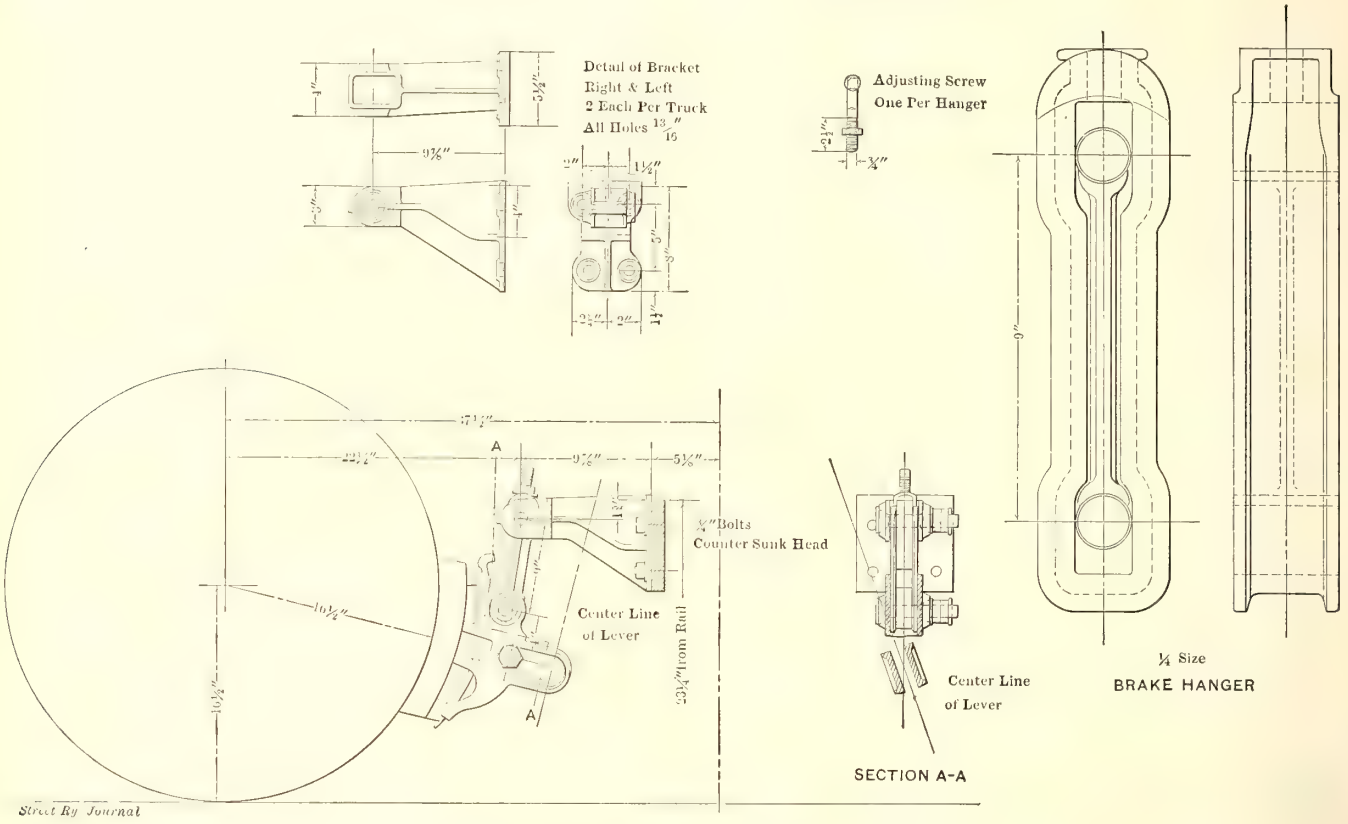
The registers now in use by the Rhode Island Company were furnished by the Rooke Automatic Register Company, of Providence, R. I. This company has been working on this device for several years and now has a complete manufacturing equipment at Providence with many machines under way.

This register is not confined to the registration of nickels only. As in Cleveland and other cities, where metal tickets and tokens have taken the place of paper tickets, it is intended that such metal tickets may be inserted into the register so long as they represent value. This saves printing bills. Where tickets are sold at a discount they can be registered separate from the nickels, though paid into the same slot. The company is equipped to furnish registers for coins of other denominations (all to be inserted through the same slot), the interior mechanism in the register recognizing the coins and properly recording their different values on the totalizers. This combination register is identical in size, shape and action as the register above shown and used exclusively for the insertion of nickels.

Up to date the Providence experiment has run very smoothly. General Manager A. E. Potter, of the Rhode Island Company, states that the system is accomplishing all that has been claimed for it.

AN ADJUSTABLE BRAKE HANGER

Chattering of the brakes just before the car settles to a dead stop is certainly annoying to passengers, and the severe shaking of all parts of the car no doubt increases the maintenance cost considerably. A remedy for chattering brakes is to have the brake hangers supported by a rigid part of the truck and then to eliminate loose pins in the brake hangers and rigging.



ADJUSTABLE BRAKE HANGER USED ON MILWAUKEE SEMI-STEEL CAR

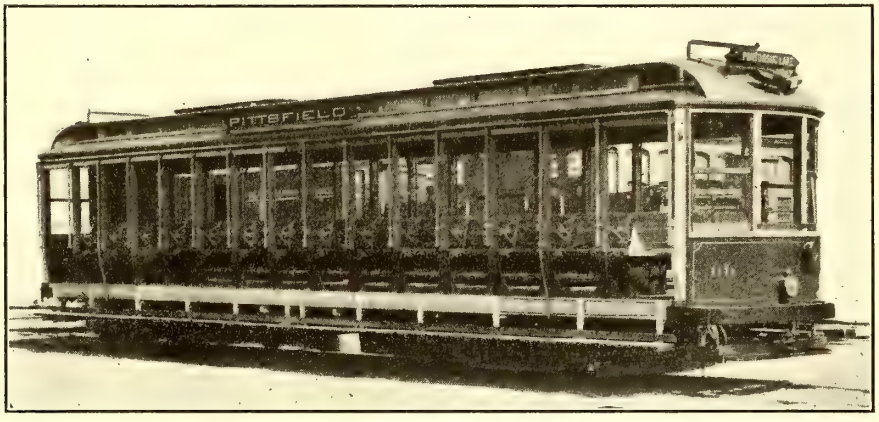
The St. Louis Car Company's open link hanger is designed with special provision for taking up wear. The hanger has been used on trucks manufactured by the company for some time, but the fact that it is employed on the trucks of the new semi-steel cars of the Milwaukee Electric Railway & Light Company makes a brief description of it opportune at this time. The link is open between the two pins and a space piece is inserted in the narrow slot. Split cone bearings are inserted between the ends of the links and ends of the space piece, and, as the parts wear, these bearings are spread and the slack taken up by tightening up the cone head bolts passing through the bearings. An adjusting screw at the top of the link which screws down against the top bearing provides for excessive wear of the parts. As there is no wear on the space pieces, the position of the brake-shoe relative to the axle is not changed by the adjustment of the other parts.

The annual picnic of the Cleveland Electric Railway Benefit Association at Shattuck's Park, on June 27, was attended by about 600 persons. Peter Campbell received the prize for having been longest in the employ of the local company, thirty-nine years.

CARS FOR PITTSFIELD STREET RAILWAY

The Pittsfield Electric Street Railway Company has recently placed in commission a number of attractive-looking vestibuled open cars built by the Wason Manufacturing Company, of Springfield, Mass., one of which is illustrated. There are a number of features of more than passing interest on these cars. The system of draining the roof is unusual—a gutter runs along the water table and from it two feeders follow the grab handles at opposite ends of the car. Another innovation is the iron bar extending across the center vestibule window to protect the woodwork when the motorman uses his switch iron. On the roof at either end is a device for protecting the sign should the trolley pole strike the roof by accident.

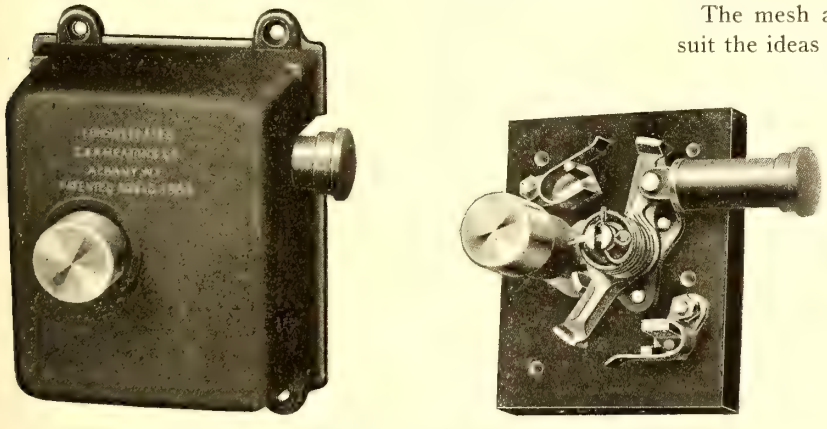
The seats are reversible, and the interiors are finished in mahogany. The truck used is the Wason No. 21 with 4-ft. wheel-base. A car with trucks minus the electrical equipment weighs 26,000 lbs. The chief dimensions follow: Length over the end pieces, 42 ft. 6 ins.; width over sills, including the sheathing, 7 ft. 4 ins.; over the posts at the seat line, 7 ft. 9⅜ ins.; height from the floor to the ceiling, 7 ft. 8 ins.; from the track to the under side of the sills, 2 ft. 5¼ ins.; size of the side sills, 5½ ins. x 8½ ins.; center sill, 11½ ins. x 3 ins.; end sills, 3¼ ins. x 5⅝ ins.



OPEN CAR FOR PITTSFIELD STREET RAILWAY COMPANY

A NEW TYPE OF CAB HEATER SWITCH

The Consolidated Car Heating Company has recently designed the single-pole, double-break snap switch, for controlling the heat in motormen's cabs shown in the accompanying cuts. When heat is required, the switch is closed by pushing in the lever at the side, and the blade is automatically locked in closed position. When heat is not required, the horizontal lever is pushed in, either by hand or by the cab door, disengaging the lock and opening the circuit. This lever is placed in the line of movement of the cab door and the closing of this door over the controller automatically cuts the heat from the cab should the motorman neglect to operate the switch.

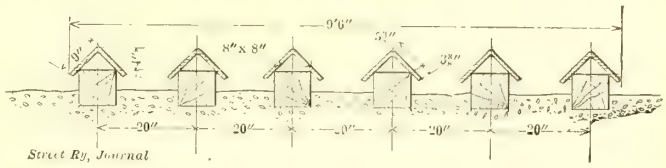


OUTSIDE AND INSIDE VIEWS OF HEATER SWITCH

Records kept by the City Register during 1906 show the United Railways Company, of St. Louis, to have made 6,493,056 trips, carrying 233,099,274 passengers.

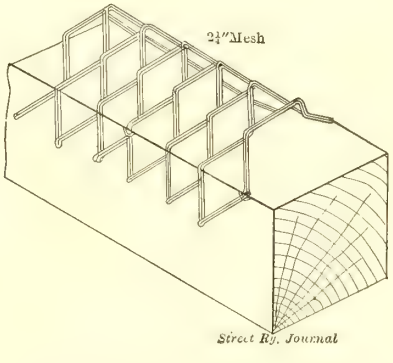
AN EXPANDED METAL STOCK GUARD

A new type of stock guard has recently been invented by F. W. Stewart, of the Climax Stock Guard Company, which differs radically from any previously put on the market. The material used is expanded metal, which is made in sections 2 ft. x 18 ins., and are then bent at right angles so that each side is 9 ins. wide. This metal is then attached to the ties as shown in the illustration, leaving a space about 6 ins. between the edge of the guard and the ballast. This gives a semi-pit effect, which, in connection with the triangle over the ties, would make a decided hindrance to cattle. At the same time there would be nothing to hold them.



SECTION SHOWING EXPANDED METAL ON TIES

The mesh and spacing of the ties could be arranged to suit the ideas of the different officials. Any number of ties required may be covered, and track work and tie inspecting may be done without removing the guard. Each section is held in place with from eight to fifteen staples. If they are crushed by anything heavy dragging from a train they can be readily shaped up and put into service for very little expense or trouble. If given a good coat of asphaltum paint or galvanized, they should last a considerable time. In a number of tests made with this guard it proved most effective, and as they are very light and shipped in bundles, the freight rate to the farthest points is reduced to a minimum.

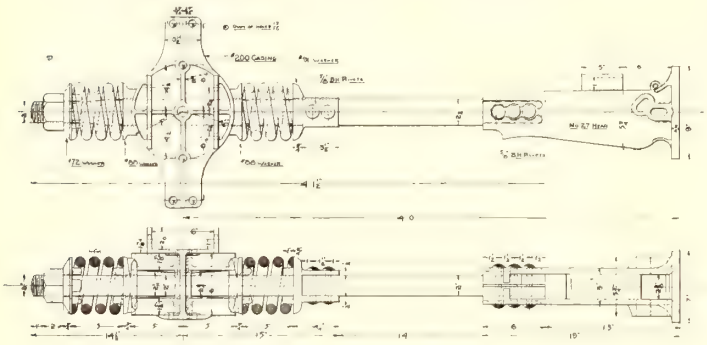


SECTION OF CATTLE-GUARD

NEW TYPES OF VAN DORN DRAW BARS

Within the last few months the W. T. Van Dorn Company, of Chicago, has designed and constructed three new types of drawbars which cover practically all the requirements of electric lines, from heavy elevated or subway traffic to interurban and ordinary city service. Strictly speaking, there is nothing experimental about these types, their construction being due to actual demand for the application of the Van Dorn type to certain given conditions.

The heaviest of the three was especially constructed for the steel cars recently built for the Hudson Companies, of



THE NO. 27 DRAW-BAR

New York, described in the Street Railway Journal of June 8, 1907. This is known as the No. 20½, the heaviest ever constructed by the company, the head alone weighing 140 lbs. The face of the head was 16 ins. wide and 9 ins. deep, and was beveled at the top and bottom 3/16 in. in 1½ ins. to allow sufficient vertical motion for the operation of the drawbars on the 1000-ft. vertical curve of the Hudson Companies' grade. This style of head uses a round pin 1⅝ ins. in diameter and a heavy forged link. The head itself was bolted to an 80-lb. A. S. C. E. standard T-rail, approximately 5 ft. long, bent to a specified shape, at the opposite end of which were bolted two heavy tail-straps of 2½-in. x 1¼-in. stock, rounded to 1¾ ins. Both head and tail-straps were secured to the rail with ¾-in. turned bolts. The friction and bolster washers on this type were unusually heavy, and the springs used on the drawbars were the heaviest type in use on any electric line, being made of 1 7/16-in. steel.

The usual type of this company's drawbar head is supported by a sectal bar, but in this case the sectal bar was discarded and the head was supported by a heavy forged clip, 11 ins. wide, of 1-in. stock, bolted to heavy lugs cast on the drawbar head, and rested on a carrying bar above the head of the drawbar. To prevent excessive wear on this clip there was placed beneath it a ¼-in. steel chafing-plate secured to it by rivets.

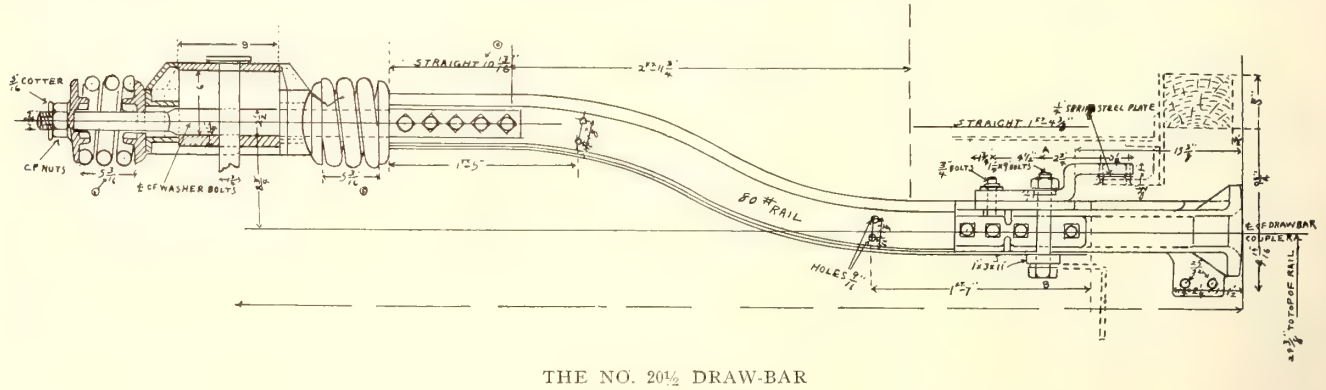
The next type, intended for interurban service, known as the No. 21, is in use on the Winona Interurban Railway, the New York & Queens County Railroad, and several other lines whose service is of a similar character. The drawbar is composed of the standard No. 21 head riveted to a 60-lb. T-rail, at the opposite end of which are riveted two forged tail-straps of 1-in. x 2-in. stock, welded together at the outer end and terminating in a single stem of 2 ins. diameter. This forked tail-strap, together with a new type of the Van Dorn casing, forms one of the special features of the drawbar, the tail-straps hitherto used having been kept separate and terminating in separate stems. The No. 200 casing used with this type is of smaller diameter than the casings of former design, and is considerably lighter in weight, but still allows the 120-deg. radial motion which is required of the drawbars on short radius curves. The main purpose in the design of this new type has been the utmost economy in weight without the slightest sacrifice of strength, and the purpose has been fairly well accomplished, as at a 4-ft. length the complete drawbar weighs but 250



THE NO. 21 DRAW-BAR

lbs., a weight which will cause no appreciable strain on interurban cars of the lightest construction.

The demand which led to the design of the third type was for a light drawbar applicable to the customary city car or light trailer, which would readily intercouple with the drawbars of the Nos. 21 and 11 type now in use on heavy interurban cars, as well as with the Nos. 5 and 5½ heads largely used in city service. To meet this demand the No. 27 head was designed. This is a medium between the Nos. 11 and 21 heads and the Nos. 5 and 5½ heads, is extremely light, weighing but 40 lbs., and the pins and links



THE NO. 20½ DRAW-BAR

used are interchangeable with those of the Nos. 11 and 21 heads. Almost any style of draft appliance may be used with this head, from the simple bar and pin to the light type casing mentioned in connection with the No. 21 drawbar. Used with this casing, it forms a very complete and simple appliance, weighing but 200 lbs. at a 4-ft. length. The head is intended to be applied directly to a flat bar of 1½-in. x 3-in. stock, but may be altered to accommodate a bar of heavier stock. This type, as well as the other two, is equipped with a tubular air-hose carrier such as shown in the reproduction of the No. 21 drawbar.

Several other designs have recently occupied the attention of this company, among them being a modified type of the No. 100 casing and an emergency knuckle of the full-sized M. C. B. type, intended to fit into the head of the com-

pany's coupler, enabling it to couple with any standard M. C. B. coupler. The company will shortly be in position to furnish knuckles of this description where conditions demand their occasional use.

EQUIPMENT FOR NEW LINE BETWEEN STROUDSBURG AND THE DELAWARE WATER GAP

The picturesque Delaware Water Gap region has been invaded by the trolley, the "Mountain View line," which is the more familiar title of the Stroudsburg & Water Gap Street Railway, being opened to the public on July 4 last. The road is only 4 miles long, running to Stroudsburg, the county seat, and the scenery met with along the way will attract thousands of people who wish to enjoy one of the prettiest rides in the country. From the crest of the mountain the railway overlooks the Delaware Water Gap to the south and the Pocono Mountains to the north. At this point will be located a park which will attract patronage from both the Gap and Stroudsburg. Temporarily the railway is operating only to South Stroudsburg, but a bridge, 600 ft. long, is under construction to bring the road into the business center of the town. The Mountain View line will add much to transportation facilities from the Gap, as heretofore there was no outlet except by steam trains. The road is constructed entirely on private right of way except at the terminals when public streets are occupied. The track is 90-lb. T-rail with stone ballast.

The rolling stock elected consists of Brill grooveless post, semi-convertible cars, which are particularly well adapted to scenic roads due to the extra big windows which in no wise obstruct the view and the protection that the cars afford from all kinds of weather.

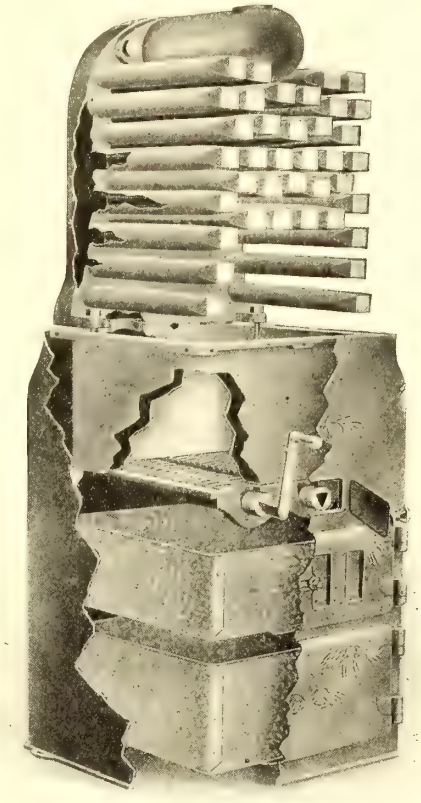
The cars are 28 ft. long over the end panels, 37 ft. 5 ins. over crown pieces and vestibules, 7 ft. 10½ ins. wide over the sills, including plates. The side sills are 4 ins. x 7¾ ins., and the end sills 5¼ ins. x 6⅞ ins. The car interiors are finished in cherry, and the ceilings are of birch veneer. Some of the grades encountered in this mountainous district are exceedingly heavy, for which reason two sets of brake rigging were furnished to work independently; hand power is used to operate the shoes on the outside of the wheels and air for the inside brakes. The car bodies are mounted on the No. 27-G1 truck with 4-ft. 6-in. wheelbase. Two 40-hp motors are used. The weight of cars and trucks, including the complete electrical equipment, is 37,200 lbs.



SEMI-CONVERTIBLE CAR FOR DELAWARE WATER GAP SERVICE

A COMPACT HOT WATER CAR HEATER

Two of the stock arguments against the use of car heaters have been based on the amount of space they take up and their undesirable prominence in the car. These objections are claimed to be largely overcome in a heater built by the Cooper Heater Company, of Dayton, Ohio, and thoroughly tried last winter by the City Railway Company, of that city. Beside the advantageous points mentioned, the new heater embodies other valuable features, as will appear from the following description:



PART INSIDE VIEW OF CAR HEATER

This heater consists of a water-lined fire pot connected to a water wall or tube sheet from which the tube projects horizontally. A dome is connected to the top of the water wall at right angles. The heater is also provided with an ash pan and coal bunker, all encased in a double-steel, asbestos-lined jacket with an air gap between.

This heater is asserted to be the only one that circulates freely and more rapidly under heavy pressure, although it has never been necessary to have over 10 to 20 lbs. It does not require dumping to clean the grate, nor is it necessary to build a fresh fire every twenty-four hours, as the fire can be kept going with little fuel and attention. As to coal consumption, it is stated that on a 45-ft. car operated in zero weather, a filled fire pot and bunker holding less than one-half bushel of hard coal will last for twenty-four hours. If the car is not in use over night or is otherwise out of service, with all dampers closed, the temperature will not drop more than 2 to 4 degs. without adding coal. If desired, liquid fuel can be used in this heater.

Since Nov., 1906, until warm weather set in this year, the City Railway Company, of Dayton, Ohio, had two of these equipments in constant use, and has furnished the following data:

The No. 1 heater which occupies but 12¾ ins. of floor space, was installed in a 20-ft. 7-in. x 8-ft., 2-in. x 8-ft. 6-in. car, inside dimensions; this heater was placed in the front vestibule, with radiation pipes running longitudinally, said pipes being located beneath and at the side of the seats.

The No. 2 heater was installed in a cross-seat convertible car, 32-ft. x 8-ft. 2-in. x 8-ft. 9-in., with radiation running longitudinally with the side of the car, beneath and at the side of the seats, the heater also being in the front vestibule. During entire service from the date of installation to the time of discontinuing this spring, the heater gave no trouble nor showed any mechanical defects. In the use of coal and its economy, as shown by tests made at intervals during the winter, it was found that with an average temperature from 10 deg. below freezing to 10 deg. above zero, the heater would not consume more than 10 cents to 12½ cents coal during twenty-four hours, coal being valued at $6 per ton. The inside temperature of the car was maintained at an average of 60 degs. At average of winter temperature, the cost per day for fuel should not exceed 10 cents per 24 hours.

Owing to the little space taken by this heater it seems well adapted for installation in the vestibule of the average city car. It is, of course, equally valuable for interurban cars. Another good feature claimed for this heater is, that it can be placed within 3-ins. of the panel work of the car without injuring it by over-heating.

OIL TESTS IN POWER PLANT SERVICE

The purchase of oil suited to the operating conditions is an important feature of power plant work. Perhaps there is no subject in which steam station engineers are more interested, for the proper lubrication of the machinery is fundamental in the requirements of continuous service. Close competition between oil salesmen is often the case in street railway installations, for the oil consumption of a large company represents a good many hundreds of dollars a year. It is, of course, a task for the chemist to analyze the various oils brought into power plant service with a view toward determining the specifications best adapted to the situation in each station and insuring the fulfillment of these specifications. At the same time, there are a few simple tests which can be made without an extensive laboratory to determine a good cylinder, engine or dynamo oil. Some of these are mentioned at length in the 1907 Question Box of the National Electric Light Association.

For either engine or cylinder service a good oil should have body enough or sufficient viscosity to prevent the surfaces to which it is applied from coming into actual contact. Perhaps this is the most important qualification of good oil, and with a careful viscosity test a good oil will not be rejected or a poor oil accepted. Viscosity is closely related to the density of an oil. The simplest means of determining the viscosity of an oil is to test the time of flow of a certain volume of oil through a small orifice as compared with the time of flow of the same volume of good oil or water. The oils and water compared must be tested at the same temperatures, and preferably at the temperature to which the oil is to be subjected. A copper or glass vessel with an orifice of about one-sixteenth of an inch in the bottom is satisfactory, except where very large quantities of oil are used. In the latter event the purchase of a viscosimeter will doubtless pay the company. Accurate tests of the viscosities of oil as compared with water have given the following results: Prime lard oil, 3.6; sperm oil, 2.2; castor oil, 2.6; rape-seed, 4.2, the temperature in these tests being 68 degs. F.

Freedom from corrosive acids, the maximum fluidity possible with the required viscosity, a minimum coefficient of friction, high flash and burning points and freedom from elements liable to produce oxidation or gumming, are all desirable features of oil for power plant service. To identify an animal oil or a vegetable oil, chlorine gas may be applied. The former is turned brown and the latter white by its action, and if there is no opportunity for further chemical tests this method of attack will often serve the purpose in a rough way, though it throws no more light upon the composition of the oil than a calorimeter test of coal exhibits the constituents of a fuel sample.

The flash and burning tests may be readily made by placing a sample of the oil in a small receptacle having a tight cover through which a thermometer can be inserted. A small hole is essential in the cover to allow the vapors to escape as the oil is heated. The vessel should be gently and slowly heated through a layer of sand, and when the oil is hot a lighted match or an incandescent wire may be passed over the hole to observe the temperature at which the oil flashes. The burning point is obtained by continuing the heating and noting the last temperature observed at the time the oil takes fire. The gumming and oxidation characteristics may be obtained by noting the time required for a small amount of oil to flow down a smooth inclined plane with the time taken by a like amount of good oil to flow over the same course.

The simplest method of finding the density without the use of instruments is to find the loss of weight of some body in oil and in pure water. The ratio of the loss gives the density as compared with water. Animal oil densities may run from 0.62 to 0.9; sperm oil at 39 degs. F. has been found to have a density of 0.88; rapeseed, 0.91, and cotton-seed, 0.92.

Moisture in transformer oil may be detected in several simple ways. By reason of its specific weight moisture in transformer oil will generally be found at the bottom of the case. As most cases for oil shipment, including transformers, are provided with plugs, it is an easy matter to secure a sample from the bottom in a test tube. By providing the latter with a tight cork and bent glass tubes about ⅛ in. in diameter and heating the test tubes, the moisture in the oil will condense in the upper part of the small tube and will be prevented by the bend from falling back into the oil. A second method is the application of a red-hot wire to the oil, a crackling sound following the presence of moisture and simply a puff of smoke if the oil is dry. A simple chemical test consists of driving off the water in a few crystals of copper sulphate by roasting. This leaves a white powder, and when oil is added to this the original blue color returns if the oil contains moisture. Of course, these tests are approximations, but they are useful in plants where the services of a skilled chemist are not available, which is the case on many electric railways. Needless to say, records of oil consumption and overheated bearings should invariably be made in power plants.

FINANCIAL INTELLIGENCE

The Money Market

WALL STREET, July 10, 1907.

Despite the heavy loss in cash sustained by the local banks as revealed by last Saturday's bank statement, and the resumption of the outward movement of gold to Europe, the local money market ruled comparatively easy during the past week. Under ordinary conditions these heavy drafts upon the banks would have been sufficient to bring about a sharp advance in money, but so far they have not had the slightest influence upon rates for either call or time loans. At the opening, call money commanded 10 per cent, but as soon as the moneys destined for interest and dividends on July 1 were redeposited in the banks there was a gradual decline to 3½ per cent. The amount of money obtained at the low rate, however, was very small, and the bulk of the week's business was transacted at above 4½ per cent. Borrowers were disposed to draw their supplies from the open market, although at the close an increased demand for time money was reported. The banks and other lenders, however, were not inclined to offer money for fixed periods with any degree of freedom in view of the low reserves, and the extraordinary demands that will be made upon these resources in the near future. During the current week the local institutions will be called upon to repay to the Government the greater part of the $30,000,000 special deposits, but these payments will be partly offset by the disbursements by the Government in connection with the redemption of Government bonds which became due on July 1. Preparations must also be made this week for the initial payments on account of the Atchison and Union Pacific bonds, as well as some smaller payments. During the week $2,750,000 gold was shipped to Europe, bringing the total shipments on this movement close to $30,000,000. It is believed, however, that the outward movement of gold is over, at least for the present. Rates for foreign exchange show a declining tendency, and predicions are made that further decline in exchange rates will be made in the near future. This belief is based partly upon the readiness of foreign bankers to offer finance bills and loan the proceeds in the local money market. There has been a moderate amount of bills of this kind offered in the market this week, and if money rates show a hardening tendency it is believed that the offerings will be large enough to reduce the price of exchange to a point that will make gold exports unprofitable. During the week a number of new security issues were announced, chief of which was an issue of $6,000,000 notes by the Westinghouse Electric Company. These notes will bear interest at the rate of 6 per cent, and will run for three years. The proceeds will be used to pay off a like amount of notes maturing Aug. 1 next. Among the other issues were $1,720,000 Atlanta, Birmingham & Atlantic Railroad equipment trust bonds, and $1,575,000 Washington Terminal Company's notes. In addition to these several other issues are contemplated, and the belief in banking circles at the close was that the money market would rule firm at about the present line of rates for the present at least.

The bank statement published on last Saturday was decidedly unfavorable. Instead of an expected gain in cash of about $6,000,000, as indicated by the preliminary figures, the statement showed an actual loss in that item of $5,025,900. Loans decreased $10,814,800, due to the shifting of loans from the banks to other institutions. Deposits were smaller by $13,491,500, thus reducing the reserve required by $3,372,875. The surplus reserve decreased $1,653,025 to $856,250, as against $6,465,075 in 1906, $7,959,825 in 1905, $36,017,725 in 1904, $8,008,475 in 1903, $12,226,900 in 1902, $5,211,525 in 1901, and $15,589,200 in 1900.

The Stock Market

Speculation on the Stock Exchange continued upon a fairly large scale during the week, but prices displayed a reactionary tendency. Operations were again largely professional in character, the volume of commission house business clearly indicating that the outside public was taking a very small interest in the market. Sentiment, however, was more cheerful, and close observers of the market were inclined to the belief that important interests were quietly picking up the standard issues. During the first half of the week the upward movement in values was continued under the lead of Union Pacific, and substantial gains were recorded in practically all quarters of the market. The Government report on cotton was decidedly unfavorable and caused a sharp advance in the price of the staple, but it failed to have any material effect upon security values. Even the bank statement published on last Saturday showing a loss of upwards of $5,000,000 in cash by the local banks, thus reducing the surplus reserve to the lowest point recorded at this season in years, was entirely ignored. During the last half of the week the market became reactionary. Further consideration of the bank statement and the resumption of gold exports to Europe were followed by profit taking and short selling by the speculative element, and as a result prices sustained moderate recessions. At the close of the week there was an abrupt fall in prices, the losses extending from 1 to 3 points in the active issues. The downward movement was accelerated by the fears of tight money, resulting from the repayment by the banks of the $30,000,000 special Government deposits, and by the payments on account of the new Atchison and Union Pacific bonds, all of which are payable this week. Another important factor working in favor of lower prices was the renewed crop damage reports, and while these reports were somewhat strengthened by a substantial advance in the price of wheat, there was a disposition on the part of the more conservative element to await the publication of the Government report on the growing crops. The leader of the decline was Union Pacific, the selling of this stock being based upon reports that the stockholders of the company had taken about 25 per cent of the $75,000,000 issue, which if true means that the syndicate will be obliged to take the bulk of the issue. Amalgamated Copper also declined sharply on the announcement that the large producers of copper metal had reduced prices, thus breaking the deadlock which has existed between producers and consumers for some time. In some grades the reductions amount to as much as 2½ cents a pound, but it is expected that a very large business will be transacted at the new prices.

Philadelphia

Trading in the local traction shares was upon a comparatively small scale during the past week, and while prices moved with some irregularity, the general tone of the market was firm. Philadelphia Rapid Transit was unusually dull, less than 2500 shares changing hands at from 24½ to 24 and back to 24¼. Philadelphia Traction scored an early advance of ½ to 94½, but subsequently lost all the improvement, while Union Traction, after selling at 59 later eased off to 58½. Consolidated Traction of New Jersey was strong at 73, an advance of ½. Philadelphia Company common sold at 42 and 41, but the preferred stock advanced more than a point to 45. Norfolk & Portsmouth Traction sold at 31. Fairmount Park Transportation made a new low record at 12. Other transactions included American Railways at 48½, Railways General at 5¼ and 5½, and United Companies of New Jersey at 244.

Chicago

The market for the local railway issues was practically at a standstill and, apart from a decline of 2 points in Chicago City Railway stock to 165 on light trading, price changes were unimportant. Union Traction common brought 3½, and the preferred sold at 18. South Side Elevated advanced to 83. Metropolitan Elevated sold at 24 and the preferred stock at 64.

Other Traction Securities

Increased activity and strength characterized the market for traction issues at Baltimore, prices for many issues scoring substantial gains. United Railway issues showed pronounced strength under the lead of the income bonds, which advanced about 2½ to 53 on transactions aggregating $50,000. The 4 per cents rose ¼ to 85¼, and the new refunding 5s moved up a full point to 80. The free stock was ½ higher at 12½. Other transactions were: Baltimore City Passenger 5s at 101½, Macon

Railway & Light 5s at 92¼, Baltimore Traction 5s at 108⅝, City & Suburban 5s at 106¾, and Norfolk Railway & Light 5s at 95. Little interest was manifest in the Boston market. Boston & Worcester common was the only issue to show any activity, upwards of 500 shares selling at 23⅞. Massachusetts Electric preferred sold at 58 and 57. Boston Elevated brought 135 for a small lot. West End common sold at 85½ and the preferred at 99¾ and 100.

For two days the past week, there were no sales on the Cleveland Stock Exchange, and little trading was done on any of the other days. Aurora, Elgin & Chicago preferred stood 75 bid and 77 asked on the close, while Northern Ohio Traction & Light occupied about the same place as a week ago, 24¼ bid and 26 asked. Forest City does not vary much, still standing at 96 bid and 98¼ asked, although no trading was done in its securities.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	July 3	July 10
American Railways	48½	48¼
Boston Elevated	133	135
Brooklyn Rapid Transit	56	57¼
Chicago City	155	155
Chicago Union Traction (common)	3½	3
Chicago Union Traction (preferred)	16	16
Cleveland Electric	—	46¼
Consolidated Traction of New Jersey	72	72½
Detroit United	64	66
Interborough-Metropolitan	16	17
Interborough-Metropolitan (preferred)	43¾	45⅞
International Traction (common)	—	—
International Traction (preferred), 4s	—	—
Manhattan Railway	—	—
Massachusetts Elec. Cos. (common)	16	16
Massachusetts Elec. Cos. (preferred)	58	a58
Metropolitan Elevated, Chicago (common)	22	23
Metropolitan Elevated, Chicago (preferred)	63	a64½
Metropolitan Street	a95	a91
North American	69⅝	69
North Jersey Street Railway	40	40
Philadelphia Company (common)	40½	41
Philadelphia Rapid Transit	24	23¼
Philadelphia Traction	94	93¾
Public Service Corporation certificates	—	—
Public Service Corporation 5 per cent notes	—	—
South Side Elevated (Chicago)	81	82
Third Avenue	105	105
Twin City, Minneapolis (common)	95¼	94
Union Traction (Philadelphia)	58½	58¼

* Ex-dividend. a Asked.

Metals

The iron markets are quiet. Foreign iron is being sold on this side on the basis of $21 and $21.25 a ton, as against $23 heretofore, and it looks as though the movement in foreign in this direction was about over. The demand for finished steel is not urgent, but the manufacturers regard the new business being booked as satisfactory. Little business is reported in steel rails, but some large contracts are said to be pending.

Copper metal is decidedly easier, the large producers reducing prices to 22 cents for electrolytic and to 22¼ and 23 for lake.

LABOR AGREEMENT AT POTTSVILLE, PA.

The arbitrators in the labor controversy between the employees of the Tamaqua & Lansford division of the Eastern Pennsylvania Railways Company and the company rendered their findings on July 2. The agreement was signed on July 3 and was made to date back to May 1, 1907; it is the same as that on the Pottsville Union Traction Company. Conductors and motormen who have been in the employ of the company less than one year receive 17 cents per hour; during the second year 19 cents per hour; during the third year and thereafter 21 cents per hour. Regular men, on overtime work, receive 1 cent an hour extra. All matters in dispute, not settled by employees and the management, are to be settled by arbitrators selected by both parties. The contract is to continue in effect until July 1, 1909.

THE SAN FRANCISCO SITUATION

In the calamity of labor, politics and graft in San Francisco, no less disastrous than the earthquake which occurred in that city a few months more than a year ago, the street railway strike and the charges of bribery made against the street railway management in that city have attracted wide attention. Under these circumstances it is interesting to read the view of the situation given in a recent issue of the San Francisco "Argonaut," a semi-literary and political weekly which has long been distinguished for the sound and broad views which it holds. Under the title "The Case Restated and Reviewed," this paper rehearses the political conditions under which the city suffered before and after the earthquake, the downfall of the Ruef-Schmitz organization a few months ago, the portion taken in that revolt by Rudolf Spreckels, who was interested in a street railway project to compete in the business of local transportation with the United Railroads, and the prosecution of Patrick Calhoun, president of the United Railroads Company on charges of bribery during the street railway strike. According to the "Argonaut" the prosecution of the labor grafters set on foot by Mr. Spreckels had at its start the good will of every citizen of San Francisco outside the lines of criminal association and sympathy. It was common expectation that the guilty members of the board of supervisors would be punished for their crimes. But the public was surprised and greatly chagrined to find that not only two or three but all of the confessed boodlers were to be given immunity, and that while under confession as shameless criminals they were to continue in official authority and draw their salaries.

The strike on the United Railroads occurred under such circumstances that the men found no sympathy outside the affiliations of a debauched labor union. The whole mass of conservative society stood as one man in opposition to it and it fell to Mr. Calhoun, as president of the United Railroads Company, to fight the battle of law and order. The crisis was felt to be one in which not merely the immediate business welfare of San Francisco but the integrity of social order was at stake. Mr. Calhoun, at that time, was among those liable to indictment for having yielded up a sum of bribe money to Ruef and Schmitz and the supervisors for the privilege of rehabilitating the railway system after the fire and equipping the lines electrically. While no one wished that he or his associates should be granted immunity for any wrongful act which they may have committed, the conservative element did expect that his hands should be left free to fight the strike in which so large a measure of public and social interest was involved. Instead he has been pursued publicly and privately in a way to embarrass him in this fight and weaken his powers of courage and resistance. The following instances are given: the attempt to declare the United Railway franchises void for non-use; forcing the Geary Street Company, which had been working under a lapsed franchise and was therefore answerable to pressure, to accept the demands of the strikers; publicly expressed disapproval of the attitude of President Calhoun towards the strikers; and the decision of the impoverished city to spend $720,000 to build a municipal street railway line through Geary Street.

Horace G. Platt and Edgar J. de Pue of the Geary Street Railroad Company have begun an action in the Superior Court for the purpose of securing an injunction against the Board of Supervisors to restrain that body from exceeding the dollar limit in its tax levy for the coming fiscal year, which it would do in order to appropriate $720,000 for the acquirement of the Geary Street Railroad. Mayor Schmitz has vetoed the appropriation made by the supervisors who now say they will pass it over his veto. The Associated Savings Banks of San Francisco, which organization includes every institution of this kind in the city, has filed a copy of a set of resolutions with the Board of Supervisors protesting against the passage of that portion of the budget which provides $720,000 for the construction of a municipal street railway on Geary Street. The communication sets forth that the association represents 150,000 depositors who would pay about $200,000 of the increased taxation imposed by the item referred to, and that it is the first business of the association to protect the interests of its depositors. The reasons given are that the item would place the taxes beyond the limit provided for in the charter, that there is no urgent need of a municipal street railway, while there are other things for which the city has greater need.

EXTENSIONS IN THE CENTRAL WEST

The semi-annual traction map for the Central States has just been issued by the American Engineering Company. It covers Indiana, Ohio, Southern Michigan and parts of Kentucky, Illinois and Wisconsin, and indicates the following among other recent changes.

In Northern Kentucky there is a connection between Henderson and Evansville, and one under construction between Owensboro, Ky., and Rockport, Ind. The line being built by Indianapolis capitalists known as the Louisville & Eastern is shown from Louisville to La Granges and from Louisville to Frankfort. Another system is being built from Frankfort to Lexington to Nicholasville; Lexington to Richmond; Lexington to Paris, and Lexington to Georgetown. It is expected that the line from Georgetown north will ultimately connect Cincinnati, either at New Port or Covington, which would give a complete circuit from Cincinnati to Lexington, thence to the capital of Kentucky, to Louisville, to Indianapolis, and making a return circuit by Dayton.

The merger line now being built between Lima and Toledo is in operation as far north of Lima as Leipsic, and the rest of the line north to Maumee is expected to be in operation in the near future, as is also the line between Bellefontaine and Lima and Springfield. An extension is also in operation south out of Zanesville to Roseville and Cooksville. The line between Salem, Ohio; Columbiana, Leetonia, Lisbon, and as fair south as West Point is now in operation, leaving only a short distance to be finished to make a connection with East Liverpool and the entire Ohio traction system. The Cleveland, Ashland & Mansfield Traction Company expects to have its line in operation between Mansfield and Ashland by Sept. 1, and completed to Seville by Jan. 1. The Akron, Wadsworth & Western has been put in operation between Akron, Barbarton and Wadsworth.

In Indiana the Indianapolis & Western Traction Company's line has been placed in operation between Indianapolis and Greencastle; the road between Greencastle and Harmony, connecting Terre Haute will not be in operation until later in the year. The extension commenced by the Stone & Webster people of Boston prior to the sale of their Terre haute properties to the merger is being completed between St. Mary's-of-the-Woods to Paris, Ill. The Indianapolis, Crawfordsville & Western will be in operation between Indianapolis and Crawfordsville July 1. The Ft. Wayne & Wabash Valley Traction line will be in operation July 1 between Logansport and La Fayette. The Indianapolis & Louisville Traction Company connecting with the Indianapolis, Columbus & Southern Traction Company for Louisville, is in operation from Louisville north to Scottsburg, but that between Scottsburg and Seymour will not be completed before Sept 1. The line between Columbus and Seymour, being built by the Irvins, of Columbus, is likewise in an incomplete condition, but is progressing satisfactorily and will be in operation the later part of August. The Winona line from Warsaw to Peru will not be in operation until late fall. The extension of the Indianapolis & Northern from Crawfordsville to Danville, Ill., connecting the McKinley system has been abandoned until next year. The line from Ft. Wayne to Decatur, Ind., is in operation and it is stated that the line will be extended to Coline, Ohio. The line between Angola and La Grange, which has been operated by gasoline before, has not yet reached the stage of operation east of La Grange, but is in operation from La Grange to Middlebury. The Chicago, Lake Shore & South Bend Railway Company is progressing rapidly with the construction of its line which runs south out of Chicago to Kensington, thence to East Chicago, thence a branch north to Indiana Harbor, then the line continues east to Gary, Porter, Michigan City, Hudson Lake, New Carlisle and South Bend. This road will be in operation Sept. 1 between South Bend and Michigan City, and early next year between Michigan City and Chicago. This road is separate and distinct from the merger lines being completed between South Bend and La Porte to Michigan City, neither of which lines have to do with what is known as the New York-Chicago Electric Air Line, which is not recognized on the official map as yet.

The Indianapolis, New Castle & Toledo system now building will not have any part of their line in operation before about Sept. 1, when the line between Indianapolis and New Castle will be first put into operation. The line between Newburgh and connecting Evansville east to Rockport is now in operation with an extension under construction from Rockport to Owensboro, Ky., and an extension from Cannelton east to Leavenworth, it being the intention to eventually connect New Albany. This system is being constructed by the Tennis Construction Company, who are doing much to improve the southern part of the State.

The proposed lines in Indiana that seem worthy of mention is a line from South Bend to Plymouth, Rochester and Logansport, and also from La Fayette, Crawfordsville and Greencastle.

The number of miles of road placed in operation since last January in the State of Indiana is 166 miles, which, added to the previous mileage of 1650 makes a total of 1816 miles. The number of miles of new construction work since last January equals 115 miles.

The mileage in Ohio last January was 2240, to which must now be added 68 miles, making 2308 miles. When all the work now under construction shall have been completed in the State of Ohio, it will have a total electric mileage of 2400 miles. At this time in Ohio only 100 miles of new road are reported to be under construction, while in Indiana there is 370 miles, most of which will be in actual operation by the end of the present year.

CLEVELAND TRACTION MATTERS

The Cleveland Electric Railway Company, on Monday, filed with the county recorder for record, through R. R. Rifenberick, 278 contracts with property owners on Central Avenue and Quincy Street, by which the company is given consent to build a street car line in front of the properties, with power of attorney for six years. These consents or contracts, it is said, represent a clear majority of the foot frontage on these streets and give the Cleveland Electric control. On account of the fact that Mayor Johnson has endeavored to impress upon the courts and others that these consents may be used for the new companies and that the law does not recognize specific grants in consents, the company has not yet filed them with the city clerk and may not do so until there is some show of securing grants on the streets through the council, which is impossible now. However, the consents are now public property and the city officials know just what the company has.

An old ordinance has been discovered which requires the Forest City Railway Company to sell nine tickets for a quarter. The company has heretofore been charging a straight three-cent fare on Denison Avenue and Fulton Road, to which these ordinances applies. Its attorneys have advised the sale of the tickets according to the ordinance, but they will be accepted only on these lines. The ordinance does not apply to Detroit Street and Superior Avenue, over which the Low Fare Railway Company is also operating cars now and the tickets will not be accepted for rides along these streets. This is another way of getting around the ordinance that was intended to apply to the entire distance the cars run.

Mayor Johnson and President DuPont of the Low Fare Railway Company have been spending some time on Central Avenue in an endeavor to secure some kind of consents from the property owners. It is said that the endeavor is to induce some of the property owners to invite in their neighbors that the Mayor might address them on the question. Some of the property owners reported that they were offered a dollar a front foot just for the statement that they had signed consents in favor of the Cleveland Electric Railway. It is supposed that the Mayor wanted to use these statements as consents.

H. J. Davies, secretary of the Cleveland Electric Railway Company, and A. B. DuPont, of the new companies, as arbitors, reported to the City Council Monday evening that the lines on which the franchises had expired, earned a surplus of $84,488.37 up to the time that they were operated at a three-cent fare at the suggestion of the city. All expenses, taxes, depreciation charges and 6 per cent interest on the physical value of the property was deducted. This is the amount due the city for the use of the streets. The grants on Central Avenue and portions of Quincy Street and Erie Street expired, according to the United States Supreme Court decision, on March 22, 1905, and the lines were put into operation on a three-cent basis on Jan 12, 1907.

President Horace E. Andrews sent a communication to the Council, stating that there had been no earnings above operating expenses and depreciation charges on these lines operated on the three-cent fare basis. He did not go into details or give any figures. The matter was referred to the street railway committee and the company will probably be asked for figures.

PLANS OF THE CLEVELAND, ALLIANCE & MAHONING VALLEY RAILWAY

J. W. Holcomb of Cleveland has stated that the bonds of the Cleveland, Alliance & Mahoning Valley Railway have been sold and that the contract with the Baltimore & Ohio Railway Company for its track between Ravenna and Newton Falls will be closed up at once, the final signatures having been delayed pending the financing of the proposition. Immediately after these details have been completed, contracts will be made for electrifying this portion of the road, and the construction of the nine miles of line between Newton Falls and Warren. This means the beginning of a system that will operate in connection with a number of other roads and they will act as feeders to each other from all that section of the state, noted for its great manufacturing industries and fertile farms. The road will be 80 miles long and, with the exception of a mile and a half, will be on private right of way, varying from 50 to 100 feet in width and owned in fee simple by the company. Furthermore the company has a private right of way in the city of Cleveland to what is popularly known as the cross-town line, which is intersected by twelve other lines radiating from the Public Square. The terminal of the road will be at the corner of Ninety-third Street and Prince Avenue and the cars will go to the center of the city from that point over the city lines. This right of way becomes more valuable, as the company will have authority to charge a five-cent fare in the city and, in addition to paying the local company mileage over its tracks, may pay something additional and then have a nice sum left.

From its terminal in the city, the line will run upon a tangent east for 4 miles and, after a curve of one degree south, passes within 200 feet of the race track at Randall, where the grand circuit races will be held after this year. From this place the line will run in almost a straight line to Hudson, 14 miles distant, after which it strikes what until a year ago was the main line of the Pennsylvania Company. For 8 miles the road will follow this line which is graded, ballasted and has all the abutments in. Little work will be required to put it into condition for laying track. Brady Lake is at the southern end of the strip of roadbed and from this point the road will go into Ravenna where a franchise through the business section of the city has been secured.

At Ravenna the road will divide, one branch going to Alliance and the other to Warren. The Alliance branch extends almost directly south through the villages of Rootstown and Randolph to New Baltimore, after which it curves to the east, passes through Marlboro and has its terminal in the business center of Alliance.

The other branch, as already stated, will consist of the road purchased from the Baltimore & Ohio from Ravenna to Newton Falls, a distance of 15 miles. The roadbed is thoroughly ballasted and equipped with heavy iron bridges. The track consists of 70-lb. and 85-lb. rails, laid on good ties and is in good shape throughout. All the depots are practically new and there is a telegraph line in operation. The remaining 9 miles to Warren will be constructed on private right of way and will be laid with 70-lb T-rails.

The projectors of this road believe so thoroughly in it that they have planned it for high-speed and all the construction work will be done to that end. It will connect Cleveland, Canton, Akron and all that section of the state with the Mahoning & Shenango Valley line which extends into Pennsylvania, reaching Sharon, New Castle and through them many other points, with the prospect of connection with Pittsburg at no distant date.

Constructed as planned, the road will really occupy a strategic position in the eastern part of the State. In the first place the company was formed by uniting the interests of the Northern Ohio Traction & Light Company, with roads connecting, Cleveland and Akron, Akron and Canton and Akron and Ravenna and further south the Stark Electric, connecting Canton and Alliance. The new company will always be assured of the co-operation of these lines in whatever it undertakes and it will form a link uniting them into a much larger system. At Ravenna the Northern Ohio Traction & Light line from Akron will meet it. This company is building west to Seville, and already has the road in operation to Wadsworth. From Seville the Cleveland, Southwestern & Columbus is building to Mansfield and this line will be connected up with Bucyrus, whence a line will reach Columbus. The Stark Electric line extends from Canton through Alliance to Salem, where the combined interests of the Youngstown & Southern and the Youngstown & Ohio River roads, connecting Youngstown, Salem, Columbiana, Leetonia and Lisbon with East Liverpool on the Ohio River will touch. The United Traction and the Steubenville Traction & Light lines will eventually connect this line with Pittsburg and a line from Beaver to New Castle has been planned, so that the connection will be complete from both directions into Pittsburg when all the gaps are filled. This gives a large territory to draw from.

The Ravenna-Warren division will be completed first and then the Ravenna-Alliance division will be taken up, with the Cleveland-Ravenna division last.

CHANGES IN THE STANDARDIZATION COMMITTEE OF THE ENGINEERING ASSOCIATION

Owing to the press of business engagements which will oblige him to spend a considerable part of the next three months in the Southwest, H. Wallerstedt, of New York, has resigned his position as chairman of the standardization committee of the American Street and Interurban Railway Engineering Association, but remains a member of the committee. His resignation as chairman has been accepted by President Adams of the association, who has appointed W. H. Evans, master mechanic of the International Railway Company, of Buffalo, as chairman of the committee. Mr. Evans has recently resigned as chairman of a similar committee of the Central Electric Railway Association, and his experience on this subject will be of the greatest value. President Adams has added another member to the standardization committee by the appointment of R. C. Taylor, superintendent of motive power of the Indiana Union Traction Company, of Anderson, Ind., and chairman of the standardization committee of the Central Electric Railway Association.

As already announced in these columns, the standardization committee has held several informal conferences and one regular meeting, and it is expected will hold another meeting toward the latter part of this month, probably in Cleveland. Since the meeting in New York on May 20-21, P. H. Griffin, of Buffalo, chairman of the American Wheel Makers Committee, which co-operated with the standing committee on cast-iron wheels of the Master Car Builders' Association, has promised in behalf of that committee any assistance required in connection with wheels. The co-operation of experts in other branches of the work has also been secured.

ST. LOUIS FINANCING

To fund maturing obligations, consisting of $1,500,000 Citizens' Railway 6s, falling due on July 1, 1907, the United Railways Company of St. Louis has arranged to issue $1,200,000 two-year notes, bearing 5½ per cent interest. These notes will be secured, first by the deposit of $1,500,000 United Railways general mortgage 4s of 1934, worth at the present time 81¼ in the market, also $500,000 of the 5 per cent cumulative preferred stock of the United Railways Company, worth about 68½. Of the $1,500,000 maturing Citizens' Railway first mortgage 6s, $300,000 will be paid out of the treasury funds of the United Railways Company. The balance will be cared for through the issuance of the notes. The notes will be dated July 1, 1907, will mature, July 1, 1909, and will appear in coupon form of $1,000 denomination each. The Mississippi Valley Trust Company and Francis Brothers & Company are offering them to yield 5¾ per cent. It is likely that the $1,500,000 United Railways general mortgage 4s underlying this short term issue will be sold at a later date, when conditions in the money market are more prosperous. The United Railways Company is the second of the North American utilities to borrow on short time paper, the Union Electric Light and Power Company having gone into the market two years ago. The North American Company, itself recently made a $3,500,000 issue of notes, which were sold to yield over 6 per cent.

NEW PUBLICATION

American Electric Railway Practice by Albert B. Herrick and Edward C. Boynton. New York: McGraw Publishing Company. 403 pages; illustrated. Price, $3.00.

The scope of this book is somewhat different from either Gotshall's "Electric Railway Economics" or Ashe & Keiley's "Electric Railways." It is designed more for the operator than for the investor or engineer, and while the principles of electric railway construction are treated, this side of the subject is subordinated to that of the daily work. The experience of both authors eminently qualifies them for this task, as one is a well known consulting engineer, the other a railway manager. The first five chapters deal respectively with preliminary estimates, field engineering for interurban roads, track construction, location of power station and overhead construction. That the book is up to date in this portion is shown by the discussion of thermit joints, and catenary construction both bracket and bridge as worked out on the New Haven road. The remainder of the book, consisting of ten chapters, is devoted to operation, and the subjects treated are time tables and schedules, train despatching and signals, rolling stock, car house design, repair shop design, overhead line maintenance, repair shop operation and maintenance of equipment. An excellent index is included.

RECENT STRIKE ON THE BIRMIMGHAM, ALA., RAILWAY, LIGHT & POWER COMPANY'S LINES

The recent strike in Birmingham, Ala., is an interesting illustration or how labor troubles develop and how quickly they may be broken up if properly handled. In the early part of May about 160 men employed on the street railway system of the Birmingham Railway, Light & Power Company organized and formed a union. The rest of the men refused to join the union and remained loyal to the company. At a number of meetings of the union a strike was discussed but no definite action was taken. An eager member of the union decided to take matters into his own hands. Without any authority from the union he stationed himself at a street corner on the morning of May 19 and ordered the crews of each car as they went by to take the cars into the barns and quit work. Each crew obeyed instructions and by the middle of the afternoon all traffic ceased. The non-union men proclaimed their loyalty to the company, but refused to operate the cars, being more or less afraid of riot and disturbance.

On the morning of May 20, the company through its engineers, Ford, Bacon & Davis, of New York, engaged Waddell & Mahon, of New York, to handle the strike. By the evening of the 21st, this latter firm through its various offices, had recruited 250 skilled motormen and conductors and a picked corps of guards and were on their way to Birmingham. The men arrived in Birmingham on the 23d, at 11 o'clock in the morning. By 1 o'clock, two hours after their arrival and after a 36-hour ride, they were fed and seventy cars had been sent out under the guidance of experienced train crews and under the protection of men who were empowered by the City of Birmingham to preserve order. The following day every car in the city was running on schedule time, and notwithstanding the unions of Birmingham has issued an order of boycott against patronizing the cars, such was the feeling of security felt by the public in the ability of the company to handle the situation that they disregarded the boycott after the second day, after which traffic became gradually normal.

Within two weeks after the time Waddell & Mahon took hold of the strike it had been completely broken, the union has been routed and disorganized and the railway company was enabled to man its cars with a force of non-union men as a permanent organization. When it is considered that the company not only operates the street railways in the City of Birmingham but also furnishes light and power, that attempt after attempt was made to cut off light and power without success in a single instance, and that no union men were taken back by the company, although they had the sympathy and financial assistance of all the other labor organizations in the city, the efficiency and dispatch with which this strike was handled and broken up are noteworthy.

STREET RAILWAY PATENTS

857,021. Signaling System for Railroads; Francis M. Black, Kincaid, Kan. App. filed Dec. 15, 1902. Details of construction of a signaling system by which a station operator or dispatcher may be kept advised of the position, direction and speed of the trains of his division.

857,040. Trolley Retriever; Charles I. Earll, New York, N. Y. App. filed Oct. 24, 1904. Details of a spring drum and ratchet device for controlling the trolley cord.

857,058. Automatic Interlocking Contact Mechanism for Electric Railway Systems; Frank Hedley, James S. Doyle and Hjalmar Wallerstedt, New York, N. Y. App. filed Sept. 11, 1905. Provides a plurality of contacts each adapted for use in connection with a particular arrangement and location of the current-carrying conductor, and respectively adapted to be brought automatically into proper position for use.

857,059. Automatic Contact Mechanism for Electric Railway Systems; Frank Hedley, James S. Doyle and Hjalmar Wallerstedt, New York, N. Y. App. filed Oct. 7, 1905. Relates to modifications of the above.

857,112. Trolley Catcher; William S. Roath, Canton, Ohio. App. filed April 26, 1905. Details of a spring drum and ratchet for controlling the trolley cord.

857,201. Switch Operating Device; Leonard S. Preston, Scottsville, Kan. App, filed April 12, 1907. A pair of pointed oppositely beveled shoes adapted to travel in the groove of the rail and engage the switch point.

857,291. Switch Stand; Malcolm W. Long, Harrisburg, Pa. App. filed Oct. 12, 1906. The operating lever is parallel with the track-way and the switch is operated through the medium of a helical gear on the shaft of the operating lever which engages the corresponding teeth of a rack-bar parallel with the shaft and connected to the switch-point rails.

857,362. Automatic Air Signal, Air Brake and Steam Coupling; Herman C. Priebe, Blue Island, Ill. App. filed March 20, 1907. A combined air signal, air brake and steam coupler for railway cars, one of which is carried by and operated automatically and simultaneously with the car coupler in the coupling and uncoupling of trains.

857,437. Car Replacer; James M. Bowman, Denison, Tex. App. filed Feb. 1, 1907. Details.

857,446. Block Signal System for Railways; Homer G. Comstock, San Francisco, Cal. App. filed Nov. 24, 1903. Provides electrically actuated signals combined with mechanism located in the path of travel of the trains, and means acting on said mechanism to close circuits for controlling distant signals.

857,534. Means or Device for Operating Tramway and Other Points and the Like; John R. Peacock, Nottingham, England. App. filed Dec. 18, 1906. A lever on the train travels in a grooved guide in the roadbed and throws the switch against the action of a spring.

12,661. Means for Operating Pneumatic Valves; William Lintern, West Park, Ohio. App. filed May 1, 1905. The air-brake lever and a lever controlling the sand are so arranged that they may be operated simultaneously by one hand.

PERSONAL MENTION

MR. G. W. BRINE, vice-president of the Georgia Railway and Electric Company, has been elected president of the Atlanta Gas Light Company, as successor to W. L. Cosgrove.

MR. GILBERT ROSENBUSCH, of the Underground Electric Railways Company of London, Ltd., sailed from Liverpool for New York on the "Adriatic," July 3, to study the latest developments in electric traction work.

MR. F. W. BROWN, who has been joint ticket agent for the Pere Marquette and the Michigan Central Railroads in Lansing, has been made general passenger agent of the Michigan United Railways, with headquarters at Battle Creek.

MR. L. E. HOLDERMAN, formerly superintendent of the East Wisconsin Railway & Light Company, at Fond du Lac, has succeeded S. P. Fuell in the same capacity with the Terre Haute, Indianapolis & Eastern Traction Company and local light company.

MR. W. S. MENDEN, chief engineer of the Brooklyn Rapid Transit Company, has been appointed general superintendent of the company in place of Mr. D. S. Smith, whose resignation

is mentioned below. For the present Mr. Menden will also perform the duties of chief engineer of the company.

MR. CHARLES S. POWELL has resigned as general agent of the Westinghouse Electric & Manufacturing Company. With his resignation the position of general agent is abolished. Mr. Powell has made no definite plans for the future but expects to remain in New York for the next two or three months.

MR. E. M. RYDER, engineer of maintenance of way of the Consolidated Railway Company of New Haven, Conn., was married on June 20, at Wilton, Conn., to Miss White, daughter of Mrs. Charles B. White, of that place. Mr. Ryder and his bride are on an extended wedding trip to the City of Mexico. After their return they will reside at New Haven, Conn.

MR. WILLIAM O. WOOD, assistant to the superintendent of the Brooklyn Rapid Transit Company, has resigned from that position and has become connected with the Inerborough-Metropolitan Company, of New York. Mr. Wood will be located at the executive offices of the company at 115 Broadway as operating statistician and such other special work as may be assigned to him by the president of the company.

MR. HENRY C. HIGGINS, manager of the Sterling, Dixon & Eastern Electric Railway (Ill.) and also manager of the Lee County Lighting Company, has resigned both positions. Mr. Higgins has been part owner and manager of both companies since their organization, and built the Interurban Railroad. His place will be filled by Mr. Edward B. Kirk, vice-president and general manager of the Winnebago Traction Company, of Oshkosh, Wis.

MR. J. E. LYONS, chief engineer of the Cleveland, Painesville & Eastern power plant at Willoughby, Ohio, has been promoted to the position of superintendent of power and cars, to take effect July 1. Mr. Lyons was master mechanic of the East Cleveland Railway Company for five years and was with the Cleveland City Railway Company for one year in same capacity. He has been with the Cleveland, Painesville & Eastern Railroad Company for eleven years.

MR. IRA A. McCORMACK has resigned as assistant to the general manager of the New York Central lines, to become president and general manager of the Randolph and Cumberland Railroad, and of an extensive development company, planned to exploit the road's resources. The resignation takes effect at once. Mr. McCormack has had charge of the New York city terminal operation of the Central and was previously connected as general superintendent with the Brooklyn Rapid Transit Company and the Cleveland Electric Railway Company. The road which he is to head extends from Cameron to Hillsons, in North Carolina, and is to be extended to a total length of 216 miles.

MR. R. P. STEVENS has been elected president of the Lehigh Valley Transit Company. He is at present general superintendent of the Auburn & Syracuse Railroad, having direction of a 78-mile system. As president of the Lehigh Valley Transit Company he will control a system of 142 miles in extent. This company operates an electric railway from Chestnut Hill to Allentown and Lehigh Valley points. Mr. Stevens is a graduate of the University of Maine and a post-graduate of the Massachusetts Institute of Technology. He has been in the employ of the Bell Telephone Company and the General Electric Company. Mr. Stevens is expected to assume the duties of the new office early in August.

THOMAS FITZGERALD, JR., has been promoted from assistant to the vice-president to assistant general manager of the Ohio Traction Company and Cincinnati Traction Company, Cincinnati. Mr. Fitzgerald is 29 years old. He is a son of Mr. Thomas Fitzgerald, general manager of the Baltimore and Ohio Railroad. Mr. Fitzgerald, Jr., was graduated from the Johns Hopkins University in the class of 1898 and started on his railroad career as an apprentice in the Baltimore and Ohio shops at Mount Clare. Then he became an inspector on the Third Avenue Railway, New York. In 1900 he was appointed superintendent of the Fairmount and Clarksburg (W. Va.) electric railroad, and was made general superintendent of the Norfolk, Portsmouth and Newport News Railway Company in 1902. In 1903 Mr. Fitzgerald was made general manager of the Lexington (Ky.) Street Railway Company, which position he filled until 1905, when he resigned to go with the Cincinnati Traction Company as assistant to the vice-president. The capable manner in which he discharged the duties of this position was noticed by Mr. S. K. Schauff, president of the company, who promoted him to the present position.

MR. LOUIS J. MAGEE, of New York, one of the directors of the Allgemeine Electricitäts Gesellschaft of Berlin and one of the pioneers in electric railway development in Germany, died in New York, July 3, of apoplexy. Mr. Magee was born in Malden, Mass., in 1862 and was graduated from Wesleyan University in 1885, in which year he entered the works of the Thomson Houston Electric Company at Lynn. After making a trip to Peru in the interests of this company he went to Germany in 1889 and organized the Union Electricitäts Gesellschaft to operate under the Thomson-Houston patents in Germany. The company did a large business especially in railway work until 1903, when it was merged with the Allgemeine Electricitäts Gesellschaft, of which Mr. Magee was elected a director. Since 1904 Mr. Magee has represented the latter company in this country and has lived in New York. He has had much to do with the arrangements between the General Electric Company and the German company in exchanging men from time to time for the widening of technical experience. Mr. Magee was a frequent contributor on German subjects to the Street Railway Journal and other technical magazines. He was a member of various scientific socities here and abroad, and of the Lawyers' and Engineers' clubs of New York.

MR. DOW S. SMITH, general superintendent of the Brooklyn Rapid Transit Company, resigned from that company last week. Mr. Smith has had a long experience in electric railway work in Minneapolis and Brooklyn. After his graduation from the University of Wisconsin in 1888, he entered the employ of the West Superior Iron & Steel Company, at West Superior, Wis., as superintendent of construction. After remaining with this company for five years he went with the Twin Cities Rapid Transit Company as general superintendent. He left that company in 1902 to occupy the same position with the Brooklyn Rapid Transit Company. Mr. Smith has not announced his plans for the future.



MR. RAYMOND D. SMITH, superintendent of the Bridgeport division of the Connecticut Company, embracing all trolley lines operating through and from Bridgeport, has resigned to accept the more important position as general manager of the Albany & Hudson Railroad Company, with offices at Albany, N. Y. Mr. Smith goes to succeed William Darbee, formerly general superintendent of the Connecticut Railroad & Lighting Company, with offices in this city. Mr. Darbee will leave Albany to become assistant general manager of the Consolidated Gas & Electric Lighting & Power Company of Baltimore. Mr. Smith, although he has been a railroad man for nine years will undoubtedly be one of the youngest general managers of a railroad in the country. He is 27 years of age and a native of Waterbury. He started in the business as an office boy in the employ of the Waterbury Traction Company at the age of eighteen. After two years of service there he came to Bridgeport where he has been located for seven years. He came to this city as private secretary to J. E. Sewell, who became general manager of the Connecticut Lighting & Power Company when that corporation took over the Waterbury Traction Company and later the Bridgeport Traction Company. Mr. Smith next became purchasing agent of the company and was next promoted to the position of transportation manager in this city. When the Consolidated Railroad Company became the lessees of the lines of the Connecticut Railroad & Lighting Company (which absorbed the Connecticut Lighting & Power Company). Mr. Smith was again promoted, becoming superintendent in charge of the entire Bridgeport division, operating all lines in this city, those as far north as Shelton, and those as far west as Norwarlk, and as far east as Woodmont.

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Of this issue of the Street Railway Journal 8000 copies are printed. Total circulation for 1907, to date, 238,350 copies, an average of 8219 copies per week.

Instructing Employees in a New Generating Station

It not infrequently happens that the carefully planned arrangements of the designing engineer of a modern generating station are rendered useless for a longer or shorter period after the plant has been put in operation because the men in charge of the station are not given sufficient instruction regarding how it should be operated. We refer particularly to provisions made by the designing engineer for caring for emergencies; for instance, at the switchboard by shunting through other circuits, circuit breakers or any apparatus out of order. In the modern power station there are also usually several methods of feeding the boilers, any one of which may be employed in case of a break-down of the pumps, or the failure of the piping ordinarily used. Employees of the less intelligent class, and we must admit that labor conditions compel the employment of these in many sections of the country, are likely to do just what they are told to do and nothing more. The boilers may have ample auxiliary feed lines and connections and emergency pumps, but on the failure of the main feed line to any boiler the employees in a new station, unless otherwise instructed and drilled, are likely to cut the boiler out instead of using some of the other possible methods of feeding it.

The designer of a plant usually makes provision for caring for emergencies on many points other than those cited. It certainly should be the duty of the operating engineer to become informed from the designer regarding them and then to pass what information he may obtain on to the men in immediate charge of the different portions of the station. It might also be well to issue blue printed or written instructions to the men regarding caring for emergencies. Without such instructions the men will, of course, finally get familiar with these emergency features, but in the meantime operating costs may be increased or reliability of service may be lessened.

The One-Room Shop

In one respect the designs of new shops for small systems differ radically. In some one large room serves for all the departments except the paint department, while in others the blacksmith shop, winding room, carpenter shop and machine shops are in separate rooms. There is, we believe, a tendency towards the single-room idea, and this plan has much to recommend it. In the first place, it entails less expense, as the cost of the partitions are avoided. Another point in its favor is that it avoids a tendency towards killing time. When two or three men, armature winders, for instance, are located in a small room where they cannot be seen and where they will have warning of the foreman's coming by the opening of the door, there is a tendency towards horse-play and loafing. When the whole shop is open the men are never certain that they are unobserved, and they are, therefore, more likely to keep at work. Moreover, the less the number of separate rooms, the greater the ease with which material can be handled. So far as this feature alone is concerned, the ideal condition occurs where the winding room, machine shop and blacksmith shop are all in one room and are spanned by an

overhead crane. Another advantage of the one-room idea is the better lighting of the whole shop. The partitions, even those at right angles to the side walls in which the windows are located, cut off considerable light.

There is one objection to the one-room idea. With it in winter the whole shop must be kept comparatively warm and at the temperature required by those doing the lighter work. But in summer the one-room shop will be cooler, as the partitions cut off the breeze. Moreover, the partitions limit the size of materials to be handled and with them for the same convenience in handling materials the whole shop building must be considerably larger. At first thought, it might be urged that the blacksmith shop should be in a separate room to prevent the smoke, which we usually associate with a blacksmith shop, from interfering with the other work. But there is with modern equipment not much occasion for smoke. Forges provided with hoods and suction drafts obviate smoke.

Electric Shop Equipment

Very many railway construction and repair shops of recent construction have adopted electrically driven tools upon a rather large scale. Singularly enough the steam roads have often gone even further in this matter than the electric roads themselves, possibly because the latter have had shops that have just grown instead of being deliberately planned on a large scale. The equipment of railway construction and repair shops with electrical drive is, upon the whole, rather more of a task than in the case of ordinary shops and factories. This is mainly because of the very wide range of work that has to be done involving the use of many tools of various sizes and functions. The easiest kind of shop to equip is one for uniform output, since the character of the machines in such case determines the nature of the equipment at the very start and the rest of the work becomes mere reduplication. The railway shop may have everything between a 90-in. or 100-in. lathe or boring mill and a 6-in. buffing wheel with a wonderfully miscellaneous collection of machines for woodworking, a boiler shop and a foundry. The shops of an electric railway are usually somewhat less diversified, but are still in a class far removed from simple machine shops. They are exceptional, too, in the large amount of night work that may have to be done and in its diversity.

Such shops are, as a rule, especially the gainers by the introduction of electric drive. For, unlike ordinary works, they have no fixed hours of operation and no two parts of the shop are certain to be running at the same time. Power is needed now here, now there, and whenever special necessity arises. Broadly, the great gain in the electric drive is the abolition of the general transmission losses in the distribution of power to irregularly and insufficiently loaded machines. There may, of course, be gains in the absolute cost of power per unit, but these are small compared with those that come from the saving of power which would otherwise be spent in increasing the depreciation of the running parts. This saving is especially great in case of shops which must often run only in part and somewhat irregularly. The fundamental gain is the ability to confine the losses to the individual machines in operation. In a measure, even the general losses due to light load upon these are kept down, for both generators and motors can be run underloaded with less loss of efficiency than in the case of almost any other machines.

In deciding upon the initial plans of an electric drive for a railway or other miscellaneous shop, two main questions have to be settled, the general system to be employed and the degree to which the subdivision of power units shall be carried. As to the first matter the natural tendency now is to use induction motors, on account of their extreme simplicity and reliability, and also by reason of the general availability of alternating current and its advantages in case of distribution to a scattered group of shops. Unquestionably the induction motor is extraordinarily convenient and dependable, but it has disadvantages in certain classes of work that prevent its complete victory over its older competitor; chief among these is the difficulty of exact and efficient speed regulation.

An induction motor can be regulated in speed upon exactly the same terms as a single street car motor, i. e., it is entirely amenable to rheostatic control with all thereby implied. In a shop where there is a large preponderance of variable-speed work, one finds an induction motor-drive rather burdensome. In such cases direct-current motors have a material advantage at the cost of a certain amount of cost and complication. In fact the cost and complication are pretty nearly proportional to the perfection of the control. The Ward-Leonard system, for instance, with its duplication of machines stands quite in a class by itself in respect to the delicacy of speed control under all sorts of load conditions. More economical under ordinary shop conditions are the several multi-voltage schemes, with or without the use of interpole motors. Still simpler is the ordinary motor. A railway shop seldom has to go into the refinement of speed control, its work being too various to permit the fine training of specialists on single machines that is needed to give variable speed devices their greatest value. In fact, in most instances the ordinary mechanical speed changing methods with induction motors should generally give sufficient range. Usually the source of power tends to simplify the choice of motors. If it is derived from a large central station or a transmission plant the chances are more than even that induction motors will best serve the purpose. If an electric railway plant is operating its own shops, either a. c. or d. c. may be available, as is also the case where special generators are installed. Generally speaking, the conditions in railway shops do not demand a sufficient amount of variable-speed work to make d. c. distribution desirable, unless d. c. happens to be the more readily available.

As to extent of subdivision the tendency is more and more towards the individual driving of large machines, coupled with group drive on small machines. Machines frequently used by themselves and requiring 5 hp to 10 hp or more quite generally justify the use of individual drive. In the portions of a shop doing pretty steady work upon all the machines, group driving is ordinarily the more economical. In repair shops in which work may have to be done at all hours in scattering corners, individual driving can economically be pushed rather further than elsewhere.

The economies of group driving come mainly from saving in first cost, resulting from the use of one large motor and its shafting instead of numerous small motors. A few years ago this gain was much larger than it now is. At present the cost of motors per horse-power does not decrease rapidly in the sizes from 10 hp up, and it is very easy to eat up the saving in fixed charges by running unutilized shafting. Now and then one can find a corner of a shop where a number of small machines are in pretty regular use and then a group drive can be used to some advantage. Large machines, especially for variable-speed work, certainly deserve individual motors. More especially is this so in railway shops since one is very likely to have to do night work at a few points of a big shop and group driving would compel the operation of a large amount of shafting merely to get power to these few machines. To obtain an installation of minimum cost and maximum efficiency, means extreme care in arranging the details of the drives so that the minimum amount of useless work may have to be done. It would pay, frequently, we think, to take up the drive, not after the shop is planned and partly built, but before the departments and machines are definitely located, so as to eliminate awkward situations.

Electric Lighting Accounting and the Street Railway Companies

A circular letter issued a month ago by the American Street and Interurban Railway Accountants' Association to the members of that body is of much more than passing importance, not only to the street railways of the country, but to the electric lighting companies as well. It seems to mark a second radical step in the movement which started when electric railway and electric light companies discovered they could economically merge their interests and their plants and bring these two classes of business under one management. This plan has been followed in so many instances that questions of management, accounting and many other matters connected with electric lighting are of almost as much interest to a large number of street railway officials as are the same subjects when pertaining directly to their own field of work.

For several years the National Electric Light Association has made spasmodic efforts to formulate and adopt a standard classification of construction and operating accounts, but owing to various reasons no final action has resulted. A committee has been at work on the subject recently, however, and submitted at the annual convention lately held in Washington a proposed classification. Owing to the press of other business this report, after about two hours' discussion, was referred back to the committee for further consideration, so that the matter will be delayed for one year more at least.

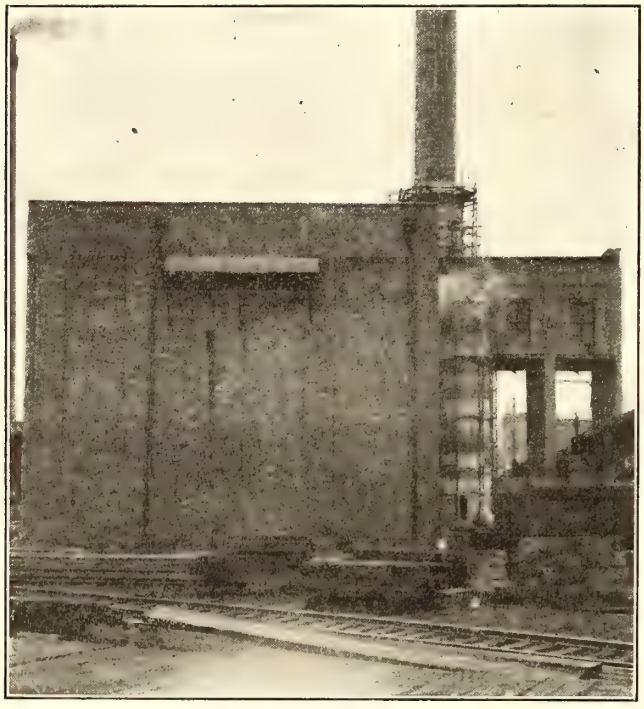
Heretofore the street railway accountants, who also have charge of lighting properties, have been willing to let the Electric Light Association lead in the preparation of a classification of lighting accounts because the work seemed particularly in their line. But as the number of cities in which lighting plants and street railways are owned by the same interests is increasing and is now very large, the subject is assuming a different aspect. Many street railway accountants are now very greatly interested in the subject, not only because they require such a standard classification for their lighting accounts, but it is obviously very important that the form adopted should be practically workable with their own standard classification, which has had ten years of service and has proved itself satisfactory by its general adoption.

The consolidation of railway and lighting companies has resulted in certain physical merging of power plants, shops, store rooms, etc., and it is evident that where this has occurred the two systems of accounts, in order to be useful, should be exactly alike in title and definition. This is particularly true in the case of general and power-house accounts. Up to this time the classifications proposed by the Electric Light Association have quite ignored this fact. The names, explanations and the arrangement of these accounts have been drawn apparently without reference to the needs of anyone else in the matter, so that had the classification proposed at Washington been approved by the Electric Light Association confusion would immediately have resulted in those companies that operate lighting and street railways jointly. The street railway departments would have to be guided by the street railway classification, and the electric light departments by a different classification, or else some companies would adopt the electric lighting accounts for the railway service or vice versa. The general effect would be an uncertainty almost as complete as if no classification at all were followed. In other words, street railway accountants who are interested in the joint service now find themselves face to face with the possibility of the formal adoption of a classification of electric lighting accounts which has so little in common with the street railway standard that it seems impossible for them to adopt it for their own companies without, in a serious way, destroying comparisons for their own use, not to mention comparisons with other companies. How very real the interests of the street railway accountants are in this subject is shown by the fact that about 21 per cent of the street railway companies reported in the 1902 United States Census were interested in commercial lighting. The percentage now is probably greater.

The effort of President Tingley, of the Street Railway Accountants' Association, to obtain information of the number of street railway companies interested in the electric lighting business, together with his letter regarding the classification proposed, may therefore be taken as a preliminary to a better understanding between the street railway accountants and the National Electric Light Association, which should be of benefit to both interests. We believe that Mr. Tingley's collection of data will show that so many companies are in the railway and the lighting business that their interests will be cared for. If the National Electric Light Association, after deliberation, decides not to follow the firmly established and satisfactory street railway classification at points where the two should harmonize, it will be exceedingly difficult to establish a real standard classification for electric lighting companies. This will be especially true if the street railway accountants eventually adopt a standard for their own lighting companies in as successful a manner as they have with their railway interests.

NEW TURBINE GENERATING STATION OF THE ILLINOIS TRACTION SYSTEM AT PEORIA, ILL.

In an article by John R. Hewitt on "A. C. Electrification" on the Illinois Traction system, published in the Street Railway Journal, July 6, 1907, reference was made of the new turbine generating station at Peoria. This station, which is now completed, is unique in several respects. The method of handling the coal and ashes is quite out of the ordinary, but the use of vertical machinery in the turbine room is probably a more distinctive feature of the station. The boiler feed-pumps, house pumps, circulating water pumps and hot-well pumps are all of the vertical type.



EXTERIOR VIEW OF PEORIA STATION, TAKEN DURING THE ERECTION OF THE STACK

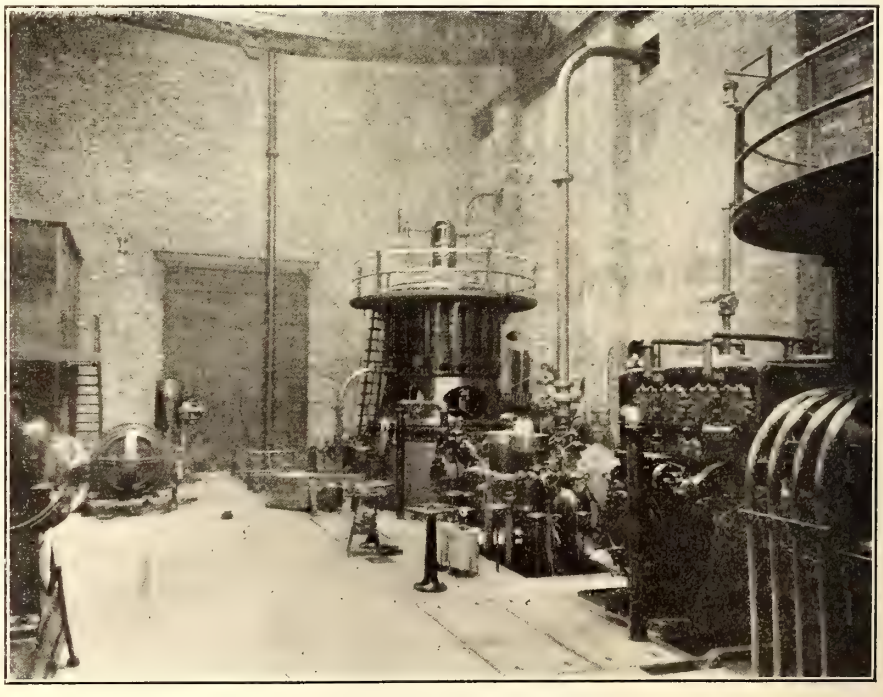
The new station is located adjacent to the old direct-current station for the Peoria city lines and is a few hundred feet from the Illinois River. In addition to supplanting the old station, which contains an 800-kw G. E. generator, driven by an Allis-Chalmers simple non-condensing engine and several belted units, the new station will feed into the high-tension system supplying current to the network of interurban lines of the McKinley syndicate throughout Central Illinois. At present it contains two 2000-kw G. E. turbo-generators, but provision has been made for extending the building and doubling the capacity whenever conditions necessitate.

The main portion of the building is of rectangular section. An extension on the north contains coal and ash pits, and the tracks of the Peoria-Bloomington interurban line of the Illinois Traction System pass through the extension over the coal pits. The building itself is of steel, brick and concrete construction. With the exception of a temporary south wall, which is of ordinary building brick, all of the walls are of paving block laid in red cement mortar. The floors are of concrete steel construction, and the roofs are of cinder concrete covered with tar paper and gravel. The ventilation of the building is well provided for by monitors over the boilers and over the center of the turbine room. The roofs, as well as the sides of these monitors, are provided with glass.

Two division walls separate the enclosed portion of the building into a boiler room, turbine room and a three-story compartment for the high-tension apparatus.

BOILERS

The boiler room contains eight 400-hp Sterling boilers, four of which are provided with Foster superheaters. They are arranged four on each side of a central firing alley running parallel to the division wall between the boiler and turbine room. A transverse passageway between the centrally located boilers divides the entire installation into two sets. The unit system of steam piping employed provides for the feeding of each turbine by the set of four boilers nearest to it. However, a transfer header along the rear wall of the building connects the headers of the two sets so that either turbine may be supplied with steam from any or all of the boilers. All of the main headers and the connecting header are of 8-in. pipe and are carried over the boilers at an equal height above the floor. This arrangement minimized the number of bends required. After each header passes through the division wall a single right angle bend brings it to the vertical leading to the turbine. No pockets are formed in the header system, and consequently no drip mains and connections are provided except at the turbine connections. The flue connections of the boilers are entirely free from bends. Uptakes about 3 ft. long make connections with steel breechings, one over the rear of each row of boilers. The breechings are suspended from the roof girders and each runs straight through the north wall of the boiler room into a reinforced concrete stack 11 ft. in diameter and 200 ft. high. The breech-



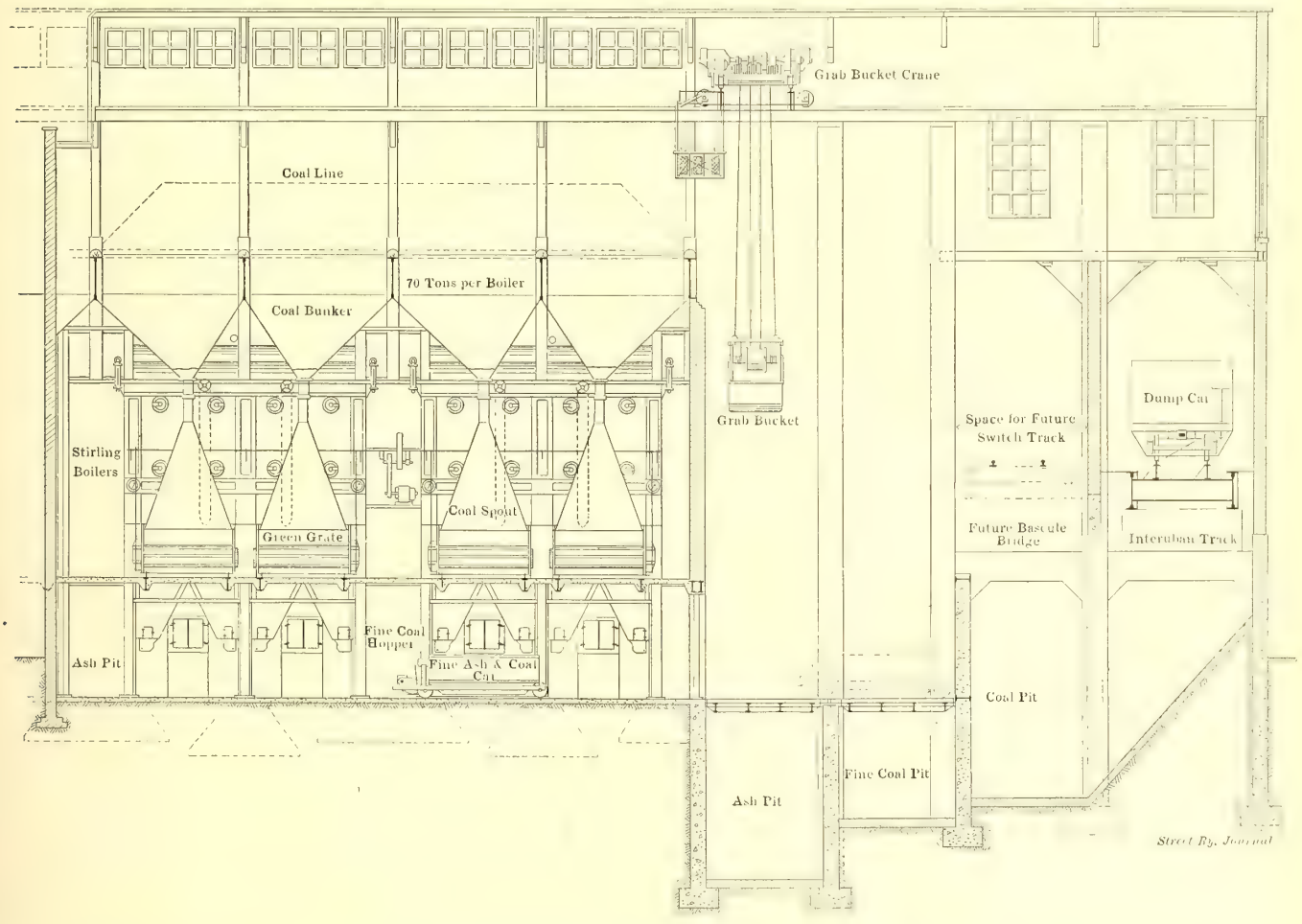
VIEW IN THE OPERATING ROOM, SHOWING ELEVATED OFFICE AT THE LEFT

ings are of ample size to serve the contemplated additional boiler installation, and measure 14 ft. 6 ins. by 9 ft. where they pass through the boiler room wall.

All of the boilers are equipped with automatic stokers of the Green chain grate type, supplied with coal from overhead steel bunkers. Each row of stokers is belt-driven from a motor located overhead in the transverse passageway between the centrally located boilers. Each motor is of sufficient size to operate all of the stokers in the event of the failure of one. A concrete hopper under the front of each boiler catches the fine coal sifting through the grates, and these hoppers, as well as the ash hoppers under the boilers, have outlets in the basement. The provisions for emptying the fine coal hoppers and the ash hoppers is rather unique. In the basement underneath the front of the company in East Peoria. The cars are dumped into the coal pit previously referred to as being under the tracks. A second opening similar to that through which the track now runs is provided for the future installation of a switch track. Coal is carried from the coal pits by means of an overhead motor-operated crane provided with a clam shell bucket of 108 cu. ft. capacity. The crane runway extends the full length of the boiler room over the bunkers and also through the north addition containing the several pits. In addition to conveying coal the crane is employed to carry the ashes from the ash pit to cars placed over the coal pit.

BOILER FEED

Two vertical simple Dean house pumps, with cylinders measuring 10 ins. x 10 ins. x 24 ins., located in the south-



FRONT ELEVATION OF BOILERS IN THE PEORIA STATION, SHOWING ALSO THE FUEL-HANDLING FACILITIES

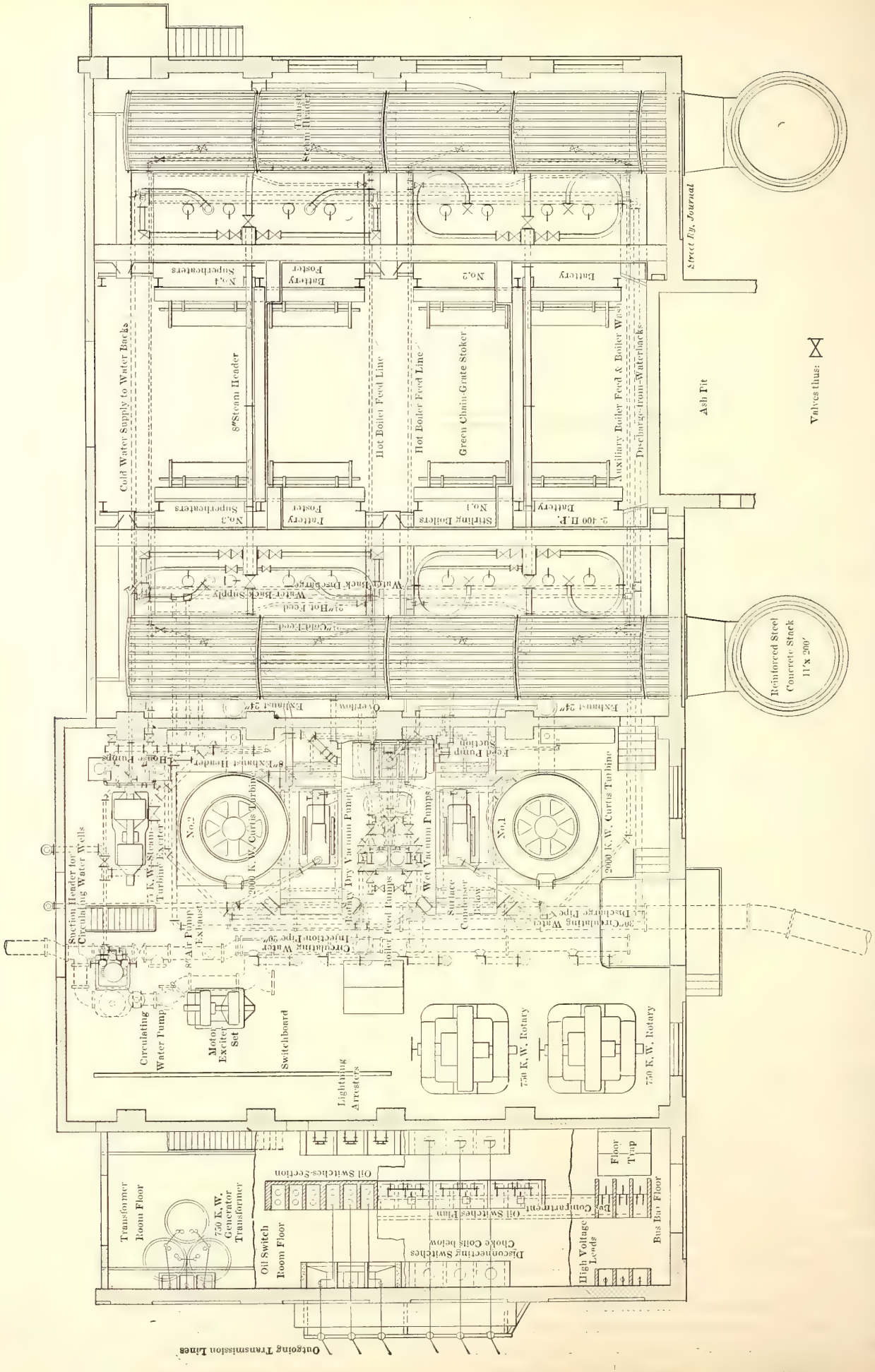
each row of boilers is a track of 60-lb. T-rails laid to a gage of 2 ft. 6¾ ins. These tracks extend under the north wall of the boiler room and over an ash pit and a fine coal pit in the extension previously referred to. Each is provided with a motor-driven hopper bottom car of steel construction, which, after being placed under the hopper discharge doors and filled, is run over one of the pits in the extension and emptied. The car is driven by a 5-hp, 125-volt motor geared to one of the axles. Current is supplied from protected trolleys supported on the hopper walls near the floor.

COAL-HANDLING APPARATUS

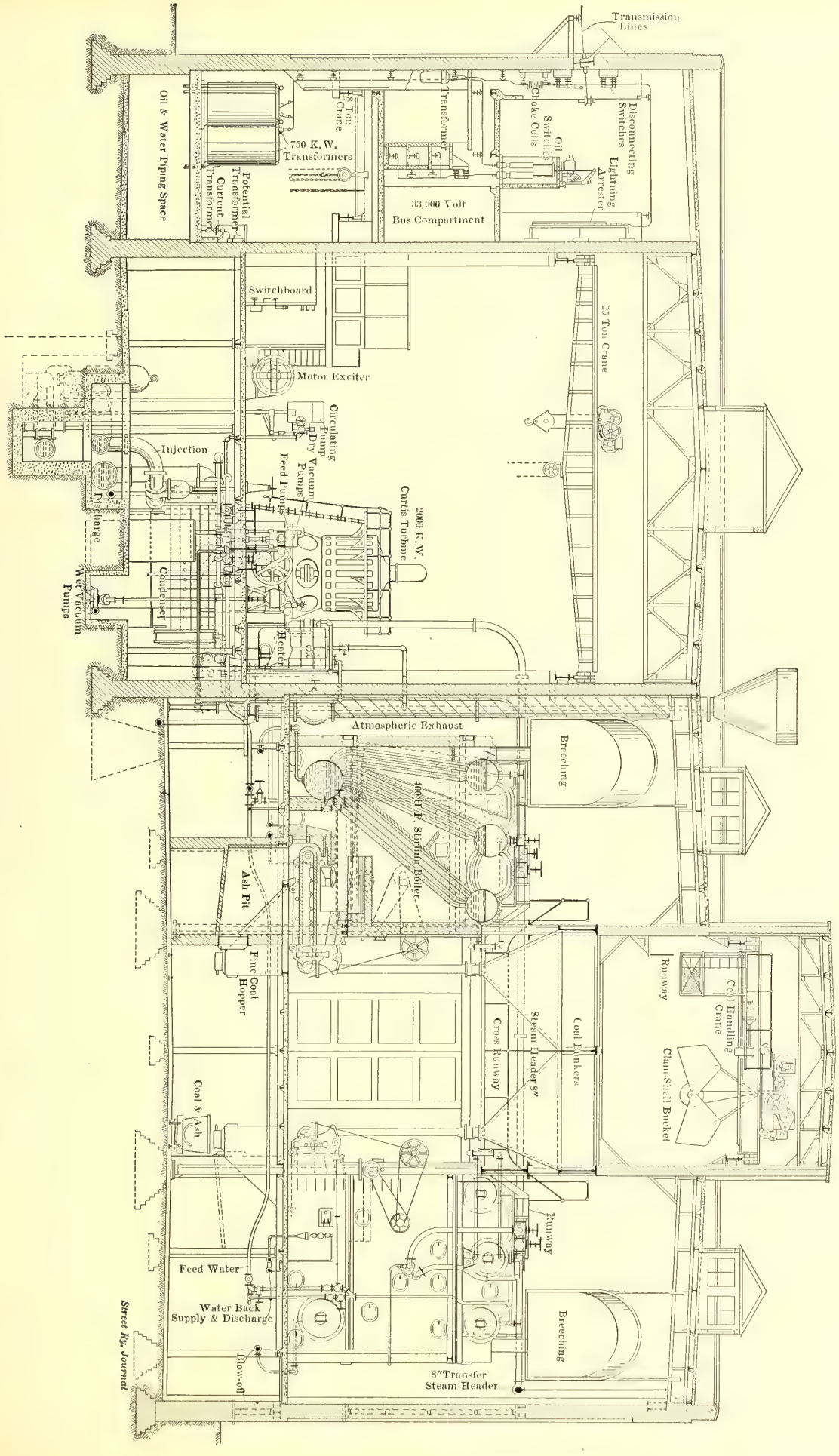
Coal is hauled to the station over the lines of the Illinois Traction System in hopper-bottom cars. The coal will probably be obtained from mines now being developed by

west corner of the turbine room, are piped to a Cochrane open feed-water heater of 4000 hp capacity, located on the turbine room floor near the boiler room division wall and midway between the two turbines. A line is also carried from the house pumps direct to two vertical Dean boiler feed-pumps, with cylinders 14 ins. x 10 ins. x 24 ins. The pumps are of the vertical type and are installed midway between the turbines with their water cylinders below the turbine room floor. All of the piping of these pumps is cross-connected so that either or both may be used to supply any of the boilers.

From the feed-pumps two independent sets of feed lines are carried to the boilers. One is regularly used to supply hot water to the boilers, while the other serves both as an auxiliary feed line and a boiler wash line. The two



GENERAL PLAN OF PEORIA POWER STATION

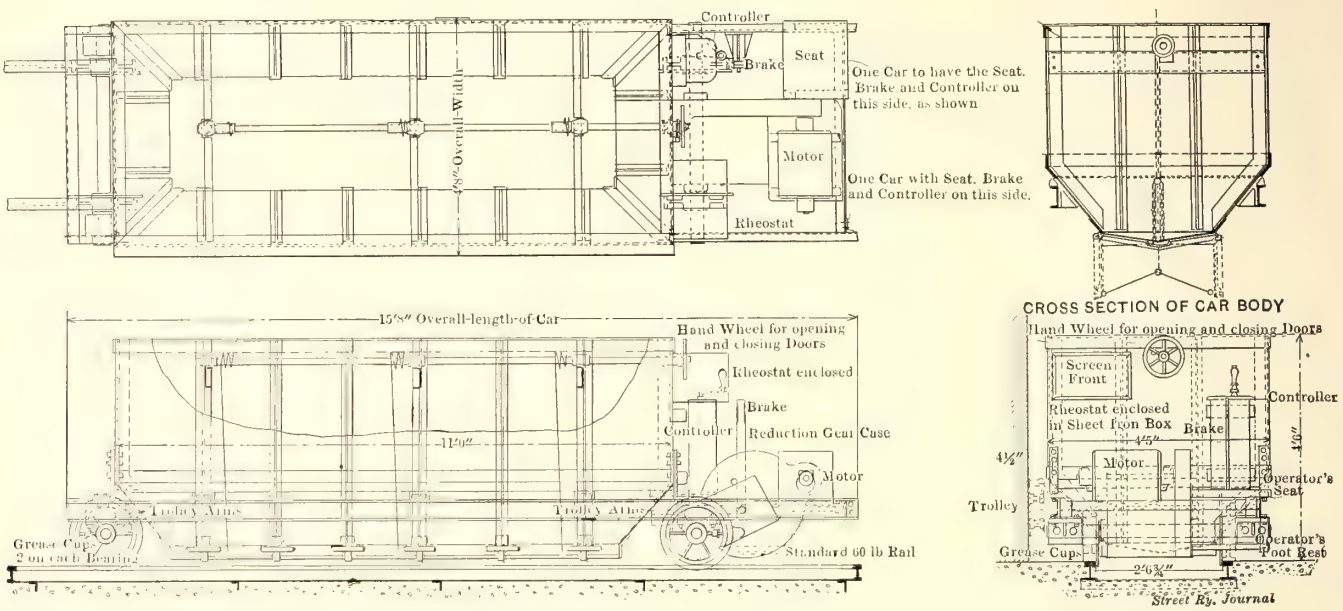


CROSS SECTION OF PEORIA POWER STATION

sets of feed lines run independently to the sides of the boilers, where they are brought together by valve connections and a single line enters the rear drum of each boiler.

THE TURBINES

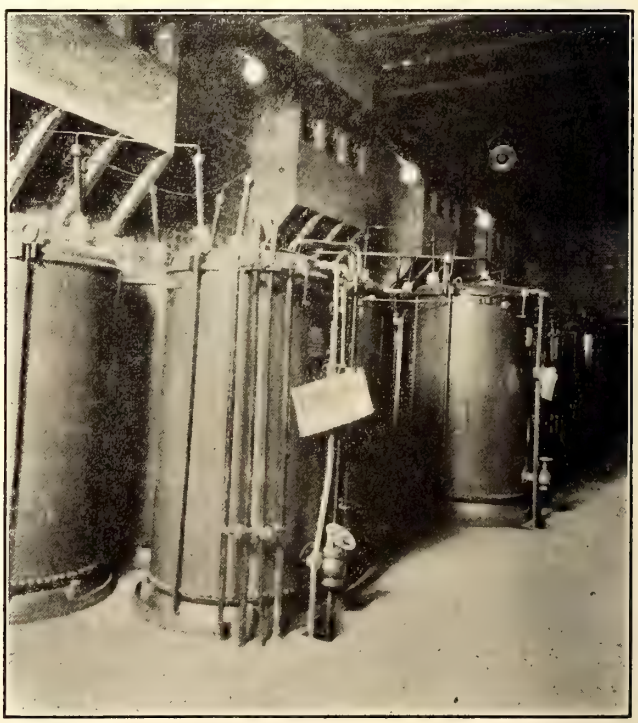
The two 2000-kw, three-phase, 25-cycle Curtis steam turbines are installed at such a distance apart as to permit the condensers and auxiliary apparatus to be located between them, and are placed on brick foundations built up from the basement floor to such a height as to bring the exhaust openings below the turbine room floor. Each turbine is provided with independent auxiliary apparatus, with the one exception that one accumulator will be installed in connection with the oil piping for the step bearings and the oil-operated governors. Wheeler condensers having 8000 sq. ft. of cooling surface are installed in the basement at the bases of the machines and in close proximity to the condenser water supply and discharge pipes. Circulating water is obtained from thirteen 8-in. tubular wells 35 ft. deep. These wells are drilled about 10 ft. apart directly under the turbine room in such a position that short pipes connect them to the suction of the circulating water pump. The wells are drilled in free water bearing gravel, and, although they are located only a few hundred yards distant from the Illinois River, tests have shown that the water drawn out of them comes from the land side rather than from the river. The wells have a continuous capacity of about 650,000 gals. per hour. The 20-inch circulating pump suction header is installed in a concrete pit about 9 ft. below the basement floor. It runs



DETAILS OF COAL AND ASH CAR



MECHANICAL STOKERS IN THE BOILER ROOM



TRANSFORMER ROOM, SHOWING THE CHUTES THROUGH WHICH HIGH-TENSION LINES ARE CARRIED TO THE FLOOR ABOVE

across the building parallel to the line of wells to the water cylinder of a Dean vertical direct-acting steam pump having a capacity of 4300 gals. per minute. While the water cylinder of this pump is installed at the level of the suction header, the steam cylinder is above the turbine room floor. The pump discharge is carried parallel to and directly over the suction and short laterals connect it to the condensers. The discharge of the two condensers is piped into a 30-in. main emptying into an adjacent sewer. Horizontal steam-driven dry vacuum pumps are located immediately over the condensers on the boiler room floor. The hot-well pumps, which are of the centrifugal type, are motor-driven from vertical motors placed above the turbine room floor. The pumps themselves are located in a pit in the basement.

EXCITERS

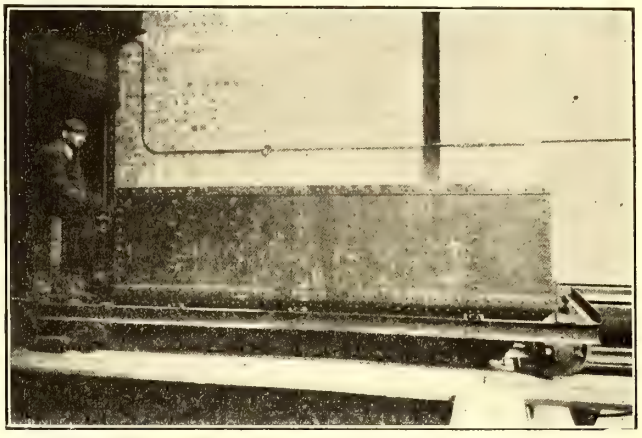
Both steam-driven and motor-driven exciter sets are installed. The steam-driven set is located near the house pumps and consists of a horizontal Curtis steam turbine with a speed of 2400 r. p. m. and a G. E. 125-volt, 75-kw generator. The motor-driven exciter set consists of a similar generator driven by a three-phase, 2080-volt induction motor.

AUXILIARY STEAM PIPING

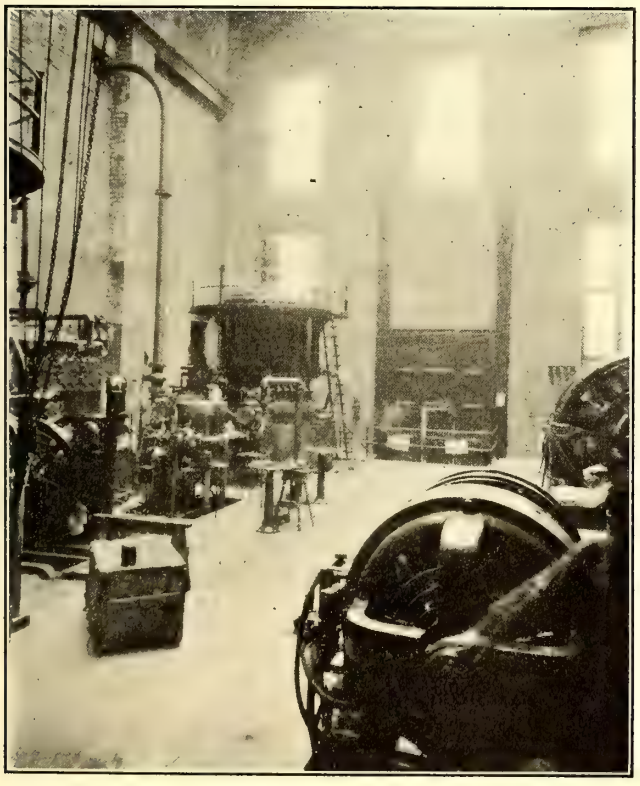
Steam for the wet and dry vacuum pumps and the oil pumps of each turbine is supplied from the main header supplying the turbine. The two house pumps and circulating water pumps get their steam from the header of No. 2 turbine.

SWITCHBOARD AND ELECTRICAL APPARATUS

The switchboard is installed on the turbine room floor in the southeast portion of the building in such a position that the operator has a plain view of the machines being controlled. All of the high-tension apparatus is located in the three-story portion of the building connected to the operating room by one small door. The generator leads, consisting of 700,000-circ.-mil. paper-insulated, lead-covered cable, pass directly to banks of 750-kw oil-insulated and water-cooled single-phase transformers on the first floor of the high-tension structure. These transformers, which have delta connections, raise the pressure from 2300 volts to 33,000 volts. The high-tension leads from the transformers, which are No. 4 solid bare wire, are carried up through concrete chutes to the motor-operated oil switches installed on the top floor of the high-tension structure. Immediately under these switches are the high-tension buses, which are carried in a brick bus structure having concrete barriers. Two three-phase, high-tension lines of No. 4 copper wire leave the station. The lightning arresters for these are placed on the walls of the switch chamber. Current for each of the two six-phase, 750-kw rotary converters is supplied from the high-tension bus-bars through motor-operated switches above the buses and



MOTOR-OPERATED ASH CAR



VIEW IN OPERATING ROOM FROM THE SOUTH



THE MOTOR-OPERATED SWITCHES AND THE BARRIERS FOR THE OUTGOING HIGH-TENSION LINES IN THE THIRD FLOOR OF THE HIGH-TENSION COMPARTMENT

through three 250-kw, 33,000 to 400-volt, single-phase transformers located on the lower floor of the high-tension structure. These transformers have two intermediate taps for supplying low voltage for starting the converters. A single 75-kw, 33,000-volt to 2020-volt, three-phase transformer connected to the high-tension buses through an oil switch furnishes current to the motor-driven exciter set.

The engine room crane motor, stoker motors, wet vacuum pump motor, ash car motors and the station lights are supplied with direct current at 125 volts from the exciter bus-bars. A Tirrill regulator is employed in connection with the exciter circuits. The three motors of the boiler room crane are supplied with 325-volt direct current obtained by installing a set of balancing coils in connection with the rotary converter and taking the current from one side. Direct current from the railway feeder circuits was objectionable because of the variation in voltage.

CRANES

In addition to the crane for handling coal and ashes the turbine room is spanned by a 25-ton crane which, with the exception of the hoist, is hand-operated. An 8-ton hand-operated crane is placed over the transformers in the high-tension structure. The station was designed and erected by John A. Radford, engineer, Chicago.

FIFTEEN-CYCLE, SINGLE-PHASE, DEMONSTRATION LOCOMOTIVE FOR THE PENNSYLVANIA RAILROAD

On pages 1139 and 1140 of the Street Railway Journal for June 29, N. W. Storer gave a brief description of a 11,000-volt, 15-cycle single-phase locomotive built by the Westinghouse Electric & Manufacturing Company. It is now possible to report the results of tests of this locomotive and to explain more fully the service for which it was designed.

The locomotive has been developed by the Westinghouse interests in conjunction with the Pennsylvania Railroad, under George Gibbs, chief engineer of electric traction, according to the program laid out by the late President Cassatt; it is the third locomotive built under that program. The first locomotive, which was designed as No. 10,001, was of the geared direct-current type; the second, known as 10,002, was of the gearless, direct-current type. Both of these locomotives were placed in service on the Atlantic Avenue improvement of the Long Island Railroad; each is driven by four 350-hp motors and weighs about 100 tons. The mechanical parts of these two locomotives were constructed at the Altoona shops of the Pennsylvania Railroad, but the electrical equipment was supplied by the Westinghouse Company.

Locomotive No. 10,003, which is illustrated herewith, has been produced as a result of a systematic investigation involving elaborate and exhaustive tests that have been prosecuted for several years. On account of the limited time available, and the necessity for the elimination of all possible delays, both the mechanical and the electrical parts were supplied by the Westinghouse interests. It has been designed of sufficient capacity for the New York terminal operation of the Pennsylvania Railroad. The duty required will be appreciated when it is known that grades of 2 per cent are encountered, yet high speeds must be attained. On the test track at Pittsburg, which is about 5 miles long, and is in reality a succession of curves, locomotive No. 10,003 recently reached a speed of 73 m. p. h., and it is claimed that a speed of 90 m. p. h. can easily be reached on a straight track.

The complete locomotive is to consist of two separate halves, only one of which has yet been constructed; the half locomotive has been found to exert a maximum drawbar pull of 24,000 lbs., indicating a tractive effort for the whole locomotive of 48,000 lbs. The former locomotives were built for third-rail direct-current operation, while the latter locomotive will use single-phase current from an over-head trolley wire. Before the construction for the electrification of the Pennsylvania terminal in New York is undertaken, it is the purpose of the Pennsylvania Railroad thoroughly to test out the merits of these two systems. The decision as to which system will be used will probably not be reached before Jan. 1, 1908.



SINGLE-PHASE DEMONSTRATION LOCOMOTIVE FOR THE PENNSYLVANIA RAILROAD

The most striking features of locomotive No. 10,003 are its entire simplicity and the accessibility of the parts that may require attention. All of the main control equipment is placed on a raised platform in the middle of the cab, on each side of which there is a wide passage way. The voltage regulating switches are arranged immediately above the main 11,000-volt auto-transformer which is carried under the cab in front of the motor axles, while the blower equipment and reverse switches are placed immediately over the

propelling motors. Ample space is left on all sides of the main motors for inspection and repair.

Some of the main data of the complete locomotive are as follows:

Total weight, tons	145
Weight on each driver, pounds	50,000
Diameter of drivers, inches	72
Diameter of pilot wheels, inches	36
Rigid wheel base, inches	90
Swivel-truck wheel base, inches	74
Total wheel base (half locomotive), inches	247
Length over all (half locomotive), feet	31
Height of locomotive, inches	160
Width of locomotive, inches	120
Weight of each motor, pounds	20,000
Rating of each motor, horse-power	500
Permissible overload, per cent	100
Number of motors per locomotive	4
Maximum output of locomotive, horse-power	4,000
Normal voltage per commutator, approximate	300
Power factor at full load, per cent	93

The motors are of the gearless type, the method of mounting being identical with that used on the New Haven



EXPERIMENTAL LOCOMOTIVE DESIGNED FOR PENNSYLVANIA RAILROAD

locomotives, as described in the issue of April 14, 1906. Other particulars will be found in Mr. Storer's paper already referred to.

It is interesting in this connection to note that the Westinghouse Company has already built, or has under construction, sixty single-phase locomotives and more than 2000 single-phase compensated series railway motors, and that at the present time at least 1000 miles of track have been arranged for single-phase operation.

The limited service on the Ft. Wayne, Van Wert & Lima road has been changed, the bi-hourly trains having been taken off and four limiteds per day substituted. All other cars will be local. President Schoepf believes that the time has not yet come for such a service and that the traction companies must draw more directly from the local business. He has never been an advocate of limited service, but this road will run enough cars to take care of the through business that comes to it. The Dayton-Toledo route of the Western Ohio is reported to be paying well.

PAY-AS-YOU-ENTER CARS FOR MADISON AVENUE, NEW YORK

It has been announced that the Madison & Fourth Avenue line in New York has been selected by the management of the New York City Railway Company as the one on which to try the pay-as-you-enter cars now being built for the company. If found to be practicable they will be introduced on other lines.

The Fourth & Madison Avenue line has been chosen for this experimental purpose as it is as free from curves and intersecting points as any of the lines in New York. The question of curves has much to do with the installation of the cars. They necessarily have long, extending platforms, capable of accommodating thirty or more passengers, but it is thought that no difficulty will be experienced on the line selected.

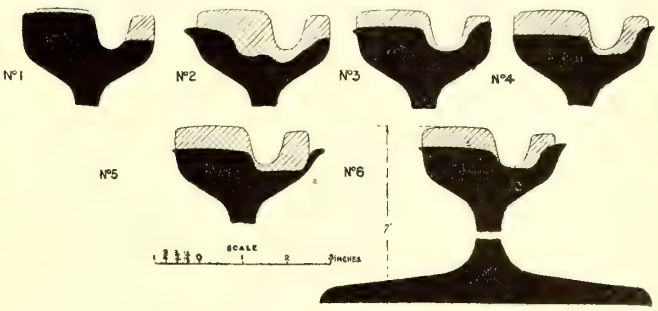
RAIL WEAR IN SHEFFIELD, ENGLAND

C. F. Wilke, city engineer of Sheffield, Eng., read a paper before the Incorporated Association of Municipal and County Engineers at Liverpool, June 20-22, on the wear of rails on the municipal road in Sheffield. The present standard rails are British standard section No. 5, 60 ft. in length, and weigh 110 lbs. per yard; the former rails were of the section shown below and weighed 108 lbs. per yard. The following table of costs of track renewals and repairs in Sheffield is given:

COST OF TRACK REPAIR AND RENEWALS IN SHEFFIELD.

Year Ending March 25.	Car miles in thousands.	Cost Per Mile of Single Track.		Cost Per Car Mile	
		Repairs.	Renewals.	Repairs.	Renewals.
1901	1,886	$136.36	$63 24	$ 00296	$ 00136
1902	3,525	291.02	188.62	.00414	.00268
1903	4,777	275.42		00344	
1904	5,768	619.54	227.18	00712	00262
1905	6,049	670.44	193.00	.00750	.00204
1906	6,236	529.48	472.90	.00598	.00526
1907	6,804	486.96	831.36	.00498	.00950

Mr. Wilke also presented the accompanying sections of worn rails taken from busy routes. He says: "The rails,



SECTIONS OF WORN RAILS FROM SHEFFIELD

of which these are fair specimens, were of low carbon, but they have worn very evenly and given good running till the last without showing signs of corrugation." The following particulars are given of each rail:

	Grade.	Radius of Curve.	Life of Rail.	Per Cent. Carbon.
Number 1*	Unused.	Track.	78 months.	0.35 to 0.45
Number 2	1:11	130 feet.	92 months.	0.35 to 0.45
Number 3	1:542	tangent.	93 months.	0.35 to 0.45
Number 4	1:15	150 feet.	84 months.	0.35 to 0.45
Number 5	1:25	230 feet.	84 months.	0.35 to 0.45
Number 6	1:23	tangent.	84 months.	0.35 to 0.45

* This rail was worn by vehicles.

SOME FEATURES OF THE ACCOUNTING SYSTEM AT LITTLE ROCK

The accounting system at Little Rock to a certain extent corresponds to that of all the roads of the Newman Syndicate, but there is in connection with it several features and original forms that have been gotten up by local men.

The data from the conductors' trip sheets and from the reports of the conductors, the starters and the inspectors is used in filling out two daily reports, that of the superintendent of transportation and that termed the "car service daily report." The superintendent's report is concerned only with the operation of the cars. It shows the number of cars in service on each line each hour of the day, and note is also made on it of chartered cars or cars in special service. The lines on which accidents take place and their nature are reported, and likewise any delays, together with their cause and duration.

The car service report is concerned only with the fares collected, transfers issued and the number of persons carried free. The totals for each run number are given, together with the names of the conductor and motorman, the number of the car and the number of trips it made. All this data is copied direct from a trip book, the pages of which have a heading similar to the car service daily report, but which, instead of giving figures for each run, show the fares collected, transfers issued and other data for each trip of a run. Most of the data of this trip book is taken directly from the trip sheets and conductor's daily report. The number of transfers, however, is taken from the closing number on

CONDUCTOR'S DAILY REPORT

Route ... Run No.
Conductor ... Badge No.
Motorman ... Badge No.
Date ... 190

Started From	Direction	Exact Time	A. M. or P. M.	Total No Pass.	5c Cash Fares	5 cent Tickets	Half fare Tickets	Comp. and Emp. Tickets	Transfers
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
TOTALS									

Car No.	Reg. No.	REG. READINGS	No Fares	Punch
		When left		
		When taken / When left		
		When taken / When left		
		When taken / When left		
		When taken / When left		
		When taken / When left		
		When taken / When left		
		When taken / When left		
		When taken		

TOTAL FARES

RECEIPTS

SUMMARY	No. PASSENGERS	AMT COLLECTED
5c Cash Fares		$
5c Tickets		
Half Fare Tickets		
Comp. & Empl. Tickets		
Transfers		
TOTAL PASSENGERS		

CAR PERFORMANCE

Car No.	Trips	Mileage
TOTAL		

This report must be carefully filled out at the close of each day's work. Conductors will fill out a separate report for each route on which they run during the day.

INSIDE PAGES OF CONDUCTOR'S DAILY REPORT

the pads turned in by the conductors each day. As transferred to the car service daily reports the totals of the footings on the trip book, of the transfers, dead-heads, half-fare tickets and cash fares must balance with the total number of passengers as indicated by the register readings, and the cash fares multiplied by 5 must of course equal the amount of money collected in cents.

The franchises of the company require that policemen, firemen and mail carriers be carried free and their passage, together with employees, is not registered, but account is kept of the number carried.

Little Rock Railway & Electric Company.—CONDUCTOR'S TRIP REPORT

Trips	Starting from	Starting to	Leaving Time at End	Register	Street Trans Rec.	O. R.	Tickets	Cash Fares	Total Fare Regist'd	Amount $	Amount Cts.	Ret Registered: Closing No. of Transfers Issued	Ret Registered: Police Firemen M. Car's	Ret Registered: Employees
½														
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
REGISTER AT START														
TOTAL FARES														

Conductors Must Not use these Spaces

ERRORS / OVER / SHORT
Transfers
Passes
Half Fares
Cash Fares
Register
Cash

TRANSFERS
Closing No.
Beginning No.
Closing No.
Beginning No.
Total Issued

RELIEFS
Register ... By Conductor
Badge ... Punch
Register ... By Conductor
Badge ... Punch
Motorman
Badge No.
Badge No.
Conductor
Badge ... Punch
Car ... Run
No. ... No.
Date
... 190...
Line

CONDUCTOR'S TRIP REPORT

CONDUCTOR'S DAILY REPORT CONTINUED.

ADDITIONAL TRIPS

Started From	Direction	Exact Time	A. M. or P. M.	Total No Pass	5 Cent Fares	5 Cent Tickets	Half-Fare Tickets	Comp. and Emp. Tickets	Transfers
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
TOTALS									

BADGES AND PASSES.

TRIP NO.	BADGE NUMBERS: Police	Firemen	Mail C.	Emp.	Card			

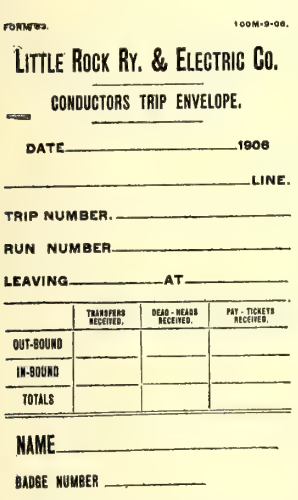
REMARKS.

OUTSIDE PAGES OF CONDUCTOR'S DAILY REPORT

Keeping a record of the totals of each trip might by some be considered to necessitate more work than is warranted by results. But such a record enables conductors to be checked by the method of averages. The receipts from trips at the same time of day for different days and for different months bear such a constant relation that if the receipts are tampered with a close comparison will usually

arouse suspicion, and the suspicion may then be verified by changing men on that particular route. The trip record also enables traffic curves to be made out which show whether larger cars should be used or the cars double-headed at certain portions of the day.

The trip sheet with which the conductor taking out the car in the morning is supplied is of course passed on from one conductor to another as reliefs are made, and it is finally turned in at night by the last conductor. Conductors are also required to keep records on daily report blanks. Each conductor is supplied with one of these and keeps it during the day. Upon this report blank is summarized by trips the fares collected by him during the day or during that portion of the day he ran on one line. Space is left on these reports for entering the badge and card numbers of those carried free.


FORM 93. 100M-9-06.

LITTLE ROCK RY. & ELECTRIC CO.

CONDUCTORS TRIP ENVELOPE.

DATE_____1906

_____LINE.

TRIP NUMBER._____

RUN NUMBER_____

LEAVING_____AT_____

	TRANSFERS RECEIVED.	DEAD - HEADS RECEIVED.	PAY - TICKETS RECEIVED.
OUT-BOUND			
IN-BOUND			
TOTALS			

NAME_____

BADGE NUMBER _____

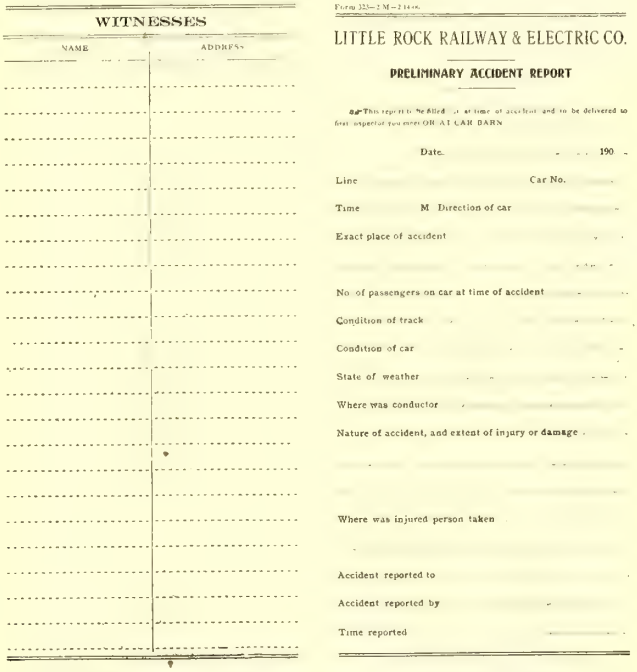
LITTLE ROCK RAILWAY & ELECTRIC COMPANY, FRONT OF CONDUCTOR'S TRIP ENVELOPE

The Steadman time limit transfer, which has printed upon it in heavy type the day of the month, is used, and while it has been found that this form entails a loss in transfers of about 15 per cent, the fraudulent use of transfers is checked to such an extent as to warrant its use. The month is punched in the office so that the conductor is required to make only two punches. Each of the seven lines has a different colored transfer. Transfer points are punched rather than lines. The time numbers are arranged vertically opposite the transfer points to facilitate reading when punching. Canceled transfers are placed in trip envelopes, together with tickets, and are deposited in boxes at the downtown end of every trip.

There are three uniformed inspectors in the employ of the company, and these make reports on special blanks of the time cars pass a certain point, of defective cars, line, or track, of violations of rules by employees, and of accidents.

ACCIDENTS

Conductors carry preliminary accident reports which are made out at the time the accident occurs and are delivered immediately to the inspectors or are taken to the office of the superintendent of transportation. In addition to blank


WITNESSES

NAME ADDRESS

LITTLE ROCK RAILWAY & ELECTRIC CO.

PRELIMINARY ACCIDENT REPORT

Date. . . 190 .

Line Car No.

Time M Direction of car

Exact place of accident

No. of passengers on car at time of accident

Condition of track

Condition of car

State of weather

Where was conductor

Nature of accident, and extent of injury or damage

Where was injured person taken

Accident reported to

Accident reported by

Time reported

OUTSIDE OF PRELIMINARY ACCIDENT REPORT

spaces for the names of witnesses other blanks are provided for noting the most important facts in connection with the accident.

Before leaving the car house for the day the trainman supplements the preliminary report with another, made in triplicate, in which all minor details of the accident are given. A diagram of a street crossing on the back side enables the trainman to indicate the relative point at which the accident occurred. The original of this supplementary report is sent to the general manager. One copy is sent to the claim department, another to the company's attorneys, and another is retained in the office of the superintendent of transportation.

The company employs a surgeon who is paid for attending

Form 321 500–9–06

LITTLE ROCK RAILWAY & ELECTRIC COMPANY

Daily Report of Superintendent of Transportation

Weather..... Date.....190....

NUMBER OF CARS IN SERVICE.

Each Trailer Counted as One Car.

LINE.	A. M.							P. M.											A. M.				
	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
Fifteenth Street																								
South Main																								
West Ninth Street																								
Highland Park																								
East Ninth Street																								
East Fourteenth																								
Pulaski Heights																								
Baseball Cars																								
Opera Cars																								
Owl Cars																								
Total cars operated																								

DAILY REPORT OF SUPERINTENDENT OF TRANSPORTATION

to its accident cases at a stipulated sum for each case according to the injury sustained. The surgeon is notified immediately when an injury is received by any one. If the injury is caused by cars or by employees of the company the surgeon visits the person injured and makes an examination of the injuries or alleged injuries. He reports on a surgeon's blank, and under "Remarks" reports anything he may have heard the injured person say regarding the acci-

Form 240—2m—9-06.

LITTLE ROCK RAILWAY AND ELECTRIC COMPANY

Accident Report

LITTLE ROCK, ARK....., 190....

Line..... Car No..... Run No..... Direction.....
Motorman..... Badge..... Conductor..... Badge.....
Exact time.....m. Exact place.....
Was car in motion..... What was speed of car.....
Was car starting up or slowing down.....
Number of passengers on car.....
Condition of car..... Where was Conductor.....
Condition of track..... State of weather.....
What was the accident or occurrence, and the cause of it.....
.....
Name and residence of person injured.....
.....
.....
What was the nature and extent of injury.....
.....
Was injured person male or female....White or colored....Age (about)...
Was any damage done by your car to any vehicle or other property, and what was the extent of it.....
.....
Description of vehicle.....
Owner's name and address.....
Driver's name and address.....
What part of wagon was struck, and by what part of car.....
Which direction was wagon going when first seen.....
Was car on time.....
How many feet ahead of car did wagon pull on track.....
Was gong being rung.....
Number of steps from front of car when stopped to place of accident .....
What was done for the injured person, and where taken.....
.....
What did driver or injured person say about the accident.....
.....
State here information not given above.

This report to be made out by employee before leaving the car house on the day of the accident.

Sign here .....

Occupation .....

INSTRUCTIONS REGARDING ACCIDENTS

In case of accident, however slight, in connection with, or near your car, to persons or property, you will render all necessary assistance, and at once obtain the names and residence of the persons injured, and of all witnesses on or near the car; then make a written report on this form answering all questions properly.

Give no account of an accident to any person other than an official of the company.

LITTLE ROCK RAILWAY AND ELECTRIC COMPANY

.....
Accident Report No.....
.....
.....
.....
At .....
Date ....., 190....

(DO NOT FILL OUT ABOVE)

WITNESSES

(White)

Name .....
Address .....
Name .....
Address .....
Name .....
Address .....

(Colored)

Name .....
Address .....
Name .....
Address .....

Form 323—2 M—2-14-06.

LITTLE ROCK RAILWAY & ELECTRIC CO.

PRELIMINARY ACCIDENT REPORT.

This report to be filled out at time of accident and to be delivered to first inspector you meet OR AT CAR BARN.

Date.....190....

Line..... Car No.....

Time.....M. Direction of car.....

Exact place of accident.....
.....

No. of passengers on car at time of accident.....

Condition of track.....

Condition of car.....

State of weather.....

Where was conductor.....

Nature of accident, and extent of injury or damage.....
.....
.....

Where was injured person taken.....
.....

Accident reported to.....

Accident reported by.....

Time reported.....

INJURY TO PERSONS.

NAME.	Address.	Color.

DAMAGE TO PROPERTY.

PROPERTY DAMAGED.	Name of Owner.	Address.	License No.

NAME OF DRIVER.	Address.	Color.

Remarks .....
.....
.....
.....
.....
.....

Motorman.....Badge No..... Conductor.....Badge No.....

WITNESSES.

NAME.	Address.

dent. This report is made in triplicate, one copy being furnished to the general manager, one to the attorney and one to the claim agent.

An examination is made of cars concerned in accidents as soon as possible after the accident is reported, and record

Form 211-12 Bks—2-05.

LITTLE ROCK RAILWAY & ELECTRIC COMPANY

Condition of Cars Report

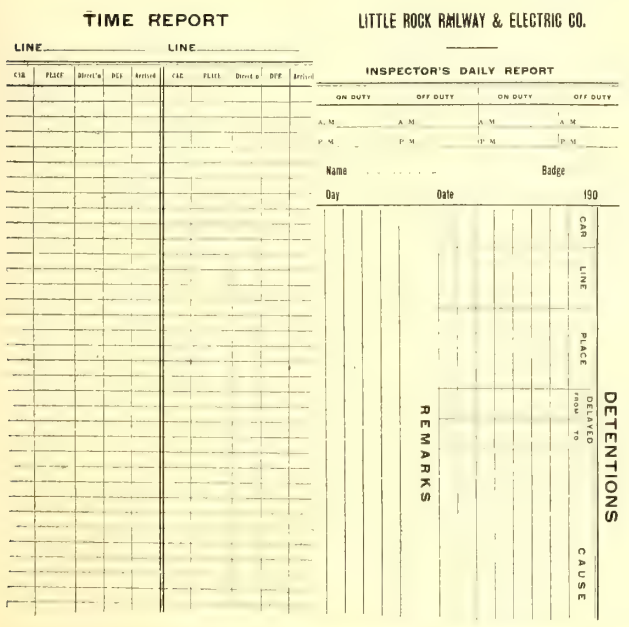
Day.....Date.....190....

CAR-BODY TROUBLE

	Car No.	Car No.	Car No.	Car No.	Car No.	Car No.	Car No.
Doors							
Window							
Ventilator							
Gate							
Seats							
Draw-bar							
Coupling pin							
Signal bell							
Bell cord							
Electric bell							
Register							
Register rod or handle							
Curtains							
Signs							
Grab-handle							
Dash or panel							
Step or runboard							
Brake staff or handle							
Gong							
Car dirty (leaving car house)							
Sand-box							

TRUCK TROUBLE

	Car No.	Car No.	Car No.	Car No.	Car No.	Car No.	Car No.
Hand brakes							
Hand brakes							
Air-brakes							
Brake-chain or rod							
Flat wheel							
Hot box							
Springs							
Motor supports							



BACK AND FRONT OF INSPECTOR'S DAILY REPORT

ELECTRIC EQUIPMENT TROUBLE

	Car No.	Car No.	Car No.	Car No.	Car No.	Car No.	Car No.
Motor pulls power							
Motor flashed							
Motor "bucked"							
Motor leads							
Controller							
Fuse-box							
Circuit breakers							
Hood switch							
Trolley comes off							
Trolley pole							
Trolley wheel							
Trolley rope							
Light circuit							
Head light							
Gear or case							
Resistance							

Time..... A. M. P. M. Sign .....

PART OF CONDITION OF CARS REPORT

of the car's condition is made in a book at the shops used for this purpose. A copy of this record is made and is attached to the accident report so as to meet the contentions generally made in accident suits as to the condition of the car at the time of the accident.

CONDITION OF CAR REPORTS

All motormen taking cars out in the morning are supplied with a car report, and are instructel to indicate by a cross any defect of the car. Even when there is no defect, they

FORM 317—10 M—3-06

Little Rock Railway and Electric Co.

CONDITION OF CAR REPORT

Car..... Line ..... Run .....

Day ..... Date..... 190.....

Make Mark thus . X, opposite defect to be reported. If the defect cannot be easily located give in additional particulars which will assist in locating the trouble. This report must be made at the completion of each day's work.

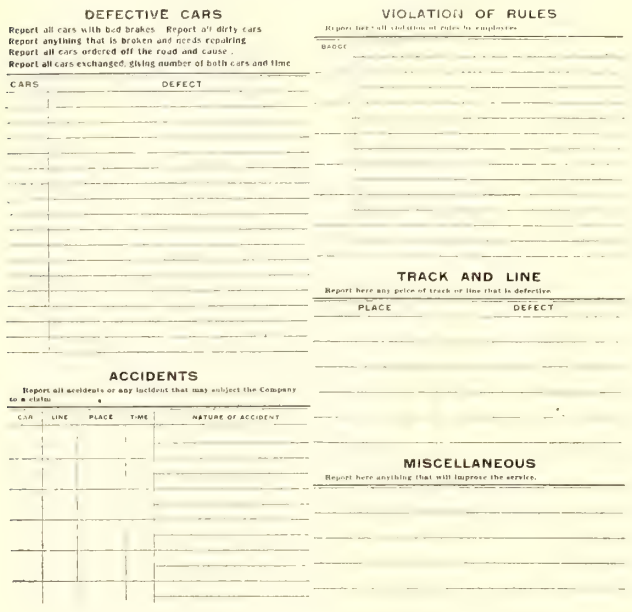
CAR BODY TROUBLE	TRUCK TROUBLE
Doors	Hand Brakes
Windows	Air Brakes
Ventilator	Brake Chain or Rod
Gate	Flat Wheel
Seats	Hot Box
Drawbar	Springs
Coupling Pin	Motor Support
Signal Bell	
Bell Cord	**ELECTRIC EQUIPMENT TROUBLE**
Electric Bell	Motor Pulls Power
Register	Motor Flashed
Register Rod or Handle	Motor "Bucked"
Curtains	Motor Leads
Signs	Controller
Grab Handles	Fuse Box
Dash or Panel	Circuit Breaker
Step or Runboard	Hood Switch
Brake Staff or Handle	Trolley Comes Off
Gong	Trolley Pole
Car Dirty (leaving barn)	Trolley Wheel
Sand Box	Trolley Rope
	Light Circuit
If car is in good condition make an "O. K." mark here.	Headlight
	Gear or Case
	Resistance

Signals out of order at .....
Track " " " " .....
Wires " " " " .....
Remarks .....

Time ..... A. M. P. M. Signed ..... Motorman

MOTORMAN'S REPORT ON THE CONDITION OF CARS

are required to sign the report and turn it in at night. From the separate reports a summary of all the defects is made on a separate sheet, and a duplicate of this sheet is sent to the night foreman, who puts his O. K. on all the repairs he makes and then leaves the sheet with the day foreman so that this foreman will know why each car is left



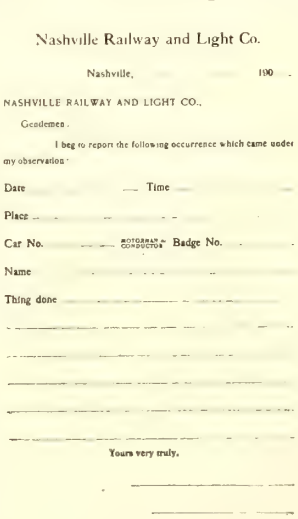
INSIDE PAGES OF INSPECTOR'S DAILY REPORT

in the shop. When all the repairs are made the sheet is O. K.'d and returned to the office. All the slips and reports are filed away to be used as reference in case of legal proceedings.

The details of the accounting system as outlined have been largely developed since the system was acquired by its present owners.

REPORTING OFFENSES AT NASHVILLE

At Nashville only the superintendent of transportation is allowed to criticise trainmen for shortcomings. Dispatchers, inspectors and all other officers noting violations of the rules make reports to the superintendent on special blanks. These give the time and place the offense was committed and describe briefly the nature of the offense. They are signed by the person making the report.


Nashville Railway and Light Co.

Nashville, 190

NASHVILLE RAILWAY AND LIGHT CO.,

Gentlemen:

I beg to report the following occurrence which came under my observation:

Date Time

Place

Car No. MOTORMAN or CONDUCTOR Badge No.

Name

Thing done

Yours very truly,

REPORTING OFFENSES AT NASHVILLE

The Easton Transit Company, of Easton, Pa., has adopted a rule requiring the conductors on open trail cars to work toward each other while collecting fares. That is, the conductor on the rear car starts at the back and works forward, while the one on the forward car starts at the front of the car and works toward the rear seats. This was done to prevent passengers from jumping from the front to the rear car to avoid the payment of fares.

THE LAWS OF MIXED VAPORS

BY W. H. BOOTH

In the modern search after good vacuums in steam engine condensers, especially with turbine engines, it is doubtful if many engineers give that full consideration to the law of mixed vapors to which it is entitled by virtue of its telling effect on steam condensation problems. Dalton it was who enunciated the law, and Rankine, in his classic work on the steam engine, gave more than ordinary attention to it, for he used language when dealing with this part of his subject that is more than ordinarily clear. Briefly, the law states that when two gases occupy the same space they will exert a pressure which is equal to the sum of the pressures each gas would have exerted had it been enclosed separately. If the law does not hold good then it is a proof of some combination between the gases.

Now we also know, or think we know, that the pressure of water vapor is a function of the temperature, and we are apt to think that if air is pumped into a vessel containing steam and hot water the steam must pass back into water so that the pressure may remain that proper to the water temperature. But such is not the case. It is one of the properties of water that the space above it must contain a definite mass of vapor proper to the temperature of the water, no matter what other gas may be present in that space. The water vapor, or presumably the vapor of any other liquid, will insist upon occupying that space to a definite fixed quantity. Pressure does not appear primarily to count, though necessarily it follows as a sequence of the temperature. In brief, if water at 0 deg. C. be enclosed in a vessel with a cubic foot of air and the whole be heated to 100 deg. C., the pressure will be something over two atmospheres; that is to say, one atmosphere for the water vapor and a full one atmosphere for the non-expanded air which started cold at one

Here the water vapor and the air follow the law of mixed vapors, but there is the unexpected phenomenon of water vapor at a pressure double that ordinarily looked on as proper to its temperature. It is simple enough when realized. The pressure will quickly fall to one atmosphere if the air be allowed to escape. A recognition of these facts makes it clear why a freshly started boiler often loses many pounds of its pressure when the engine starts, the fact being that the gage pressure shown was fictitious and caused by air imprisoned in the boiler when started up.

If the temperature in a condenser is known, the vacuum should be known. If the vacuum is not so good as the temperature would indicate, the reason must be sought entirely in air, for the vacuum pressure is the sum of the vapor pressure proper to the temperature and of the pressure the air would show on the gage if present dry and alone. Thus, if a condenser has a temperatuure of 126.1 degs. F. and a vacuum of only 11.7 lbs., there must be as much air present as would fill the dry, empty condenser to a pressure of 1 lb., for $14.7 - 11.7 = 3.0$, and the absolute pressure corresponding to a temperature of 126.1 is 2 lbs. Whence $3 - 2 = 1$ lb., and this 1 lb. is due to air, and where there is a wide difference between temperature and the vacuum obtained air leakage must be sought for. It is useless and wasteful to run an air pump quickly to remove air in large volumes. Air should be excluded so perfectly that the vacuum will not deteriorate 10 per cent in an hour after the plant is stopped.

THE PRINTING DEPARTMENT OF THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY

The printing department of the Milwaukee Electric Railway & Light Company was organized about one year ago primarily to print tickets and transfers, but the scope of its work has gradually broadened until practically all of the printing required by the company is done by it. From two employees, a man and a boy, the number has increased to approximately fifteen. The department's first quarters were in a small room on the fourth floor of the new Public Service Building, but it has outgrown them and is now located across the hall in two rooms—one 27 ft. x 125 ft. and the other 27 ft. x 30 ft. The large room, which contains the machinery, is provided with an overhead traveler for conveying stock paper from one portion of the room to the other and is lighted by Cooper-Hewitt and 64-cp incandescent lamps. The machinery is so located that in going through the several processes of trimming, printing, perforating and stitching the paper is carried continuously from one end of the room to the other. In accordance with the policy of John I. Beggs, president and general manager of the system, all of the machinery is the best obtainable. Transfers and tickets are printed on a specially designed press made by the Harris Automatic Press Company. It runs two colors, numbers and perforates 600,000 tickets per hour and prints, numbers, dates and perforates automatically 125,000 transfers per hour.

Ordinary press work is done on a Miehle press. In addition, there is a Colts Armory press for embossed covers and other heavy work and a Chandler & Price press for getting out small forms, such as tags and business cards. Ruling for ledgers and blank books is done on a Hitchcock ruling machine. Other apparatus consists of a Seybold cutter, a Latham numbering machine, a Latham stitcher, a perforating machine and a press for bailing canceled tickets and transfers. All of the machinery has individual motor drive.

The composing room equipment is very compactly designed. All the woodwork in the room is of the same finish as that of the interior of the building. The only things not printed by the company are the large posters or dash signs for the cars. The work of the department includes the printing and ruling of ledger, pay-roll and other large sheets, the printing of checks, personal cards, typewriter letters, load records, contracts and advertising matter.

Job No. 970

The Milwaukee Electric Railway & Light Co.

PRINTING BUREAU

This Job Ordered by .....

Authority .....

Date Received .....

To Be Delivered to .....

Not Later Than .....

If, for any reason this work was not delivered on or before date specifed, state why

.....

.....

Quantity and Description .....

.....

Stock Required .....

.....

.....

.....

.....

Color of Ink .....

BINDING

Ruling	*Check Binding* .....
Stitching	*Cloth* .....
Numbering	*Half Leather* .....
Blocking	*Pamphlet* .....
Perforating	.....

STANDARD RECORD OF JOB ORDER

Report of PRINTERY for the Month of 190

JOB NO.	FORM NO.	DESCRIPTION.	ORDERED BY	Date Received	Date Finished	Delivered to	COST OF PRODUCTION				VALUE	REMARKS
							LABOR Acct 110 116	MATERIAL Acct 113 119	MISCELLANEOUS Acct 111 112 114	Total Cost		

AMOUNT OF PRODUCTION. Based on price paid for each piece of work to concern doing same last previous to establishment of Printery or in case of new or special work what would be considered Plant charge by outside concern .....

COST OF PRODUCTION

Salaries and Wages Accts 110 to 116 .....

Materials Accts 113 and 119 .....

Miscellaneous Accts 111 112 and 114 .....

Fixed Charges (Accts 112 118 and 117) .....

EXPENSES as Itemized .....

PROFIT (black ink) or LOSS (red ink) .....

Total Expenses .....

REMARKS:

In Charge

MONTHLY REPORT OF THE PRINTING DEPARTMENT OF THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY

Cloth and paper binding is done, but other binding is sent out.

A very close account of the expense of the department and of each job is kept and the cost compared with what it

would have been under outside contract. By this means the fact as to whether the department is a paying institution can always be determined.

Orders for work are received from the purchasing department in the same manner as they would be received if the department were not connected with the company, except that the requisition is termed an inter-department order. It is put into a numbered job envelope into which all information relating to the job is afterward filed. Compositors and other employees fill out time cards specifying the amount of time spent on each job. The labor charge for each job is entered on a "printery cost ticket" for that job from the time cards each morning. When the work is completed the cost of the stock is entered as material used and the cost of any other special expenses is entered under "special expenditures." To the material labor and special expense charges is added the proper percentage of the total charges for rent, power, light, superintendent's salary, interest on investment and depreciation. The proportion for each job is obtained at the end of the month by taking the proportion of the total general expense that the labor and material charges for that job bear to the total labor and material charges of the deprtment for the month.

At the end of the month a complete report of the department is sent to the auditor. This report specifies each job, by whom the work was ordered, and whether it was delivered to the proper department. The labor, material and miscellaneous costs are itemized and comparison of the actual cost with the cost if the work had been done outside is made, as in each job record.

STOCK RECORD

About $5,000 worth of material is usually carried in stock. This, however, is largely stock for transfers. Each grade or kind of paper is designated by a lot number and a stock record card is made out for it. When a job record card or envelope is made out the material used and its value is entered on the stock record card. The balance of stock on hand is carried out with each entry.

While the printing department, with investment depreciation, rent and everything considered, has been able to do work at a little less cost than the work could have been gotten for from outside concerns, there are several other features which make it a desirable institution. In the matter of transfers the ability to get these out on short notice is of great value. Moreover, more care is taken in getting the work out neatly and extra charges for changes of copy or form are eliminated.

The Milwaukee Electric Railway & Light Co.

PRINTERY TIME SLIP

Name..... Date.....190

JOB NO.	OPERATION	FROM	TO	TOTAL TIME
			Total Time.....	

Every Employee is expected to fill out this slip properly and place on the Superintendent's desk at the close of each day's labor. Any time spent on work not directly chargeable to a specific job should be distributed judiciously among the various job numbers.

EMPLOYEE'S PRINTERY TIME SLIP

Job No . . . Form No.....

Quantity..... ....Name.. .. ..

The Milwaukee Electric Railway & Light Co.

PRINTERY COST TICKET.

DATE	NAME OF EMPLOYEE	OPERATION	TIME	AM'T

MUNICIPAL OWNERSHIP VS. PRIVATE OWNERSHIP

After an investigation extending over nearly two years and embracing many of the principal cities both of the United States and Great Britain, the National Civic Federation Commission on Public Ownership and Operation has completed its duties. Four interesting reports have just been made public. Two of these are on labor conditions and two on the water, gas, electric lighting and power plants. Of the two reports discussing the labor situation under municipal and private ownership, one is by Prof. John R. Commons, of Wisconsin University, and the other by J. W. Sullivan, editor of the "Clothing Trades Bulletin," of New York. The report of Professor Commons is more favorable to municipal ownership of public utilities than is that of Mr. Sullivan. The reports upon the public utilities represented by the gas, electric lighting and power and water installations are made by Walton Clark, of Philadelphia, and Charles L. Edgar, of Boston, who are opposed to municipalization, and by Edward W. Bemis, of Cleveland, and Prof. Frank Parsons, of Boston, who favor it.

As already announced in this paper, the committe of investigation of the Commission is composed of twenty-one members, as follows: Prof. John R. Commons, of the University of Wisconsin; J. W. Sullivan, editor of the weekly "Clothing Trades Bulletin," and a prominent labor leader; Walton Clark, vice-president of the United Gas Improvement Company, Philadelphia; Daniel J. Keefe, president of the International Longshoremen, Marine and Transport Workers' Association; Walter L. Fisher, president of the Municipal Voters' League of Chicago; Melville E. Ingalls (chairman), chairman of the Cleveland, Cincinnati, Chicago & St. Louis Railroad Company; Prof. Frank J. Goodnow, of Columbia University; Dr. Albert Shaw (vice-chairman), editor of the "American Monthly Review of Reviews"; Edward A. Moffett (secretary), editor of the "Bricklayer and Mason"; Edward W. Bemis, superintendent of water-works, Cleveland, Ohio; Milo R. Maltbie, formerly editor of "Municipal Affairs," of New York; Charles L. Edgar, president of the Edison Electric and Illuminating Company, of Boston; H. B. F. Macfarland, Commissioner of the district of Columbia; W. J. Clark, foreign manager for the General Electric Company, New York City; Timothy Healy, president International Brotherhood of Stationary Firemen; Dr. Talcott Williams, journalist; F. J. McNulty, president International Brotherhood of Electrical Workers; Prof. John H. Gray, of Northwestern University; Prof. Frank Parsons, president of the National Public Ownership League, and Albert E. Winchester, general superintendent of the electric works of the city of South Norwalk, Conn., and W. D. Mahon, president of Amalgamated Association of Street and Electric Railways of America.

Fifteen members of the investigating committee sailed for Europe on May 22, last year, and returned to the United States in August. Among the cities visited abroad were Glasgow, Newcastle-on-Tyne, London, Liverpool, Norwich, Manchester, Birmingham, Dublin, Leicester and Sheffield. Investigations in the United States were made in Cleveland, Chicago, Philadelphia, Wheeling, Detroit, Indianapolis, Richmond, Atlanta, South Norwalk, Syracuse, Allegheny, New Haven and Hartford. A staff of engineers, accountants and statisticians, numbering over twenty, of national reputation, were employed to examine thoroughly every undertaking visited by the committee. These experts were so chosen, that in each examination made, both sides of the municipal ownership question were represented. Thus, one engineer, accountant or statistician approached the subject under consideration favorably disposed toward municipalization, while his colleague began his task holding views in opposition to that principle.

Abstracts of the reports already given to the press are printed below. It is expected that the reports on municipal and private ownership of street railways will be made public in about a week.

MR. SULLIVAN'S REPORT

The prevailing wage policy in the British municipalized undertakings investigated is to pay the skilled workman trade-union rates and the unskilled "a minimum wage." In all but the most poorly paid forms of labor municipalization has not raised the wage of workday conditions of the employees above conditions in the private undertakings, the exceptions noted showing the dubious advantages of possibly providing municipal employees with work at the expense of the community or furnishing them with a leverage for the play of politics.

But with respect to "common, unorganized labor," the investigators found a difference somewhat favorable to British municipal employees. The report cites facts that explain the causes. (1) The municipal laborer is a picked man. (2) This class of labor offers an especial field for the Municipal Employees' Association, the new political trade unionists, and the Socialists and humanitarians of all walks of life, who, demanding for labor at least "a living wage," desire to redeem municipal employment from participation in Great Britain's almost universal sweat-shop labor market. Steady, able-bodied and capable of exerting on city councils a combined pressure, municipal unskilled laborers, no matter how organized or whether organized at all, obtain better terms than the employing councillors accord to the men they hire in their private capacity for similar work.

BRITISH MUNICIPAL TRAMWAYS

Turning to the tramways and light railways, we find 3400 miles in the United Kingdom, the number operated by all the companies being some 1500 miles. The mileage operated by the seven companies and municipalities investigated by our experts reached perhaps 500, about that in Boston. The British tramway-wage situation can only be seen correctly in the light of municipal developments out of what were company undertakings, the latter invariably being far different in their status as to property and degree of progress from the street railways of America. No street car undertaking in Great Britain has ever been a "private" enterprise in the sense in which the word is applied in this country. The twenty-one years' term of the franchise, the veto of company petitions by village authorities, the enormous cost of Parliamentary powers and local assents and various other restrictions non-existent in the United States, shackle and impoverish British tramway company management, and consequently forbid an intelligent investigator to employ British example to illustrate possibilities in America through change from private to municipal ownership. British tramways have always been semi-municipal. The English field of tramway exploitation, if common report in Britain is correct, has been occupied by only the most venturesome promoters, and their work has certainly not been ordinarily successful in the development of the industry, as compared with American standards and results. As by the terms of their franchises all English tramway undertakings may be taken over by the municipalities, directors

manage their properties with that end in view. While the companies seldom equal average private employers in ability to pay the wages of municipal tramway undertakings, the municipalities investigated by our committee are the most famous scenes of notable attempts at social reform carried on both by the champions of collectivist ownership and humanitarians endeavoring to mitigate the evils of slum life and to lower a general death rate that gave several of the cities in question an unenviable reputation. As a result, chiefly during the transition from horse to electric traction, British municipalities have established a lead as to wages and workday, but by no means a notable lead, and one not yet finally established. Compared, however, with the remarkable changes for the better in wages and hours in the American street car industry under companies, the best of the British municipal labor improvements seem hardly more than trivial.

MUNICIPALIZATION IN AMERICA

In America, the municipalized enterprises visited by our labor investigators have been rich mines for significant facts relating to politics rather than to labor. These facts are not unusually among those heretofore emphasized by the American advocates of municipal ownership. The testimony as to political rottenness, root and branch, in several of the cities is conclusive. An employee can only hold office in uncertainty, with its consequent evils. He knows not what a coming term will bring. This form or disquiet is not usual in private employment. That it exists in Great Britain among municipal works managers is a certainty. Any advantage in wages or hours to be figured out for the municipal enterprises investigated in America over the private ones compared with them look much like stale illustrations of the soft berths to be found in public employment. To what extent the jobs are political for the employees, single or collectively, or a bid for the labor vote is constantly a question. On this point my colleague aptly says: "In the municipal undertakings a larger proportion of the positions are likely to be semi-political."

EFFECT ON LABOR UNIONS

Municipalization cannot but carry peril to the trade union. In the first place, the field for the labor vote manipulator enlarges with municipal employment. But many unionists refuse to be moved about like pawns, and the union member declining either to support or to fight the growing strength of pernicious labor politicians might drop out of the union should occasion arise. Again, individual unionists at work for municipalities learn to look to politics for help; whole unions do so, as in the case of the British electrical workers. They are engrafted political clubs, not trade unions. One showing of our labor investigations is a tendency of municipal employees in either country to refuse to enter unions when nothing is to be gained at once for themselves, or having organized and taken a profit to quit singly or in a body.

"Open shop" is the inevitable character of municipal, as all other government, employment. Appointments must be possible to all citizens. Union rules and orders must give way in the shop to the law and official decisions. Through the activity of business agents union men may obtain at some plants a larger proportion of situations than non-union, but rarely can the agent compel the municipal employee, if firmly unwilling, to pay his union dues. By the agitation of central labor unions, groups of municipal employees may get better terms from a city and then be free to remain apart from the labor movement. In fact, the enemies of trade unionism might divide and conquer it through municipal ownership, were the cost not socially prohibitive. Municipalities are impersonal employers. They operate through mechanisms. Petitions from individual employees, for example, may meet refusal by a reference of the signers to the regulations; those from a body, if recognized at all, must go by way of red tape finally to the power making appropriations. The higher municipal officials can arrange for such matters as the comfort and convenience of employees only as themselves invested with funds and authority, which is rarely the case, or they may affect to sympathize with the members of a force while really plotting against their interests. But the private employer or his representative can be reached directly by the employed and a decision arrived at quickly.

WELFARE WORK

So far as welfare work is concerned, British employees have not been taught to expect the same attention as the American. While the welfare works of Great Britain's municipal undertakings are a shade better than the private, they seem to have not been worth any especial notice from our own investigators. When a good word is said for Liverpool's coffee and cake and billiard rooms at one of the car depots, and the tidiness of two or three retiring places at other plants, the subject is quite exhausted. In this country the company plants visited have usually far better methods both for assuaging hardship and encouraging men in self-respect and worthy ambition than the municipal. In Chicago, the Edison Company's close personal relationship with its employees stands in sharp contrast with that municipality's neglect of even decent accommodations for its electrical workers. Mean appointments and dirt are characteristic of Chicago's municipal electric stations. The Edison Company's system of instruction and club-room features has no counterpart in the city's electrical department, while the company's gradation of employees and promotion on merit form a practical civil service that needs no commission with theories and is operative every day in the year.

Not one of the British or American municipal plants of any kind presented a systematized combination of features in the form of benefits, education, grading, welfare work, care for the aged, etc., that gave the slightest foundation for the claim of municipalization advocates that with public ownership arise striking evidences of closer sympathetic relations between employer and employed. On the contrary, in reciting the undeniable facts as to the watchfulness of American companies over the health, comfort, technical education and advancement in business of their employees, one's words may be construed as praise where no more than exact report is the intent. The reader is invited to consult our labor statements on these points and form his own judgment. The Chicago Edison Company and the Philadelphia United Gas Improvement Company, each far more extensive than the largest municipal gas or electric works visited abroad, exhibit both ripened business judgment and strong sentiments of fellowship in numerous forms of care for their employees, whether at work or at play. It is but one's plain duty to call attention also to the exemplary oversight of the Indianapolis Water Company in regard to the material conditions of its force, to the New Haven Company's record for retaining its employees, and to the Atlanta Company's interesting methods of rewards beyond wages.

The American employee properly infused with our

national spirit seeks a career in which he, alike with his fellows, may hope to reap due rewards and suffer just penalties, while retaining in every respect his liberties as a freeman. But the obstacles to this ideal condition are in public employ endless. A public employee without backing may never be given occasion to prove his peculiar abilities; even bare legal recognition of his proper claims may tardily be conceded. The average public employee displays a sufficiently high order of merit to hold his place if he merely follows the code of rules mechanically. To a certain limit he may be slovenly, indolent, ill-natured, unhelpful, selfish, unobliging to the public, and yet incur no punishment. Private employment in general does not develop this character; it rewards ideas, alertness, civility, cleanliness, energy.

POLITICAL CONDITIONS

There are striking differences in political conditions between the United States and Great Britain. In this country the three interests of local, State and national policies may be united in one executive committee; in Great Britain representative men of all the cities visited denied that any machine whatever in the American sense existed among them. In some of these cities any connection between local and national politics was also disavowed, and even where Councillors were classed as Liberals and Conservatives at election it was asserted that in Council, Conservatives at times spoke and acted as Radicals, while Liberals might be as reactionary as the Whigs.

In the United States there are nowhere such legal restrictions of citizenship as to cut away the laboring class vote by 25 per cent, or at times more, even as high as 40 per cent, as in London and Liverpool. Nor does there exist in this country such a relationship between municipality as employer and its wage-workers as to bring up for discussion the disfranchisement of city employees. There is no multiple voting here on property, no representation by citizens living in territory lying outside the constituency represented, no selection of men of other classes as the official spokesman of the labor element. The American workmen have no conception of the British system of caste. In America there has been no recent upheaval of the working classes resulting in the election of labor representatives in Congress and the City Councils composed of leaders with more or less revolutionary programmes.

These facts indicate either that the professional politician of Great Britain has not awakened to his opportunities or that the opportunities do not exist. In either event, that country has been barren ground for the boss, the heeler, the gang, and a mass of purchasable voters, represented in legislative bodies by a machine man. Further, our workingmen reformers have a different political outlook before them and different materials to work on from those of the British workingmen reformers. In education and democracy the American masses are immeasurably ahead. British workmen in the mass earn hardly as much money as our Southern negroes.

Living is often said to be cheaper in Great Britain, but this is so only when the poor people go without things that all Americans can have.

PROFESSOR COMMONS' REPORT

In order that my position may be clearly understood, I will say in advance that neither municipal ownership nor private ownership have accomplished the good results in the United States that should be expected of them, and both are far behind what both have accomplished in Great Britain. I attribute this backwardness mainly to the infancy of the movement for municipal ownership in the United States. The question has not yet been big enough here to attract attention, and all the energies of the people in municipal government have been consumed in fighting the private corporations which have possession.

The two most noticeable facts regarding the movement in Great Britain are the steady improvement made in municipal operation after municipal ownership had become a settled policy, and also the great improvement in private ownership and operation during the same period. In comparing the two countries, I have been impressed by this fact more than anything else, that successful private operation follows successful municipal operation. This is seen most strikingly in the fact that the British companies were willing that our engineers should make a physical valuation of their properties for comparison with their capitalization and their earnings, whereas the American companies would not permit such a valuation. Many of the British companies also for years have been subject to complete publicity of their accounts and examination of their books by public auditors and accountants, thus furnishing information that we were not able to get in America. This higher view on the part of the companies has come about because they have before them the menace of municipal ownership if they do not live up to their public obligations. They cannot afford to have strikes, because they would at once arouse into action the demand for municipal ownership. They cannot afford to keep their accounts private, because in order to head off municipal ownership they must let the people know just how much profit they are making.

MONOPOLIES AND POLITICS

The kind of business that we are dealing with are essentially monopolies performing a public service, and are compelled to make use of the streets which are public property. If their owners are private companies they are compelled to get their franchises and all privileges of doing business, and all terms and conditions of service from the municipal authorities. And in carrying out their contract with the municipality they are dealing continually with municipal officials. Consequently it is absurd to assume that private ownership is non-political. It is just as much a political question to get and keep honest or business-like municipal officials who will drive good bargains with private companies on behalf of the public and then see that the bargains are lived up to, as it is to get similar officials to operate a municipal plant. We do not escape politics by resorting to private ownership—we only get a different kind of practical politics.

In many American cities the employees of public service corporations take a most active interest in politics and in some cases the men are given leave of absence on pay to work in the primaries of both parties.

POLITICAL APPOINTMENTS

In cities where the convention system prevails instead of the direct primaries it was not found that the wage earners of the private companies took a similar active interest in political campaigns, but men are often employed by the companies on the recommendations of aldermen at times when their contracts were before the council for renewal. Curiously enough, the politician profits more in some respects by the appointments which he secures for his supporters with a franchise company than he does by those on municipal jobs. Since all parties understand that the

alderman's influence stops after appointment, there is no ill feeling on the part of his supporter if he is discharged.

It is for this reason that the private company has an advantage over the municipal management under the spoils system, for it can get rid of a political appointee after trying him out and finding him inefficient. He and his family and friends continue to be the supporters of the alderman who has done his best for them, and his discharge at the same time makes room for the alderman to name another man who also with his family and friends become supporters. It is different in municipal employment, where it is expected that the politician who gets the job for his follower will keep it for him. If he is removed from that job he loses confidence in the ability or good faith of the politician. On account of these differences in the attitude of workmen, politicians and managers, the private corporation in politics is more efficient from the standpoint of its stockholders than the municipal undertaking in politics, and at the same time the capable politician can build up his organization just as effectively under one system as under the other.

The experience of Glasgow is instructive. Fifteen years ago the practice of hiring employees on the recommendation of councillors was universal in all departments. But with the growth of municipal ownership it has almost disappeared. Our investigations have shown that the strongest safeguard for a manager against the pressure of outside recommendations is the recognition of organized labor within his department. Wherever we have found a class of employees organized and dealt with as such through their representatives we have found those positions exempt from politics. This follows from the nature of labor organization which cannot survive if individuals are given preference on political, religious, personal or any other grounds than the character of the work they do.

Under the convention system of nominations the principal activity of private corporations was found to be that of contribution to the expenses of campaign committees and candidates.

POLITICAL CONDITIONS

In all of the cities visited in Great Britain, except Glasgow and London, it was found that national political parties managed the municipal elections. The exception in Glasgow is mainly owing to the fact that there the Liberal party is so overwhelming that the Tories have no chance. In the British cities only the councillors are elected, one each year, holding three years for each ward. The councillors elect the aldermen and the city officials. Most important of all, the councillors and aldermen are not required to live in the wards they represent, and many of them live in the suburbs. One-half to four-fifths of the councillors and aldermen live outside the wards they represent, and the proportion is strikingly larger in the working-class wards which elect two-thirds to nine-tenths of their councillors from outside. Many inquiries were made as to the reasons, on the part of voters, for this indifference as to the place of residence of their candidates, and the explanation that seems adequate is the absence of campaign and corruption funds and the inability of councillors to find jobs for their constituents. Furthermore, councillors and aldermen are unsalaried. This freedom of choice makes it possible to elect both the leading business men and the leading labor men to govern the city. Not only do we find eminent bankers, financiers and employers of labor in the councils, but we find the secretaries and officials of trade unions, most of them living outside the wards they represent. The absence of such leaders and truly representative men from American city councils is the most discouraging fact brought to our attention. One reason for this condition of affairs in England is that the bankers, financiers and merchants who serve the cities as aldermen on the finance committees are free to do so because neither they nor their clients or business associates are interested in stocks which might be depreciated if they helped the city to drive a good bargain.

The increase in municipal ownership in Great Britain has, of course, brought an increase in the number of municipal employees, and this has caused apprehension in certain quarters. Generally the chief officers of the municipal enterprises take the ground that they and other employees should not vote in municipal elections, and they openly set that example to their subordinates. Some of them go even so far as to advocate the disfranchisement of municipal employees in municipal elections. This has also been advocated by some of the councillors. However, such a proposition is no longer seriously considered. If the vote of municipal employees is a menace the remedy must be looked for in directions other than disfranchisement. It goes without proof that such a remedy is needed, for municipal employees sooner or later cast their votes for candidates who promise or have secured a betterment of their condition, regardless of its effect on the enterprise as a whole. Omitting disfranchisement, there are two directions in which such a remedy can be found, first a limit to be set beyond which municipalization shall not go, and second, the attitude of the public and especially of the workmen in private employment.

MUNICIPALIZATION AND TRADES UNIONS

The municipal undertakings in both countries are necessarily "open shop," in the sense that employment is open both to union and non-union men. In the case of the more skilled trades this usually results in the employment of union men, depending partly on the attitude of the manager. This attitude is favorable to the unions in all of the British municipalities except Liverpool and is favorable in the American cities of Cleveland, Detroit and Chicago. In these places the managers consult the union officers in arranging wages, hours, and conditions of work. The three American places mentioned are those where the political machine, supported by the contractors and franchise corporations, has been eliminated from the control of the city government by a popular revolt against the corporations. But in Allegheny, Syracuse, Wheeling and Indianapolis, where a combination of politicians and franchise corporations is in control of the municipal government, the attitude is distinctly hostile to the unions, and appointments and promotions are made with reference to the political adherence of the employees.

The British organization of street railway employees, which nominally includes teamsters and drivers as well as motormen and conductors, is practically confined to the latter, and for the last six years has increased its membership solely among motormen and conductors. Its membership consists of 9,500 in municipal employment and 1,500 in private employment, a ratio of one-half of the motormen and conductors employed by all municipalities and one-third of those employed by all companies. The three private companies investigated, namely London, Norwalk and Dublin, have taken a decided stand against the organization, have discharged those of its employees who became members and have required bonds or deposits which are

forfeited if the men quit without giving one or two weeks' notice. Two of the municipalities, London and Manchester, are organized in this association to the extent of nine-tenths of their employees, while in two other establishments investigated, Liverpool and Glasgow, the municipalities have established benefit associations and in Liverpool the union was disrupted by embezzlement on the part of its officers. The wages are so much in advance of what these employees received from the former private companies that the union does not appear to offer them any particular advantages if they should join it.

WELFARE WORK

In the matter of "welfare work," or provision for the comfort, cleanliness and recreation of employees, the best conditions were found in the works of the Commonwealth Electric Company at Chicago, the municipal water works at Cleveland, the Philadelphia gas works, the municipal gas at Leicester, municipal trams at Glasgow and Liverpool and South Metropolitan gas at London. In general, the buildings and works constructed during the past four or five years both in private and municipal undertakings, show a great improvement over the older buildings and works, in the provision for baths, lavatories, lunch and cooking rooms, recreation rooms and grounds. Taking the entire list of properties visited, the best under one form of ownership is equaled by the best under the other form, and so on down to the worst. The superior character of the municipal undertakings over private undertakings in Great Britain is partly owing to their more recent construction and the converse is true in the United States.

INVESTIGATION OF WATER AND LIGHTING PLANTS

The review of the effect of municipal ownership on water and lighting plants is contributed by a committee of four appointed by the Commission. Two of the writers, Walton Clark, vice-president of the United Gas Improvement Company, of Philadelphia, and Charles L. Edgar, president of the Edison Electric & Illuminating Company, of Boston, criticise severely the municipal plants examined, while two other writers, Prof. Frank Parsons, of Boston, president of the National Public Ownership League, and Edward W. Bemis, superintendent of the Cleveland, Ohio, water-works, find much to favor in municipal plants which were investigated. Separate reviews of British municipalization, including tramway operation, will be made public later.

Messrs. Clark and Edgar concur in the statement that the inquiry of the committee, both from the standpoint of British and American experience, more especially the latter, has shown that "where municipal ownership has been removed from the realm of philosophic discussion and put to the test of actual experience it has failed ingloriously." The belief is expressed by these gentlemen that the "few enthusiasts" who still advocate municipal ownership "will soon be convinced by the logic of events, and turning their energies to other things will through them realize their ambitions of usefulness to their fellows." Professor Parsons and Mr. Bemis, on the other hand, take a most hopeful view as to municipalization, declaring that the failures of municipal ownership are insignificant compared to the failures of private ownership, either in number or importance. "It is not public ownership, but private ownership," Professor Parsons says, "that is responsible for our periodic crises and the ruin of our industries." As to the fitness of American cities to manage business affairs, many of them, he says, have proved their fitness, and the rest can be made fit. "It is not impossible," he adds, "that the elimination of the public service corporations through public ownership is one of the things that would do more to help along the process of making our cities fit."

AMERICAN AND FOREIGN PLANTS EXAMINED

The following American plants were visited and examined:

Public Gas Plants—Wheeling, W. Va.; Richmond, Va.; Holyoke, Mass.; Westfield, Mass.

Private Gas Plants—Atlanta Gas Light Company, Atlanta, Ga.; City Gas Company, Norfolk, Va.; United Gas Improvement Company, Philadelphia, Pa.; Fitchburg Gas & Electric Company, Fitchburg, Mass.; Beverly Gas & Electric Company, Beverly, Mass.

Public Water Plants—Cleveland, Ohio; Chicago, Ill.; Syracuse, N. Y.

Private Water Plants—New Haven Water Company, New Haven, Conn.; Indianapolis Water Company, Indianapolis, Ind.

Public Lighting and Power Plants—Chicago, Ill.; Allegheny, Pa.; South Norwalk, Conn.; Detroit, Mich.; Danvers, Mass.; Holyoke, Mass.; Westfield, Mass.; Marblehead, Mass.; Peabody, Mass.; Taunton, Mass.; Chicopee, Mass.; North Attleboro, Mass.

Private Lighting and Power Plants—Northampton Electric Light Company, Northampton, Mass.; Fitchburg Gas & Electric Company, Fitchburg, Mass.; Salem Electric Company, Salem, Mass.; Beverly Gas & Electric Company, Beverly, Mass.; Gardner Electric Light Company, Gardner, Mass.; Abington & Rockland Electric Light & Power Company, Abington, Mass.; Attleboro Steam & Electric Company, Attleboro, Mass.

THE REVIEW BY MR. EDGAR AND MR. CLARK

Mr. Edgar and Mr. Clark agree in setting forth numerous objections to municipalization, a very important one being that in several British cities which have tried public ownership, it has been found that the organization of municipal workmen constitutes a serious threat against the municipality itself, and, as a result, the disfranchisement of city employees is being seriously considered in England. Were municipal employees in this country to organize, under extended city control of public utilities, the writers declare the remaining voters would find themselves beneath "a tyranny of democracy which is no less galling to the individual oppressed and no less detrimental to the welfare of the State than is the tyranny of a despot." The remedy proposed in England, disfranchisement, is declared to be "unthinkable" in the United States. Under public ownership of public utilities, it is declared, those in control of the government are submitted to continuous temptations; first through the opportunity to build up a political machine, with the city employee as a basis, and, second, through the opportunity to unduly favor contractors, with the expectation of either financial or political benefit to themselves.

"There is little about municipal trading to attract men of the first class." Mr. Edgar and Mr. Clark unite in saying, "We have not found evidence in the United States that the personnel of the city government of Chicago (referring to Mayor Dunne's administration) or Wheeling is superior to that of Atlanta or Norfolk, or that the introduction of municipal water and electric plants in Detroit has brought a higher type of citizenship into the governing body than we find in New Haven, which has neither."

The labor situation at the gas plants examined is com-

pared to the advantage of the private plants. "The general impression made at Wheeling," says Messrs. Edgar and Clark, "was that no one about the works took any more interest in his duties than was absolutely necessary to enable him to hold his job, and no one, either at the works or on the street, was at all interested in getting work done in an efficient manner. The power of appointment at Wheeling did not rest with the superintendent, and therefore the employees did not have the fear of discharge by him in case they did not perform their work properly. At Norfolk and Atlanta the certainty of prompt discharge in case they did not satisfy their immediate superiors in the operation of the plant acted to make the men work better and more efficiently than was the case at Wheeling."

Referring to the Philadelphia gas works as an instructive comparison of the results of municipal and private operation, the reviewers quote Dr. L. S. Rowe as authority for the statement that the quality of the gas supplied has been improved by the company now operating the service, and that through the rental paid, the city has received for eight years an average profit of $491,674 annually, while for the last few years under city operation there was a loss of $245,398 per year. The private company, however, charges no more than did the city, but supplies better gas. "The Commission's records," say Mr. Edgar and Mr. Clark, "indicate a high degree of efficiency in the company operation of the Philadelphia gas works, and kindly and liberal treatment of employees. On these latter points Dr. Rowe speaks as follows: 'As has been shown (under municipal management), there were abuses in almost every branch of the operation. The purchase of coal and the residuals products were each under the control of favored individuals; the wages account was padded with incompetents, the friends of men prominent in city politics. It is unquestioned that there were leaks in the management of the gas works at other points than the distributing system; it is true that the labor account was debauched, and it is certain that in the purchase and sales departments there were influences at work which worked harm to the city's interests. But the loss through such sources was inconsiderable when compared with those inflicted by councils by the senseless blocking of the way to improvement in cutting off the appropriations for modernizing the plant. During the entire period of municipal operation the officers in charge were engaged in a losing fight to preserve the works from ruin. There never was a time during the entire period of responsible control when it could truly be said that the works were in an efficient condition.' "

Four of the best known American municipal electric plants, those of Chicago, Detroit, South Norwalk, Conn., and Allegheny, Pa., were examined by the Commission and the experts. Of these South Norwalk is the only one that does commercial lighting. As to the cost of operation of these plants, the Chicago plant is cited to show that including items for depreciation, interest, taxes, proportion of salary, insurance and water, there is a loss to the city, based on simple interest on the amount paid, of $6.70 per lamp per year, or a total of $284,202 annually, compared with what the cost would be if service were taken from a private company. Computed with compound interest on the amount paid, the loss is $11.07 per lamp, or $469,217 per year. These figures are based on statements submitted by the Commission's expert accountants and do not agree with the estimates of the city electric department, which show a saving to the city.

As to the character of the plants, that in South Norwalk is criticised for its use of a d. c. 220-volt two-wire system, a type never generally adopted in this country. This equipment, say Mr. Edgar and Mr. Clark, compels the consumer in South Norwalk to pay 20 per cent more for the light produced than would be necessary under a better system.

The Detroit electric undertaking is found to be of a type of about fifteen years ago and the capacity can hardly be expanded within the present building unless the type of operating units is charged to those of a more modern class.

The Allegheny plant is described as "poorly designed, inefficient and expensive to operate." Appropriations for technical equipment have been neglected to such an extent, say the reviewers, "that the electrician had to build his own switchboard out of such junk as he could collect from machine-shop yards."

Of Chicago's four municipal electric plants, three are declared to be of obsolete type, while the fourth is not properly constructed for economical operation. The stations are scattered through the city without system and are very poorly located. The plants use 1,400,000,000 gallons of city water (minimum) for which no charge is made. Of the 6700 lamps in use, 4180 are of a type which has been generally discarded throughout the country.

On the subject of operating efficiency, it is set forth that economical operation in Allegheny is much hindered by the unnecessary number of employees. Six or eight of the force could be dismissed, reducing the payroll 15 to 18 per cent, and "the half dozen extra laborers often put on for political purposes at election time could be dispensed with, changes which would add to the efficiency of the service as well as lowering its cost." In Chicago, the civil service rules are declared to be a source of inefficiency. Men who have become inefficient are held in responsible positions longer than they should be and the best men are often prevented from being advanced in rank or chosen from the outside because of lack of the special knowledge required by the civil service examiners.

In their examination of water plants Messrs. Edgar and Clark found the service in the private plants superior, on the whole, to those in the municipal plants. Summarizing the results of the investigation as to the quality and purity of the water supplied, Messrs. Edgar and Clark say:

"This phase of the question may be summarized with the statement that while the natural conditions in the different cities call for different methods of treatment, it is evident that the two companies examined were more solicitous regarding the purity of the water supply, and adopted more thorough means for insuring the same than did the three municipalities who ran their own water department. The conclusion drawn as a result of our investigation into the quality of the water is that the water supplied by the two companies is good, sanitary water; that its quality is much better than the water supplied in Chicago, somewhat better than the water supplied in Cleveland and quite as good as the water supplied at Syracuse. The latter place is blest with water from a source which, down to the date of this report, has remained pure without any special expense or effort on the part of the water department. It seems that the citizens obtain the cheapest water in Cleveland, while New Haven is the second cheapest. At Indianapolis the poor man gets water fairly cheap, but the cost increases rapidly as the class of dwelling improves. At both Chicago and Syracuse the poor man pays a high price for water."

Under the heading "Financial," an exhaustive review of the economic operations of municipal and private undertakings both in Great Britain and the United States is given by the reviewers, who find that it is admitted by the advo-

cates of municipalization that the debts of British cities have been enormously increased by its operations. "We venture to believe," they say, "that the loss to the communities whose municipal industries we have investigated from bad management and lack of enterprise, resulting in restricted service of modern utilities, is many times the profit these cities claim to have realized from their Rip Van Winkle methods of serving the public. It is not worth while to discuss the effect on the finances of American cities of the municipal operations of the industries that we have here investigated. Properly audited they have, with one or two exceptions, lost money, and their plants are all inadequate to good service, and have, with the exception of the water plants, little more than a scrap value in view of the present state of the arts. What effect could such poor efforts as we have witnessed have on public wealth or public comfort? It cannot fail to be bad."

THE REVIEWS OF PROFESSOR PARSONS AND MR. BEMIS

In favoring municipal ownership Professor Parsons declares that in most discussions of the subject too much attention is given to the purely financial side of the question. "Dollars and cents are not to be neglected," he says, "but life, liberty, justice, virtue and intelligence—the whole character product and social product of our institutions—are of greater moment than their money product." Taking up financial results, Professor Parsons gives it as his view that the municipal plants are more economical. "Broadly speaking," he says, "recognizing that there are exceptions to all rules, the facts show that municipal plants tend to make lower prices to ordinary consumers than private plants in the same country working under similar conditions, and they do not grant electric rebates or other favors by secret agreement with large users, as is not infrequently the case with the larger companies. In the comparatively few cases where municipal systems do not make low charges the public still gets the benefits that under private operation go to the stockholders, for the profits of the public plants are used to improve the service, pay off the capital, relieve taxation or accomplish some other public purpose. Municipal plants are found, as a rule, to have a lower capitalization than private plants, both in relation to output and in relation to assets."

Discussing so-called failures of municipal ownership, Professor Parsons claims that some of such cases are really failures of private ownership. "Take Philadelphia gas, for example," he says, "It does not appear that Philadelphia ever had real public ownership of the gas works. She had government ownership of gas works. But government ownership is not public ownership unless the people own the government. Philadelphia had the paper title to the gas works, but the people did not own or control them because they did not own the city government. The councils were full of the agents and allies of the private street railway, telephone, gas and electric light interests and they purposely mismanaged the gas works, allowed them to be filled with supernumeraries and let them get out of repair by refusing year after year to appropriate, even out of the receipts of the plant itself, the money necessary to keep it in order, so that they might have an apparently good excuse for executing a lease of the works to themselves. Philadelphia did not have real public ownership of gas, but one of the worst forms of private ownership—ownership by political grafters, in the pay of corporations but masquerading as public servants."

Mr. Bemis declares that the over-capitalization and high earnings thereon of private companies and the demoralizing relations often existing between private companies and city governments are the two great reasons for the municipal movement.

Mr. Bemis' review of the Philadelphia gas situation is in marked contrast to that of Messrs. Edgar and Clark. Mr. Bemis also quotes Dr. Rowe as authority on the subject, to show that when direct municipal operation began, Dec. 31, 1886, the plant had been entirely paid for out of profits, with the exception of $1,802,948. After including the expenses of collection, maintenance of street lamps, etc., borne by other city departments, the net cash turned into the city treasury during the years 1888-1897, inclusive, was $2,937,719.56. To this should be added the amount spent for extensions of the works, mains and services, which is easily computed from Professor Rowe's data at $4,344,316.92. This would make a total of apparent profit during the eleven years of municipal operation of $7,282,036.48. Since this profit was computed after including the operating expenses, and the expenditures for repairs of 8 cent to 10 cents per 1000 ft. a year, the depreciation could not have eaten up any large part of this apparent profit.

The price of gas was reduced from $1.50 to $1.00 at the close of 1893. At first there were deficits, but these rapidly declined. According to Professor Rowe, there was a net profit during the eleven months of city operation in 1897 of $123,915.06, after paying the expenses incurred on account of gas in other city departments.

"By reason of municipal ownership, Philadelphia was able to lease to the United Gas Improvement Company most valuable street mains, land and holders, to say nothing of such portions of its other plant as with moderate repairs could be put in good shape. By asking for no rental or taxes on this plant which had been paid for out of the profits of city ownership, Philadelphia was able to secure a lease under which it received 10 cents per 1000 ft. of all gas sold to private consumers during the first ten years of the lease, 15 cents during the next five years beginning next January, 20 cents from Jan. 1, 1913, to Jan. 1, 1918, and 25 cents for the remaining ten years. The city also receives free of charge 700,000,000 ft. of gas yearly for street lamps and public buildings, and the maintenance of those street lamps by the company."

That the municipal electric light undertaking at South Norwalk, Conn., is one of the most successful plants, either public or private, in the United States or Europe, is the opinion expressed by Mr. Bemis. The operation of the Chicago plant, also, is commended, the expert quoted by Mr. Bemis estimating the profit to the city on the plant up to the close of 1905 at $710,433. The spoils system has been singularly kept out of the Chicago plant, according to Mr. Bemis, although the plant itself is not all that could be desired. He continues:

"Next to South Norwalk the most successful municipal electric lighting plant has been that of Detroit. If it had been allowed to do a commercial business, its success would have been even greater than has been possible with only the lighting of streets and public buildings.

"Allegheny, although confined to street lighting, and suffering from the spoils system and a poor location, has, nevertheless, saved enough to pay for her plant out of the difference between her operating expenses and the $96 a year which Pittsburg has had to pay for similar arc lights prior to 1906."

SEMI-CONVERTIBLE CARS FOR THE NORFOLK & SOUTHERN RAILWAY

Five very attractive combination passenger and smoking cars of the grooveless post semi-convertible type have been added to the equipment of the Norfolk & Southern Railway. Cape Henry and Virginia Beach, the points reached by this line, are indicative of a large excursion business and it was largely on this account that the type of car mentioned was chosen. Virginia Beach, one of the most attractive resorts on the coast, is 18 miles due east of Norfolk and has a stretch of sand second to none in the country, which is much frequented by automobiles and other vehicles, the run from Virginia Beach to Cape Henry Light, 6 miles away, being particularly well patronized in this respect.



SEMI-CONVERTIBLE CAR FOR THE NORFOLK & SOUTHERN RAILWAY

The new cars are equipped with every comfort including extra long seats which this particular type of car makes possible, arm rests, push buttons, basket racks, etc. The seats in the smoking compartment are of the longitudinal variety, and, like the transverse seats in the other compartment, of Brill manufacture. The trucks are the builders' 27 E-1½ type with 6-ft. 6-in. wheel base; both the motors on each car are of 75-hp capacity and are under the smoking compartment end of car. The chief dimensions are: Length over the end panels, 36 ft.; over the vestibules, 45 ft. 5 ins.; width over the sills, including the sheathing, 8 ft. 4 ins.; size of the side sills, 4 ins. x 8¾ ins.; end sills, 5¼ ins. x 6⅞ ins.; sill plates, 15 ins. x ⅜ in.

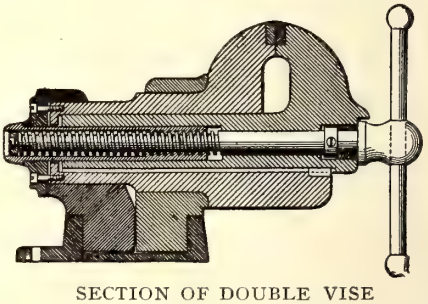
DOUBLE AND SINGLE SWIVEL VISES

The Pittsburg Automatic Vise & Tool Company, of Pittsburg, makes a line of vises so designed as to have their jaws describe any degree of two complete circles. This movement not only makes them high-speed tools for the work bench, as the operator is able to turn his work instantly to the most advantageous position, but the tools are also adapted as a chuck for the drill-press, planer or other machinery.

The operator can readily and easily remove the body of the vise from its base upon the bench to extra bases in other parts of the shop simply by lifting the body of the vise from the hollow base. Work too heavy to be lifted upon the bench and placed in an ordinary vise can readily be stood on one end on the floor, the jaws of the double swivel vise thrown at right angles, the jaws opened, and then thoroughly clamping the upper end of the object to be held. In this position any work can be accomplished on the end of the bar, such as sledging and chiseling.

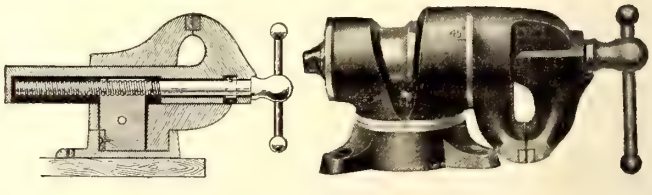
The double swivel movement has many advantages, one of which is that in case of a workman desiring a smaller face vise than that of the one upon which he is working he can readily throw the jaws at right angles and use the side of the same, which will enable him to do the most delicate work, due to its small dimension. The double swivel vise, by the turning of the jaws, can be made to hold securely any work while lying flat upon the bench.

Another very important feature in this vise is a slight groove through the face of the front jaw, which permits a firm grip to be had upon any round work to be sawed, filed or worked upon in the regular machinist's vise. The vise is automatically locked by the tightening of the jaws upon the piece held. The vise is composed of eight sections. These consist of the front and rear jaws, two yokes, screw and nut, base and friction plate. The base is formed with an annular seat for the body of the vise. The body consists of two yokes, each provided with a section, or half of a hub, seated in the base, and adapted to be slightly tilted in respect to each other and their seat, so when they are drawn toward each other at their top they will be pressed outward below and locked in the base seat.



SECTION OF DOUBLE VISE

The rear jaw can be rotated about its axis within the body of the vise. It has two diameters, the larger working in the front yoke and the smaller in the rear.



SINGLE VISE COMPLETE AND IN SECTION

A special bearing is placed on the screw between its head and fixed collar to afford freedom of turning, but it is designed to be driven or forced tightly upon its seat in the front jaw, to serve as a reliable backing for the collar when the screw is rotated to open the jaws. This also gives the head of the screw a solid bearing against the full stock of the front jaw; therefore, there is nothing to break or give way or become weakened under the severe strains or pressure through the action of the screw. Thus it will be understood that when the screw is tightened it tilts the body sections towards each other and locks them against rota-

tion in the base. The inner jaw member has a splined connection with the inner jaw to prevent its rotation.

The single-swivel vise possesses but one movement. It is automatically locked by the tightening on the piece of the jaws. By lifting the body of the vise from the base, the vise can readily be carried anywhere. It can also be made stationary or any desired degree of friction secured in the swivels by tightening a small thumb screw.

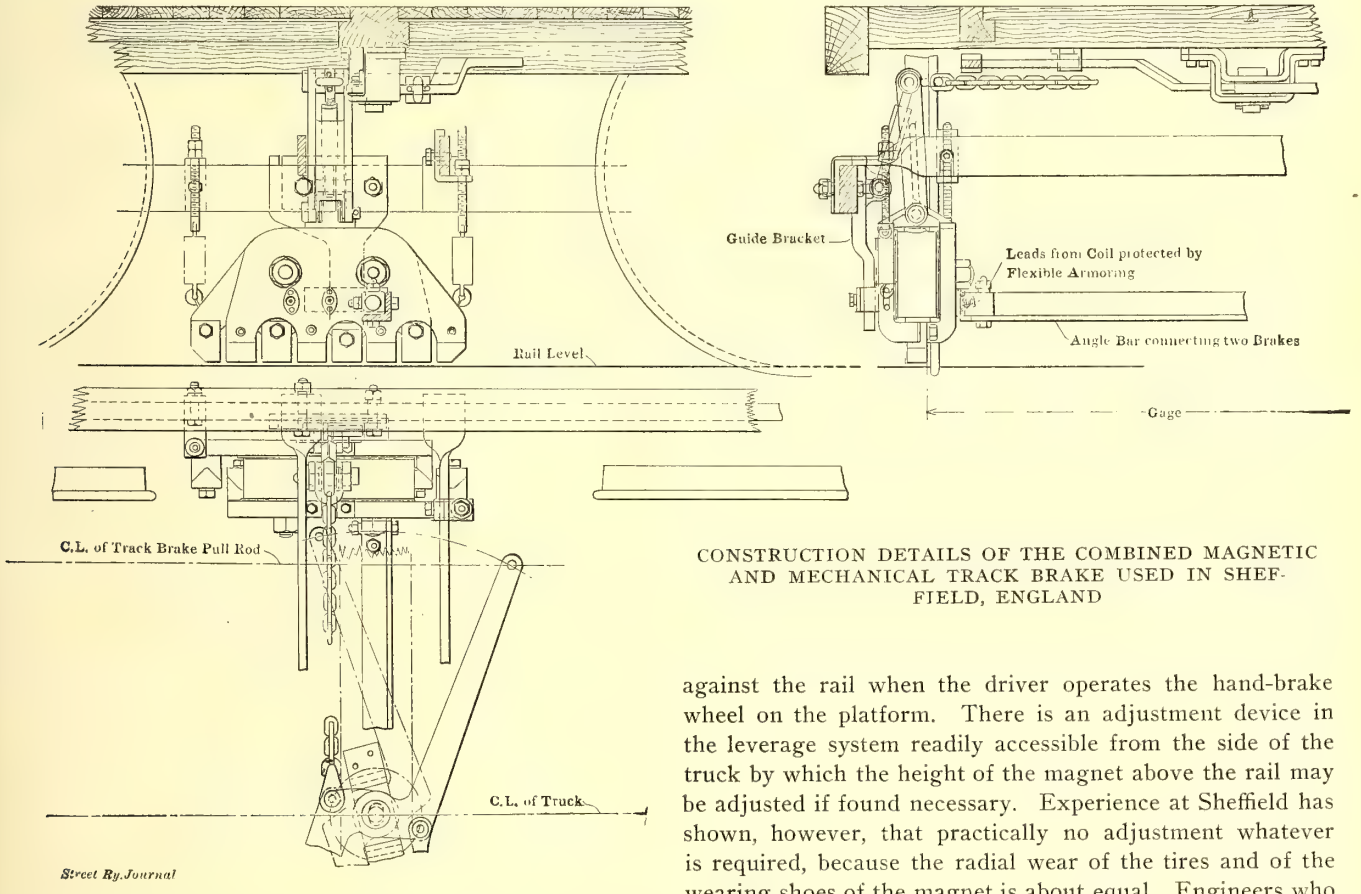
This vise consists of but five parts, the rear and front jaws, screw, nut and base. The locking dog is constructed to permit the screw to pass through its upper extremity. It is pivoted near its bottom upon an alloy steel bar supported by the base. Thus, when the jaws are tightened upon an object the screw draws the dog towards them, which naturally throws its bottom out against the walls of the base, thus locking it firmly, no matter what the pressure may be. The pipe attachment for the single-swivel vise takes any size pipe from ⅛ in. to 6 ins., inclusive.

SOUVENIR STAMPS FOR PARK ADVERTISING

Souvenir postal cards which have for their subject views along electric railway lines have long since been utilized by electric railway companies in different parts of the country for advertising purposes. Now comes the Twin City Rapid Transit Company, through its passenger agent, A. W. Warnock, with a variation of the postal card idea that is quite ingenious. It is a stamp book containing twenty-four souvenir stamps gummed ready for use, which have for their subjects, views along the Twin City Company's lines. Despite the reduction the engravings are very good. On the back of the book is a place for the address just as on the front of a postal, a 1-cent stamp only being necessary for mailing.

COMBINED MAGNETIC AND MECHANICAL TRACK BRAKE USED IN SHEFFIELD, ENG.

An improved form of track brake has been supplied to the Sheffield Corporation by the British Thomson-Houston Company which should go a long way toward solving the vexed problem of tramcar brakes. This brake is a combined magnetic and mechanical track brake, so designed that it can be applied by the driver as an ordinary mechanical slipper brake, as an electro-magnetic track brake, or as both combined. The general features of the brake will be apparent from the accompanying drawing. The track slipper consists of this company's usual track brake magnet, one attached to each side of the truck, with a simple system of levers by which the slipper is pressed



CONSTRUCTION DETAILS OF THE COMBINED MAGNETIC AND MECHANICAL TRACK BRAKE USED IN SHEFFIELD, ENGLAND

against the rail when the driver operates the hand-brake wheel on the platform. There is an adjustment device in the leverage system readily accessible from the side of the truck by which the height of the magnet above the rail may be adjusted if found necessary. Experience at Sheffield has shown, however, that practically no adjustment whatever is required, because the radial wear of the tires and of the wearing shoes of the magnet is about equal. Engineers who are using mechanical track brakes with wooden shoes will appreciate the value of this feature because it will allow the track brake wearing shoes to be renewed when the car is re-wheeled, instead of each day, as is necessary at present.

The power of the magnetic track brake and its ability to control a car is well known. Of the power of the brake when applied mechanically, the following test carried out at Sheffield gives ample testimony. The car was driven at full speed on a level track with the motors in full parallel. The track brake was then applied mechanically by hand without shutting off power. This rapidly brought the car to rest, the wheels spinning on the track through being driven by the motors. The ability of the brake to stop the car when the full power of the motors is acting to keep the car in motion, is ample proof of its great power and efficiency. When it is also remembered that the action of the brake is in no way dependent upon the rotation of the wheels, and that the brake cannot in any case lock the wheels, its safety and reliability should be fully appreciated.

RECENT EXTENSIONS ON THE SEATTLE-EVERETT INTERURBAN LINE

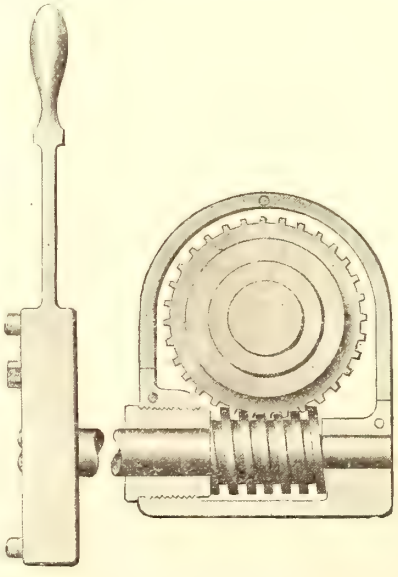
The Seattle-Everett Interurban Railway is a partially completed line now in operation between Seattle and Lake Ballinger (formerly Lake McAleer) a distance of approximately 14 miles. Five additional miles will be opened to the public at the end of the present month, which will put the lines past Hall's Lake. It is expected that by Jan. 1, 1908, the system will enter Everett, and when all the work is completed there will be 32 miles of track. The company operates twenty-five freight cars, one electric locomotive and fourteen passenger cars. The road is equipped with 60-lb. T-rails; the trolley wire used is 00, and the single feeder is a cable of 500,000 circ. mil capacity. The country through which the line runs is teeming with business and the company finds the hauling of ties, lumber, etc., very profitable; in fact the management states that at the present time it is impossible to procure sufficient freight cars to take care of the business.



ONE OF THE SEATTLE-EVERETT INTERURBAN RAILWAY COMPANY'S NEW CARS

Four of the passenger cars were recently purchased from the American Car Company and a specimen is shown in the accompanying cut.

The first thing to catch the eye on these new cars is the dead panel at each end. This lends additional strength to the construction and also gives a very pleasing appearance to the interiors as the panels on the inside are tastefully decorated. The same idea is carried out in a number of the Brill cars which are now operating on the Seattle Electric Company's lines in Seattle. The interior finish is cherry; ceilings of bird's-eye maple. The gongs, signal bells, seats, etc., are all of the builder's make. The trucks are of No. 27 G-1 type with 4-ft. 6-in. wheel base; four 40-hp motors are used per car. The chief dimensions are: Length over the end panels, 30 ft.; over the crown pieces, 40 ft.; width over the sills, 8 ft. 4½ ins.; height from the track to the under side of the sills, 32 13/16 ins.; from the under side of the sills over the trolley board, 9 ft. 3¼ ins.; the bottom framing consists of 6-in. I-beams with 3¾-in. x 7¾-in. fillings; center sills, 4¼ ins. x 4 1/16 ins.; end sills, 5½ ins. x 7¾ ins.

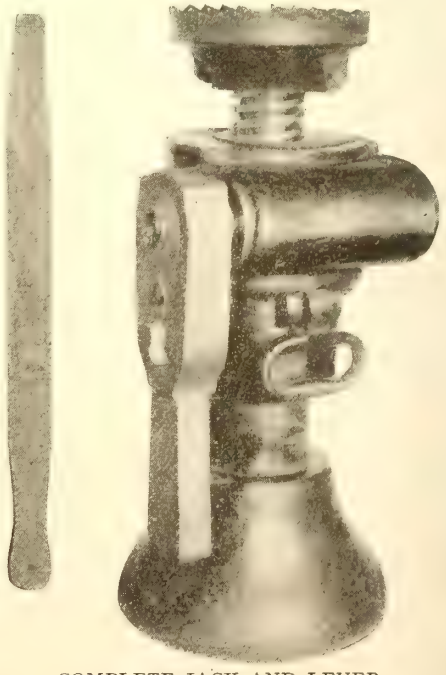


SECTION OF JACK

JACKS FOR RAILWAY SERVICE

The Security Register & Manufacturing Company, of New York and St. Louis, has acquired all the rights to make and sell the Roth high-pressure one-man jack. This device has been in use for several years, but hitherto has not been actively placed before the electric railway public.

Some idea of the work that can be done with this type appears from a United States Navy trial with a 20-ton Roth screw jack where one man raised 27.34 tons with an 8-in. lever, and 41.73 tons with an 18-in. lever. It is asserted that even 62½ tons have been raised with the 20-ton jack without injury. The wheel and screw are said to fit with such accuracy that the jack will not sink even one-thousandth of an inch under load. The ball bearings are of steel of such quality that in the navy test mentioned, the bearings, though embedded ⅛ in. to 3/16 in. deep in a lathe by 40,410 lbs. pressure remained uninjured. As the jack is not of the hydraulic type it has no pump, valves, stuffing boxes, freezing liquids or other trouble-making complications.



COMPLETE JACK AND LEVER

FINANCIAL INTELLIGENCE

The Money Market

WALL STREET July 17, 1907.

Monetary conditions have improved considerably during the past week. As a result of the payments of the special government deposits by the banks on July 10, rates for both call and time money hardened decidedly, but subsequently there was a relaxation in the asking charges for all classes of accommodation. From 8 per cent, the high rate of the week, call money declined to below 3 per cent, the average rate for the week being about 5 per cent. Time money likewise developed comparative ease, rates declining a shade below those heretofore quoted. By far the most important developments in the situation was the heavy gains in cash reported by the banks on last Saturday. The preliminary estimates of the week's currency movements indicated a very heavy loss in the cash holdings of the local institutions, but instead of this the bank statement published a week ago revealed an increase in cash of more than $4,000,000. Since that time the banks have gained upwards of $2,600,000, and it is expected that the cash holdings of the local institutions will be further augmented by the receipts of currency from the interior, and by the heavy government disbursements on account of pension and other payments. Another factor working in favor of this center is the shipments of gold from the Klondike region. Shipments have already begun, and the receipts of the yellow metal from this source are expected to be fully as large as those in the preceding years. The demand for money for stock market purposes has been comparatively light, and especially so for time money, owing to the high asking rates prevailing. During the greater part of the week six months' accommodations commanded the full legal rate of 6 per cent, which, together with the brokers' commission of 1-32 of 1 per cent, made the rate for such accommodations too high to induce borrowers to take on any considerable amount of money for that maturity. The banks, however, were not inclined to offer with any degree of freedom. The demand from corporations continues, the most important development in this connection being the decision of the "Soo" line to double its capital stock from $21,000,000 to $42,000,000. The new stock will be divided into $7,000,000 preferred and $14,000,000 common, and will be offered to stockholders at par. The foreign exchange market rules well below the gold export point, and it is expected that the outflow of the yellow metal has been arrested, at least for the present. The managers of the Union Pacific bond syndicate have sent notices to its members calling upon them to pay the initial instalment of 20 per cent of the amount of their subscriptions. This instalment is payable on July 22, and calls for upwards of $14,000,000.

The bank statement published on last Saturday made an extremely favorable exhibit. Instead of an expected decrease of $6,000,000 in cash, the bank showed an actual gain in that item of $4,075,700. Loans decreased $10,888,400, and deposits decreased $7,780,400. The reserve required was $1,945 100 less than in the preceding week, which, added to the $4,075,700 increase in cash, augmented the surplus reserve by $6,020,800. The surplus now stands at $6,877,050, as against $12,830,800 in the corresponding week of last year, $19,523,250 in 1905, $44,563,350 in 1904, $13,278,475 in 1903, $15,709,275 in 1902, $12,809,375 in 1901 and $19,960,125 in 1900.

The Stock Market

There was a marked falling off in the volume of business on the Stock Exchange during the week, and prices continued to move with more or less irregularity. Speculation was again confined almost entirely to the professional element. In some quarters it was reported that investors were more disposed to purchase the standard stock and bond issues at the prevailing level of prices, but apart from this buying there was nothing to indicate that outsiders were inclined to enter the market to any appreciable extent. During the first half of the week the general trend of values was downward, prices for practically all of the active leaders falling one to three points. The selling was due in part to the sharp rise in both call and time money rates, resulting from the repayment by the banks of the special government deposits, the asking rate for six months' accommodations rising to the full legal charge of 6 per cent. In addition, the small subscription to the new bond issues was used to depress prices, but the importance of this factor was greatly exaggerated. The puzzling situation in the copper metal market received considerable attention. At the close of last week the announcement was made that the large producers had ordered a sharp reduction in prices of practically all grades of copper metal, with a view to breaking the deadlock that had existed for months between producers and consumers. It was the opinion of those well versed in the market situation that the reduction in prices would result in the placing of large orders for the metal by consumers, but, contrary to general expectations, the producers have sold very little copper for domestic use. Sales for foreign account have been fairly large, owing to the scarcity of stocks abroad, but so far as the domestic consumers are concerned, there is a disposition to await a further lowering in prices before placing orders. The attitude of the producers, however, is against any further reduction in prices at this time, but in view of the sharp reductions in copper metal in the London market, and reported sales at below the prices fixed a week ago in the local market, some interesting developments may be looked for in the near future. At the close of the week sentiment was more cheerful and the closing market was strong. The improvement in the money situation resulting in lower rates, doubtless was largely responsible for the better feeling existing at the end of the week. Instead of an indicated loss in cash of nearly $6,000,000, the banks showed a gain in that item of more than $4,000,000, and since that time the cash holdings of the Clearing House institutions were materially augmented by the refunding of government bonds and pension payments. Sterling exchange rules well below the gold export point, and the monetary situation may be said to be more encouraging than for some time past. Other influences having a bearing upon the values at the close, were the continued heavy movement of freight reported by the traffic managers of large railway systems, substantial gains in railway gross earnings and favorable weather in grain States, the latter being reflected in lower prices for wheat.

Philadelphia

The trading in the local traction issues has been extremely light during the week, but prices show very little change from those prevailing at the close of last week. In the early dealings, Philadelphia Rapid Transit yielded a point under what looked like speculative liquidation, but in the subsequent trading there was a full recovery to 23½. Philadelphia Traction was steady at 94½; and Union Traction lost ½ from 58½ to 58. Philadelphia Company common sold at 41 and 40½ and the preferred stock changed hands at 44¾. American Railway held firm at 49. Fairmount Park Transportation was traded in at 12¾, and United Companies of New Jersey sold at 244.

Chicago

The most important development in the Chicago traction situation was the publication of the plan for the reorganization of the Chicago Union Traction Company. Its successor, the Chicago Railways Company, will have $100,000 capital stock, which will not be exchanged for securities of the Chicago Union Traction Company and underlying concerns, but will be held in trust and will receive dividends which will be disbursed by the new company upon certificates of participation. These certificates will be offered in exchange for stocks of the North and West Chicago Street Railway Companies and the Chicago Union Traction Company. The plan involves a scaling down of all classes of the old stock. Notes amounting to $10,000,000 will be issued to take the Chicago Union Traction Company out of the hands of the receivers and the bonds for rehabilitation purposes will also be issued by the new company. Both of these classes of securities will rank ahead of the participation certificates.

Other Traction Securities

Trading in the local traction issues was extremely quiet, but prices for nearly all of the shares ruled somewhat higher. North Chicago, for instance, advanced from 42 to 45, while West Chicago stock sold at 34 and 34¼. Northwestern Elevated common advanced ½ to 22, and South Side Elevated sold at 82½.

Transactions at Baltimore were confined to small amounts, as follows: United Railway 4s, at 85⅜ and 85½; United Railway refunding 5s, at 80; Baltimore Traction 5s, at 105⅝; Norfolk Street Railway 5s, at 102⅝; Norfolk Railway & Light 5s, at 95; Richmond Traction 5s, at 104¼, and United Railway incomes at 52¼. In the Boston market Massachusetts Electric common advanced from 16 to 17, but the preferred declined from 57 to 56. Boston Elevated sold at 135½, and Boston & Worcester common crossed 23⅞ and 23¾. West End common sold at 86 and the preferred at 100.

On Monday a total of 385 shares of Cleveland Electric changed hands within a short time. All the shares for immediate delivery were purchased at 47, but 150 shares were sold at 49, buyer sixty days. After this owners asked 50. Little trading was done in other traction securities, and the figures stand about where they did a week ago. Aurora, Elgin & Chicago was quoted at 33, but no bid above 30 was made. Preferred stock of this company stands at 72 bid and 77 asked. Northern Ohio Traction & Light held to 25 bid and 26 asked.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week.

	July 10	July 17
American Railways	48¼	48½
Boston Elevated	135	135
Brooklyn Rapid Transit	57¼	57½
Chicago City	155	150
Chicago Union Traction (common)	3	3
Chicago Union Traction (preferred)	16	15
Cleveland Electric	46¼	45¼
Consolidated Traction of New Jersey	72½	72½
Detroit United	66	67¼
Interborough-Metropolitan	17	16¼
Interborough-Metropolitan (preferred)	45⅞	45
International Traction (common)	—	45
International Traction (preferred), 4s	—	67
Manhattan Railway	—	132
Massachusetts Elec. Cos. (common)	16	16½
Massachusetts Elec. Cos. (preferred)	a58	56
Metropolitan Elevated, Chicago (common)	23	23
Metropolitan Elevated, Chicago (preferred)	a64½	64
Metropolitan Street	a91	a91
North American	69	68¾
North Jersey Street Railway	40	40
Philadelphia Company (common)	41	40
Philadelphia Rapid Transit	23¼	23¼
Philadelphia Traction	93¾	—
Public Service Corporation certificates	66	—
Public Service Corporation 5 per cent notes	—	—
South Side Elevated (Chicago)	82	82
Third Avenue	105	104
Twin City, Minneapolis (common)	94	92½
Union Traction (Philadelphia)	58¼	58

a Asked.

Metals

According to the "Iron Age" the pig iron markets are lifeless. The steel works and mills are still very well supplied with work, but new tonnage is not and cannot be well expected to come freely at this season of the year. At some of the independent tin plate mills some of the tin house labor has gone out, but the matter is of little consequence.

The copper market has weakened again. Electrolytic sold at 21 cents in New York, and it has since been offered at lower figures. Twenty cents for electrolytic is freely talked about.

LAKE SHORE IMPROVEMENTS NEARING COMPLETION

With the exception of an additional 2000-kw generator in the power house at Fremont, the Lake Shore Electric Railway Company has practically completed all the improvements begun eighteen months ago when E. W. Moore became president. The Sandusky-Fremont line has just been put into operation, and has been permanently financed. The main line has been double tracked between Cleveland and Lorain and a new 2000-kw unit has been installed in the power station at Avon Beach. Improvements have been made on the local lines at Lorain and new equipment has been purchased. It is believed that the road now has sufficient power and equipment to operate properly for the next five years. The money for the improvements, with the exception of that for the Sandusky-Fremont line, has been secured by loan and will be added to the floating debt. As soon as the money market clears up this debt will all be paid by the issue of bonds. At present nothing further in the way of extension will be made, but later on the line will probably be extended to connect with the Western Ohio and with the Columbus lines.

THE SAN FRANCISCO SITUATION

The strike among the employes of the United Railroads of San Francisco is practically over and the sympathies of the better class of citizens are now solidly in favor of the Railway Company. Although there is still some disturbance it is mostly in the poorer districts of the city. The strike has been a costly one for San Francisco and appears to have been engineered more for political reasons than from economic causes. Moreover, the situation has been complicated by attempts of outside parties to utilize the difficulties of the company to secure franchises for an opposition system.

According to Patrick Calhoun, president of the United Railroads of San Francisco, who has recently outlined the history of the trouble and defined his views on trade unionism, the men at the time of the strike were receiving 50 per cent higher wages than at the time that the United Railroads took over the street railways in March, 1902. The rate of wages on the Market Street line was then 22 cents an hour, and on some of the other lines it was 21 cents. Soon after the United Railroads was organized, the carmen struck for a flat rate of 25 cents an hour. That demand was acceded to. A year later they again demanded an increase, coupling their demand with a threat to strike. The question was arbitrated by W. D. Mahon and Mr. Calhoun, with Oscar Strauss, of New York, now Secretary of Commerce and Labor, as the third arbitrator. The arbitration board fixed the scale as follows: 25 cents per hour for the first year, 26¼ for the second, and 27½ for the third. On May 1, 1905, a two years' contract was entered into by which the United Railroads agreed to pay this rate of wages for the two ensuing years. It was this solemn contract which the carmen violated in August, 1906. Nevertheless, the company consented again to arbitrate the question of wages and hours, after the men returned to work. The award made by the arbitration board, of which Mr. Chief Justice Beatty was chairman, fixed the rate at 31, 32 and 33 cents an hour for the first, second and third years respectively. In other words, the Carmen's Union struck once within a year in flagrant violation of its solemn written contract, and it struck twice within a year in reckless disregard of its own general laws, and having failed once to acquiesce in the decision of an arbitration board by extending for a year the high rate fixed by the award, it puts itself forever beyond the pale of recognition.

In defining his views on trade unions Mr. Calhoun says: "I am not opposed to unionism, but I am opposed to the principle of force in unionism. The labor unions in San Francisco have by their excesses carried prices to such a height that they will be destructive unless men of courage are willing to check them. Unions must not be permitted to prevent free men from earning their daily bread unless they belong to a union. The United Railroads is by far the largest property owner in San Francisco, and I am one of the largest property owners because I am one of the largest owners of the stock of the company. I would rather see my property sink into the sea than surrender to the dictation of any set of men who said to me that even the humblest man, if he was a self-respecting American citizen seeking employment in my company, should not be allowed to work. The fight my company is making is vital to the prosperity of the city. If the United Railroads cannot operate its cars free from the dictation of anybody, then there is no such thing in San Francisco as property rights or civil liberty."

PLAN OF REORGANIZATION OF CHICAGO COMPANY APPROVED

The Chicago traction plan has been announced by George W. Wickersham and L. C. Krauthoff, the committee and counsel having the matter in charge. A hearing on the plan has been called for July 29, and, in pursuance with the provisions of the traction ordinances, the discharge of the receivers of the companies and the turning over of their properties and operation to the Chicago Railways Company will now be asked for. It is expected that the Chicago Railways Company will be in charge and the plan in working order within a short time.

The Chicago Railways Company has authorized or will authorize the creation and issue of the following securities:

1. A first mortgage to secure an issue of 25-year 5 per cent gold bonds out of which to provide the funds required to enable the Railways Co. from time to time to comply with the requirements of the ordinance concerning rehabilitation, additions, etc. As the amounts which will be needed for these purposes cannot be fixed with exactness, the amount is left without limitation, except as to the purposes for which such bonds may lawfully be authenticated under the mortgage.

2. A consolidated or second mortgage to secure an issue of 20-year 4 per cent bonds aggregating $32,800,000, of which $15,000,000 shall be of series A, having priority in all respects over bonds of series B, and $17,800,000 shall be of series B.

3. An issue of 20-year 4 per cent sinking fund income debentures of $5,000,000.

4. An issue of 5-year 6 per cent collateral notes redeemable at par on any interest date three years or more after date not to exceed $4,500,000.

5. An issue of 10-year 5 per cent collateral notes redeemable at par on any interest date three years or more after date, interest payable only if earned after payment of all prior fixed charges, not to exceed in the aggregate $5,000,000.

6. The stockholders of the Railways Co. will make the capital stock the subject of an issue of income participation certificates as follows: A. Series A, entitled to priority of annual income to the extent, if earned, of 8 per cent or $8 per share of the nominal value of $100, and as to principal if any over series B and C, amounting to $12,250,000. B. Series B, entitled subject to the prior rights of series A, and in priority over series C, and to the extent, if earned, of 8 per cent, or $8 per share of the nominal value of $100, and as to the principal, if any, amounting to $6,000,000. C. Series C, subject to the prior rights of series A and series B, amounting to $5,000,000.

7. Said first mortgage and consolidated mortgage and the bonds to be issued thereunder and said debentures and collateral notes shall be in such form as the committee and counsel with the approval of the board of directors of the Railways Co. may prescribe or consent to.

It is proposed that the cash requirements of the situation shall be met and supplied by means of two syndicates. The first is to be a rehabilitation syndicate to furnish $12,000,000 in cash, which sum shall be set apart and solely applied to the rehabilitation, etc. The second is to be an organization syndicate, which is to furnish about $4,000,000 in cash, which is to be set apart and solely applied to the following purposes: for paying or acquiring receivers' certificates, amounting to $400,000; for other certificates amounting to $250,000; for paying or acquiring car trust and equipment obligations issued amounting to $760,000; for paying or acquiring notes secured by real estate mortgages; and for cash to be paid into the treasury of the Railways Company on demand of its board of directors or of the committee for the discharge of organization legal and other expenses, and for other purposes amounting to $2,141,000.

The ten-year five per cent collateral notes are to be used in payment of the indebtedness of West Chicago Street Railroad, North Chicago Street Railroad Company, and Chicago Union Traction Company.

The various purposes to or for which the securities of the Railways Company are to be distributed and the amount of such securities respectively apportioned thereto are as follows:

1. For the $500,000 outstanding North Chicago City Railway 4 per cent first mortgage bonds, $500,000, or 100 per cent, consolidated mortgage 4 per cent bonds, series A.

2. For the $2,500,000 outstanding North Chicago City Railway Co. second mortgage bonds, $2,500,000, or 100 per cent, consolidated mortgage 4 per cent bonds series A.

3. For the $4,012,000 outstanding first mortgage bonds of the Chicago West Division Railway, $4,012,000, or 100 per cent, consolidated mortgage 4 per cent bonds, series A.

4. For the $3,171,000 outstanding North Chicago Street Railroad Co. 5 per cent mortgage bonds, $634,200, or 20 per cent of consolidated mortgage 4 per cent bonds, series A, and $2,536,800, or 80 per cent of consolidated mortgage 4 per cent bonds, series B.

5. For the $1,614,000 outstanding North Chicago Street Railway Co. 4½ per cent refunding mortgage bonds, $1,614,000, or 100 per cent of consolidated mortgage 4 per cent bonds, series B.

6. For the $3,683,000 forty-year first mortgage bonds of the West Chicago Street Railroad Co. $736,600, or 20 per cent of the consolidated mortgage 4 per cent bonds, series A, and $2,946,400, or 80 per cent of the consolidated mortgage 4 per cent bonds, series B.

7. For the $6,317,000 forty-year consolidated mortgage bonds of the West Chicago Street Railroad, $6,317,000, or 100 per cent of the consolidated mortgage 4 per cent bonds, series B.

8. For the $497,000 outstanding certificates of indebtedness of the West Chicago Street Railroad, $298,200 or 60 per cent of the consolidated mortgage 4 per cent bonds, series B, and $198,800, or 40 per cent of the 4 per cent sinking fund debentures.

9. For the $1,306,000 outstanding Chicago Passenger Railway Co. consolidated mortgage bonds, $653,000, or 50 per cent of the consolidated mortgage 4 per cent bonds, series B, and $653,000, or 50 per cent of the 4 per cent sinking fund debentures.

10. For the $1,500,000 outstanding West Chicago Street Railroad Tunnel Co. 20-year first mortgage bonds, $1,500,000, or 100 per cent of the consolidated mortgage 4 per cent bonds, series B.

11. For the outstanding 2,499 shares of the capital stock of the North Chicago City Railway Co., $499,800, or 200 per cent, of the consolidated mortgage 4 per cent bonds, series B.

12. For the outstanding 6,246 shares of the Chicago West Division Railway Co., $1,249,200, or 200 per cent, of the consolidated mortgage 4 per cent bonds, series B.

13. For the outstanding 6,103 shares of the capital stock of the Chicago Passenger Railway Co., $152,575, or 25 per cent, of the 4 per cent sinking fund debentures.

14. For the outstanding 59,200 shares of the North Chicago Street Railroad Co., $5,920,000, or 100 per cent of the participation certificates of series A.

15. For the outstanding 99,890 shares of the West Chicago Street Railroad Co. $6,243,125, or 62½ per cent, of the participation certificates of series A.

16. For the 120,000 outstanding shares of the preferred stock of the Chicago Union Traction Co., $6,000,000, or 50 per cent, of the participation certificates of series B.

17. For the 200,000 outstanding shares of the common stock of the Chicago Union Traction Co., $5,000,000, or 25 per cent, of the participation certificates of series C.

18. Deposited as collateral security to secure the Railways Co.'s 5-year 6 per cent collateral notes and subject thereto, charged under the Railways Co.'s 10-year 5 per cent collateral notes, $6,617,200 of the consolidated mortgage 4 per cent consolidated bonds, series A, and $150,000 of the consolidated mortgage 4 per cent bonds, series B.

19. Deposited as collateral security to secure the Railways Co.'s 10-year 5 per cent collateral notes, $35,600, of the consolidated mortgage 4 per cent bonds, series B, and $3,995,625 of the 4 per cent sinking fund debentures.

The number of shares given above under the numbers 11, 12, 13, 14 and 15, are those held by persons other than the various companies.

The securities or appropriate evidences thereof of the Railways Company allotted in respect of the shares of the stocks of the North Chicago City Railway, the Chicago West Division Railway, the North Chicago Street Railroad, the West Chicago Street Railroad, and the Chicago Union Traction, shall, all other things having been tended to, be delivered to the Chicago Title & Trust Company as trustee for distribution and delivery. All deposits and exchanges of securities shall be made as of Aug. 1, 1907.

The first mortgage to secure the bonds to be delivered to the rehabilitation syndicate for furnishing $12,000,000, is required by the Railways Company for rehabilitation, equipment, and other construction work shall be entitled to all the rights, priorities, and first liens mentioned in sections 7 and 20 of the ordinance.

Any and all payments of interest, dividends, or other sums on account of the principal, or as interest or dividends upon any of the deposited securities which shall be or become payable on and after Aug. 1, 1907, shall be paid to and collected by the depository, and upon receipt thereof the depositary shall pay and dispose of said amounts with the written approval or upon the written direction of the committee.

The City Council has extended the time for the acceptance of the street railway ordinance by the Chicago Union Traction Company From July 26 to Sept. 14, on the request of Judge Grosscup. The judge in his communication, which was addressed to Mayor Busse, stated that all the stocks necessary had been deposited with the Chicago Title & Trust Company, but that it will still be necessary for the circuit court to hear a petition asking that the property in his hands shall be turned

over to the Chicago Railways Company, and there was danger that this could not be done before July 26. The cause of the delay is the disagreement still existing among the stockholders of the companies under the control of the Chicago Union Traction Company. No action has been taken with respect to disposing of the unsubscribed balance of the $26,000,000 issue, which was offered to stockholders at par. It is understood, however, that several offers have been received by the company for a part or all of the bonds. Of the practically $9,000,000 subscriptions received thus far it is understood that $8,000,000 came from abroad.

INTERURBAN RAILROADS NOT AN ADDITIONAL SERVITUDE—ONLY SPECIAL DAMAGES MAY BE RECOVERED

The Indiana Supreme Court on June 26 rendered an important decision in the case of Lottie Kinsey vs. The Union Traction Company and other traction companies, involving the right of such companies to use the streets to operate heavy interurban cars. The complaint states that the original franchises granted upon College Avenue, Indianapolis, on which the complainant is a property owner, were for light passenger cars giving a local service, that since that time the company has reconstructed its track with heavy T-rails, that the cars operated over it, both freight and express, are fully as heavy as those of the ordinary steam roads and of the same pattern and shape; that these cars shakes the plaintiff's house and has caused the plastering and ceiling to crack, and that the noise and vibration disturb the rest and break the sleep of herself and family, etc. Other allegations declare that by reason of the large size of the cars and the noise made by them in running over the road, horses hitched in front of her dwelling have become frightened and have broken away; that the cars stir up "whirlwinds of dust," which are borne into her house, damage furniture and carpets and cause much additional labor to keep the house in order. This had reduced the value of the real estate at least $5,000. The plaintiff also alleged that she never consented to the use of the street for the operation of any interurban cars; that they have not paid for such use, and that they do not claim to have any right to such use other than those acquired by contracts with the local company and the city, to none of which she was a party or gave her consent. The complaint insisted that the use of College Avenue in front of her premises constituted an additional servitude and easement upon her property which neither the public nor the city of Indianapolis, nor any of the defendant companies was entitled to use without compensation for which she demanded judgment.

The court was divided, two for and three against the idea that special damage was shown. The opinion of Judge Jordan, which was concurred in by Judge Montgomery, was that the purposes, uses, equipments and mode of operation of the interurban roads are materially different from those of the urban and street railway, except that the former employ electricity as a motive power. The interurban road is not a street railway in fact, nor is it operated for street purposes, or to promote the utility of the public streets of the city of Indianapolis. It is absolutely an independent railway, engaged in a general passenger and freight traffic between distant cities and communities, and as a result of its operation the usual discomfort and annoyance due to the operation of the ordinary steam roads are present, viz., loud noises, dirt and dust, shaking or vibrations of the ground, and other annoyances or detriments which affect the owners of abutting property situated on the streets over which the road is operated. The opinion says: "Perhaps these and the perils of the street do not constitute a burden to the same degree as that imposed by a steam road, but the question is, is it a burden upon the public street in addition to that to which it was originally dedicated or appropriated? Surely this road so nearly approaches the ordinary steam commercial railroad that a dividing line between it and the latter cannot consistently with reason be drawn." While it may be conceded that the use of the public streets by appellee company for the operation of its railway is quite a matter of economy in its favor, still, such use, as shown in this case, is a diversion from and incompatible with the public use to which the streets were originally dedicated and appropriated, and is, therefore, an additional burden upon the fee of the abutting owner, for which the latter is entitled to compensation.

The cases cited, notably those of the courts of California, apparently adhere to the view that no railroad constitutes an added burden. The courts of Maine, Oregon and Kentucky appear, to an extent, at least, to entertain this liberal and antiquated view. This doctrine, as the decisions show, has no sanction in this State and under the circumstances the decisions of these latter courts cannot be regarded or accepted as influential authorities in the determination of the question presented in this appeal.

The majority of the court, however, have reached the conclusion, and so hold, that under the facts averred in the complaint and the law applicable thereto, appellee's railroad does not constitute an additional burden or servitude upon any of the public streets of Indianapolis; that the complaint states a cause of action in favor of appellant only for the recovery of the special damages which she has sustained, as shown by the facts alleged, and for this reason it is held by the majority that the lower court erred in sustaining the demurrer to her complaint. The judgment is, therefore, reversed and cause remanded, with instructions to the lower court to overrule the demurrer to the complaint and for further proceedings not inconsistent with the holding of the majority of this court.

JUDGE HADLEY'S OPINION

In Judge Hadley's separate opinion, he said:

As the uses of the village street are expected to expand to meet the exigencies of the increasing public, new and improved modes are expected to respond to the new requirements. It was the application of these principles that brought the telephone poles and wires into the curb line of the streets, and none will gainsay that the use of those wires in the city of Indianapolis dispenses with thousands of passages through the streets every day. It likewise brought the street car confined to a fixed track in the middle of the street, first 14 ft. long, propelled by horses and capable of carrying a dozen passengers; then about 22 ft. long, propelled by electricity, with capacity for twenty-five passengers, and finally cars 44 ft. long and capable of carrying 125 passengers.

Then what may a street railroad company, organized to operate a street railroad within the city of Indianapolis rightfully do within the limits of its charter? It may adopt any means for the transportation of persons and property not harmful to the abutter nor inconsistent with any proper use of the highway, and useful and efficient in facilitating the passing and repassing of persons and freight through the streets.

JUDGE GILLETT'S OPINION

Judge Gillett, in his separate opinion, said:

The cars of an interurban road, when operated in a city, do not materially interfere with the abutter, nor are they antagonistic to the rights of persons upon the street, and as they materially augment the convenience of the individuals (as distinguished from the carrier) who possess the easement of travel thereon, such a line should be particularly distinguished from that of a steam railroad, the presence of which upon a city street is for the sole convenience of the carrier, besides being largely subversive of the travel thereon, and, for reasons which have often been pointed out, extraordinarily burdensome to the abutter. With scarcely an exception, it is held by the courts of the various States that a local surface electric railroad is not an additional burden. (Note to 2 Am. and Eng. Anno. Cases, 530, 535.) With the fact admitted that the streets of the State belong to the whole people, it seems to me that it must also be held that an interurban line is not an additional burden, since it is in aid of what is proper street travel and traffic. Granting that the country is as much entitled to the use of the city street as the people of the municipality, and bearing in mind that there is no substantial difference in burden between the local and the interurban car, I perceive no ground in principle for a distinction between them. * * *

The mere fact that in the case before us the use involves the carriage of property (as in the Mordhurst case) affords no just ground for holding that thereby an additional burden is created, for the transportation of property is a primary use of a public way. I may further add that the suggestion that the companies are operating commercial railways appears to me as affording no ground in principle for holding that the abutter is entitled to compensation, for all railways, urban or otherwise, if conducted for private gain, are commercial railways. The use of this term may be justified in referring to a class of railways which occupy the street solely for their own convenience, but if a railway is upon the street for the convenience of individuals who have occasion to use it, it will at once be perceived that so far as its being commercial is concerned, its presence there can be abundantly justified, as in the case of an ordinary street railway.

Judge Monks concurred in the opinion of Judge Gillett, and by so doing constituted the majority of the court.

DECISION OF RAILROAD COMMISSION IN MILWAUKEE CASE

The Wisconsin Railroad Commission on July 12 rendered two reports on the complaints recently brought by the city attorney against the Milwaukee Electric Railway & Light Company and the Milwaukee Heat, Light & Traction Company. In its findings the Commission recommends that the Milwaukee Common Council co-operate with the street railway company in its effort to better the local car service by granting franchise privileges which President John I. Beggs has repeatedly urged are needed to round out the local facilities.

The original complaint alleged high fares and inadequate service on certain lines, demanded air brakes on all city cars, the cessation of the operation of freight and construction trains, the employment of flagmen at certain steam railroad crossings and a better condition of the cars.

Hearings were held in Milwaukee on Feb. 20, 21, 26 and 27, and March 19, 20 and 21, and arguments were made at Madison on April 23. Nearly 100 witnesses were heard and nearly 2,000 pages of testimony were taken. Among those who testified at the hearing were Prof. W. D. Pence, the Commission's engineer; George Weston, its expert, and Bion J. Arnold, of Chicago, all of whom endorsed the company's position and agreed with Mr. Beggs that the Common Council grant the franchises which he believes are necessary to unify the Milwaukee street railway system.

In discussing fares, says the Commission in its report: "By common consent the question of the reasonableness of the rates of fare was left in abeyance until after the valuation of the property of the company which is now in progress shall have been completed. The burden of the testimony offered on behalf of the complainant was directed toward the matter of service during so-called rush hours." The Commission then discusses the charges of overcrowding made on the Eighth Street line and cannot find them substantiated. At other points better policing would make possible the operation of a larger number of cars. The report then recommends the cleaning of cars once a day and the use of air brakes.

This latter point, the report says, was more stubbornly protested than any other. In reviewing the testimony on brakes the Commission says that its import was generally identical with the deposition of George Weston, the independent expert in its employ, who admitted that "for ordinary scheduled stops there is no question but that the hand brake is just as efficient as the air brake," but that "where it is necessary to make emergency stops and in congested territories particularly, an air brake is superior to a hand brake."

"Yet there is no escape from the conclusion that air brakes, as a matter of fact, do make it possible to prevent accidents which it might not be possible to avoid with hand brakes," says the Commission. "And if a single life can be saved through the use of the air brake, who will say that it should not be done. Taking into careful consideration all the testimony upon the question of brakes, we are convinced that the adoption of air brakes is in the direction of progress. We do not believe that the facts in this case warrant an order from this Commission compelling the railway company to equip all its cars with air brakes, but we do believe that it is our duty to prescribe the use of air brakes or other power brakes on all double-truck cars which may hereafter be constructed or acquired by the company. We also recommend that whenever it is practicable in reconstructing cars now in use to add the power brake equipment, that it be done."

The Commission finds that the company does not operate its utility cars for other than its own convenience and not as a common carrier, and that it has the right to transport its materials and supplies in that manner. While these cars are being operated at night, it says they should be operated in such a manner as to interfere least with the transportation of passengers and with the comfort of people living near lines over which such are being operated."

The Commission sides with the company in maintaining that sending a conductor forward to see that the Kinnickinnic Avenue crossing is clear is much safer than placing a flagman at the crossing.

Considerable space is taken to discuss the question of extension plans, and the report concludes as follows: "We respectfully suggest, therefore, that the city authorities of Milwaukee take whatever action may be necessary for the immediate execution of the plans of construction and operation recommended above, and we recommend that the street railway company likewise proceed to the execution of these plans as rapidly as the action of the city authorities may permit. The execution of these plans we believe absolutely necessary in order that the citizens of Milwaukee may secure relief from present conditions and to give all the citizens of the city adequate service in the future."

The second report rendered by the Commission was in the case of Charles Gillett against the Milwaukee Electric Railway & Light Company and the Milwaukee Light, Heat & Traction Company, and related particularly to the service to Wauwatosa. The Commission finds that the service has been greatly improved and that it was adequate during last February and March. It orders that this service be continued, but on the question of a reduction of fare it does not order any change.

HANDLING EXPRESS ON NEW YORK, NEW HAVEN & HARTFORD'S ELECTRIC LINES

President Lucius S. Storrs, of the newly incorporated Electric Express Company, which has just taken charge of all express and freight business on the trolley lines controlled by the New York, New Haven & Hartford Railroad interests in Massachusetts, has outlined for the STREET RAILWAY JOURNAL how the company came to be formed and how it plans to do business.

"It was really the experience with carrying parcels and express matter on our Berkshire lines that suggested the new company," said Mr. Storrs. "The Berkshire Street Railway had trolley express rights when we acquired it, and it was doing some business carrying light matter on the regular passenger cars. The service was not satisfactory, however, and it was a source of bother to the operating department.

"The new company will do an express business on the trolley lines in just the same way that the American or any other big express company takes charge of that class of business on the steam railroads. The Electric Express Company will make contracts for the right to have its agents and goods carried by the cars of the street railway companies, and then will take charge of all freight and express matter. This will save a lot of trouble in handling that class of business, for it will put the responsibility under one head, and will relieve the operating department of a good many things that are really foreign to its sphere of duty.

"The officers of the Electric Express Company are the same as those of the New England Investment & Securities Company; but the express company has a manager of its own, who will have the actual direction of express business. The manager is C. V. Wood. Mr. Wood started the first express cars in Springfield this week. He will continue in Springfield alone until he gets the business well established there. Then he will take up Worcester and its surrounding district, and continue until the new service is established in that territory. Local rights have been asked for there. Similar work will later be done in the Berkshire district. There is no need to hurry. The development will be carried on gradually.

"We intend to have special freight and express stations for the new company. One has already been provided for Springfield by some slight remodeling of the old car barn on Bond Street. This is just off Main Street, in the business district, and was already connected by spur tracks with the principal track system of the city. We have two trolley express cars, double truck, weighing about twenty tons. These are similar to the double-truck passenger box cars, except that they have two sliding doors in each side and are practically without windows. Each car starts out by making two trips daily, one running from Springfield to Westfield and the other from Springfield to Palmer. We shall have express stations at these points before long. At Westfield it will be necessary for us to put up a small new building. At Palmer we expect to be able to make use of an old storehouse. Special track connections will have to be provided at each terminus."

Mr. Storrs, president of the Electric Express Company, is vice-president of the Investment & Securities Company, which is the New Haven's holding company for Massachusetts trolley companies. James T. Harmer as comptroller, and Leverett Candee as treasurer, serve for both the Securities Company and the Express Company. President C. S. Mellen, of the New Haven, is president of the Securities Company.

CIRCUIT COURT DECIDES IN FAVOR OF CLEVELAND ELECTRIC RAILWAY

Through the decision of the Circuit Court Friday, July 12, holding that the Low Fare Railway Company has no rights on Central Avenue and Quincy Street, the Cleveland Electric Railway Company has gained one more important point in its fight against Mayor Johnson and the city administration in general. This is the Isom injunction case, decided by Judge Phillips, of the Common Pleas Court, against the Low Fare Company some time ago, and every point he made is sustained by the Circuit Court. The questions entering into the case are as to whether consents of owners of abutting property are necessary and whether the consents secured by the Forest City Railway Company and used in securing a franchise on these streets could also be used by the Low Fare Railway Company.

The court held that consents are necessary and that this has been established by a number of decisions of the Supreme Court. Several of these decisions were mentioned in the finding. It was also held that the law requiring consents of property owners is valid and necessary to prevent the usurpation of the rights of the people. The objection that the law does not affect the people generally was met with the statement that, to be valid, a law does not necessarily have to do this, but that it does affect all alike who come under its provisions.

Consents used in securing the franchise of the Forest City Railway Company cannot be used for the Low Fare Company. The court presumed that the Forest City Railway Company's franchise is valid, and said that while it holds the rights, they cannot be granted to another. Among other things the court said: "A street railway franchise carved out of the severeignty of a State is not a thing to be played with, in the courts or out of them. * * * We are of the opinion that the municipality was without authority to grant the Low Fare Company franchise, with or without consents. It undertakes to grant the Low Fare Company not only the right to use the tracks of the Forest City Company, but to pre-empt the right of way to the exclusion of the Forest City Company's tracks. The Forest City Company grant included the right to make traffic arrangements with other companies. Its right to sell or assign cannot be violated, either by the city or the property owners. An ordinance which assumes the contrary is void, as a violation of the obligations of contract."

Requirements for consents, the court said, acts as a check on municipal authorities when they seek to make grants where the residents do not desire them. They form a protection against the encroachment of the authorities upon their rights.

No consents not given specifically to the Low Fare Company can be used by it, according to the decision. Consents given specifically might be used generally for a new grant, but this is an extension grant. In the case of a new grant, bidding is required by law and it is presumed the grant will go to the lowest bidder.

In case the Forest City Company grant is held to be invalid, then the Low Fare Company has nothing upon which to extend.

Notice is given that the case would be appealed to the Supreme Court. In order to secure a decision from that tribunal several months will probably be required. Meantime the residents of the two streets are complaining because of lack of facilities.

Shortly after noon Monday, W. B. Colver, of the Low Fare Company, tendered the Cleveland Electric Railway Company, through President Horace E. Andrews, a grip said to contain $19,000 in gold, the amount fixed by the City Council for the joint use of the old company's tracks on Euclid Avenue. The remaining $63,000 for the use of the tracks on Euclid, around and through the Public Square, over Superior Street from that point to the viaduct, over Detroit and West Twenty-Fifth Streets to the point reached by the Forest City Railway tracks, was not offered. President Andrews asked why the entire amount was not brought, but the answer was not forthcoming. It is presumed that the officials did not care to have the entire amount tied up, since their cars are already operating over all but the Euclid Avenue portion, the Cleveland Electric having never asked that the injunction secured against the company be enforced since it was suspended when a truce was declared. The tender was refused by the Cleveland Electric officials.

Monday was the day when the new ordinance granting the Low Fare Railway Company the right to operate over these streets went into effect. It was designed to evade a court decision made some time ago, when the first ordinance was found invalid. Between 2 and 3 o'clock the company ran its cars out Euclid Avenue to East Fourteenth Street, the point where the extension from the Erie cemetery loop reaches the lines of the old company. The connections had not been made, however, and the cars returned from that point. They were in operation all afternoon.

When it was seen that the Low Fare Company intended to operate its cars over that piece of track under what is considered a subterfuge ordinance, attorneys for the Cleveland Electric applied for an injunction to prevent its taking advantage of the supposed grant.

MEETING OF THE COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION

J. F. Dostal, secretary of the Colorado Light, Power & Railway Association, has just announced that the fifth annual convention of the association will be held at the Savoy Hotel, Denver, Col., Sept. 18, 19 and 20.

TEXAS MIDLAND CONSIDERING ELECTRICITY

It is reported that the Texas Midland Railroad, which is owned by E. H. R. Green, son of Mrs. Hettie Green, is to be converted into a third-rail line. Mr. Green has been in active charge of the Texas Midland for the last twelve years. The road is 120 miles long, and runs from Paris to Ennis. Mr. Green is said to be investigating the water and fuel situation. If the report as to these factors is favorable the plans for converting the road into an electric line will be carried out without delay. The general offices of the road are located at Terrell.

DECISION ON ROANOKE FARES

About nine months ago certain citizens of Salem, Va., which is about 8 miles from Roanoke, petitioned the State Corporation Commission of Virginia to require the Roanoke Railway & Electric Company, which operates an interurban electric line to Salem, to reduce its fares. The rates in force were 35 cents for a round-trip ticket and 20 cents for a one-way ticket. The company also sold books of twenty-five coupon tickets for $2.50, or a rate of 10 cents each way. The petitioners asked that the fare be made 5 cents. In its answer the company agreed to reduce the round-trip tickets to 25 cents and to make the one-way fare 15 cents cash, dividing the line into three 5-cent zones. At the same time it applied to the American Street & Interurban Railway Association for information as to what rates of fare would be equitable between the two cities as compared with the practice of other roads with similar conditions.

The commission held a hearing upon the subject on July 19, and among those who gave expert testimony on the subject was Prof. B. V. Swenson, secretary of the American Street & Interurban Railway Association, who had previously made a trip to Roanoke to familiarize himself with the conditions, and who presented some elaborate statistics of the fares charged elsewhere. Before the Commission had finished its hearing a compromise was effected between the company and the petitioners and this compromise was adopted by the Commission. It provides that the company shall sell books containing ten tickets, good between Salem and Roanoke, for $1, good for three members of a family of the person who buys the book, the names of the members to be inserted in the book; also that the company is to sell books containing forty tickets between Washington Heights and Salem, or between Edgewood and Roanoke, for $3, the books to be subject to the same conditions as the ten-ticket books. The cash fare is to be 15 cents, with 25 cents for a single round-trip ticket.

STONE & WEBSTER PUBLIC SERVICE JOURNAL

This is the title of an attractive monthly magazine published in Boston by the Stone & Webster organization, and designed primarily to keep the members in touch with each other and to inspire an esprit de corps. The first number, that of July, 1907, has an attractive appearance and contains a number of original articles as well as news from the different companies owned or managed by the firm. The longer articles include the following: Early History of the Firm, by Russell Robb; General Electric Commutating Pole Railway Motors; Value of Public Confidence; Depreciation; Chemical Fuel Economizers, and The Retired Manager Talks. The department "News from the Companies" occupies more than half of the 48 pages of the pamphlet and gives a resume of recent events which concern the different properties. Quotations on the securities of the public service corporations under the management of Stone & Webster are included in the paper.

PLANS FOR BEGINNING NEW HAVEN'S ELECTRIC SERVICE OUT OF NEW YORK

The executive committee of the directors of the New York, New Haven & Hartford Railroad met at the Grand Central Station Thursday, July 11, and discussed plans for opening the electrified line from New York to Stamford, Conn. Favorable reports were received and it was stated that the road would be opened for service between New York and New Rochelle Sunday, July 21, and to Port Chester by Sept. 1.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED JUNE 25, 1907

857,572. Track Lifting, Leveling, Ballasting and Tamping Machine; Clement I. Amey, Toronto, Canada. App. filed Dec. 31, 1906. Relates to a machine which will successively perform the operations of lifting and leveling the track rails, depositing the ballast between the ties and tamping it under them, the operations of ballasting and tamping being performed simultaneously at progressive places.

857,591. Trolley Harp; Arlington D. Brittain, Youngstown, Ohio. App. filed April 18, 1906. A pair of arms bolted to the trolley harp and projecting rigidly upward therefrom and adapted to guide the wheel on the wire. A specially constructed wheel having removable flanges is employed.

857,612. Trolley Stand; Edgar L. Fixler, Delta, Ohio. App. filed July 12, 1906. Relates to a trolley stand from which a broken pole may be quickly removed and replaced with safety to the operators.

857,643. Trolley Guard; George L. Matheney, Bridgeport, Ohio. App. filed July 12, 1906. A pair of upwardly spring pressed lugs are mounted at each side of the trolley wheel so as to yield downwardly in passing guy wires, etc.

857,686. Electrically Propelled Vehicle; Russell Thayer, Philadelphia, Pa. App. filed April 4, 1907. An electric truck adapted to run on a car track and receive current through a trolley pole when it is possible, but having storage batteries by which it may proceed independently of the track when desired.

857,729. Electric Brake; Emil Franke, Astoria, N. Y. App. filed Aug. 4, 1906. Electro-magnets mounted under the car have armatures coupled so as to work in the same direction when the magnets are energized, telescopic rods adapted to carry the armatures and permit them to move in the same line, and rods between the brake beams and armatures whreeby the brakes are set when the magnets are energized.

857,752. Mechanical Power Brake; Louis Pfingst, Boston, Mass. App. filed March 6, 1903. The usual hand brake has an armature thereon which acts to assist the application of the brake whenever the curcuit thereof is closed.

857,780.—Bridge and Gage Plate for Railroad Rails; Franklin E. Abbott, Buffalo, N. Y. App. filed Aug. 20, 1906. Provides a bridge plate arranged to span the space between adjacent ties and which is so constructed as to prevent endwise movement of the rail joint.

857,781. Combined Railroad; Franklin E. Abbott, Buffalo, N. Y. App. filed Sept. 24, 1906. Consists of a combined rail and rail base plate, the former being of standard form, except for the base, which is reinforced at the point of usual weakness, and the plate providing a seat or support for such rail.

857,792. Railroad Brake; Howard A. Coleman, Sanborn, Ia. App. filed March 4, 1907. The brake is applied through the medium of a crank shaft having soft iron contacts thereon which are attracted by electro-magnets to partially rotate the shaft.

857,860. Rail Joint; George J. Becker, Buffalo, N. Y. App. filed March 18, 1907. Consists in a base set into depressions in a plurality of ties so as to prevent lateral and endwise movement thereof, in providing the base with upstanding flanges between which the rails set upon the base are confined, and in securing the rails and the base to the ties with spikes which serve to secure the base to the ties and the rail to the base.

857,907. Cross-Tie; John S. Schaeffer, Brookville, Pa. App. filed March 4, 1907. Details of a reinforced concrete tie.

857,911. Fluid Pressure Brake; Walter V. Turner, Wilkinsburg, and Robert H. Blackall, Edgewood Park, Pa. App. filed Sept. 26, 1903. Provides a valve means operatively separate from the triple valve for releasing fluid from the maintaining chamber and also from the brake cylinder when the train pipe pressure is increased for the purpose of releasing the brakes, whereby this fluid will be discharged even though the triple valve should stick or for any reason fail to move to release position at that time.

857,912. Fluid Pressure Brake; Walter V. Turner, Wilkinsburg, and Francis L. Clark, Pittsburg, Pa. App. filed Dec. 27, 1904. Provides a feed valve device with certain additional regulating means and connections with the engineer's brake valve, whereby the same may operate to regulate the train pipe pressure to the desired degree when the brake valve is in running position, and also to control communication to the train line when the brake valve is on lap and to then maintain the train pipe pressure at whatever degree of reduction is made at the brake valve.

857,987. Fastening Device for Rails; Armand Flamache and Jules Gernaert, Brussels, Belgium. App. filed May 15, 1906. A fastening device for rails consisting of a resilient socket or sleeve longitudinally slotted from end to end.

858,067. Brake-Shoe; Joseph D. Gallacher, Glenridge, N. J. App. filed Feb. 19, 1906. The method of forming a brake-shoe consisting in placing the plate upon the back of the wearing sole, bringing the ends of the plate toward each other, to thereby lock the latter to the wearing sole and simultaneously form an attaching lug for the brake head.

858,110. Railway Track Construction; John H. F. Shulze, New York, N. Y. App. filed March 20, 1907. Consists of rails which are longitudinally divided on a central vertical plane. The two sections of the rail are bolted together, with the abutting ends of the aligning sections breaking joint with those forming the opposite side of the rail. Each rail section is constructed with an extended base flange which is embedded in a roadbed of concrete.

858,120. Signaling System for Alternating Currents; Louis H. Thullen, Edgewood Park, Pa. App. filed March 2, 1906. Relates to block signaling on railroads where alternating currents are employed to actuate the signals. Provides an inductive bond between the track sections which will be opaque to alternating currents, but give a free path for the passage of the propulsion current from block to block.

858,121. Air Brake System; Leroy Tucker, Peru, Ind. App. filed Oct. 19, 1906. An automatic air brake system operated by a triple valve having a valve adapted to be opened to produce the emergency pressure in a brake cylinder, a pressure gage so connected to the triple valve as to indicate the change in pressure due to the opening of the emergency valve.

858,178. Car Seat; Fred H. Henry, Phialdelphia, Pa. App. filed Dec. 15, 1906. Details of construction of a "walk-over" car seat.

858,235. Rail Joint and Anti-Creeping Device; Francis M. Volk, Minturn, Cal. App. filed Nov. 1, 1906. A rail chair having a base portion, a fixed integral angle plate, and a flange between which and said angle plate the rail is adapted to seat,

and a movable angle plate having its outer edge turnably fitted to the inner wall of the flange of the chair.

858,238. Trolley Finder; Frederick G. Weber, Askland, Ky. App. filed Feb. 19, 1907. V-shaped arms are pivoted in advance of the trolley wheel and are thrown to operative position by the trolley cord when the wheel is being positioned on the wire.

858,255. Trolley for Electric Railways; Harry Bennett, Newark, N. J. App. fild April 17, 1906. The trolley pole is formed in two pieces, the upper end telescoping into the main portion and spring impelled upward therefrom.

858,355. Trolley Catcher; Robert Shields, South Boston, Mass. App. filed March 14, 1906. Details of a spring drum and ratchet device for controlling the trolley cord.

12,667. Car Replacer; George H. Sargent, Flushing, N. Y. App. filed April 2, 1907. Details.

PERSONAL MENTION

MR. R. S. IVES, superintendent of the Chicago & Milwaukee Electric Railway, has announced his marriage last month to Miss Emma Nichols, of Shawnee, Okla.

PROF. W. F. M. GOSS, of Purdue University, has resigned from that institution to accept the position of dean of the engineering department at the University of Illinois.

MR. LEVERITT M. CLARK has been appointed master mechanic of the Indianapolis Traction & Terminal Company, of Indianapolis, to succeed Mr. W. H. Evans, resigned, who now is master mechanic of the International Traction Company, of Buffalo. Mr. Clark formerly was master mechanic of the Indianapolis & Northwestern Traction Company, of Lebanon.

MR. HARLAN A. WELLSMAN has resigned as superintendent of motive power of the Camden Interstate Railway Company, of Huntington, W. Va., with which he has been connected for several years. Mr. Scott Coalgrove, who has been Mr. Wellsman's assistant, will succeed him. Mr. Wellsman will devote himself entirely to the management of the H. Wellsman Electric Company, of Ashland, Ky.

MR. HERBERT S. WHITON, chief engineer of the Ponce Electric Company, of Ponce, Porto Rico, has been appointed manager of the company in place of Mr. Gardner Rogers, who is returning to the Boston office of Stone & Webster. Mr. James B. Walker, of the Boston office, has been appointed assistant treasurer at Ponce, vice Mr. William H. Stone, who is leaving the company to become manager of the Mayaguez Light & Power Company, of Mayaguez, Porto Rico.

MR. RICHARD F. GOTSCHALK, president of the Columbus Street Railway & Light Company, of Columbus, Ind., met with an accident on July 10 which resulted fatally. Trouble was experienced with the trolley wire, and Mr. Gotschalk, in endeavoring to fix it, slipped from the ladder which had been placed against the guy wire and fell into the street. Mr. Gotschalk was identified with the Columbus company and its constituents for a number of years, going to Columbus from Chicago in 1889. He was forty-two years of age and is survived by a widow and two children.

MR. CHARLES H. CHAPMAN, who has been superintendent of the Consolidated Street Railway Company's lines at Middletown, Conn., for some years, has been promoted to be superintendent of the Consolidated lines in Bridgeport, to succeed Mr. R. H. Smith, resigned, whose appointment as manager of the Albany & Hudson Company was recently announced in the Street Railway Journal. Mr. Chapman will be succeeded at Middletown by Superintendent Church, of Southington. Mr. Robert T. Lee, who is in charge of the Meriden division as superintendent, will have the territory formerly under Mr. Church added to his division.

MR. H. GILLIAM, who was formerly connected with the construction department of the Westinghouse Electric & Manufacturing Company, has been appointed electrical superintendent of the New York, New Haven & Hartford Railroad, with headquarters at Stamford. He will have general jurisdiction over the maintenance and operation of electric transmission lines, with accessories, power houses and electric locomotives on the New York division. Mr. C. L. Peterson has been appointed chief engineer of the power station, with charge of the operation of the maintenance of station equipment, and Mr. J. C. Welch has been appointed to have charge of the maintenance and operation of electric locomotives.

MR. GUY W. TALBOT, vice-president and general manager of the Corvallis & Eastern Railroad, lately acquired by the Harriman interests, has resigned to become vice-president and general manager of the Oregon Electric Railway. His connection with the Corvallis & Eastern will end as soon as his successor is chosen, when he will devote his entire time to the management of the Salem electric line, now nearing completion. Mr. Talbot came to Portland a year ago in April to become general manager of the two Hammond lines in Oregon, the Astoria & Columbia and Corvallis & Eastern. Both these properties have since been sold, one to the Hill interests and the other to the Harriman. Mr. Talbot began his railroad career with the Burlington at Des Moines, Ia., and was later connected with the Des Moines Northern & Western, the Des Moines Union & Terminal Company, the Iowa Central and the Peoria & Pekin Terminal Railway. He came from the general managership of this last property to Portland.

MR. WILLIAM J. WILGUS, vice-president of the New York Central & Hudson River Railroad, has tendered his resignation to take effect Oct. 1 next. The great work of Mr. Wilgus in conceiving and directing the New York - Croton - White Plains electrification of the New York Central is too fresh in the minds of all railway men to require elaboration at this time. He has desired for some time to sever his connection with this and other work, but he has stayed with the company long enough to see every New York Central train entering Manhattan Island electrically operated, and he will leave at a time when the important problems are solved and little more than the completion of the terminal and the extension of the system along its original lines remain. The hearty feelings of good will from the company that Mr. Wilgus takes with his departure are well expressed in a letter to him by Mr. W. C. Brown, senior vice-president of the New York Central, who declared the change of power in the New York electric zone and the rebuilding of the Grand Central Station to be the most stupendous work of engineering ever known; that it had gone forward under Mr. Wilgus' direction practically without a halt and certainly without a failure in any essential feature; and that such imperfections as experience had developed had been introduced in the work without material change in the original plans. Mr. Wilgus has been asked by the company to remain as consulting engineer on the New York electric zone, Detroit River tunnel and Buffalo terminal improvements, but he has not accepted this offer as he desires to be entirely free in making his plans for the future. Although he is only forty-one years old, Mr. Wilgus has had a career of remarkable range in the steam railroad line. After his graduation as a civil engineer from a school in Buffalo, his home city, he started in 1885 as a rodman and draftsman on the Minnesota & Northwestern Railroad. The following year he became the Minneapolis terminal engineer for the same company; in October, 1887, he designed the Chicago, St. Paul & Kansas City Railway, and after several promotions left in April, 1890, to become locating engineer for the Duluth & Winnipeg Railroad; the next year saw him as constructing division engineer of the Chicago, St. Paul & Kansas City Railway. During 1891 he first became actively interested in electrical apparatus, but continued with Western railroads until 1893, when he became assistant engineer of the Rome, Watertown & Ogdensburg division of the New York Central, and in 1895, in conjunction with his other duties, he became chief engineer of the Buffalo Terminal Railway. In 1897 he was transferred to New York and became successively resident engineer, chief assistant engineer, engineer of maintenance of way, chief engineer and vice-president, as well as chairman of the advisory board of engineers on the Detroit River tunnel.



W. J. WILGUS

Street Railway Journal

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NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8000 copies are printed. Total circulation for 1907 to date 246,350 copies, an average of 8211 copies per week.

The Scope of the Purchasing Agent

If there could be a race between individuals whose duties call for some knowledge of a wide variety of subjects, the purchasing agent of many an electric railway would run a close second to the daily newspaper man. There are companies where the purchasing agent is little more than a clerk who receives requisitions from department heads for different makes of material and in rewriting them for transmission adds only such details as relate to shipment and payment. On other roads the wishes of the heads of the departments requiring the goods are often largely ignored because the purchasing agent is required to place the order with the lowest bidder.

It is clear that neither of these methods is ideal. If the engineers, master mechanics or other officials can specify at will what they want to use, their natural predilection for the higher-priced product may not only soon exhaust their department appropriations, but the consequent scattering of purchasing power weakens the organization and introduces chances for corruption. On the other hand, simply to give an order to a solicitor for business because his bid is the lowest is not productive of true economy in the long run and offers to the manufacturer a constant temptation to lower the quality of his material.

However experienced a purchasing agent may be, he cannot be expected to know everything, yet he should be entrenched in a position where he can properly gage the wants of every branch of the company and keep the expense account within reasonable limits. He should be able to determine the economic relation between differences in first cost and differences in length of service, two qualities which are rarely in exact ratio. While he may be guided largely by the advice of the department chief, he cannot shift the responsibility of his office or the duties which he owes to the general manager of the company under whose direction he usually works. Whether he selects the more expensive or the less expensive article, he should be prepared to justify his choice as being the one most economical in the long run if called upon to do so by the officer directly in charge of his department.

Advertising Trolley Facilities at Steam Railroad Stations

Much more might be done by progressive electric railways in the line of advertising their facilities at the stations of steam railroads in their territory. The idea prevails that such a course is equivalent to bearding the competitive lion in his den, but we question if this is the true point of view. Sharp competition between steam and trolley service exists in a great many places, but in general the idea is fast spreading that the trolley roads and the steam lines are supplementary to one another, and as fast as figures are made public in districts where there is considerable traveling the truth of this relation is being surely established.

There certainly can be little objection on the part of the steam road to the advertising of non-competitive service around a city by the local trolley system. The news stands generally are provided with trolley guides, and nothing is gained in the long run by hindering the free movement of

travel. When the local trolley lines constitute the principle link between the steam station and the center of the town the fact should be advertised by an illuminated or plain sign in or near the steam terminal or through station, or by a clearly printed and conspicuously posted schedule in a place that will catch the eye of the stranger who has come to the town. One instinctively glances about a station on alighting from a train for the first time in a new town, and in the rare cases where a local trolley schedule meets the eye, the satisfaction is great and the reward of the trolley company reasonably sure. The trouble is that the street railway company does not always realize the competition it must meet in the way of hacks and cabs, with the result that ten, fifteen or twenty nickels are spent by the stranger sometimes for a ride of less than two blocks—the most profitable of all passengers for the railway company to carry. There are ways enough of advertising trolley facilities without going into details here; the point we wish to make is that there is a growing need of such publicity work in the steam railroad stations, and we believe that if the steam railroad people are approached in the right way, a mutually helpful co-operation will result. Electric railways deliver many passengers to the steam roads through the knowledge car conductors have of the latter's schedules, and there is no reason why the rule should not work both ways in the future.

The Deformation and Wear of Wheels and Rails

The paper by H. R. A. Mallock before the Institution of Civil Engineers which was published in our issue of July 13, and the discussion that followed it, deserve more than a passing attention on the part of engineers in this country. Many statements are made, both in the original paper and the discussion, that tally closely with investigations that have been made here, while there are some in which there is a marked difference. The weak point in the paper when considered from the standpoint of practical work is the assumption on the part of the author that the wheel and the rail are of the same material. This not only does not hold for a steel wheel on a steel rail, but is far from the truth when a chilled cast-iron wheel on a steel rail is considered. As far as American practice is concerned, the higher carbon content of the steel tire, together with the mechanical and heat treatment which it receives, produces a different quality of metal from that found in the head of the rail, so that the assumption that the compression of wheel and rail is the same under the load will not hold. Unfortunately, Mr. Mallock did not explain the method by which he measured the curvature of the area of contact between the wheel and rail; how he found that it was a circle, "and that the radius of this circle is twice the radius of the wheel." Whether this is the case when the metal of wheel and rail is the same, according to the assumption, we are not prepared to say, but investigations along the same line in this country have led to the conclusion that this is not the case when the metals of the wheel and rail are different.

Attention has already been called in this paper to the fact that after the imposition of an excessive load upon the rail by the wheel, a visible depression is made in the rail, while nothing of the sort can be detected in the wheel. Now, if the depression in the wheel and the rail were the same, it would appear to be quite contrary to the natural order of things for the wheel to recover its shape and the rail not to do so. Furthermore, it has been found that the depression made in the rail by a cast-iron wheel is greater than that made by a wheel with a steel tire, so that there is an earlier breaking down of the metal. Observations, then, that have been made in practical working in this country go to show that the radius of the curve of the area of contact of the wheel and rail is much shorter than twice the radius of the wheel, but as to just what it is, measurements have not been taken.

If, then, the rate of depression given by the author is not conceded, the calculations made regarding the maximum pressure at the center of the area of contact must be modified. But regarding this it is quite well agreed that the pressure existing at the center of the area of contact is much in excess of the average and is quite sufficient to account for the breaking down and flow of the metal of the head, which would undoubtedly be much in excess of what it is were it not for the influence of the time interval to which attention was called in the discussion.

The influence of wheel diameter does not seem to be really as great as it was assumed to be. Not but that this dimension is of some importance, but as far as the tangible results of a vertical load are concerned, there seems to be little difference between wide variations of diameter; so that when we compare the effects of wheels whose diameters run from 33 ins. to 36 ins. as they do on most electric cars, the difference in effect on the track is probably infinitesimal.

Towards the close of the discussion the matter of corrugated rails was brought to the front, but nothing new was evolved, and the whole subject still remains one of scientific guessing that it has been from the first. That this most important branch of the subject involving the annual destruction of thousands of tons of rails, should be left without any persistent course of investigation by which the real cause is to be run to earth is very strange.

The statement of one speaker that "the greatest strain when a wheel passed over a rail was not at the bottom or lowest fiber of the span, but at the top, produced by the local action of the wheel," is exactly in accord with the results of practice. Unfortunately, we are still in the dark as to the penetration of the effect of loading into both wheel and rail, and it holds for almost everything that was said upon the subject at the meeting, that the statements can neither be proven nor contradicted. We simply know that the rail-wear under the present conditions of heavy loading is enormous, both in rate and total magnitude. It also appears from recent investigations that the shape of the rail-head and wheel-tread have a most important effect, not only upon the wearing qualities of each, but also upon the tractive power required to pull the car. From investigations made along these lines the indications are that when air resistance, journal friction and direct rolling resistance have all been subtracted from the total, there will still remain a considerable portion that is attributable only to the frictional resistance of the wheel against the rail. These investigations have not yet been pushed far enough to make

it possible to offer any direct recommendations as to the best forms to adopt. This much is certain, that a great deal of work still remains to be done before we will be in a position to state what form of wheel and rail, and what amount of loading will produce the most satisfactory conditions of wheel and rail deformation and wear.

Labor Under Municipal Ownership

The reports on municipal ownership drawn up by the National Civic Federation, which we are abstracting, are like all such reports, somewhat unsatisfactory. Municipal ownership seems to be one of those subjects toward which no man is able consistently to present an open mind. Someone has truly said that all mankind divides itself into the radical and conservative, seldom or never providing an intermediate stratum. So likewise it is with the question of municipal ownership. Men are either for it or against it, and that strongly. One sees municipal ownership as through rose-colored glasses, and another through spectacles of deepest saffron.

It therefore happens that the reports of Mr. Sullivan and Professor Commons, which we published last week and which discuss the labor situation, present radically different views of even facts bearing upon municipal ownership. The mind of academic inclination is nearly always inclined to look at the matter from a purely theoretical standpoint, seeing merely the obvious advantage of communal administration, without full appreciation of its very grave, practical disadvantages.

There seems to be little doubt that in this country the employees of municipal plants are likely to receive slightly better wages than the employees of private plants, and to toil somewhat shorter hours. This extra cost of labor is, in fact, one of the handicaps of municipal ownership in America. The extra advantages, unfortunately, do not represent a more liberal policy or a higher grade of labor, but merely a species of largesse, to which municipal employees, by custom, seem to consider themselves entitled. In fact, the American practical politician in the average American city government seems to have drifted towards a species of applied socialism, and certain citizens at large are taxed in proportion to their means, to support in semi-idleness the ever increasing guild of municipal parasites.

A great difficulty in operating municipal plants of every kind is in the entrance of politics into the administration, causing, among other evils, abnormally high pay for abnormally inefficient labor, and the result is usually disastrous. Even the civil service system sometimes, in one way or another, applied to municipal appointments, does not rob them of their political character, and merely makes it the more difficult to discharge incompetent men. In some cities employees appointed directly or indirectly through political influence, can be removed only after the preferment of charges and a trial before the Mayor, possibly the same Mayor who appointed the incumbent. Under such conditions it is well nigh impossible to get rid of inefficient labor. It is doubtless true that some employees in municipal plants gain advantage in wages and hours of labor, but they generally do it through political activity and at the expense of their brother workmen, who are less active or more scrupulous.

We do not believe that the best interests of labor, organized or unorganized, are served by the existence of a class of particularly well paid city employees, who look to the ward primaries rather than to their individual ability, or their fraternal relations with other workmen, for the retention of their jobs. In private management a laborer, although not always well paid, stands in line for advancement. Whatever faults private employment may have it has generally the advantage of being worked on an informal but rather effective merit system which pushes a good man to the front and into higher pay. The upper strata of every street railway organization, for instance, are composed quite largely of men who have worked their way up from the ranks. Such opportunities are difficult to find in any municipal plant.

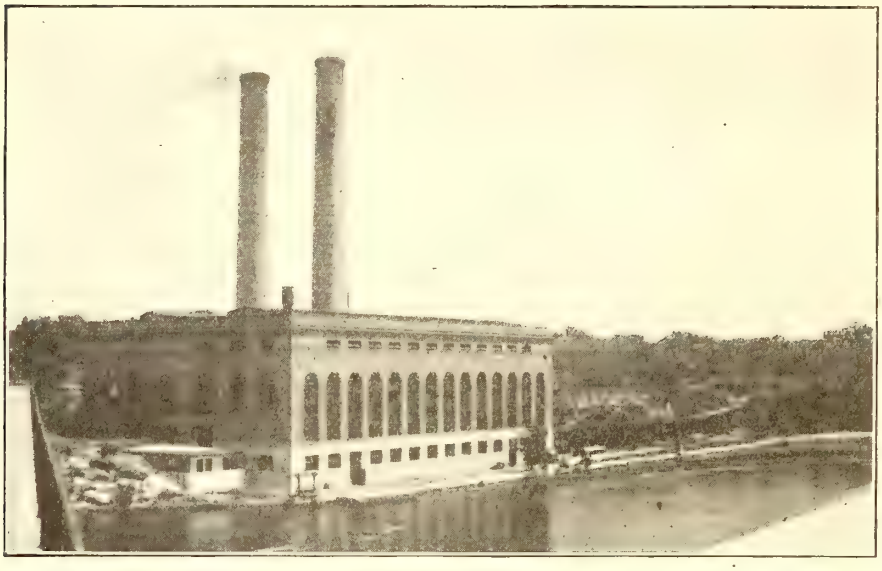
One cannot judge municipal ownership here, by municipal ownership abroad. While graft is not unknown in a British municipality, it seems to be generally admitted that the graft which exists is less wide-spread and less efficiently organized than in American cities. The electoral franchise is less nearly universal there than here and the potential machinery far less extensive and highly specialized. Under such conditions it is not surprising to find municipal workmen of a relatively higher class under considerably more stable employment than here. All this tends to a somewhat greater degree of success in municipal ownership than has been found in American cities. As we have remarked more than once, municipal ownership in Great Britain has been very often notoriously unsuccessful, and if this is true under the comparatively non-partisan management found abroad, what can we expect in this country? Wherever a municipal enterprise has been kept out of politics it has had at least a fighting chance for success. Wherever it is conspicuously in politics it is foredoomed to failure, and failure, not only from the standpoint of the citizen at large, but from the standpoint of the laboring classes; all are sharers in the loss which it occasions. And we have several times shown the municipal enterprises which are conspicuously successful are those which do not require a great force of employees having intimate relations with the whole body of citizens.

So far as labor unions are concerned they must, from necessity, stand with the great bulk of the citizens against municipal ownership. Municipal and governmental administration is of legal necessity non-union in principle if not in practice, and the union may get along peaceable enough with the municipal enterprise as it does for the most part with the private enterprise, but it gains nothing in the former case that it does not possess in the latter and is not even at liberty to make a formal contract with the employer, when that employer is the public rather than a private party.

Take it all in all, therefore, it seems to us that from a practical standpoint, the prospects of the laboring man are not improved, but rather damaged where municipal ownership is in force. The more technical conditions resulting from municipal ownership of street railway enterprises, as revealed in the reports of the National Civic Federation, will be discussed in a later issue.

THE STEAM POWER STATION OF THE TWIN CITY RAPID TRANSIT COMPANY, MINNEAPOLIS

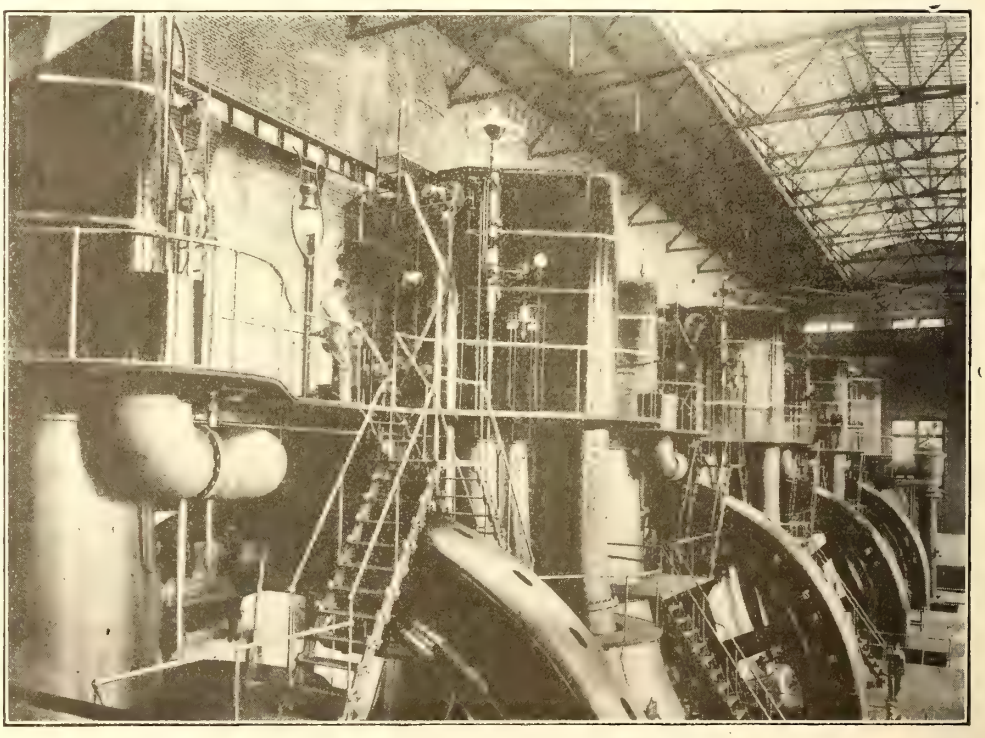
The steam-driven electrical generating station of the Twin City Rapid Transit Company, of Minneapolis, has a normal rated capacity of 35,000 hp and an overload capacity of 50,000 hp. The generating equipment of this station is operated in parallel with the equipment of a 10,000-hp hydro-electric station which is approximately 1000 ft. distant. The two stations furnish power to ten electric sub-stations in St. Paul and Minneapolis and in the adjacent towns, the maximum distance of transmission being about 25 miles. The generating equipment of the two stations delivers three-phase alternating current at 13,200 volts which rotary converters in the sub-stations transform to direct current at 600 volts. Each power station supplies about one-half the total requirements in kw-hours, the steam station taking the variations in the load, as shown on the typical load curve on page 127.



THE MINNEAPOLIS POWER PLANT OF THE TWIN CITY RAPID TRANSIT COMPANY

The steam power station is on the east bank of the Mississippi River just below the flour mills in the center of the city. It is in a brick building, 155 ft. 11 ins. by 225 ft. in plan and 93 ft. in height from the floor of the engine room basement to the roof. A 12-in. longitudinal brick wall divides the building into a boiler room and an engine room. The boiler room is 83 ft. wide, the full length of the building, and has a clear height to the roof girders of 52 ft., a basement 14 ft. high extending under its full length. The engine room is 67 ft. wide, the full length of the building, its floor being 4 ft. lower than the boiler room floor. A basement 20 ft. high extends the full length of the building under the engine room.

The boiler room contains twenty-four 556-hp Babcock & Wilcox water-tube boilers, which are placed in two rows, with twelve boilers to the row. The fronts of the boilers in the rows face on a firing floor 14 ft. wide along the longitudinal center line of the room. The coal supply for the boilers is delivered to the station in cars on a switch which connects with the main line tracks of the Great Northern Railway. This switch extends the full length of the building close to the land side of the latter. Coal may be unloaded into a receiving hopper under the track and at one corner of the building, or on a 24-in. endless belt conveyor built by the Jeffrey Manufacturing Company, which extends the length of the building between the latter and the track and delivers coal to the receiving hopper. This conveyor is 205 ft. long from center to center of the coal pulleys, and when traveling at 280 ft. a minute has a capacity for handling 75 tons an hour. It is back-geared to a 10-hp General Electric motor, which is enclosed in a dust-proof steel case. The sideboards of the conveyor are 1½-in. oak plank attached to iron frames, those on the track side being built in sections which lean against the cars on the track and prevent coal falling under the latter as it is shoveled over the sides.



INTERIOR OF ENGINE ROOM FROM THE SWITCHBOARD GALLERY

The receiving hopper at the end of the conveyor discharges into a single-drum McCaslin coal crusher in a room outside of one corner of the basement under the boiler room. Run-of-the-mine coal is generally received at the station and is all reduced by the crusher to pieces under

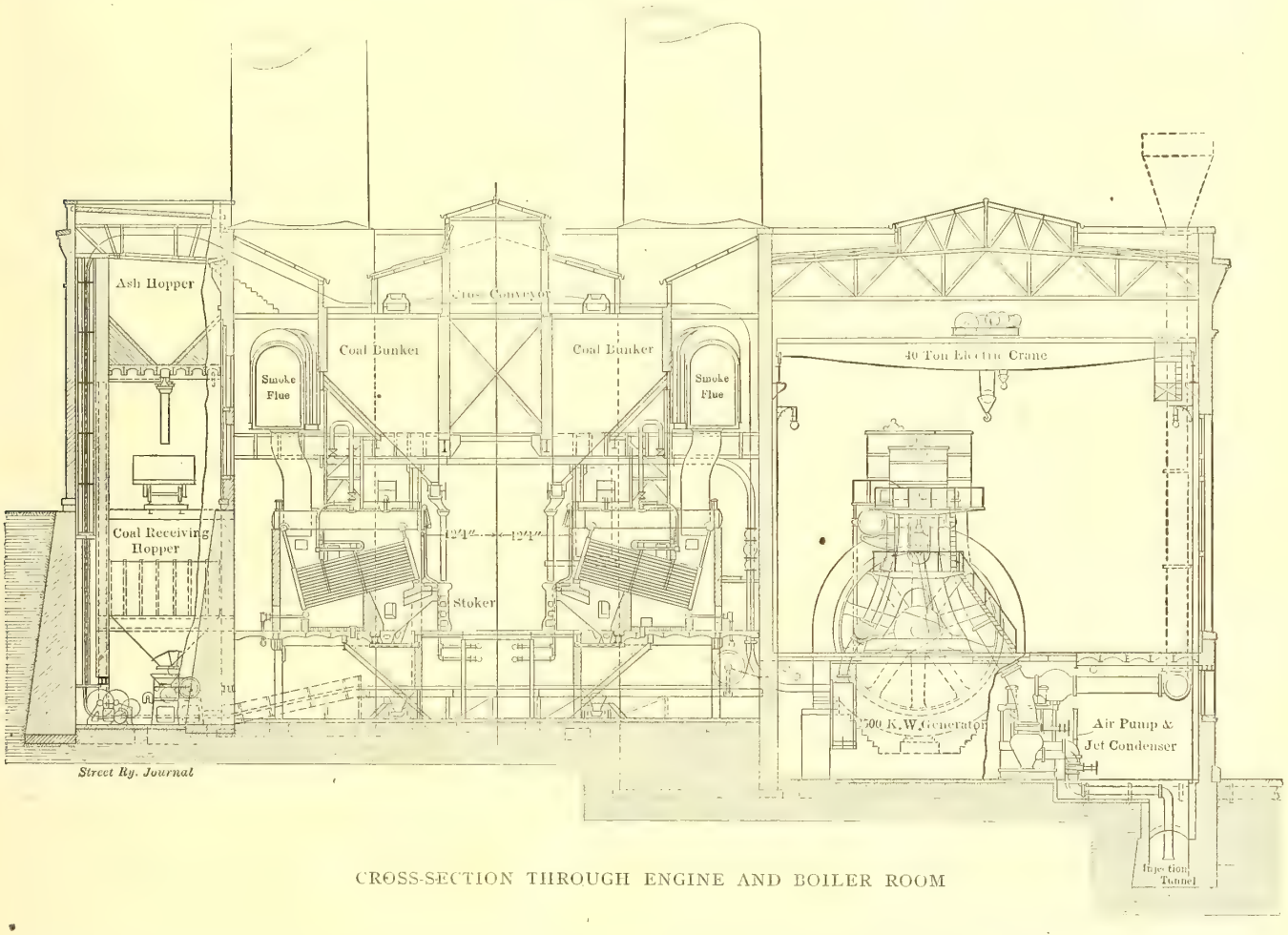
¾ in. in maximum dimensions. The crusher delivers to a conveying system which supplies coal to bunkers directly above the boilers.

This conveying system is of the McCaslin gravity-overlapping-bucket type. It is comprised of a transverse conveyor, at the same end of the building as the coal crusher, and two longitudinal conveyors, one serving the bunkers over each row of boilers. The transverse conveyor runs horizontally from the crusher room to the opposite side of the building, then up the side of the latter to the roof girders, back horizontally just under these girders to the crusher side of the building, thence up over an ash hopper, which is directly over the unloading track along the side of the building, and down vertically to the coal crusher again. The two longitudinal conveyors extend horizontally under fronts of the boilers the length of the basement beneath the boiler room, up at the opposite end of the building to the roof, back horizontally over the bunkers to the transverse conveyor and down again to the basement. The transverse conveyor carries the coal from the crusher to either of the longitudinal conveyors into which the coal is automatically discharged. These conveyors elevate and distribute the coal to the bunkers over the boilers. The transverse conveyor is driven by a 7½-hp, 600-volt, direct-current motor; each longitudinal conveyor is driven by a 25-hp, 600-volt, direct-current motor. The motors are at the bottom of the down-takes in all three conveyors, and the apparatus for taking up slack in the conveyors is at the bottom of the up-takes.

Four coal bunkers, with a combined capacity of 2800 tons, are provided. Two of these bunkers are over each row of boilers, each bunker supplying three batteries of two boilers. The bunkers are of cinder concrete and are carried by a structural-steel frame. They are placed so a light well, 14 ft. wide the full length of the boiler room, is obtained between them, giving good light and ventilation to the whole boiler room and particularly to the firing room floor. The bottom of each bunker has six steel hoppers, which lead through under-cut gate valves, controlled from the firing floor by hand chains, to spouts feeding the stokers with which the boilers are equipped.

The stokers are of the Roney automatic type, with engine-driven rocking inclined grates having 111 sq. ft. of heating surface each. The fire arch of the boiler furnaces has a single span. The ashes are discharged from the stokers into ash hoppers in the basement. These hoppers are built of steel and are lined with fire brick. The ashes are discharged from them through a gate at the bottom directly into the horizontal run of the longitudinal conveyors, the hoppers for one row of boilers being served by one conveyor and those of the other by the second. The conveyors elevate the ashes to the top of the building and discharge them into the upper horizontal run of the transverse conveyor, which carries them to the ash hopper over the unloading track along the building. This hopper is lined with cinder concrete and discharges at the bottom through a gate in a chute leading to cars on the track beneath it.

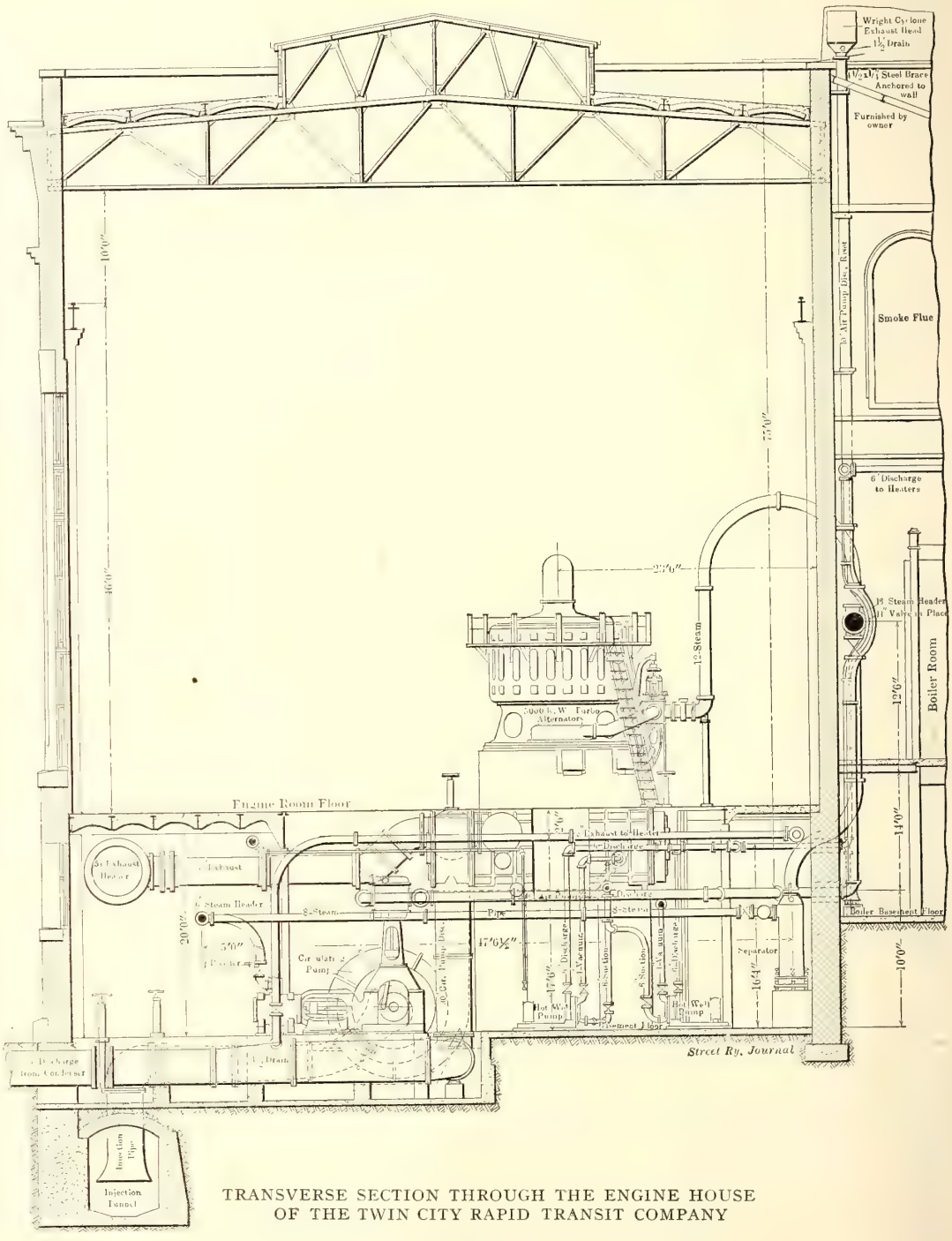
The boilers have a normal rated capacity of 556 hp each and a maximum capacity of 825 hp. They are operated at 180 lbs. pressure, and are equipped with Babcock & Wilcox superheaters, which are contained within the boiler settings just above the tubes of the boiler, and are capable of producing 100 degs. F. superheat. Each boiler has three



CROSS-SECTION THROUGH ENGINE AND BOILER ROOM

steam and water drums, 36 ins. in diameter and 23 ft. 3 ins. long. The boiler tubes are of the wrought-steel sectional type, 4 ins. in diameter and 18 ft. long, and are in twenty-one sections, of 13 tubes each, to the boiler. The total heating surface of each boiler is thus 5560 sq. ft., or 10.5 sq. ft. of heating surface to each square foot of grate area. Each row of boilers is served by an Alphonse Custodis hollow, radial molded brick stack, 162 ft. high and 16 ft. inside diameter. These stacks are placed on the transverse center line of the boiler room and are carried 63 ft. above the floor of that room, so they have a total height of 220 ft. above the furnaces. A smoke flue extends in both directions from each stack well above the settings of the boilers, the connection of each of the latter to these flues being made through a short vertical breeching.

The water supply of the station is taken from the river and is handled by four service pumps in the basement of the engine room. Owing to the presence of an objectionable amount of foreign matter in the river water all of the water used in the station is passed through a rapid sand filter plant built by the Norwood Engineering Company. This plant is in a detached brick building, 35 ft. 4 ins. x 48 ft. 8 ins. in plan, which has a concrete sub-structure and is at the upstream end of the main station building. Two horizontal simplex low-pressure Blake steam pumps, with a capacity of 600 gals. each, deliver water from the river or hot-well of the condensers to the filter plant.



TRANSVERSE SECTION THROUGH THE ENGINE HOUSE OF THE TWIN CITY RAPID TRANSIT COMPANY

The discharge from these pumps is an 8-in. pipe, which is controlled by a butterfly valve, and has its outlet in a sedimentation basin, 24 ft. x 33 ft. in plan and 17 ft. deep, within the filter building. When necessary, sulphate of alumina is applied to the raw water to assist in the removal of impurities. A sedimentation period of one and one-half hours is provided in the basin when the plant is operating at full capacity, and the basin is provided with baffles, so the coagulant has an opportunity to become flocculent and to mix well with the water. The plant contains four filter beds, which are each 10 ft. x 13 ft. in plan, and have a combined capacity of 1200 gals. per minute. The filters contain 8 ins. of gravel, in three sizes, at the bottom, and then 28 ins. of sand. They are equipped with the usual strainer drainage and air wash systems. A 6-in Lawrence centrifugal pump, operated by a 20-hp motor, provides water for washing the filters, and an 8 in. x 12-in. air compressor driven by a pulley on the pump shaft furnishes air for agitating the sand during washing. A clear water well located under the filter beds forms a suction well for the other two service pumps.

This filter plant has been in service for a year and has proved to be particularly valuable in removing impurities from the raw water. The river is turbid at times and generally contains a considerable amount of raw sewage at the station; it also carries a large amount of bark produced

from the numerous wood-working industries above Minneapolis. The water from the hot-well is condensed steam from the engines and contains more or less oil. These various foreign matters are so completely removed by the filter plant that very little trouble is experienced with the boilers from the feed-water.

The two service pumps which draw from the clear well of the filter plant are of the Dean Bros. horizontal, duplex, double-acting type, and have a capacity of 1200 gals. each. These pumps deliver to the feed-water heaters.

Two open feed-water heaters, with a capacity of 350,000 gals. per hour each, are installed in the boiler room, one in each of the two spaces in front of the stacks. One of these heaters was built by the Stillwell-Bierce & Smith-Vaile Company and the other by the Platt Iron Works. They both have a 12-in. steam inlet and an 8-in. steam outlet; their water supply lines are 8 ins. in diameter and are provided with a regulating valve.

Six pumps supply water to the boilers from the feed-water heaters. Four of these are marine, vertical, double-acting, twin Dean Bros. pumps, with a normal capacity of 300 gals. per minute; the other two are Admiralty pattern, pot valve, vertical duplex Worthington pumps, each with a normal capacity of 600 gals. per minute. Two independent headers are supplied from the pair of Worthington pumps and two from the pair of twin Dean Bros. pumps, cross connections being made between the two corresponding pipes of the two sets of lines. These headers are in the basement immediately under the firing room floor, each boiler having a separate connection to two of them. The feed-water pumps are also connected so they can supply either hot or cold water to each header system.

A main live-steam header, 16 ins. in diameter, extends along the wall which separates the boiler room from the engine room. This header is in two sections, one on each side of the stack serving the row of boilers on that side. These sections are connected by a 14-in. loop with cut-off valves at each end. An 8-in. auxiliary header, with connections to the service pumps, air pumps and a steam-driven exciter unit in the engine room, is also provided. A battery of two boilers from each row is coupled with the battery across the firing floor from it and a 12-in. steam connection with the 16-in. header is provided for each of these sets of four boilers. This connection is reduced to 10 ins. in diameter from the first to the second battery. Each boiler of the set of four has a 7-in. connection with the main, connecting the set with the header. Two cut-off valves are provided on each of these 7-in. connections, and a cut-off valve is placed in each 12-in. connection at the header. Cut-off valves in the latter also provide for operating independently any one of the units in the engine room with steam from four boilers.

The engine room contains six main units, four reciprocating engines direct connected to engine generators, and two turbo-generator units. The four reciprocating units comprised the original installation in the engine room; the two turbine units are not yet quite ready for service, although they are installed. The original units have vertical cross-compound condensing 46 in. and 94 in. x 60-in. Allis-Chalmers engines without fly-wheels. These engines have a normal rated capacity of 500 ihp, with a steam consumption of 11½ lbs. per ihp-hour, the steam being at 175 lbs. gage pressure and 75 degs. F. superheat, and the engine exhausting into 26 ins. of vacuum and operating at 74¼ r. p. m. Under these same conditions the engines have a rated maximum capacity of 9000 ihp when running at 73 r. p. m. The engines are equipped with the Reynolds-Corliss valve gear having an automatic weighted governor operating both the high and low-pressure sides. The steam supply and exhaust valves are operated by separate eccentrics; the speed control is operated by a motor controlled from the switchboard. Each of these engines occupies a floor space of 17 ft. x 36 ft., and has an approximate height of 36 ft.

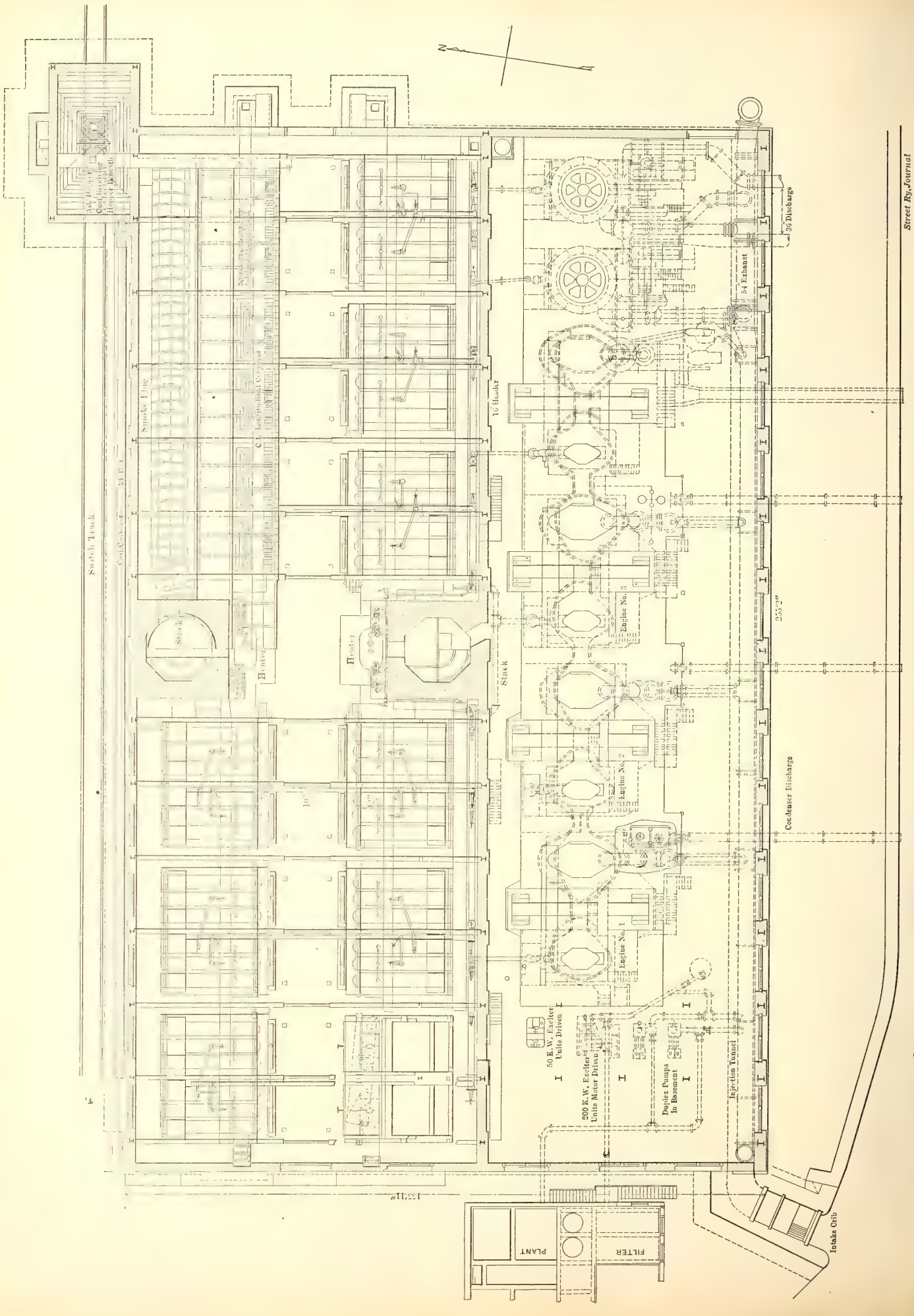
A three-phase, 35-cycle revolving-field fly-wheel type General Electric generator, capable of producing 3500 kw at 13,200 volts, is direct connected to each of the main engines. The revolving field of each generator is equivalent to a fly-wheel weighing 308,000 lbs at a radius of gyration of 12.2 ft. These generators each occupy a floor space of 8 ft. x 24 ft., and have an approximate height of 34 ft.

Three of the main engines are each provided with a vertical, twin, beam-connected 18-in. and 48-in. x 24-in. Blake air pump and jet condenser having a single-acting air end and a double-acting steam end. The pumps of these condensers draw from a 6-ft. x 8-ft. injection tunnel which extends from an intake in the river at the upstream end of the building under the engine room basement along the river side of the latter to the downstream end of the building. The cooling water is discharged from each condenser directly into the river.

The fourth engine is equipped with an Allis-Chalmers barometric-type condenser with the condenser chamber attached to the engine cylinder. This condenser has two barometric columns, one 16 ins. in diameter for the removal of both air and water, and one 20 ins. for an overflow. Cooling water for the condenser is supplied by a 20-in. centrifugal pump driven by a Ball engine.

These four engines are also arranged with 30-in. connections to a 42-in. free exhaust header in the basement of the engine room, a relief valve being placed in each of these connections. This header extends the full length of the basement and connects at each end with a riser leading to an exhaust head above the roof. The part of the header adjacent to the turbines is increased to 54 ins. in diameter. A 12-in. auxiliary exhaust header is also provided for the feed-water heaters, and has a 5-in. riser extending to an exhaust head above the roof. The condenser engines and the feed-water pumps exhaust into the feed-water heaters, and the stoker engines exhaust under the grates.

The noteworthy feature of the whole station is the fact that the two turbines having a combined normal rated capacity of 10,000 kw occupy the space originally provided for one 3500-kw reciprocating unit, although the turbine auxiliaries are somewhat crowded in the basement. The two turbine units are of the five-stage Curtis type, mounted on a base condenser; each of them is direct coupled to a six-pole, delta-connected, three-phase, 35-cycle, 13,200-volt, alternating-current General Electric generator producing 5000 kw at 700 r. p. m.The steam consumption of these units, with steam at 175 lbs., 2 ins. absolute back pressure and 100 degs. F. of superheat, is guaranteed to be 18.3 lbs. per kw-hour at half load; 17 lbs. at full load; 17.5 lbs. at 50 per cent overload and 17.8 lbs. when the load varies between 50 per cent and 150 per cent of the full load. Each unit is controlled by a centrifugal governor, which mechanically operates a poppet type valve in the steam supply line, the variation in speed from no load to full load being guaranteed not to exceed 2 per cent, except that a sudden change in load may cause 4 per cent momentary variation.



GENERAL PLAN OF THE TWIN CITY RAPID TRANSIT COMPANY'S POWER STATION

The step bearing of the turbine is supplied with 12 gals. of oil a minute under a pressure of 550 lbs. per square inch. The piping system which supplies oil to these bearings is furnished with pressure by two twin Worthington steam pumps, which are connected in relay so in case one pump fails to maintain the required pressure the second will start. A hydraulic accumulator built by R. D. Wood & Company is connected with this piping system to maintain the pressure on the latter. This accumulator has an 8-in. ram with an 8-ft. stroke, and is weighted to produce a working pressure of 550 lbs. A motor-driven triplex pump is also provided as an auxiliary to the steam pumps, and is started automatically if the accumulator falls below the predetermined height. A separate pump and system of piping supplies oil at 80 lbs. pressure for the governors, steady bearings and general lubrication of the turbines. The discharge from the step bearings and governors flows into closed settling tanks, the pumps drawing from these tanks. The water, sediment and dirty oil are drawn from the bottom of the tanks and passed through two Turner filters.

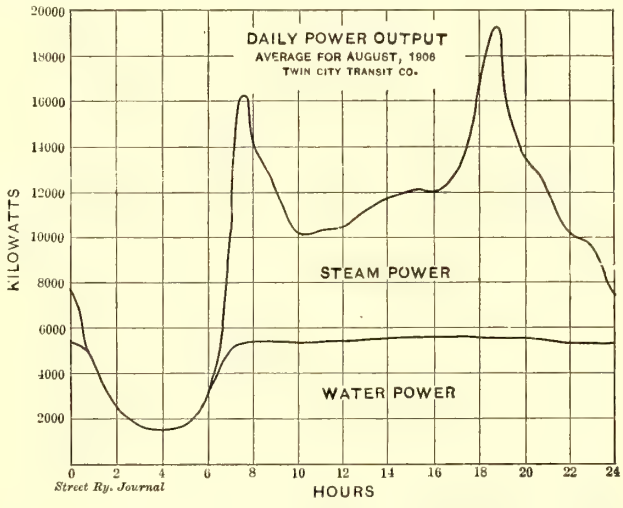
The base condenser of each turbine has 20,000 sq. ft. of surface in brass tubes having an outside diameter of 1 in. The cooling water for each condenser is drawn from the injection tunnel under the basement floor by a 30-in. special volute centrifugal pump with an enclosed impeller. The maximum amount of water required is 18,000 gals. a minute. A vertical 20-in. x 24-in. dry vacuum pump, fitted with a Cincinnati air valve gear controlling the three constant points in the compression cycle, namely, the opening of the suction, the closing of the suction and the closing of the discharge, is provided for each unit. This pump and the centrifugal pump for circulating cooling water are direct connected to a four-valve, 19 in. x 24-in. horizontal Corliss engine. A 4-in., two-stage horizontal turbine pump direct connected by a flexible coupling to a 20-hp, 550-volt, direct-current motor is provided for lifting condensed steam from the bottom of the condenser to the feed-water heater.

One engine-driven and two motor-driven exciter sets are installed in the engine room. The engine-driven set has a 50-kw, six-pole, shunt-wound, direct-current generator coupled to a 11-in. x 11-in. vertical, single-cylinder engine having a piston valve and automatic fly-wheel governor. The motor-driven sets each have a 200-kw, eight-pole, shunt-wound, direct-current generator direct connected to a 300-hp induction motor, the sets operating at 520 r. p. m.

The switchboard from which the operation of the equipment of the engine room is controlled is on a gallery 31.5 ft. above the floor at the end of the room farthest from the turbine units. This switchboard has twenty-nine panels of blue Vermont marble, all of the instruments having a marine finish. The arrangement of this switchboard will not be described in detail here. The general system of high-tension connections, however, is as follows: The 13,200-volt current from the generators is conveyed by three-phase cables to the generator oil switch, to disconnecting oil switches and to bus-bars. The latter are divided into three sections by means of oil switches. All incoming and outgoing lines are three-phase cables. Current to outgoing lines is conveyed from the bus-bars through disconnecting switches, an oil switch and disconnecting switches, in order. In case two or three cables supply a sub-station, they are connected on different sections of the bus-bars. Static arresters are installed on outgoing and incoming lines to relieve any heavy electrical strains. The grounding of any cable is shown by a Westinghouse static detector. Any piece of high-tension apparatus can be disconnected in order to make repairs or for inspection and cleaning.

The engine room is served by an electrically-driven traveling crane having a span of 65 ft., a 40-ton main hoist and a 5-ton auxiliary hoist. This crane has a vertical lift of 60 ft., and was built by the Whiting Foundry Equipment Company.

The steam power plant was designed and built and is operated under the direction of E. H. Scofield, chief engineer of the Twin City Rapid Transit Company, of Minneapolis. Sargent & Lundy, electrical and mechanical engineers, of Chicago, were consulting engineers to that company during the preparation of the plans and the construction of the station.



TWIN CITY DAILY STEAM AND WATER-POWER CURVES

AN ACCIDENT FAKIR TRAPPED BY THE UNITED RAILWAYS & ELECTRIC COMPANY OF BALTIMORE

The case of John D. Robinson, who sued the United Railways & Electric Company, of Baltimore, for injuries alleged to have been received while a passenger on one of the company's cars, clearly demonstrates what may be accomplished by the co-operation of steam railroads, street railways and casualty insurance companies in following up and vigorously prosecuting people who take out policies of insurance with a double-indemnity clause and get into an alleged accident on a street car. Not only will they collect from the insurance companies, but they also try to collect from the railway companies as well, and use the money obtained from the one to fight the other. Robinson had been suffering from a hernia for several years, yet he testified on the witness stand that he was a well man before the accident, and that the hernia was a direct result of the accident. His claim against the company was refused and he immediately filed suit. In the trial of his suit, the jury rendered a verdict in favor of the defendant, and Robinson was immediately indicted for perjury. He pleaded guilty and was sentenced to one year in the Maryland Penitentiary. The railway company and the police authorities were enabled to bring Robinson to justice by the assistance of the Alliance Against Accident Frauds. Prior to the indictment of Robinson it was a common thing for men who had been in a street railway accident in Baltimore to claim that a hernia followed as a direct result of the accident, but since the indictment of Robinson this kind of claims against the company has been practically eliminated.

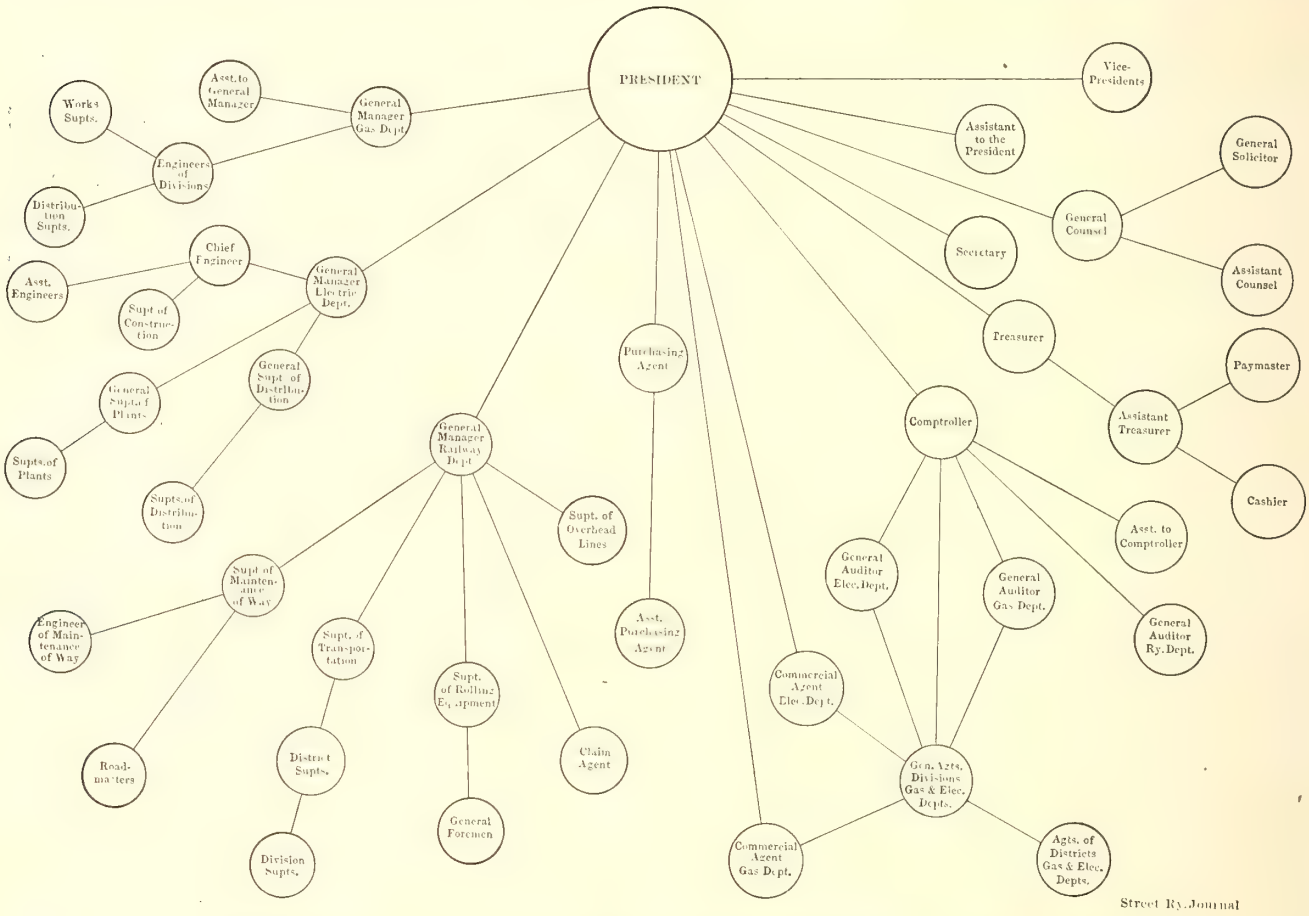
ORGANIZATION OF THE PUBLIC SERVICE CORPORATION

The Public Service Corporation of New Jersey is unique among the public utility companies of the country, in that it conducts all the gas, electric railway and electric lighting interests in some 170 separate municipalities. The communities served have a combined population of about 1,750,000 and cover an area of about 1000 square miles. The system is entirely in the State of New Jersey and has 652 miles of track. The company represents an aggregation of some thirty different public service corporations, which, by consolidation, merger and lease, are now conducted by the main corporation, whose head office is in Newark. The physical characteristics of the railways of the corporation, as well as the system of power distribution, formed the subject of a series of articles in the STREET RAILWAY JOURNAL during January, 1906, and December, 1903, and it is the purpose of the present article to outline the system of organization by which the energies of the company in its various departments are directed.

The management of the affairs of the company rests primarily with the board of directors, of which the president of the company, Thos. N. McCarter, is chairman, but is under the immediate direction of the executive committee, which consists of the president, as chairman, the three vice-presidents of the company, A. B. Carlton, J. J. Burleigh and C. A. Sterling, also Randal Morgan, Thos. C. Barr, Lewis Lillie, Uzal H. McCarter, A. R. Kuser, Mark T. Cox and Walton Clark.

There are two sub-committees of the executive committee. These are the "works committee," which consists of the president, the three vice-presidents and Messrs. Clark and Barr, and the "finance committee," which consists of the president, U. H. McCarter, Mark T. Cox and Lewis Lillie. These committees report to the executive committee. The works committee passes upon all matters relating to operation and the finance committee upon all matters relating to the finances of the company. The works committee has a sub-committee entitled the "engineering committee." It consists of the president, as chairman, Vice-President Sterling, the three general managers and George J. Roberts. The engineering committee passes upon all plans, specifications, etc., relating to the engineering features of the company and reports to the works committee.

An examination of the accompanying chart will show the active organization of the company, with the officers



ORGANIZATION CHART OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY

In practice there is, of course, some flexibility in the organization, as needs require.

All departmental heads report directly to the president, except on matters relating to the Southern division. Following the list of officers, commencing at the right of the president, will be found the three vice-presidents, whose names have already been published. These officers act in the order of their seniority in the absence of the president, and perform such special duties as may be assigned to them. Messrs. Carlton and Sterling have their headquarters in Newark. The headquarters of Mr. Burleigh are at Camden, where he is in general charge of the Southern division of the company, and receives such reports of that division as would be reported directly to the president in the other divisions. The assistant to the president is E. W. Hine, who frequently represents the president before municipal bodies. The general counsel, Frank Bergen, is in

general charge of the legal work of the company. The general solicitor, who reports to the general counsel, has special charge of litigation in connection with claims, and consequently is legal adviser to the claim department. The assistant counsel has charge of such other legal work of the company as may be assigned to him by the general counsel.

The office of secretary of the company is filled by Frederick Evans, who, in addition to this office, is also secretary of all of the various committees of the company. Mr. Evans also has charge of the general correspondence of the company and its relations with the press, and interviews, as a rule, are given out through him.

The treasurer, J. P. Dusenberry, is custodian of the company's funds and in charge of all receipts and disbursements. The paymaster, cashier and assistant treasurer report to him. It is the policy of the company to pay its employees weekly in cash so far as possible, and this work devolves upon the paymaster, so far as the railway employees are concerned. Owing, however, to the extent of territory served by the company, it has been found impracticable to extend this service to employees stationed at some distance from the railway lines of the company. In consequence, the employees of the gas and electrical departments are paid through the local cashiers of the various divisions. The railway employees are paid from a pay-car, which is assigned to a separate division each day. The employees of the gas and electrical departments are paid semi-monthly. The office of comptroller is occupied by P. S. Young. The accounting of the company is divided into three departments, each department being in charge of a general auditor, as shown in the chart; and each auditor reports to the comptroller.

The gas and electric commercial offices of the company are situated in the localities served and are divided into divisions with district sub-divisions. Each division is in charge of a general agent, to whom the district agents report. these local offices deal directly with the consumer, solicit business and collect bills. The general auditor of the electrical department is E. J. Allegaert, of the gas department W. H. Pettes, and of the railway department M. R. Boylan.

The purchasing agent of the company is J. A. Pearson, of Philadelphia, who is also purchasing agent of the United Gas Improvement Company, of Philadelphia, and who has his office at the corner of Broad and Arch Streets, in that city. Mr. Pearson, however, also has an office in Newark, where he is represented by an assistant purchasing agent. The purchasing department, of course, confers with the general managers of the departments in regard to purchases of materials and supplies for their departments. Large orders, such as for cars, rail, coal, etc., are approved by the executive committee before the transaction is completed.

The operation of the system of the Public Service Corporation is divided into three departments, each in charge of a general manager. The general manager of the gas department is H. D. Whitcomb, Jr., with his engineers of divisions, works superintendents and distribution superintendents. The electrical department is in charge of Dudley Farrand, who, in addition to the duties pertaining to the production and distribution of current for lighting purposes, also has charge of the production of electric power for the railway system. This includes the construction and maintenance of all of the power plants. The responsibility of the electrical department in the supply of current for railway purposes ceases at the bus-bars of the production stations, but for lighting purposes it includes the delivery of the current to the consumer.

The railway department is under the management of Richard E. Danforth, who recently succeeded Albert H. Stanley in that position. In addition to the operation of cars, this department also has charge of the construction and maintenance of the railway track and overhead lines and the construction and maintenance of the power distribution system after the current leaves the bus-bars of the power station. The railway department is divided into subdivisions, in charge, respectively, of the superintendent of maintenance of way, superintendent of transportation, superintendent of rolling equipment and the superintendent of overhead lines. For ease in operation, the department is further divided into districts, each in charge of a district superintendent, and these districts into divisions, each in charge of a division superintendent.

In addition to the officers already mentioned, the gas and electric departments each has its own commercial agent. These agents are engaged in the promotion and the solicitation of business in their departments. Percy Ingalls has charge of this work for the electrical department and W. H. Allen for the gas department.

The main offices of the company are in the Prudential Building, Newark.

TEST ON 5500-KW TURBINE

The result of some tests on one of the 5500-kw turbo generators in the power station of the Interborough Rapid Transit Company was given in a recent issue of the "Electric Journal." At 28 ins. vacuum there was a consumption of dry steam per kw-hour of 22.44 lbs. at 2000 hp; 20.05 lbs. at 3000 hp; 18.87 lbs. at 4000 hp; 18.18 lbs. at 5000 hp; 17.70 lbs. at 6000 hp; 17.27 lbs. at 7000 hp, and 17.14 lbs. at 8000 hp. Tests were also conducted with 27-in., 26-in., and 25-in. vacuum. The rate of change per inch of vacuum between 26 in. and 28 in., referred to 30 ins., was about 5 per cent of the average corresponding water rate. With lower vacuum the percentage changed to about 3.5 per cent per inch of vacuum. The tests were conducted with saturated steam containing as high as 2.5 per cent moisture. Had superheated steam been used it is probable that the full-load steam consumption would have been approximately 11 lbs. per brake hp-hour with 100 degs. superheat. Comparing this with the economy of a large Corliss engine with an assumed mechanical efficiency of 91 per cent, the engine would have to show an equivalent water rate of close to 10 lbs per ihp per hour to equal the performance of this turbine.

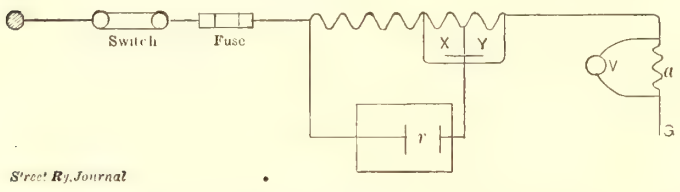
PROPOSED ELECTRIC ORE-CARRYING LINE IN GERMANY

It is reported that the Prussian Government railway authorities have decided to build an electric railway from the Essen coal and iron district, across the semi-mountainous Eifel region to the Saar and Lorraine districts. One of the great electrical companies of Berlin will equip the road. The object is to secure the cheapest transportation for low-grade iron ore from Lorraine to the furnaces of the lower Rhine, while Lorraine draws vast quantities of coal and coke from Essen. Streams in the Eifel range will generate the electricity.

FLEXIBILITY OF WATER AS A VARIABLE RESISTANCE

Some time ago a railway repair shop electrician was requested by his superintendent to go down to a prominent vaudeville theater and "fix 'em up," meaning, in substance, that there was to be put on an electrical production that called for facilities not at hand. The proposition was as follows: An electricity performer needed 125 amps. of current at 110 volts; his lamps would not operate satisfactorily with alternating current, so he must have direct current; the only direct-current source available was the 475-525-volt street railway circuit. It was necessary, then, to use a resistance that would safely carry 125 amps. and leave a voltage not exceeding 110 volts available to the performer. The figures were something like this: 110 volts on the stage means that a resistance in the cellar must divert 500-110 = 390 volts; we must have a resistance that will consume 390 volts at 125 amps; such a resistance would be 390 ÷ 110 = 3.54 ohms, with some way to handle variations. The electrician decided on what he would use. The stage manager somehow learned that a water rheostat figured in the proposed arrangement, and he almost had a fit, because, as he said, the last time a water box was used "it foamed clean to the roof and the lamps acted as if they were on a jigger." As there was lots of time, however, he agreed to a demonstration.

The arrangement used was as indicated in the diagram,



ARRANGEMENT DEVISED TO SECURE 110 VOLTS ON A 475-525-VOLT CIRCUIT

where R is a series of General Electric starting coil grids capable of carrying a current of 100 amps. for thirty minutes without undue heating and measuring 390 ÷ 100 = 3.9 ohms. In parallel with this battery of grids was connected a water box r, proven, by experiment, able to carry a current of 50 amps. without foaming and giving a convenient resistance variation that would hold the current anywhere between the limits of 10 amps. and 50 amps. As the resistance of the performer's end of the circuit would be 110 ÷ 125 =0.88 ohm, an experimental resistance of this value was connected at a to correspond to the performer's load. A voltmeter V was connected across a. To allow for emergencies, which did not occur, an extra frame of twenty grids was connected in series with R and a circuit-breaker X connected in parallel with it and closed; another circuit-breaker Y was connected in parallel with the last frame of the regular series R and left open.

The regulation was effected as follows: First resistance R was thrown in circuit, giving, on junction with the experimental load a, a current of about 100 amps. The water box circuit was closed then and its resistance varied until the voltmeter across the experimental load indicated 110 volts. By regulation of the water resistance the voltmeter needle could be kept constant at any value from 100 to 120. The object of circuit-breakers X and Y was to give a greater variation in event of great line variation or of one of the performer's lamp circuits failing. Kicking X open would increase R's resistance twenty grids, and closing Y would decrease it twenty grids. It was not necessary to use either of the breakers. The performer's electrician tried the arrangement and pronounced it entirely satisfactory.

It is sometimes a serious problem as to how to vary heavy currents gradually, especially when the currents must be maintained for any length of time. The writer has tried several methods and has found that unless there are facilities for varying the voltage of the supply current a water box in parallel with a constant resistance is the most satisfactory arrangement. He has used it for regulating currents between the limits of 400 amps. and 700 amps.

THE DEFORMATION OF RAILS AND WHEELS

In the July 13 issue of this paper an abstract was published of the paper presented by H. R. A. Mallock on the action of wheels on rails in electric roads at the engineering conference, held in London last month under the auspices of the Institution of Civil Engineers.

The discussion on this subject according to "Engineering," was opened by F. E. Robertson, C. I. E., who said that the real cause of excessive wear at the present day was to be found in the increase of wheel loads and decrease of diameter of the wheel. The safe load was a function of the diameter of the wheel. In dealing with complaints made lately by Indian railways that their new rails wore less well than the old, he had asked for samples of both kinds. Twelve samples from new rails and twelve samples from old rails had been tested analytically, mechanically, and microscopically, and it was proved that there was really no difference between the groups of old and new. The real trouble lay with the new classes of locomotives that had been introduced. He thought Mr. Mallock would have been nearer the mark had he taken 8 tons as the wheel-load at the present day, instead of 4 tons.

The next speaker was A. W. Szlumper, who stated that the wear of rails in tube railways was not phenomenal on the straight portions of the line, and was so only on the outer and raised rails on curves. In corroboration of this assertion he instanced the case of ordinary Bessemer rails on a 1 in 30 incline on the straight that had been laid now for nine years on a line with 5-minute traffic, and the wear was only 1/16 of an inch. But on the high rail on curves at switches and crossings they had much trouble. The question of wear of wheels was, however, equally important. In order to reduce these troubles they had put in guard-rails, had carefully adjusted the gage, and had taken the precaution of greasing the guard-rails twice a week. The life of rails had by this means been increased by sixteen to twenty or more months. The introduction of hard rails would, he considered, merely transfer the wear from the rail to the wheel. With regard to Mr. Mallock's figures, he thought the area of contact calculated too small, and he believed that only elastic deformation was caused. Mr. Mallock suggested that the worst effect would be realized when wheels and rails were new, as then the area of contact was smallest. His (Mr. Szlumper's) experience showed that wear was very little at first, and much greater subsequently, when the wheel and rail have assumed approximately the corresponding shapes.

Prof. Carus Wilson stated that he had made experiments which gave results analogous to those that might be expected from Mr. Mallock's figures. With a 40-in. wheel, and a load of 3.2 tons per inch run, he found that the stress

in the top fiber of the rail amounted to 18 tons per square inch. In his view, the tendency of the rail to tear apart was more serious than the question of wear. The greatest strain when a wheel passed over a rail was not, he said, at the bottom or lowest fiber of the span, where it would be expected, but at the top, produced by this local action of the wheel. In the upper fiber there was direct tension, as the result of the load, and this gradually diminished towards the middle of the cross-section. Professor Wilson continued that if corrugated rails were examined, microscopic cracks would be found extending from the top downwards, corresponding with the effect he would expect from heavy wheel-loads. Corrugations tended to reduce the area of contact to a small fraction of an inch, and therefore the cracks appeared.

Prof. B. Hopkinson considered that the time-factor should not be omitted in such calculations. In some tests on wire that he had made, a load of 500 lbs. had produced permanent deformation, but if the load was applied for only 1/1000 of a second, an 800-lb. load produced no permanent deformation. In some other tests it was found that a load of 25 tons per square inch might be safely increased to 50 or 60 tons if applied for 1/1000 of a second, it then producing no permanent deformation. If the lesson taught by these laboratory experiments was applicable, it would suggest that wear was less on sections on which fast running was the rule, and greater on slow sections or roads.

R. H. Burnett said that wear might be reduced by paying greater attention to the design and construction of trucks, which were, as a rule, now, of too short a wheel-base.

This point was further commented on by W. H. Short, who said that the side wear of the outer rail produced by the leading outside wheel was, he considered, unavoidable. It was practically independent of the speed, or radius of the curve. If the factor of friction were taken as 0.25, there was, he said, with a truck of 5-ft. wheel base and with correct super-elevation, a force thrusting against the outer rail equivalent to three-quarters of the total load on the wheel. An increase of wheel base to 10 ft. reduced this by 20 per cent. The ill effects increased inversely as the diameter of the wheels, and, again, the rate of wear increased as the wear increased. The service of the guard-rail arose from its sharing with the outer rail this outward thrust.

Prof. W. E. Dalby drew attention to the fact that locomotive tires are often found not to be circular after running some time and have to be trued up. He thought that where stops were frequent and there was much braking, other wheels would also be found to be in this state, which might be the cause of some of the trouble.

Dr. Harbord said that, as a rule, the tire and rail were not of the same quality of steel, as Mr. Mallock had assumed, and that while rails had an elastic limit of about 20 tons, tires had an elastic limit of 26 to 28 tons. With regard to actual wear, he would point out that high-silicon tires (containing 0.3 to 0.35 per cent Si) had been in use for years, and had worn well, as the effect of silicon was to produce a sounder steel.

D. D. Coath said that wear could only be got over by the elimination of friction between the tire and rail; this could be done, he asserted, by putting the flanges on the outside of the wheel-tread in a manner that had been worked out by him, which, however, he was afraid was some 70 years too late.

W. Willox said that he considered ripples of wear of little moment, but waves or corrugations such as he had had experience of were more important. They were from 9 ins. to 5 ft. and 6 ft. in length, up to 5/16 in. in depth, and might appear in six weeks or only after three or four years, and under all conditions of traffic and location; there appeared to be nothing consistent about them, or the reason for, or manner of, their appearance. Test pieces cut from ridges and from hollows revealed no clue to the problem, which was a most serious one financially, as good rails were often ruined in this way after only a short life.

E. Benedict suggested that the ridges might be found to travel either backwards or forwards, if observations were made to this end. He pointed out that, as a train progressed simply by means of the frictional grip of the driving wheels on the rail, wear must take place, in the case of driving wheels and on the rail. For other wheels the wear on the rail is small, as it it pure rolling friction.

J. W. Twinberrow thought that wear on heavy electric traction roads was mainly due to the fact that designers had followed in the steps of tramways where no need for this existed. A longer truck wheel base would be beneficial. The motor trucks were too weak, consisting, as a rule, of ordinary trucks with bracing removed, and driving gear crowded in instead, and they should be made much more rigid. When the drive was applied close to one wheel, the other, on account of the torque, was out of phase, so to speak, and this produced rhythmic vibration in the shaft, causing unequal wear. Once this had started it increased very rapidly. On the question of brake-work, which usually seemed to be hung on anywhere, he thought that the proper system should be to block both sides of each wheel, or else the insides of the wheels, and not the outsides, as was so commonly done; for in this latter case the spring base was, perhaps, as little as one-half the braking base, whereas they should be at least equal, or the spring base the greater of the two.

R. J. Howley was the next speaker, and said that his experience only enabled him to speak of tramways, but he might say that he had found corrugations on tracks of all kinds, and even on cable tramways, so that this effect was not due to the trucks used in electric traction. It was due to the rolling load, which worked the rail up into lumps. The quality of the rails must be looked to for the cause. In an analysis of "quiet" and "roaring" rails he found that the ratio of carbon to manganese was low in "roaring" rails and high in "quiet" ones. Out of twenty-four samples in which the ratio of carbon to manganesse was high, only one rail was a "roaring" rail. When this ratio was 40 to 100 the rails were "roarers"; all above this were "quiet."

The chairman (W. R. Galbraith), in closing the discussion, said that it might be of interest for members to hear a true account of trouble reported on the Waterloo & City Electric Railway. As first laid, this line was tight to gage, and wear on curves was serious; but this had now been rectified, and wear was not abnormal. He also read an extract of a letter from the engineer of that line, in which it was said that when new the rolling stock had had no play at all allowed for the axle boxes in the guides, so that the wheel base was too rigid, and this contributed to excessive wear.

H. R. A. Mallock, in replying, said the time factor should really be included in the calculation, and that the result would be that the load could be materially increased over that on which his calculations were based, and he had only omitted the point to condense the matter into the time allowed.

PASSENGER PLATFORM AT BAY SHORE PARK, BALTIMORE

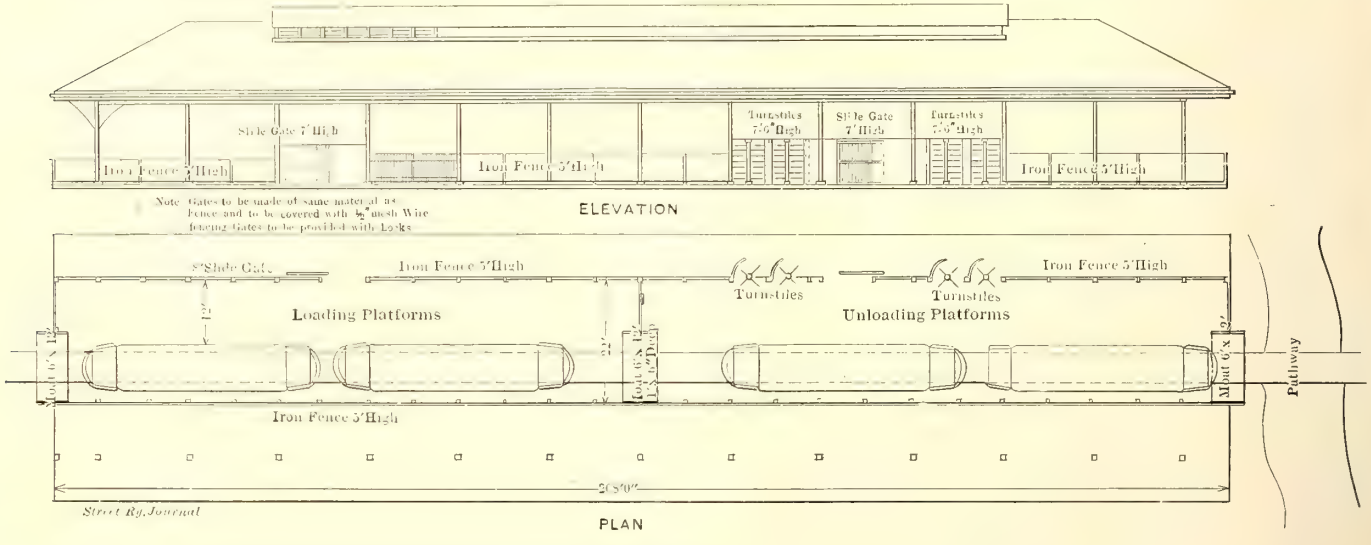
Bay Shore Park, on Chesapeake Bay, has developed into a very popular recreation ground for the Baltimoreans glad of the opportunity to see salt water. The park is owned and operated by the United Railways & Electric Company, cars entering the station run alongside a 5-ft. iron picket fence on the outside, which effectually prevents any boarding of cars from that side. The passenger platform is divided in two sections—one for unloading and the other for loading. They are 12 ft. wide and taken together 208 ft. long. The platforms are separated by a picket fence which has a locked sliding gate that can be opened only by employees. In addition to this fence, it will be noted that a moat has been built between and alongside the track at the dividing line, and similar moats at the points where the tracks enter and leave. Although these moats contain only 18 ins. of water, their width of 6 ft. is great enough to discourage those who would take an unfair advantage in getting on the cars.



ENTRANCE TO THE BAY SHORE PARK TERMINAL, SHOWING ONE OF THE MOATS

Passengers on leaving the cars proceed directly to the park grounds by passing through the turnstiles, as no other exit is possible, unless the attendant find it necessary to operate the sliding gate.

The entrance to the loading platform is controlled by a sliding gate which can be closed by the attendant when the platform becomes too crowded. At present 1000 passengers an hour can be handled with cars running on the 3-minute maximum headway with 50 passengers to the car. As the trip to the center of Baltimore takes 1 hour, practically all of the passengers wait for seats. The capacity of the platform is considerably greater than the figure given would indicate, but is limited by conditions that make a shorter headway impracticable at the present time.



PLAN AND ELEVATION OF THE BAY SHORE PARK TERMINAL OF THE UNITED RAILWAYS & ELECTRIC COMPANY

and much of its success is due to the comfortable cars and fast schedules maintained for this resort. The Bay Shore line is double track, and a great portion of it is on right of way. At a short distance from the park, however, the incoming and outgoing tracks diverge so that a single-track loop is formed at the terminal. To improve the car facilities at the park and avoid troubles due to opposing lines of traffic, a platform was constructed which is of somewhat unusual type but answers the purpose very well.

As shown in the accompanying plan and elevation, the

Under an agreement reached with the Philadelphia Rapid Transit Company, the Lehigh Valley Traction Company will be able to run its cars into the Philadelphia company's station at Chestnut Hill instead of stopping in the open at the Wheel Pump Hotel.

MUNICIPAL OWNERSHIP OF GAS AND ELECTRIC LIGHTING PROPERTIES

The reviews of the effect of municipal ownership upon public utilities by members of the National Civic Federation are being completed. Those on gas and electric lighting are abstracted below. One of these reports was submitted by Milo R. Maltbie, one of the Public Utility Commissioners for New York City, recently appointed by Governor Hughes. The other is a joint report of Charles L. Edgar, president of the Edison Electric Illuminating Company, of Boston, and Walton Clark, vice-president of the United Gas Improvement Company, of Philadelphia.

MR. MALTBIE'S REVIEW

The gas plants examined by the investigating committee of the Commission were those conducted by the municipalities of Birmingham, Glasgow, Manchester and Leicester, and by private companies at Sheffield, the Newcastle & Gateshead Company, and the South Metropolitan Company, of London. On the important subject of maintenance of plants, etc., Mr. Maltbie says that during last year every municipality set aside out of earnings a larger total to maintain or extend the plant or wipe out indebtedness than did any private company. As to the price of gas to the customer, Mr. Maltbie points out that the private company at Sheffield is able to buy good gas and coke-making coal at a lower price than any other company or municipality and finds a market for its coke at its very door in which it receives more per ton than any other undertaking save one; and that it sold its by-products for more than the cost of its coal, oil and other supplies, making profit thereon of 2.13d. per thousand cubic ft. of gas sold. No other undertaking was so fortunate, and a comparison as regards prices and costs between Sheffield and any other plant not so well situated would be misleading and unfair. If it should be assumed that the residuals paid the cost of gas materials in every plant, and if the charges for maintenance, rates and taxes, contributions to the public funds, should be equalized, the average price at which gas could have been sold by the municipal plants would have been 16.84d. per 1000 ft. and the private companies 21.31d. In operating expenses there is not much difference between the municipal and private plants, the difference in expenses being confined to interest, dividends and credit balance.

All of the undertakings examined, according to Mr. Maltbie, have a good record in character of service, and barring the few accidents which happen in all plants, gas has been continuously furnished, both by the companies and the cities. He finds, however, that the municipalities are better prepared to furnish an uninterrupted supply during a strike than the private companies. The quality of the gas itself Mr. Maltbie finds to be superior in the municipal plants, according to the official reports. The charge was made, however, that the tests were not fair, in that the municipalities tested their own gas, while that of the companies was tested by an official examiner not connected with the companies. Mr. Maltbie declares, however, that so far as the independence and reliability and accuracy of the persons making the tests of candle-power are concerned, there is no difference between the companies and the municipalities, except possibly Leicester, and there the allowance would be very small.

The municipal plants Mr. Maltbie found to be conducted with greater efficiency than the private undertakings. Thus, in the municipal gas plants, the loss due to leakage and gas used at work was 6.95 per cent of the gas made and the companies 8.17 per cent. The amount per mile of mains was 359,000 cubic ft. for all municipalities and 489,000 cubic ft. for all companies, a still greater difference, which is due again to the larger number of miles of mains which the municipalities have.

Discussing progress and the introduction of new inventions, Mr. Maltbie's view is that the municipal plants are as modern, as efficient, and as fully up-to-date as the company undertakings. He also gives it as his opinion that the encouragement given to the production of new inventions and the discovery of new processes by a probable demand for them, is certainly as great under municipal operation as under private management.

The electric lighting plants investigated by the Civic Federation Commission were the municipal ones at Manchester, Liverpool, Glasgow, and the borough of St. Pancras, London, and those operated by the Newcastle Supply Company, the Newcastle District Company and the four London companies: the City of London, Westminster, St. James and Central. Charges by the municipal plants were more economical, according to Mr. Maltbie, the cities charging .529d. per unit less than charged by the private companies. As to efficiency of service, there was no difference between the municipal and the company undertakings, as regards the promptness with which current was turned on and complaints attended to, the convenience of the location of offices, the testing of meters, the restoration of paving after streets were opened, the care given to street work generally, although there were more complaints upon this score against companies than municipalities, the construction of extensions, and the extent to which the entire area of supply was served and appliances carried in stock for sale or rent.

The character and equipment of the plants investigated are discussed. Mr. Maltbie summarizes the result of this branch of the examination, saying it appears that one of the company stations is more modern and efficient than any one maintained by a municipality; but it is also true that two of the companies are more backward and have a more antiquated equipment than any municipality. Upon the whole, the municipal undertakings seem to be as modern as those belonging to the companies, but not so well located or arranged, and perhaps not quite as efficient.

In concluding his review of the reports of the experts Mr. Maltbie says:

"The opponents of municipal activity have frequently tried to scare the British voter and to prejudice him against the operation of public utilities by local authorities by citing the large increase in total indebtedness within the last fifty years, as compared with the decrease of the national debt. They have pointed out that the local debt has more than trebled in the twenty-five years from 1875 to 1900, and that the amount of local debt per £100 of ratable value of property has doubled in the same period, while the national debt has decreased almost 18 per cent.

"Over 40 per cent of the local debt is for water, gas and electricity works, tramways, markets, harbor improvements, wharves, cemeteries, baths, workingmen's dwellings, etc. In every one of these cases the debt is represented by physical assets. It has also been definitely shown not only that the debt is not a burden upon the taxpayer, but that the taxpayer gets a financial benefit from municipal operation, and therefore from the very debt which is claimed to be a burden upon him. It is not evidence, but it is suggestive, that the local tax rates were lower for every group of towns when there was municipal operation of gas, electricity or trams than where companies were operating."

REVIEW BY MR. EDGAR AND MR. CLARK

Mr. Edgar and Mr. Clark open their comments on the British gas situation by pointing out that the private companies supply gas at lower prices than do the municipalities. Thus, the relatively small cities of Newcastle and Sheffield get cheaper gas from private companies than do the larger cities of Manchester, Birmingham or Glasgow. The difference in cost per ton of coal does not explain this difference in the selling price of gas, according to the reviewers, who find that the greater efficiency in management and in energy in selling the by-products has much to do with the lower prices. The service given the consumer by the private companies is declared to be superior to that given by the cities, although it is pointed out that the investigation of the candle-power of the light supplied was incomplete in the municipal plants because of the declination of the authorities to permit the experts to make full examination.

"The whole question of the quality of the product of the municipalities is in doubt," say the reviewers. "The members of the Commission and the experts who are familiar with gas and photometry see no escape from the conclusion that the above facts show that the service of the municipalities is not what it is claimed, that the municipalities are unwilling to have the actual quality of their service determined by independent and competent authorities, and that the gas supplied by private companies is much superior in candle-power to that supplied by municipalities."

Considering the general gas service, from a financial standpoint and with a view also to the character of service given and the maintenance of plants, Mr. Edgar and Mr. Clark declare in favor of the private companies. They find that apparently the citizens of municipalities operating gas plants are not seriously concerned with the operation; do not regard the operation of the gas plant as a matter of general interest, and do not take that interest in it which is advanced as one of the arguments in favor of municipal ownership and operation. The lack of interest in municipal plants indicates a general indifference on the part of the public to a condition that they tolerate because they know not how to remedy.

"On a superficial view," continue the reviewers, "the fact that municipal undertakings contribute some of their earnings to the city treasury, and thus aid in reducing the tax rate, seems an advantage gained by that method of operation. Leaving aside the question of injustice involved by a system of relieving the taxpayer at the expense of the gas consumer, let us examine, in the municipal plants investigated, what would have been the effect if the companies' prices had prevailed.

"Glasgow cannot enter into this comparison, because that city has been, for many years, prohibited by act of Parliament from applying any of the profits from its gas undertaking to the common good. London is omitted because of its widely different conditions.

"In the year covered by this investigation, if, in the city of Birmingham, the Newcastle price of gas had prevailed, the consumers would have been £262,600 better off; if the Sheffield price had prevailed, the Birmingham gas consumers would have saved £350,900. The amount paid by the Birmingham gas undertaking into the common good was £69,813. So it seems that this city is playing a losing game with its municipal plant; it is mulcting its gas consumers from £250,000 to £350,000 a year in order that it may help out the municipal treasury with a paltry £70,000. In the case of Manchester, if the Newcastle price had prevailed, the gas consumers would have saved £47,500; at Sheffield's price they would have saved £111,300. The amount contributed to the city treasury by the gas business was £60,000. In the case of Leicester, at Newcastle's price, the consumers would have saved £65,200, while if Sheffield's price had obtained they would have saved £90,500. The amount contributed by the gas business to the common good was £43,466."

The examination of the electric lighting systems of Great Britain, both municipal and private, shows, according to Mr. Edgar and Mr. Clark, that municipalities in England, though said to be much better governed than are those in the United States, are by no means as well adapted for commercial operation of an electric lighting plant as are private companies controlled by men of average honesty and ability whose training and initiative are given full scope. "It appears," they add, "that so far as the prices charged are concerned, the system of municipal ownership and operation of electric undertakings in England has given its advocates no reason for feeling ashamed or elated, but that so far as extending the benefits of electric light and power and so far as progressiveness in developing the industry so as to give the best possible service are concerned, it has shown itself to be entirely outclassed by the system of private operation."

MUNICIPAL OWNERSHIP OF STREET RAILWAY PROPERTIES

The reviews of the effect of municipal ownership on street railways for the National Civic Federation municipal ownership committee were prepared by W. J. Clark, of the General Electric Company, and Prof. Frank Parsons, president of the National Public Ownership League. They are published in abstract below:

MR. CLARK'S REPORT

It should be stated for the benefit of general readers that no American street railways were investigated by the Commission, and that the only tramway installations which were directly investigated in the United Kingdom are the following:

Municipally Owned.	Privately Owned.
Manchester.	London United Tramways.
Liverpool.	Dublin United Tramways.
Glasgow.	Norwich Electric Tramways.
London County Council.	

According to the British census of 1901, 69 per cent of the entire population of the United Kingdom was urban in its character. This computation included as urban population the residents in England and Wales in towns of 2000 population or over, and the residents in Ireland and Scotland in towns of 3000 population or over. The total of such urban population was 29,144,726.

According to the United States census of 1900, its urban population was 44.6 per cent of the total inhabitants. This computation included, however, residents in communities of 1000 population or over. The total of such urban population was 33,850,000.

In the comparisons which follow there is a slight advantage in showing in favor of the United Kingdom, because the population in communities of less than 2000 is not included to make up the total urban population as is the case in the figures given for the United States.

The British Parliamentary return on tramways for 1902, and the United States census bulletin on street railways for

the same year (the last official publication covering details of all American street railways), contain figures quoted below, and with the above totals on urban population of the respective countries are the basis for calculation accompanying such figures.

In 1902 the total length of tramway track in the United Kingdom was 2336 miles. In the United States there were 22,328 miles of track. The urban population in the Kingdom was, therefore, 12,476 per mile of track. In the United States it was 1516. Therefore, the urban resident in the United States had comparatively eight and one-half times greater trackage facilities available to him for travel than had a similar resident of the United Kingdom.

The same year there were 7752 cars on British tramway lines, or one for each 3760 of the urban population. It is thus apparent that the urban resident of the United States had comparatively more than six and one-half times the number of cars available for his use than were available to the English urban resident.

A total of 1,394,452,983 passengers were carried in 1902 on the tramways of the United Kingdom. On the street railways of the United States 5,521,509,521 passengers were carried. Of this last, however, 1,062,403,392 were on transfers, or practically 90 per cent of the entire number of passengers carried in the United Kingdom. Thus, American street railways carried free, nearly as many passengers as the entire number carried in the United Kingdom, all of whom that are accounted for paid fares.

We hear a great deal of talk about the overcrowding of cars in American cities. The above figures clearly demonstrate, however, that, on the basis of passengers carried per car per year, the American street railway car averages but slightly more than one-half the passengers carried by the street railway car of the United Kingdom. That is, the American car averages 93,585 passengers per year, as against 182,463 passengers per year carried by the average car of the United Kingdom.

The average number of rides per capita of the urban population in the United Kingdom was 48, as against 161 in the United States, which fact speaks volumes for the appreciation of extended facilities by the public of the United States.

The average receipts per passenger in the United Kingdom was 2.26 cents, as against 3.76 cents in the United States. However, 9.65 passengers rode per car-mile in the United Kingdom, as against 5.2 passengers per car-mile in the United States. These figures show 21.81 cents revenue per car-mile in the United Kingdom, as against 19.55 cents revenue per car-mile in the United States. In other words, the British passenger paid about 60 per cent of the rate of fare paid by the American passenger, but as above stated, his facilities for travel were from 12 per cent to 15 per cent of those enjoyed by the American passenger.

In 1902 there were two cities of over 100,000 population in the United Kingdom without street railways. In the United States there were none.

In the United Kingdom there were seven cities of from 50,000 to 100,000 population without street railways. In the United States there were none.

In the United Kingdom there were thirty-nine cities of from 25,000 to 50,000 population without street railways. In the United States there were none.

In the United Kingdom there were 295 communities of from 8000 to 25,000 population without street railways. In the United States there were twenty-one.

In 1890 the length of tramway line (not track) in the United Kingdom was 948 miles. In 1902 it was 1484 miles, showing an increase in twelve years of but 536 miles. In 1890 the length of street railway lines in the United States was 5783 miles. In 1902 it was 16,538 miles, showing an increase in the intervening period of 10,755 miles, or an increase nearly twenty times as great as that in the United Kingdom.

The increase in passengers carried between 1890 and 1902 in the United Kingdom was 868,083,655. In the United States the corresponding increase was 3,598,499,318, or, say, four and one-half times greater than that in the United Kingdom, which, of course, is not a growth proportionate to the great increase in facilities afforded in the United States. To put it another way, the passengers carried per mile of line in 1890 in the United Kingdom were 555,232; in 1902, 939,658, showing an increase in the intervening period of 394,426. In 1890, in the United States, 349,838 passengers were carried per mile of line. In 1902, but 333,862, a decrease of 5976.

These figures clearly demonstrate that the British policy has been to electrify and not greatly extend existing tramways, except through densely populated districts, which means obtaining the greatest possible revenue without affording adequate transportation facilities, whereas, in the United States, private enterprise has constructed lines which afford public facilities, but which, in many instances, do not bring an adequate return.

It is well to note in this connection that the policy pursued in the United Kingdom must necessarily result in low rates of fares. If, in such cities as New York, Philadelphia, Chicago and St. Louis, we were to cut down the miles of track to correspond to the conditions prevailing in such cities as London, Glasgow, Manchester and Liverpool, we would find that there would be only about 21 per cent of the present track, and, furthermore, that this comparatively small and inadequate trackage would be, for the most part, confined to the densely populated districts. If a person desired to travel beyond this section it would be necessary for him to walk or use some conveyance other than the electric car.

From 1902 to 1905 the miles of tramway track in the United Kingdom had increased from 2336 to 3376, a total of 1040 miles. In the United States during the same period the increase in miles of street and similar railways was from 22,328 to 33,250, a total increase of 10,922, or over ten times the increase in the United Kingdom.

During the same period the increase in cars in use on British tramways was from 7752 to 10,344, a total increase of 2592. In the United States the increase was from 59,000 cars in 1902, to 79,751 in 1905, a total increase of 20,751, or between seven and eight times as great as in the United Kingdom.

Some comparison of facilities available in cities of comparatively the same size in the two countries may be desirable. Hence the following comparison of miles of street railway track in certain cities. The figures for the United Kingdom are for 1905. Those for the United States are for 1902. (Figures on track from Parliamentary return. On population from tables of "London Electrician.")

For the United States the figures given cover only the actual trackage within the incorporated limits of the respective municipalities, and do not include the extensive suburban and interurban track connected therewith. If we consider the twenty largest cities in the two countries we find the following most interesting facts:

The combined population of the twenty American cities

is 12,854,897, as against 14,771,518 for those of the United Kingdom.

The combined miles of track for the twenty American cities is 5966, as against 1567 for those of the United Kingdom.

The average population per mile of track for the twenty American cities is 2155, as against 9426 for those of the United Kingdom.

UNITED KINGDOM

British Street Railways—1905

Cities	Population Served	Miles of Track	Populat'n per Mile of Track
Greater London	6,581,000	274.68	23,958
Glasgow	1,000,000	147.62	6,779
Manchester	850,000	146.19	5,130
Liverpool	798,000	104.00	7,663
Birmingham	650,000	44.5	14,606
Leeds	450,142	89.07	6,765
Sheffield	432,940	65.83	6,577
Potteries district	400,000	38.43	10,409
Dublin and district	393,994	107.5	3,685
Belfast	358,680	73.14	4,767
Bristol	358,000	52.00	6,885
Edinburg	331,997	43.00	7,720
Bradford	324,000	96.69	3,351
West Ham	300,000	17.03	17,616
Salford	300,000	70.75	4,242
Newcastle-on-Tyne	300,000	49.85	6,017
Hull	253,865	27.19	9,368
Nottingham	239,800	30.12	7,961
Leicester	228,100	37.00	6,165
Bolton	221,000	42.2	5,237

UNITED STATES

American Street Railways 1902

Cities	Population Served	Miles of Track	Populat'n per Mile of Track
New York	3,716,169	1,349	2,754
Chicago	1,873,820	925	2,026
Philadelphia	1,367,716	540	2,533
St. Louis	612,279	345	1,775
Boston	594,618	253	2,073
Baltimore	531,313	228	2,330
Cleveland	414,950	182	2,280
Buffalo	381,403	198	1,926
San Francisco	355,919	283	1,257
Pittsburg	345,045	176	1,960
Cincinnati	332,934	197	1,690
Milwaukee	313,025	117	2,675
Detroit	309,619	*316	979
New Orleans	300,625	176	1,708
Washington	293,217	150	1,955
Newark, N. J.	265,394	94	2,632
Jersey City	219,462	60	3,658
Louisville	215,722	125	1,726
Minneapolis	214,112	128	1,673
Indianapolis	197,555	124	1,593
Providence	186,742	80	2,334
Kansas City	173,064	133	1,301
St. Paul	172,038	105	1,638

* There is probably some error in this census figure.

The above thoroughly demonstrates that the primary object for which local transportation lines are created, to wit, giving best of public facilities, has been far better attained in the United States than in the United Kingdom.

Another point of great advantage in American street railways as against those operated in the United Kingdom is that the former are, on the average, operated 18 hours per day, while those of the latter do not average more than 15 hours operation each day. Then, too, in the larger American cities there is an all-night service, while such is not the case in the cities of the United Kingdom.

It is true that the development of electric traction enterprises by British municipalities did not commence until a much later date than in the United States; in fact no moves were made in this direction until its great success had been thoroughly demonstrated in America, on the Continent, and even in the United Kingdom itself by private enterprise at Leeds, Dublin, and elsewhere, and long after private enterprise had expended enormous sums in perfecting its operation, thus obviating the necessity of British municipalities standing any portion of the tremendous development charges of what has been so beneficial to humanity and which has added so materially to the capital charges of traction companies the world over.

This is thoroughly illustrated by the following extract from the report of the Glasgow Commission Tramways after their visit to America the latter part of 1896:

American managers and engineers, while they smile at our still continuing to operate with horses, at the same time congratulate us on our having been able to wait. The pioneers of the electric overhead system have come through a trying and expensive experience. The first motors, generators and equipments were crude and soon had to be thrown aside in favor of newer designs. They also in their turn became obsolete. Even up till within the last two years great improvements were made but now it is generally believed that engines and generators, motors and line equipments have all been by experience so much improved that now they are practically standardized, and they can undoubtedly be bought at very much less money than at any former time.

Consequently with all this past experience of other before them the progress of British municipal officials in tramway development in recent years should have been very rapid, but, as stated, it has not been so.

The taking over of British tramways from their company owners by the municipalities, while in accordance with the tramway act of 1870, under its so-called "Scrap Iron" clause can hardly be designated other than as legalized confiscation. How little these municipalities paid for the properties which they thus acquired, and the losses and pioneer work which went therewith, few realize.

According to the Parliamentary return of April 5, 1906, on tramways and light railways, it appears that in England and Wales there were expended by local authorities on construction or purchase of old lines and works now superseded, but £2,516,148; in Scotland for the same purpose, £130,837; in Ireland, £332,364; total for the Kingdom, £2,979,349, or, say $14,800,000, covering the most valuable tramway properties in the Kingdom, a less figure than has been paid by present street railway companies in several medium size American cities for the plant and business of the companies which have preceded them.

The strongest arguments ordinarily advanced by the advocates of municipal tramway ownership are the profits which the municipality or public receives from their operation, and there is a mistaken impression prevailing that these are comparatively larger than similar financial benefits which American municipalities derive from street railway companies.

The British Parliamentary return for 1906 on tramways and light railways shows that the total rates and taxes paid by the tramways in the Kingdom were £121,761 for the companies, and £262,527 for the municipalities, a total of £384,288, or, say $1,900,000.

Differently than is ordinarily supposed, about one-half of this amount goes to the National Government, which levies an income tax of 5 per cent upon the net earnings of the tramways, so that the municipalities receive direct from those sources less than a total of $1,000,000.

For the sake of comparison it should be said that the street, surface, elevated and underground railroads of New York State in the year ending June 30, 1904, paid in taxes $3,943,697, and that in 1902 the operating and lessor street railway companies in the United States paid in taxes $13,366,335. It is now estimated that the total taxes paid by

the street railways of the United States are about $18,000,000.

It will be rightly argued by the advocates of municipal ownership that the municipalities which own tramways derive financial benefits therefrom, other than the mere receipt of taxes through the payment of the debt incurred for the creation thereof, by sinking fund or otherwise; the sum set aside for depreciation and renewal funds, and actual net profits which are, or should be, applied to the relief of taxation.

To best illustrate what the British municipalities and local governments are receiving from tramway operation, and to compare the same with conditions in the United States, the following tabulation is given:

UNITED KINGDOM.

Estimated total derived from municipal and company tramways by local and municipal government from taxation	£200,000
Repayment of debt or sinking fund by municipal tramways	663,336
Reserve including depreciation and renewal funds	623,617
Relief of rates (local taxation)	205,981
Other matters including balance carried forward from fiscal year ending March 31, 1906	96,587
Total possible financial benefits derived by national and local governments from operation of tramways in the United Kingdom	£1,789,521
Or say	$8,679,176

Subsequently the inaccuracy of British municipal tramway accounts will be shown and their tendency to unfairly demonstrate favorable results from operation in such a manner as to thoroughly discredit them and show that the above is far more favorable than actual results secured; but for the purpose of comparison it is necessary to here take the official statements as made in the parliamentary report on tramways and light railways, 1906.

UNITED STATES.

1906.

Estimated taxes paid by operating street railway companies based on 33⅓ per cent increase in actual amount of $13,078,899 paid in 1902	$18,310,458
Estimated taxes paid by lessor street railway companies same as actual in 1902	287,436
Estimated personal taxes paid by holders of capital stock $1,844,565,136 (see U. S. Government Statistical Abstract 1906) at one-half of 1 per cent.	9,222,820
Estimated personal taxes paid by holders of bonds $1,524,371,926 (see U. S. Government Statistical Abstract 1906) at 1 per cent	15,243,719
Total	$43,054,433

So it is seen at a glance that the State and municipal governments of the United States receive at least $34,375,257 per annum more from the operation of street railways than do the local and municipal governments of the United Kingdom.

Now to correct some of the inaccuracies of British municipal accounting.

According to the parliamentary report on tramways for 1906 the total paid up capital of municipality owned tramways of the Kingdom was £35,423,947, on which as already credited to public earnings from tramway operations in the foregoing calculation but £800,751 had been allowed for depreciation or slightly less than 1.83 per cent.

Every practical man realizes that at least 5 per cent should be allowed for depreciation, so a proper charge for this on the paid up capital of £35,423,947 would be £1,771,197. Consequently the difference between the actual sum provided for depreciation, viz., £623,617 and the proper figure just stated amounting to £1,147,580 or $5,565,963 should be deducted from the $8,679,176 shown as the returns to the local and municipal governments of the United Kngdom from the tramways, leaving net only $3,113,213.

This shows that the net return to local public authorities in the United Kingdom is $925 per mile of track whereas in the United States it averages $1295.

The difference in favor of the United States on this phase of conditions would naturally be improved if proper additions amounting to many millions were made to the capital account of British municipal tramways. While if the great increase in taxable values and returns therefrom arising from the more general development of street railways in America were taken into account, the financial returns to American State and local governments would be demonstrated as enormous; all of which has resulted without the taxpayers being subjected to any risk whatever.

Advocates of street railway municipalities have little to say on the feature of risk to municipalities and their tax payers due to embarking in such enterprises, but that serious risks do exist from so doing is illustrated by the list of British municipal tramway undertakings, of which, according to the parliamentary return for 1906 there are 40 out of a total of 175 which show direct loss from operation or an actual deficit when sinking fund payments and reserves for depreciation are considered.

This number would be greatly added to if the accounts of the various municipal undertakings in the United Kingdom were properly kept.

Much credit is taken by the municipalists for the improvement of labor conditions arising from many British tramways coming under municipalistic control.

This subject has been so thoroughly treated in the admirable paper by Professor John R. Commons and Mr. J. W. Sullivan, which will be published as part of the records of this Commission, it is considered unnecessary to dwell on this feature to any great extent other than to say that rates and hours of labor on American street railways have improved comparatively as much from the days of animal traction up to the present as has been the case in Great Britain.

It is also considered well to insert the following comparative table showing rates of wages paid conductors and motormen on certain British tramways and on certain street railways in the State of New York. The figures are from the paper of Messrs. Commons and Sullivan and the New York Railroad Commissioners reports.

System.	Conductors Rates per Hr. Cts. Cts.	Motormen Rates per Hr. Cts. Cts.
Glasgow	11.2 to 13.9	11.2 to 13.0
Manchester	11. " 13.5	11.5 " 14.
Liverpool	10. " 12.	12. " 13.
London County Council	11.6 " 15.	11.4 " 15.
London United	9.6 " 12.	12. " 14.4
Dublin	7.2 " 9.84	8.4 " 11.14
Norwich	7.5 " 9.	9. " 10.
New York City Railway	20 cts. to 25 cts.	22.5 cts. to 24 cts.
International Traction, Buffalo	21 " " 25 "	21. " " 25 "
Rochester	22 " approx.	22. " approx.
Syracuse	21 "	21. "
United Trac. Albany & Troy	22 "	22. "
Schenectady	20 " to 25 cts.	20. " to 25 cts.

The secretary of the American Street and Interurban Railway Association has furnished the following data which have just been compiled (May, 1907), showing the wages of conductors and motormen in twenty-one of the largest cities in the United States.

AVERAGE WAGES PER HOUR OF CONDUCTORS AND MOTORMEN

Name of City	Minimum Rate in Cents	Maximum Rate in Cents
New York (average of all roads in city of Greater New York)	21.4	23.1
Chicago	24	27
Philadelphia	21	21
St. Louis	23	23
Boston	24.2	25.3
Baltimore	18	20
Cleveland	21	24
Buffalo	21	24
San Francisco	31	33
Cincinnati	19	21
Pittsburg	25	27
New Orleans	21	21
Detroit	23	25
Milwaukee	19	23
Washington (average of two city lines)	21.25	21.25
Newark	19	22
Jersey City	19	22
Louisville	20	22
Minneapolis	21	25
Providence	18.2	22.7
Indianapolis	17	19

The same comparative difference in rates of wages exists for all other classes of street railway labor; so it is seen that American street railways pay practically double the rate for salaries and wages that are paid in the United Kingdom, and this is the most important item of their operating expense.

In the State of New York a decrease of wages to British standard would reduce the operating expenses of local transportation lines about $14,000,000 per annum, an amount equivalent to about 38 per cent of their gross receipts. As their average receipts per passenger in 1905 were 4.12 cents, it is apparent that if British rates of wages were paid by them they would be as well off if they received an average of only 2.45 cents per passenger, which is only one-fifth of a cent higher than the average paid in the United Kingdom.

The higher rates of taxation in the State of New York and greater costs of essentials to operation make the increase in the costs per passenger far greater than one-fifth of a cent.

To contrast differences in payments for accidents alone. According to the railroad commissioner's report of New York for 1906, the total gross receipts from passengers on the street, surface, elevated and underground railways of the State were $77,841,051. Total passenger car miles run were 307,619,065; total damages paid, $2,920,308. This averages 3.76 per cent on the total gross passenger receipts and 0.948 of a cent per car mile.

According to the British Parliamentary report on tramways and light railways of 1906, the total gross passenger receipts on all tramways in the United Kingdom were £10,248,204 or say $49,603,789. Total car mileage was 244,149,464. Total compensation for personal injury or accident paid £164,342, or say $787,058. This averages 1.6 per cent on the total gross passenger receipts and 0.322 of a cent per car mile.

Thus in New York State alone the total amount paid on account of damages was $2,133,250 greater than by all the tramways of the United Kingdom; while the percentages of same to gross passenger receipts was nearly two and one-half times as great and per car mile nearly three times as great.

If the above calculations were extended to all the street railways of the United States, in accordance with the census figures of 1902, the average receipts per passenger which would leave the street railways in the same financial position as now from their operation, would be 2.24 cents, arising from the difference in wages alone, or less than the average rate of fare in the United Kingdom; while, as already stated, the American passenger has facilities for travel available to him many times greater than those existing in the United Kingdom.

The total paid annually by all street railways of the United States for damages now amounts to over $10,000,000.

Turning more directly to British conditions, few Americans realize the obstacles which tramway companies meet in attempting to obtain franchise rights, or the enormous expense to which such companies are subjected in procuring the same.

In most cases the consent of all local authorities affected by the proposed construction of lines must be had before a hearing will be given by either the Board of Trade or Parliament, and in all cases the consent of at least two-thirds of the local authorities must be had. This power is used by the local authorities to force the companies to make excessive payments for, or assume obligations in connections with public improvements not necessitated by tramway construction. The obtaining of frontage consents and compliance with other features of procedure is exceedingly expensive; while hearings before the Board of Trade or Parliamentary committees are still more so. If perchance the company, after overcoming these handicaps, does secure a franchise, it is but for a brief period of years, scarcely long enough to warrant the heavy expenditures required for modern electric railway construction, especially when it is considered that at the expiration of the franchise the municipality can take it over at scrap value.

Against this, municipalities can with little difficulty, and at comparatively slight expense, obtain their Parliamentary rights to construct and operate tramways in perpetuity with a complete monopoly for all time to come. If a prominent British municipality wishes to secure Parliamentary legislation favorable to its tramways or other public utilities, and if it wishes to oppose any contemplated legislation unfavorable thereto or which would result in the creation of any company undertaking, it has at its command a more powerful political influence than exists in the United States. This through an association of the municipalities comprised of several hundred members which is dominated by the Town Clerks of the respective municipalities who are permanent high salaried officials and who are generally animated by the desire of increasing the importance of their own positions and influence through the municipalization of all public utilities. In every municipality they either are or can easily become the most powerful political factors, especally as regards Parliamentary matters.

Rarely are members of Parliament residents of the localities from which they are elected and which they represent. They need the strongest possible local support to be elected. This naturally centers in the municipal governments of their districts, and the Town Clerks and other permanent municipal salaried officials command this influence far more thoroughly than do the more prominent elective officials of the various municipalities. So when a Town Clerk makes a request of a member of Parliament representing his locality the usual result is not unlike what occurs in America when a political boss makes a similar request of some public official whose election he has made possible. With this combined potent influence at work all over the Kingdom in favor or against a particular Parliamentary measure, the effect can be readily imagined.

British conditions in this respect are not unlike what

would occur in an American State providing the State and local "machines" of all parties were kept constantly united to exert their combined influence on legislation. The manner in which the municipalities are favored over companies in the tramway field are thus self-evident; on legislation, on capital account from the outset, on operating expenses and in reaping benefits in later years from traffic created or built up by the tramways. This fact should never be forgotten in comparing British municipal and company tramway conditions or results.

Owing to the narrow streets in most British cities, the construction of new lines of tramways has, almost without exception, necessitated many street widenings. In this connection, municipally owned tramways have been especially favored, as has already been referred to.

While the members of the Commission were in Great Britain and at previous and subsequent meetings of the City Council of Liverpool, it was made officially apparent that the total cost of street widenings and improvements necessitated by the construction of the municipal tramways there had been slightly over £1,000,000, practically all of which is carried in a general public loan for street improvements.

In the Parliamentary report on tramways of April 6, 1905, the expenditures for this purpose by the Liverpool Tramways is shown to be only £9,857.

At a meeting of the London County Council, held Oct. 16, 1906, the fact was demonstrated that no less than £4,044,844 had been expended by the Council on account of the tramways, of which only £377,260 had been charged to the tramway capital account. The total capital account of the London County Council, according to the Parliamentary return of 1906, is £4,188,095, so it is seen that there had been buried in other accounts expenditures in behalf of the tramways amounting to within about £400,000 of the entire capital tramway account.

At the discussion following this expose, Captain Swinton, a prominent member, brought out the fact that since the Council had entered the tramway field, the expenses of the general office had amounted to about £1,200,000, of which there had been charged to the tramway accounts £8,160, and stated that in his opinion on this feature alone the Council's tramway undertaking owed the people of London at least £500,000. This is a larger sum than has been shown, as the net earnings of the properties even by the juggled accounts of the London County Council. (See "London Times" and other London papers, Oct. 17, 1906.)

Such conditions as those just stated naturally cast suspicion upon every feature of municipal tramway accounting, especially when it is noted from the tramway returns what small charges, if any, have been made by the leading municipalities for these purposes.

For street widenings, etc., Manchester shows, as charged to its tramway capital, but £11,588; Glasgow, nothing; Bradford, £8,827; Derby, nothing; Huddersfield, nothing; Hull, nothing; Leeds, nothing; Nottingham, nothing; Oldham, nothing; Plymouth, nothing; Portsmouth, nothing; Preston, nothing; Southampton, nothing; Southport, £3,327; Wolverhampton, nothing; Belfast, nothing.

The total charges to capital accounts of municipal tramways for this purpose, for the entire Kingdom, as shown by the Parliamentary return of 1906, is but £750,092, or only £5,000 more than Sir J. Clifton Robinson has testified that the London United Electric Tramways Company was alone compelled to pay for similar purposes, to say nothing of the financial obligations which it has assumed as regards paying a large annual charge for wayleaves.

It is almost needless to remark that, if all of the accounts of the municipal tramways of the Kingdom, their operating expenses have been favored as greatly at the expense of general funds, as has been shown to be the practice of the London County Council, then all their boasts of economical operation must disappear and deficits appear in place of apparent profits from operation.

Against such a condition as has been recited, the accounts of all company tramways in the Kingdom, under the law, must be thoroughly audited and proper distribution thereto certified by chartered public accountants.

According to the Parliamentary tramway return of 1906, the total paid-up capital of the municipal tramways was £35,423,947. These had 2499 miles of track open for traffic, which is a capitalization of approximately £4,069 per mile of track.

The paid-up capital of the tramway companies was £22,514,470. Their miles of track were 1084, making £20,493 per mile of track, an unfavorable showing for companies upon its face.

Were municipal capital accounts corrected, however, in accordance with the above, the comparison in this respect would then not be unfavorable to the companies, especially when their serious disadvantages and handicaps are considered. The car-mileage of the municipal tramways was 154,963,781; that of the companies, 89,183,383; car miles per mile of track, municipal, 62,011; company, 82,273. This demonstrates that despite the fact that the municipalities have, with few exceptions, acquired the best properties of the Kingdom, they are giving a service about 25 per cent less frequent than is given by the companies. Or, state it another way, the average headway between cars on the municipal lines on a 24-hour basis is, approximately, 8.1 minutes, while upon those of the company but 6.3 minutes. This, of course, demonstrates that the companies operate a more frequent service at a consequently greater expense to accommodate their patrons than do the municipalities.

The total gross receipts of the municipal tramways were £6,853,486 for the year. The operating expenses, including taxes, but not rental of leased lines, amounted to £4,323,734. The net receipts were £2,529,752.

The percentage of operating expenses to gross receipts was 63.1 per cent. The gross receipts of the companies were £3,789,692. The operating expenses, including taxes, but not rental of leased lines, amounted to £2,512,029. The net earnings were £1,277,663. The percentage of operating expense to gross receipts was 66 per cent.

In view of the manner in which the municipal tramways are favored in their showing on operation by charges to other public accounts, and of the superior service operated by the companies, the latter are to be congratulated upon the showing thus made.

The gross receipts per car-mile on the municipal tramways were 10.62d. or 21.24 cents. The operating expenses were 6.69d. or 13.38 cents.

The gross receipts per car-mile of the company tramways were 10.9d. or 20.18 cents. The operating expenses were 6.73d. or 13.46 cents.

Considering the additional burdens of expense borne by the companies, comparison with the favored accounts of the municipal tramways certainly demonstrates that were actual results from operation shown by the municipalities, the superior management of the companies would be clearly demonstrated.

The average receipts per passenger of the municipal tramways was 2.1 cents, by the tramway companies 2.41 cents,

but as the companies are running an average service nearly one-third more frequent than that of the municipalities, the companies are certainly entitled to this small difference in fare.

Those who advocate municipal ownership and operation of American local transportation lines invariably attempt to befog their readers on the question of rates of fare charged on British tramways, giving the impression that these are much lower than they actually are. It is true that rates of fare are lower in Great Britain than in this country, but the distances which may be ridden for such fares are also very much shorter, which fact is not generally stated by the advocates of municipal ownership. We, as experts, do not hesitate to say that should the street railways of the United States adopt a graduated fare, there is no question but that their returns from passenger traffic would be larger than at present, for there would then be no free transfers and each passenger would pay proportionately to the distance which he rides, thus enormously increasing the short-haul traffic which every railway man knows is the most profitable.

If due allowance were made for high rates of wages and other essentials to operation in the United States, particularly as regards supplies, taxes, and damage accounts, American graduated fares could easily be made comparable with those prevailing in Great Britain or even lower. In fact where an approach has been made in America toward adopting the graduated-fare principle, to wit, upon interurban electric railway lines, such rates of fare are already comparable with present fares prevailing in the United Kingdom.

Statistics recently (April, 1907), compiled in the office of the American Street and Interurban Railway Association show that for seventy-four interurban railways located in nineteen different States, the following averages prevail:

Population of larger terminal	133,900
Population of smaller terminal	37,200
Fare in cents per mile (one way)	1.69
Fare in cents per mile (round trip)	1.57

When it is considered that these interurban roads, to a great extent, run through sparsely settled districts, often extending several miles between small villages, with little intervening population, the comparison of these rates with those of the densely populated cities of the United Kingdom is certainly decidedly in favor of the American interurban railways. As shown by the schedule of our experts, Messrs. Turner and James, the rate of fare averages over 1 cent per mile upon the combined municipally owned lines of Glasgow, Manchester, Liverpool and London County Council.

In considering this general proposition from the standpoint of public benefit, it must, of course, be admitted that with the graduated fare system the individual pays for what he gets. In other words, a portion of the fare of the passenger who rides a short distance does not go toward paying the expense of those passengers who ride distances so great that the expense of carrying them is larger than the fare they pay; but viewed broadly, and considering benefits to communities as a whole, there is no question whatever, but what the flat fare rate in America has done much more for them than could have been accomplished in any other way, especially for the laboring classes; this through a distribution of the population over greater areas, thus improving sanitation, public health and morals, while enormous financial advantages have accrued to local treasuries because of the great increase in building and of real estate values.

The schedule of the Commissioners' experts, Messrs. Turner and James, contains much information concerning fares charged on the various British systems which they investigated. These are of little value for comparison with each other owing to the widely varying conditions in connection with the various projects. Such for instance, as contrasting Norwich, a small city, with either Glasgow, Manchester, Liverpool or London. Neither can comprehensive comparisons be made between the London United system, whose lines are suburban or interurban in their character, with those of the cities just mentioned.

However, for comparison with American conditions, the following tabulation has been compiled from the figures of Messrs. Turner and James on Glasgow, which has the lowest rates of fare of any municipal tramway in Kingdom:

Rates of Fare in Pence	Maximum Distance in Miles	Passengers Carried	Possible Length of Rides in Miles	Passenger Earnings
½	.58	58,540,026	33,953,215	£121,958
1	2.3	117,897,292	276,164,001	491,239
1½	3.48	13,100,122	45,588,424	81,876
2	4.59	3,648,195	16,745,219	30,402
2½	5.88	1,024,122	6,021,837	10,667
3	6.9	1,235,246	8,553,197	15,441
3½	8.11	241,241	1,956,464	3,518
4	9.19	81,249	746,678	1,354
Totals		195,767,519	389,700,935	£756,480

Analysis of the foregoing will show that the average possible length of ride available to passengers was 1.93 miles and the average fare to be paid therefore was 0.94 pence and the longest ride available for the equivalent of a five-cent fare (2½d.) is 5.88 miles.

Contrast this with conditions existing on certain American street railway systems. According to the records of the American Street and Interurban Railway Association, May 31, 1907:

Name of System	Longest Ride for 5 Cents Without Changing Cars	Longest Ride Possible for 5 Cents Through
New York City Railway Company	12.37	37.2
Philadelphia Rapid Transit Company	14.24	26.13
Pittsburg Railways Company	10.5	14.1
United Railways of San Francisco	7.4	13.4
United Railways & Electric Company, Baltimore	10.6	17.3
United Railways Company, St. Louis	14.49	22.35
Washington Railway & Electric Co.	6.6	13.5

In conclusion a word will be said regarding claims which are constantly made regarding the superior credit which British municipalities possess over public utility companies.

According to quotations in the London Stock Exchange Daily List of May 16, 1907, the total number of municipal securities there quoted was 169.

Of these, 32 were quoted at par or above; 12 from 95 per cent to 99 per cent; 25 from 90 per cent to 94 per cent; 73 from 85 per cent to 89 per cent; 15 from 80 per cent to 84 per cent; 9 from 75 per cent to 79 per cent; 3 from 70 per cent to 74 per cent.

Under the law all these were issued practically at par, and as the aggregate of the issues is several hundred millions of dollars, it is seen at a glance that an enormous loss has fallen upon British investors because of their investment in municipal securities.

It is also apparent that British municipalities to raise funds in the future must pay a higher rate of interest than in the past.

A surprising revelation in connection with the quotations is that certain of the London County Council securities are selling as low as from 72 per cent to 74 per cent. Certain of Glasgow at from 77 per cent to 79 per cent. Certain of Liverpool at from 76 per cent to 78 per cent. Cer-

tain of Manchester at from 87 per cent to 89 per cent.

Against this Dublin United Tramways Company's common shares were quoted at from 142 per cent and a fraction to 152 per cent. The preferred shares of the same company at from 135 per cent to 145 per cent. London United Tramways Company accumulative preferred stock was quoted at from 77½ per cent to 87½ per. cent. The debentures of the same company at from 85 per cent to 89 per cent.

No quotations were made on other tramway securities issued by the companies investigated by the Commission.

PROFESSOR PARSONS' REVIEW

Professor Parsons calls attention to the rapid progress in municipal operation of street railways in Great Britain. From 1894 to 1906 the number of municipal systems rose from 3 to 123. The marked success of municipalization in Leeds and Glasgow, he sets forth, gave the movement irresistable momentum, and in 1906 all the principal cities of the United Kingdom had municipal operation of their tramways except Dublin, Bristol, Norwich and Edinburgh. The principal reasons for the municipalization of British tramways, according to Professor Parsons, have been poor service by the companies; their ill-treatment of employees; their refusal to assent to the adoption of electric traction, extension to suburban districts, and other vital improvements; the constant difficulty experienced by the cities, amounting to practical impossibility of securing a reasonable regard to the public interest, or even the fulfillment of actual contracts; the growing belief on the part of the public that the streets and all monopoly uses of them are public property which should not be handed over to private parties, and the desire that the profits of the undertaking should inure to the benefit of the public. When the Commission was in London a visit was paid to Sir Clifton Robinson, the president of the London United Tramway Company, the largest in Great Britain, Mr. Ingalls, chairman of the Commission, asked: "Why was it the companies did not develop electric traction and give the people a thoroughly good service? We understand that the service under the old companies was very bad; why was it?" Sir Clifton replied: "It was ignorance more than anything else; they put in some nephew or relative or friend of an owner to be manager or director—men who knew nothing of transportation. They paid all their profits in dividends, kept nothing for renewals or reserve, did not think ahead or foresee that the cities might take over the plant; and then when it came near to the end of the twenty-one year terms and there was a prospect that the cities would buy, the companies did not pay any dividends at all in many cases, so that when the term was up almost the whole community was down on the companies, and all the cities had to do was to shake the tree and the rotten fruit fell into their mouths."

The British companies opposed extensions, plastered their cars with unsightly advertisements, and refused to reduce fares, saying they could not afford it. But the municipalities took the lines, adopted electric traction and sent the old horse-car system to the scrap-heap, extended the lines, reduced the advertisements to due subordination, lowered the fares, shortened the hours of labor, and after all, realized not the losses the companies predicted, but comfortable profits for the people. Except in the case of Leeds, the rate of reduction of fares is nine to thirty times as great for the municipal period as for the company period and fifty times as great for the municipal systems as a group as compared with the companies in a group. Next to the wish to obtain a better service at lower fares, says Professor Parsons, the predominant motive in the municipalization of British tramways has been the desire to improve the conditions of labor. The companies worked the men 11 to 14 hours a day for seven days, while the cities have made the hours of labor from 9 to 10 per day, with one day's rest in seven. Increases in wages were made also, amounting to 50 per cent in Liverpool, from 43 to 63 per cent in Manchester and to 42 per cent in London. Notwithstanding these benefits to labor the reductions in fares were considerable, and the total savings from reduced rates for the twelve years under municipal management at Glasgow are estimated at $23,000,000, as compared with the old company basis. The benefits to labor under city management at Glasgow are computed at $515,000. There has also been a rapid extension of the lines into Glasgow's suburbs, 50 miles being the total of new line during the period of city operation. Another very important result of public ownership, Professor Parsons finds, was the rapid substitution of electric system for horse-car lines, and in this connection he points out that in New York City in 1906 there still remained 45 miles of horse-car line.

Transit changes are judged in British cities by the minimum fare, the average fare and the distance given for various fares, especially the average distance for a penny (2 cents) which, the Professor says, is the fare the mass of the people pay. All the cities have a 1 cent fare for short distances, from half to three-quarters of a mile, except Liverpool, but none of the private companies has a lower fare than 2 cents for the ordinary passenger traffic. A comparison of Dublin, private ownership, and Glasgow, public ownership, shows, according to Professor Parsons, that the Dublin charges, within the rates on which substantially all the traffic moves, are from 50 to 100 per cent above the Glasgow rates for the same distance. For the municipalities as a group the average distance for 2 cents is about 2.2 miles, against 1.6 miles for the companies as a group. It is found also that the people like the graded plan of charging fares according to the distance traveled. While the Commission was in Manchester, one of its members, discussing the graded fares, said to the chairman of one of Manchester's public service committees: "In my city you can ride 12 miles for 5 cents." "Yes," replied the chairman, "and you can ride 12 yards for it, too." In addition to the regular reductions of fares, the tramway managements are required to run workmen's cars mornings and evenings at rates about half the ordinary allowed by law.

The service is good according to British standards and in some instances is excellent, even according to American standards, says Professor Parsons. The speed of British cars is low as compared with American systems, but the speed limits are fixed by the Board of Trade. The narrow streets, together with British caution and regard for safety make it impossible for the street cars to equal the American speed. Thus the tramway lines, public and private, are not to blame for the fact that they are not allowed to exceed 8 m. p. h. in city streets, or from 12 to 16 miles in country districts. There is no all-night service except on the London County Council (public ownership) system. The average hours of service per day show to the advantage of the city-owned systems, their cars being in operation 20.1 hours per day to 18.5 for the company cars.

In various respects the equipment of the municipal lines is superior to that of the companies. Advertisements are not allowed on the cars in Glasgow or Manchester, for

aesthetic reasons, each city foregoing $50,000 a year revenue which it could obtain in a lump sum for the advertising privilege. In Dublin, however, the private company's cars are covered with advertisements in giant letters, and the sign giving the destination of the cars is almost completely obscured by these advertising signs.

The cars and plants of all the systems under consideration were found to be adequate, modern and efficient. Repairs are well kept up, the plants are clean and neat, the works are properly ventilated and complaints are properly attended to. The Glasgow cars and buildings (public) are especially attractive.

Analyzing the financial conditions of the public and private traction systems in Great Britain, Professor Parsons declares that the municipal system at Glasgow has about $4,000,000 more assets than liabilities, but that the London United, a private company, has $16,580,000 of capitalization and $5,820,000 of tangible assets. The Dublin United, also a private company, has $4,500,000 of capital in excess of tangible assets. The three municipalities together have $2,560,000 more physical assets than liabilities, while the companies have $15,850,000 more liabilities than assets. In addition to the payment of regular taxes, just as if they were private concerns, the four municipal plants—Glasgow, Manchester, Liverpool and the London County Council—have paid nearly $4,000,000 in relief of general taxation. The benefits of the profits of the municipal systems are shared by 6,747,994 persons, while the profits of the private companies are divided between stockholders who number less than 8000.

Discussing the political results of municipal ownership in Great Britain, Professor Parsons says:

"There has been an increase of political and social efficiency as well as of economic efficiency. Under the company's regime, democracy was at a discount; popular sovereignty was below par. The people found they could not control their own streets, nor secure fair treatment of labor in public service industries, nor obtain rapid transit and other vital improvements on reasonable terms. The tramway owners, with the power of private monopoly in their hands, overruled the will of the people. The companies behave much better now. Not only has the fear of speedy municipalization in case they did not satisfy the new standards and the educated public sentiment developed by municipal operation made a strong impression on the remaining companies, but they have also been stimulated by municipal example to do their best to rival the advancement made by public managements. They give more consideration to public opinion, and pay more regard to the public interest in the conduct of their business. But the dominance of public interest, so far as it has been secured either in public or private systems, is in large measure the result of the development of municipal operation. For some purposes the power to municipalize is almost as effective as municipalization itself. Under the pressure of new standards and an educated public sentiment developed by municipal operation in the full publicity created by it in respect to all tramway costs and methods, the present companies at their best are managed with so much regard and to the common interest that a casual observation might lead one to think there is nothing to be gained by further municipalization. Yet, the cities and towns continue to municipalize the tramways. They believe that a well managed public tramway is better, from the public standpoint, than even the best private system, for several reasons: (1) It secures to the public the profits taken from the public through their patronage of public-service monopolies operating under franchises granted to the public; (2) it tends to lower fares and widens distribution of the benefits of the service—a public plant is more apt to regard a surplus as a reason for reduction of charges; (3) it aims primarily at service, while a company management must aim at dividends—it is benefit for all versus profit for a few as the fundamental motive and purpose; (4) it gives the municipality direct and complete control of its streets in place of indirect and partial control; (5) it eliminates the opposition of interest between the owners and the public, which may, at any time, give rise to difficulty, dispute and obstruction of the public will and interest; (6) it makes the managers the direct agents and employees of the people instead of the agents of a company employed and paid by private parties to work for the interest and obey the instructions of those parties—a city, as well as an individual, can control its own servants and make them obey its will and wish better than the servants of some other person; (7) it adds a new field for civic activity and the development of civic activity and the development of civic interests and motives and the habits of thought and action on which good citizenship depends."

MORE CABLE CARS FOR EDINBURGH

The tramway committee of the Edinburgh Town Council has decided to recommend the acceptance of the tender of Dick, Kerr & Company, for cabling Broughton Street and Gilmore Place for £37,381. Other extensions aggregating £73,000 are under contemplation.

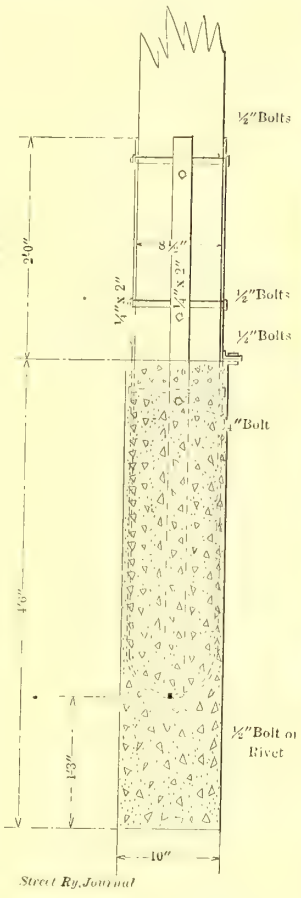
A LAND COMPANY SUCCESSFULLY OPERATED IN CONNECTION WITH A RAILWAY

William B. Strang, who owns the Kansas City & Olathe Electric Railway, known as the Strang line, two years ago selected a route on top of a high ridge extending along the historic Santa Fe trail and surveyed for a line from Kansas City to Olathe, Kan. When Mr. Strang put his engineering force in the field he purchased 3000 acres of land adjacent to his proposed railroad and organized the Strang Land Company, which opened up beautiful town sites along the route of the line and advertised them extensively in the local press in Missouri and Kansas, announcing that lots would be sold at public auction, and free transportation would be furnished to all who wished to attend the sale. During the three days the sale lasted the company furnished transportation to about 4500 and sold nearly all the lots. The company has drilled gas wells on all the town sites, and all who build will be furnished natural gas free of charge. The land company has proved to be a profitable subsidiary to the railroad company by encouraging traffic and settling the country along the line.

Sir Thomas Shaughnessy, of the Canadian Pacific Railway Company, announces that his company is considering the substitution of electric for steam locomotives for use on heavy grades in British Columbia. Several tests that have been made of late have proved entirely successful, and the company's engineers are satisfied with the plans.

CONCRETE STUBS FOR POLE LINE CONSTRUCTION

A concrete stub which is meeting with favor in pole-line work is being introduced by M. H. Murray, of Bakersfield, Cal. The idea is to isolate the pole from the ground and so prevent deterioration through moisture and from other causes, and also to brace the pole as shown in the accompanying illustration. The advantage of these prepared bases over bases built on the site as required, as has been done in some installations, is readily apparent. The transportation of material and supplies is done away, and the delays and inconveniences incident to such work are entirely eliminated, the regular equipment of the pole line gang being the only equipment required. Another feature is that the bases can be easily installed on lines already in operation without interfering with the transmission, as was done in installing 150 of the bases for the Power, Transit & Light Company, of Bakersfield, while the line was carrying 11,000 volts. These bases are 4 ft. 6 ins. high by 10 ins. wide, and the poles are sunk to a depth of 3 ft. 3 ins. In the accompanying illustrations a pole is shown with the base along side and 11,000 volts on the line while operation is going on, and



CONCRETE POLE BRACE



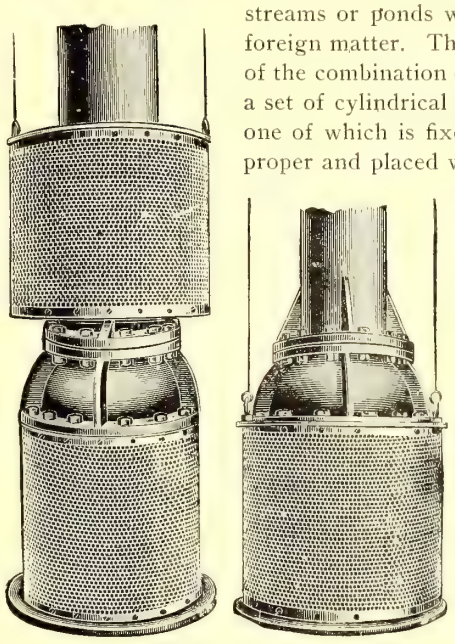


POLES IN POSITION WITH BRACE ATTACHED

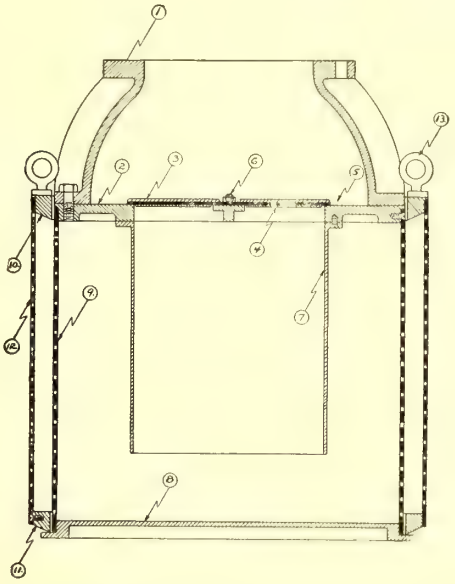
another with the work completed. The bases are also being installed at Emeryville, Oakland, Cal., on the Key Route Railway.

A FOOT VALVE THAT CAN BE EASILY CLEANED

The Newman Manufacturing Company, of New York, is making a foot valve, designed with a view of automatically obviating, as nearly as possible, the trouble caused through the entry of refuse into the pipes of water systems, thus making possible the taking of water continuously from streams or ponds where there is much foreign matter. The apparatus consists of the combination of a foot valve, with a set of cylindrical screens, the smaller one of which is fixed to the foot valve proper and placed within the other and so arranged that the larger or outside one can be raised above the water line for cleansing without the necessity of disconnecting the valve or stopping any part of the plant. Refuse, such as leaves, fish, sticks, paper, rags, etc., that lodges against the outer screen is easily removed therefrom by bringing the screens to the surface of the water by means of ropes or chains attached to screw-eyes. In all cases, except those of large size valves, one man can attend to the cleaning in a very few minutes. As the outer screen is lowered again into position the knives or scrapers attached to it at top and bottom scrape over the outer sur-



VIEWS SHOWING OUTER SCREEN RAISED AND OUTER SCREEN RESTING ON BOTTOM PLATE



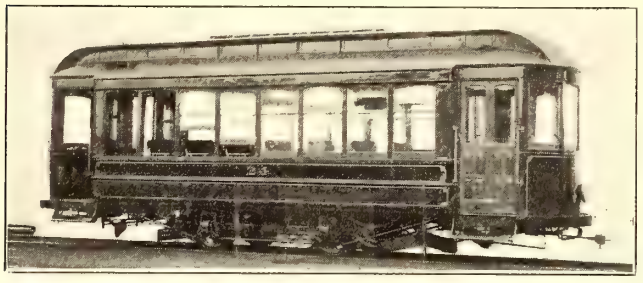
THE GENERAL CONSTRUCTION OF VALVE

face of the inner screen and clean it. By means of the suction-pipe extension the suction is brought to within a few inches of the bottom plate of the valve, thus permitting successful operation in shallow water. In cases where the lift is not great and the suction pipes are short and foot valves are not a necessity, the company recommends the continuous service foot valve screens.

SEMI-CONVERTIBLE CARS FOR PEEKSKILL, N. Y.

To meet rapidly increasing business, the Peekskill Lighting & Railroad Company has added a number of Brill grooveless post semi-convertible cars to its equipment.

The company operates a 12-minute schedule on its main line which runs from the New York Central & Hudson



EXTERIOR OF PEEKSKILL CAR

River Railroad passenger station to Lake Mohegan, a distance of 5 miles, traversing a rolling country to a point 740 ft. above the Hudson River. It is the intention of the management shortly to extend this line through to Shrub Oak and Jefferson Valley. On the Verplank Point line a 20-minute schedule is in effect, but greater things are expected of Verplank when the State park is opened in 1909. The company now has two amusement parks, Shady Lake Park and Electric Park, which are open for the summer months only.

The new cars for the line are generally similar to the single truck semi-convertibles which have been described in the Street Railway Journal from time to time. They measure 20 ft. 8 ins. over the end panels and 30 ft. 1 in. over the vestibules; the width over the sills, including the sheathing, 7 ft. 8½ ins.; over the posts at the belt, 8 ft.; the size of the side sills is 5 ins. x 3⅜ ins., and of the end sills, 3½ ins. x 6⅝ ins. The cars have plush seats; the inside finish is in cherry, and the ceiling of birch. No. 21 E truck used on the cars has a 7-ft. wheel base.

CYPRESS FOR POLES AND TIES

While cypress is a soft wood and necessitates the use of tie-plates when used for ties, it possesses natural advantages peculiarly its own which make it especially advantageous for use in railroad work. This is especially true in the case of poles, for cypress grows very straight and tapers only about 1 in. in 10 ft. of length. The quality of strength and the ability of cypress to resist moisture have been appreciated since the time of the ancients, many of the mummies being buried in cypress caskets. The reason for the long life of cypress is not far to seek. It is a swamp timber, and only reaches its highest development where the ground is quite moist. Naturally, when cypress is cut and replaced in moist soil, as is frequently the case in pole and tie work, it is merely a return to a natural environment, and though now lumber it still remains almost immune to excessive moisture—a condition that would be sufficient of itself to cause rapid deterioration of other woods. The satisfactory use of cypress in steam railroad work led to its introduction for use for poles and ties in electric railway construction, and has caused many dealers heretofore dealing exclusively with the steam railroads to turn their attention as well to meeting the demands of the electric railways for ties and poles. Among the companies thus catering to the requirements of the electric railway companies is the Kennett Cypress & Hardwood Lumber Company, of Davenport, Iowa, which owns extensive lands with mills at McKay, Mo. This company is constantly cutting and carries on hand stock from which it is prepared to meet demands at short notice.

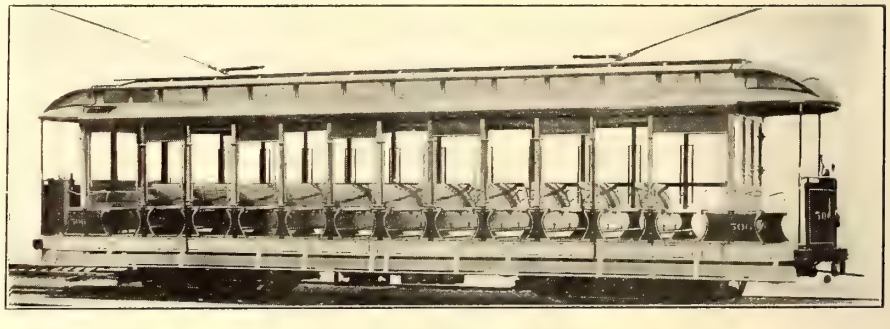
NEW LINE SUCCESSFUL

The new through electric railway between Worcester and Springfield, which was opened July 5, has proven very successful from the point of view both of the company and the public. This line was made up by a continuation of the Worcester & Southbridge from Sturbridge, and of the Springfield & Eastern from Palmer, both lines being under the control of the New Haven. The Worcester & Southbridge was originally built for the operation of high-speed cars, and the Springfield & Eastern has been largely reconstructed to meet the demands of a fast schedule. The roadbed of the intervening track is of first-class construction.

THIRTY-FIVE CARS FOR THE WORCESTER CONSOLIDATED RAILWAY

The Worcester Consolidated Railway Company has added to its equipment thirty-five cars built by the John Stephenson Company. Ten of these are fifteen-bench open cars, one of which is illustrated, and the order also included fifteen 30-ft. closed and five 34 ft. of the same type. Aside from the new equipment the company operates 326 passenger cars over about 140 miles of track.

The features and chief dimensions of the car illustrated follow: Length over its end posts, 34 ft. 2½ ins.; over the crown pieces, 42 ft. 3¼ ins.; width over the sills, including the sheathing, 7 ft. 9 ins.; over the posts at the belt, 8 ft. 2 ins.; height from the floor to the ceiling, 8 ft. 2⅝ ins.; from the track to the under side of the sills, 2 ft. 6 ins.; from the track to the running board, 20½ ins.; size of the side sills, 4½ ins. x 8½ ins.; center sills, 4½ ins. x 7½ ins.; cross-bars, 4½ ins. x 4½ ins.; end sills, 5 ins. x 6¾ ins.; sill plates, 10 ins. x ¾ in. The trucks are of the No. 27 G-1



OPEN CAR FOR WORCESTER

type with 4-ft. 6-in. wheel base and four 40-hp motors are used. The weight of the car and the trucks with the electrical equipment is 43,400 lbs.

The fifteen 30-ft. closed cars referred to have longitudinal plush seasts, as they will be operated in the city; the five 34-ft. closed cars will be operated in the outlying districts and have transverse seats of cane; the latter cars have straight sides.

FINANCIAL INTELLIGENCE

The Money Market

WALL STREET, July 24, 1907.

About the only unfavorable development in the monetary situation during the past week was the strengthening of the foreign exchange market, which suggested the possibility of a resumption of the outward movement of gold to Europe. The upward movement in exchange carried rates for prime demand sterling to within a small fraction of the point at which gold shipments could be made to Paris provided the Bank of France should offer the same inducements as were recently allowed by that institution to draw gold from this side. At the present time there are no indications that the French bank will allow interest on the gold while in transit, but if such a decision should be reached by the managers of the Bank of France, it is not believed that any considerable amount of the yellow metal would be sent forward at this time, as such operations would undoubtedly result in an advance in money rates here, which would serve to check the outward movement of gold. Otherwise the developments of the week were of a favorable character. The payment of a 20 per cent instalment on account of the Union Pacific new 4 per cent bonds and the payment of 50 per cent instalment on the General Electric Company's new issue were made without causing the slightest disturbance in the local money market. The demand for money from stock exchange houses was very moderate, and there was a noticeable falling off in the demand from railroad and other corporations. Bankers, however, reported an increased demand from mercantile sources. During the week the surplus reserve of the New York City banks were augmented by a substantial gain in cash, and present indications point to a further substantial increase in the cash holdings during the current week. Since last Friday the local institutions have gained nearly $2,000,000 from the Sub-Treasury, despite the falling off in Government disbursements on account of pensions, etc. Money is reported in active demand at all of the leading interior centers, but the demand upon the New York banks from the West for crop-moving purposes will be at least a month later as a result of the unfavorable planting weather at the beginning of the season. At the close of the week there was nothing in the situation, barring the possibility of gold exports to Europe, to cause any decided change in rates for money. Preparations will soon be made for the payment of the August 1 interest and dividend disbursements, which are estimated at $70,000,000, but these payments will be made without causing anything more than a temporary flurry in interest charges, which usually accompany such operations.

The bank statement published on last Saturday made a favorable exhibit. Loans increased $414,100. The increase in cash amounted to $2,768,900. Deposits increased $2,231,500, which resulted in an increase in the reserve required of $557,875. The surplus was therefore increased by $2,211,025, bringing the total surplus up to $9,088,075, as compared with $19,391,000 in 1906, $14,949,950 in 1905, $50,609,600 in 1904, $18,915,400 in 1903, $16,502,400 in 1902, $21,029,375 in 1901, and $24,081,900 in 1900. Money on coal loaned at 4 per cent and at 2½ per cent. Time money was quoted at 4½ per cent for sixty days, 5¾ per cent for ninety days, 5¼ per cent for four months, 5½ for five months, and 5½ and 6 per cent for six months.

The Stock Market

There was a decided improvement in the stock market during the past week. Trading was upon a somewhat larger scale, and while prices displayed heaviness at times the general trend of values was toward a higher level. Speculation continued largely professional in character, although some increase in the volume of commission house business was reported. There was also a perceptible improvement in the bond market, the high grade railroad bonds and the short-time notes being in fairly active demand at slightly better prices. During the first half of the week prices advanced rather sharply under the lead of Union Pacific, Southern Pacific and the Hill stocks, and later on Atchison developed considerable strength, and substantial gains were recorded in other parts of the list. The strength in Union Pacific and Southern Pacific was based upon the extremely favorable showings made by both companies in their preliminary statements of earnings for the fiscal year ended June 30. The heavy increase in earnings gave rise to reports that the dividend rate on Southern Pacific would be increased, but no definite information was obtainable on that point. Other developments working in favor of higher prices was the action of the Amalgamated directors in declaring a quarterly dividend of $2 per share, thus putting the stock upon a straight 8 per cent annual basis. The crop news coming to hand was generally favorable, and railway traffic returns continued to show substantial gains over those for the corresponding period of last year. During the last half of the week the market developed heaviness. The bear element took advantage of the strike of the ore handlers at the mines of the United States Steel Corporation in Minnesota to sell stocks, and some stress was laid upon the talk of a resumption of gold exports to Europe. At the close of the week, however, the market developed renewed strength, and in some instances prices reached the highest points of the present upward movement.

The local traction issues were depressed, there being a disposition on the part of traders to await the outcome of the investigation of these properties by the Public Service Commission.

Philadelphia

The extreme dulness prevailing in the general securities market during the week was reflected to a great extent in the traction issues. Trading in them was upon an extremely small scale, and while firmness was shown in some of the inactive issues, the general trend of values was toward a lower level. Philadelphia Rapid Transit sustained an early loss of a full point, but subsequently recovered nearly all of the decline. Philadelphia Traction and Union Traction, however, showed weakness, both issues losing ½ point, the former to 94 and the last named to 57½. American Railways ran off to 48½ and Consolidated Traction sold at 72⅛. Philadelphia Company advanced to 40½. United Railways of San Francisco brought 43, and Union Traction of Pittsburg preferred advanced to 46 United Companies of New Jersey also advanced a fraction to 245⅛.

Chicago

Opposition to the proposed plan of reorganization of the Chicago Union Traction Company has developed on the part of the bondholders of the underlying companies, and it is reported that either material changes in the present plan or the adoption of a practically new plan will be necessary. Trading in the local traction issues was extremely quiet during the week, but prices held firm. North Chicago advanced to 45¾, and West Chicago rose from 32 to 33. Northwestern Elevated preferred sold at 66.

Other Traction Securities

Interest in the Baltimore tractions centered almost entirely in the United Railway issues, all of which displayed decided strength. The stock scored an extreme gain of nearly a point to 13¼, while the incomes moved up from 53 to 54 on the exchange of about $27,000 bonds. The 4 per cents sold at 86 and the refunding 5s brought 80. Norfolk Railway & Light 5s changed hands at 94. The Boston market was dull but steady. Boston elevated advanced to 135½, and West End common and preferred rose ½ and 1 point, respectively. Massachusetts Electric common sold at 16 and the preferred at 58 and 57½. Boston & Worcester brought 23¾ and 23⅝.

Security Quotations

The following table shows the present bid quotations for the

leading traction stocks, and the active bonds, as compared with last week:

	July 17	July 24
American Railways	48½	48
Boston Elevated	135	136
Brooklyn Rapid Transit	57½	57⅝
Chicago City	150	160
Chicago Union Traction (common)	3	—
Chicago Union Traction (preferred)	15	—
Cleveland Electric	45¼	46½
Consolidated Traction of New Jersey	72½	71
Detroit United	67¼	—
Interborough-Metropolitan	16¼	16½
Interborough-Metropolitan (preferred)	45	44⅜
International Traction (common)	45	—
International Traction (preferred), 4s	67	—
Manhattan Railway	132	130
Massachusetts Elec. Cos. (common)	16½	15
Massachusetts Elec. Cos. (preferred)	56	56
Metropolitan Elevated, Chicago (common)	23	22
Metropolitan Elevated, Chicago (preferred)	64	64
Metropolitan Street	a91	a91
North American	68¾	68¼
North Jersey Street Railway	40	40
Philadelphia Company (common)	40	40½
Philadelphia Rapid Transit	23¼	22½
Philadelphia Traction	—	94
Public Service Corporation certificates	—	66
Public Service Corporation 5 per cent notes	—	90
South Side Elevated (Chicago)	82	80
Third Avenue	104	104
Twin City, Minneapolis (common)	92½	95
Union Traction (Philadelphia)	58	57

a Asked.

Metals

The "Iron Age" says that the unwarranted strikes of the dockmen at the upper Lake Superior shipping harbor and of the Messaba mines have no immediate effect upon production, since the blast furnaces are supplied with ore. Any prolonged suspension of work will probably lead to the blowing out of some furnaces which have been in need of repairs. There has been rather more inquiry for all grades of pig in nearly all the markets during the past few days, induced possibly by the labor troubles at Lake Superior. Car builders have taken some fresh business with more under negotiation.

Copper market continues very dull and prices are unchanged.

ANNUAL OUTING OF OFFICERS OF NEW YORK CITY RAILWAY COMPANY

The annual outing which President Vreeland, of the New York City Railway Company, extends to the officers and heads of departments of that company, occurred on July 24, and was held as usual at Brewster, N. Y. About eighty were present, including a few officers connected with steam railroad companies entering New York City and others who were especially invited. The day was an ideal one and the clam bake, which was as fine as usual, was greatly enjoyed. It was held on the shore of Tonetta Lake, on the grounds of the Tonetta Outing Club. A special train leaving Grand Central Station about 9 o'clock in the morning took the guests to Brewster, and a special train carried them home in the evening after they had spent a delightful morning at the club and afternoon at President Vreeland's summer residence, where they had an opportunity of meeting Mrs. Vreeland, who received with a number of ladies residing in Brewster.

CONNECTICUT COMPANY ORDERS CARS AND EQUIPMENT

The Connecticut Company, acting for the New York, New Haven & Hartford Railroad, is reported to have placed an order for 103 closed trolley cars, costing approximately $5000 apiece; twelve snow plows at $2500 each, with much other material for operation. It is estimated that the order will entail a total expenditure of $600,000. The 103 closed cars at $5000 each will total $515,000. The snow plows will cost $35,000 more, while $50,000 will go for the other equipment.

THE AFFAIRS OF THE HAVANA COMPANY

Warren Bicknell, president of the Havana Electric Railway Company, has returned to his home in Cleveland, after a short visit to Havana. He says that the business of the company is showing a handsome increase, but otherwise there is little that can be said at the present time. General Manager Frank Steinhart furnishes Mr. Bicknell with a weekly statement of the business each day as compared with the corresponding day of last year, and a chronological history of events as they occur, including the various transactions that have taken place, closing contracts that have been under way, changing of schedules, number of cars in operation, both regular and special, accidents of all kinds, etc. Mr. Bicknell made a study of the power house and succeeded in reducing the operating expense and at the same time increased the efficiency of the plant.

ELECTRIC SERVICE BEGUN ON NEW HAVEN

The New York, New Haven & Hartford Railroad began on Wednesday, July 24, the operation of trains over its electrified line between the Grand Central station and New Rochelle, with a service of ten trains a day, five each way daily. The company had planned to begin the service on the previous Sunday, but this was abandoned and the date fixed for Wednesday. The trains operated by electricity are: westbound, 7:50 a. m., 8:05 a. m., 8:28 a. m., 8:37 a. m.; eastbound, 6:28 a. m., 7:20 a. m., 5:06 p. m., 5:16 p. m., 5:45 p. m. They are made up just as the steam trains were, of four or five coaches to meet the requirements of the service. The system installed is the Westinghouse single-phase, and the installation, including both power house and locomotives, has been referred to from time to time in these columns. As previously stated, H. Gilliam, formerly with the Westinghouse Company at Pittsburg, has been appointed electrical superintendent, in charge of electric operation, with headquarters in Stamford, with jurisdiction over the maintenance and operation of electric transmission lines, with accessories, power house and electric locomotives, on the New York division. These other new officers previously referred to briefly in the Street Railway Journal, have also been officially announced with their duties:

C. L. Peterson is chief engineer of the power station at Stamford, having charge of operation and maintenance of station equipment. In all matters pertaining to the operation and maintenance of the power station, he will receive his instructions from the mechanical superintendent. All requisitions on the mechanical department are to be approved by the electrical superintendent.

The maintenance and operation of electric locomotives and instructions to motormen and their helpers, will be under the jurisdiction of J. C. Welsh, road foreman of electric locomotives, who shall receive his instructions in electrical matters pertaining to the operation and maintenance of the electric locomotives from the electrical superintendent. In mechanical and ordinary routine matters he will report to the master mechanic in the usual manner. Requisitions and accounts will be controlled in the master mechanic's office.

The supervisor of bridges will have charge of the maintenance and repairs of all bridges and culverts and of the catenary bridges and electric transmission lines. He shall report to the division engineer in all ordinary and routine matters, and to the electrical superintendent in all matters relating to the character, method and execution of all maintenance, repairs and restoration of catenary bridges, transmission lines, and other appurtenances and otherwise excepted. All routine reports, materials and payroll distributions, methods of accounting, etc., will be handled through the division engineer's office, being noted for his information, as far as desired, by the electrical superintendent. The electrical repair car and force in connection with the same shall be under the jurisdiction of the supervisor of bridges.

Repairs to track and track bonding will be under the charge of the roadmaster, reporting through the division engineer to the engineer, maintenance of way. The electrical superintendent shall supervise and direct the proper installation and maintenance of track bonds through the engineer, maintenance of way.

D. E. Tyree is appointed electrical inspector, who will report direct to the electrical superintendent. The electrical inspector will have access to the power station and the privilege to inspect the electrical locomotives during operation.

CITY CLUB REPORT ON NEW YORK TRANSIT

The City Club of New York has sent a report to the Public Service Commission for the New York City district, containing its recommendations for action of the commission in the city transportation systems. Briefly, they are as follows:

For the Brooklyn Bridge, the club recommends for immediate relief the use of two or more platforms, instead of one, during the rush hours at the New York terminal of the elevated bridge lines, and the establishment of a surface line from the east end of the Williamsburg Bridge to the City Hall. It also recommends as soon as possible the operation of all elevated trains crossing the Brooklyn Bridge into a subsurface terminal, and an effort to effect an agreement between the Interborough Company and the Brooklyn Rapid Transit Company so that free transfers will be issued at Borough Hall and beyond to and from the new Brooklyn-Battery tunnel.

For the subways it recommends the use of Illinois Central type of cars, to shorten the station stops and increase the number of seats, and that more trains be run during the slack hours and on Sundays. For additional convenience and safeguards, it advocates the use of illuminated signs on the outside of every car, destination signs on the interior, more station signs, better car illumination and the engagement for permanent service of a qualified sanitary expert. Modifications in the present form of construction are recommended in the form of a concrete floor through the subway and immediately in the vicinity of stations, and the installation of fire hydrants, more emergency stairways and additional means of ventilation. For extensions, the club believes it very desirable to complete the subway loop by extending it south from the Brooklyn Bridge through Nassau Street and thence by a new tunnel to Brooklyn; the construction of an extension under Flatbush Avenue to the south side of Prospect Park; the Fourth Avenue line in Brooklyn, and the construction of a subway south from Times Square to the Battery via Seventh Avenue and West Broadway, if private bidders cannot be found for this line. In this connection the report states that on May 25 last 3001 persons entered the subway at the Grand Central Station in one hour, all southbound. This number is sure to increase, and in three or four years from thirty to forty trains an hour will be necessay to transport south those who pour into the subway at the Grand Central. It is therefore recommended that a direct way of going downtown for the people of the upper West Side is essential.

For the elevated roads, as a relief for overcrowding, the report recommends the operation of additional trains on all lines, and an increase in the length of trains. For additional convenience and safeguards it recommends the inclosure of platforms and the more careful cleaning of cars. For extensions, it recommends the installation of a third track on the Second and Third Avenue lines, but only if such an extension can be done without double-decking the structure and without deterring others from bidding on an East Side subway, and provided the company agrees to change its roadbed so as to reduce noise according to the best known methods.

For surface lines, the report requires the operation of more cars and the use of trains of two cars, which is a plan reported to be in successful operation in Washington, Boston and Columbus. The experimental use of double-deck cars on badly congested streets is also recommended. Under the heading of "additional conveniences and safeguards" it recommends the universal transfer system between all elevated, surface and subway lines, vestibules on all cars, power brakes, effective wheel guards, cross seats, experiments with the Montreal fare system, clearer destination signs, that all conductors be furnished with pocket guides of local information, and that all cars be supplied with jacks and emergency tools. For changes in tracks, roadbed and car houses, the report recommends immediate electrification of all lines using horse cars, the removal of unused car tracks, the use of automatic sprinklers in the present car houses and the fireproof construction of all new car houses.

Under the heading of "general investigation," the report recommends a comprehensive investigation of the transportation needs of the city. This would include a study of the districts between which people travel, the effect of the new transit lines on the movement of population, the unoccupied territory in the city and vicinity, where new business centers are being established, whether there is any tendency to move factories to outlying districts, whether the increasing vehicle and pedestrian traffic will require any changes in grades of street surfaces at street crossings and the relative efficiency of bridges and tunnels.

The report concludes with a recommendation of the suspended mono-rail system in use at Barmen-Elberfeld, in Germany.

CHICAGO, MILWAUKEE & ST. PAUL ELECTRIFICATION OUT OF CHICAGO

The Northwestern Elevated Railroad and the Chicago, Milwaukee & St. Paul are said to be preparing to accept the ordinances of the city of Chicago and of the city of Evanston, authorizing the companies to join their roads at the terminal of the Northwestern Elevated by a gradual incline, and to electrify the road between Chicago and Evanston. It is planned to substitute at an early date for the St. Paul suburban steam railroad an improved service on the Evanston division of the electrified road. President Starring states that not only will there be an improved service free from the smoke and cinders of the steam road, but the interval between cars will probably be shortened to 5 minutes. The schedule time between Davis Street, the central station of Evanston, to Van Buren Street will be 40 minutes. Bids are being received by the Northwestern Elevated for an order of forty new coaches of a special and improved design, to be used in the extended service of the road.

No definite announcements can yet be made concerning the financing of the new enterprise. The road is to be electrified and operated jointly by the Northwestern Elevated and the St. Paul. According to the ordinance, the fare from any point within Chicago to any other point of the road within the city limits shall not be greater than 5 cents, but there will be an additional fare for transportation from Chicago to Evanston, the exact amount of the tariff not being yet determined. The ordinance must be accepted within sixty days from its passage, and the service must be installed within a year from the acceptance of the ordinance.

ELECTRIFYING MORE NEW YORK CITY LINES

Work is now under way on the electrification of the First Avenue line of the New York City Railway Company from the Harlem River to Fifty-Ninth Street. Gangs of men are at work tearing out the old horse car rails and installing the new system at Ninety-Sixth Street, Eighty-Sixth Street and Fifty-Ninth Strreet. It is intended also to soon start a force at work at 125th Street, and the work will be vigorously carried on from these four points with a total force of about 2500 men, which will be organized as rapidly as possible.

With the completion of the new track from Fifty-Ninth Street north the electrification of the line south of that point to Forty-Second Street and from Thirty-Fourth Street to Twenty-Third Street will begin, and it is expected that this much of the work can be finished this summer. With the intermediate sections of this line which have already been electrified, the completion of the work outlined will give First Avenue an electric line north from the Williamsburg Bridge, thus greatly improving the surface line facilities on the East Side.

With the complete electrification of the First Avenue line there will be a direct electric route from the Harlem River to the postoffice, which will connect all of the bridges, built and building, but on account of the delay in getting the work started this cannot be accomplished until next summer.

It was intended to begin the electrification of the First Avenue line and of the Twenty-Eighth and Twenty-Ninth Streets cross-town line on April 1. The contracts had been let and all of the material had been delivered by that date, but there was an unexpected delay in securing the necessary permits from the city. The final permit was not secured until last week, and immediately on its issuance the electrification work was taken up.

On account of this delay, however, and the further delay incident to the organization of a large force of men, the electrification of the Twenty-Eighth and Twenty-Ninth Street lines probably will have to go over until next summer, as the work cannot be carried on after frost is in the ground. It is doubtful if the electrification of the First Avenue line can be carried out south of the Williamsburg Bridge.

TRANSIT INQUIRY IN NEW YORK—OTHER MATTERS

The Public Service Commission, whose jurisdiction extends over New York City, has decided to make a complete investigation of the transit situation in the city. Questions of operation of the various lines, transfer facilities, etc., will all be gone into thoroughly. August Belmont, when he learned of the Commission's action, said:

"The Interborough-Metropolitan Company will meet the Commission in a straightforward and cordial spirit, and will cooperate with it in every way possible."

President Theodore P. Shonts, of the Interborough-Metropolitan, said:

"The interests which I represent will meet the Commission half way and give them all the information they want and all the assistance we can. We only ask that they study both sides of the question, for there are two sides to it. I believe that with real co-operation the work of the Commission can be very helpful to the public and to us."

President Edwin W. Winter, of the Brooklyn Rapid Transit Company, said:

"We will aid the Commission in every possible way. It is likely that some way of improving the service may be found, and improvements are what the company is looking for. We will probably get some help from the Commission."

When the Commission met, Chairman Willcox brought up the subject of a transit inquiry. He said:

"I regard it as fundamental to the proper performance of the duties of this board that it should, at the earliest possible day, familiarize itself thoroughly through proper investigation and report with all of the conditions of fact and of law which are raised or created by the present actual organization and operation of the street railways of this city.

"This report of facts, when completed to the satisfaction of the board, will constitute the basis for its determination as to what its duties actually are, and the extent to which and the manner in which it can treat or deal with the existing railway companies in respect to future franchises, as well as in respect to operation of the railways of the city under the franchises already enjoyed by each corporation."

He then presented the resolution, which was adopted, as follows:

Now, therefore, be it Resolved, That this Commission shall forthwith, as required by sections 45 and 48 of the Public Service Commission's law, investigate and examine the general condition of the Interborough-Metropolitan Company and the Brooklyn Rapid Transit Company and of all companies controlled by and operated in the interest of either of the said companies, their capitalization, their franchises, and the manner in which their lines, owned, leased, controlled or operated, are managed, conducted or operated, including the adequacy, security and accommodation afforded by their service, and with respect to their compliance with all provisions of law, and also for the purpose of determining as the result of such investigation whether the said corporations do in fact illegally and as monopolies control and operate the several properties now under their control and operated in their interests, for the purpose of determining what is the capacity of each of the individual corporations so owned and controlled to render adequate service as required by law, and for the purpose of determining and performing the duties of this Board in the premises.

A supplementary resolution was passed giving Commissioner Wilson entire charge of the investigation. He has not yet decided when the investigation will begin.

The Public Service Commission has adopted a resolution changing the date of the public hearing on the form of the contract for the Fourth Avenue Subway in Brooklyn from July 25 to July 30. The adjournment was rendered necessary because of certain delays in printing the contracts. This rapid transit route is intended to run from Chrystie Street in Manhattan, across the Manhattan Bridge, and under Fourth Avenue and other streets in Brooklyn, with the four tracks, to Fortieth Street and Fourth Avenue. At this point a branch with two tracks is to run to Fort Hamilton, and another with two tracks to Coney Island. The total cost of the entire subway is esimated to be $23,000,000. The contract for construction is to be let in sections, the entire work being divided into fourteen sections. The hearing on the 30th of July will be on five of these sections, the portion of the subway from Nassau to Forty-First Street, with the exception of the section from Ashland Place to Sackett Street, for which the plans are not yet ready.

The Public Service Commission is giving this hearing for the purpose of hearing objections to the features of the form of contract as drafted. Copies of these contracts may be obtained at the office of the Commission, which, under the law, must sell them for ten cents a copy.

William M. Ivins, special counsel for the Public Service Commission in its inquiry into the Interborough-Metropolitan and Brooklyn Rapid Transit systems, conferred, Wednesday, July 24, with the Commissioners, but refused to announce his plans. The Merchants' Association sent a communication in regard to moving platforms. The association urges this as the most practical and immediate method of solving the Brooklyn Bridge crush problem. The communication concluded with the suggestion that a hearing should be held at which experts only should be heard.

DATA SHEET ON INSURANCE

The insurance committee of the American Street & Interurban Railway Company is sending out this week a data sheet, requesting information from member companies on the subject of insurance. The committee is made up of H. J. Davies, chairman, of Cleveland; A. H. Ford, of New York; G. L. Estabrook, of Philadelphia; C. O. Kruger, of Philadelphia, and R. B. Stearns, of Highwood, Ill. The material obtained by means of these blanks, together with such other material as may be collected by the committee, will be used as a basis of the final report to be presented at the Atlantic City convention in October. The question of giving publicity to any special information will be considered from the standpoint of its effect upon the individual company and also upon the interests of the association in general, but information marked confidential will be so considered. The accompanying letter states that the committee wants not only to present statistics at the Atlantic City convention on the cost of fire insurance, losses sustained and amounts recovered from the insurance companies, but to collect statistics showing the origin of fires and also to compare forms of policies. For this reason companies are requested to send copies of the descriptions of the properties insured. The questions asked follow:

1. Company. 2. City. 3. State. 4. Urban or interurban system.

5. Premiums paid or funds set aside for fire insurance, losses sustained and amounts received from insurance companies for losses. This is to be given for the last five years and should show the amount of insurance carried, premiums paid, average rate per $100 of insurance, insurance fund, losses and amounts received.

6. State origin of fire (if you have had a fire), and particularly whether or not the fire started in a car. 7. State cause of fire, as far as possible. 8. Describe briefly any improvements which have been made in your properties with a view to preventing a recurrence of fire.

9. What fire protective devices do you employ? 10. Have you a fire organization among your employees? 11. What instructions do you give employees in regard to the preventing and extinguishing of fires? 12. What portions of your property are you not carrying with insurance at the present time?

13. (a) Have you equipped any car houses with automatic sprinklers? (b) If so, do you use the aisle sprinklers? (c) Have your sprinklers prevented fires? 14. Have you had any trouble with aisle sprinklers interfering with the operation of your cars in the car house? 15. If you have installed automatic sprinklers, do you consider them objectionable from an operating point of view? 16. Have you an employee whose sole duty it is to inspect your properties, with a view to safeguarding them against damage by fire?

17. Insurance companies will frequently grant a reduction in rates upon the making by the insured of improvements recommended by them, especially if such rebate or reduction be asked for before or at the time the improvement is made. (a) Have you obtained any such reduction or rebate? (b) If so, for what improvements? (c) What amount per $100 of insurance?

18. (a) Have you obtained a reduction in rates of insurance within the past three years? (b) If so, please state the reasons for the reduction. 19. Important.—Please enclose copies of the forms attached to your insurance policies.

THE CLEVELAND SITUATION

Lightning struck the power house of the Forest City Railway Company at Cleveland, Tuesday, July 16, and the generator was so badly injured that it was necessary to send out of town to have some of the parts replaced. As a result, the road was compelled to suspend operation for the remainder of the week. A request was made to the Cleveland Electric for power, but President Andrews replied that his company did not consider that the Forest City Company existed legally and that it did not care to aid in the operation of a line that is being run in violation of law.

Councilman John D. McLain has brought suit against President Horace E. Andrews to recover $50,000 damages, on the allegation that Mr. Andrews made the statement that McLain had accepted $1,000 for his vote and that the money came from Mayor Johnson. This is the first personal damage suit that has grown out of the traction fight in the Council.

Owing to the fact that the Forest City Railway Company had failed to make a statement of its condition, as required by the rules, the governing committee of the Cleveland Stock Exchange ordered that its securities be removed from the listed to the unlisted column. This brought forth a report of the financial condition of the company. Just what action the Exchange will take now is not known. The statement of money expended for construction and equipment of the Forest City Railway is as follows:

Consents	$24,705.84
Legal services	44,719.26
Injunctions	6,051.88
Miscellaneous organization expenses	3,365.35
Engineering and superintendence	2,478.93
Track and roadway construction	240,844.60
Paving	81,999.24
Electric line construction	87,278.94
Real estate used in operation of road	4,590.55
Building and fixtures in operation of road	24,227.24
Power plant equipment	137,718.00
Shop tools and machinery	4,060.00
Cars	141,756.63
Electric equipment of cars	59,683.04
Miscellaneous equipment	2,800.23
Interest and discount	16,373.02
Miscellaneous	25,533.06
Private siding, Denison Avenue	9,045.04
Furniture and fixtures	1,891.61
Uniforms	1,530.68
Municipal Traction Company	8,191.04
Trailers	11,141.80
Total	$939,985.98

Statement of General Ledger, May 31, 1907:

ASSETS

Franchise account		$200,000.00
Petty cash, not including any Municipal Traction trust fund		1,552.89
Petty cash kept in the office of the Municipal Traction Company for payments of claims and other items		3,000.00
Cash account Municipal Traction trust fund, kept in Citizens and United Banks		306.13
Fred C. Alber, due on $909,570 stock allotted	$47,124	
Stock not allotted	965,430	1,012,554.00
Disbursements on C. & E. Ledger since Oct. 13, 1903		939,985.98
Taxes paid to date		1,440.32
Bills receivable		157.50
Net rental received from Municipal Traction Company		26,641.55
Total		$2,185,638.37

LIABILITIES

Capital stock	$2,000,000.00
Bills payable	158,996.82
Dividend payments to stockholders	26,641.55
Total	$2,185,638.37

MUNICIPAL TRACTION COMPANY

Quarter ended une 30, 1907—

Traffic receipts, car earnings		$40,455.22
Traffic receipts, ticket sales		185.29
Earnings from other sources		735.06
Gross earnings		$41,375.57
Total operating expenses	$23,649.38	
Rental paid to Forest City Railway Company	13,952.00	37,601.38
Net earnings		$3,774.19

The Cleveland Electric Railway Company has filed suit in Common Pleas Court, asking that the Forest City Railway Company, the Low Fare Railway Company and the Municipal Traction Company be enjoined from using any of its property. This petition, if granted, would confine the new companies to the territory now occupied by them on the West Side. They could not get to the East Side at all.

In this suit practically the same allegations are made as were incorporated in the suit asking that the companies be enjoined from using the Euclid Avenue line from the Public Square to East Fourteenth Street. It is stated that the franchise around the Erie Street Cemetery was granted the Low Fare Company so that extensions might be made over routes now occupied by the Cleveland Electric without the necessity of securing franchises through competitive bidding. The story of the midnight connection of the Low Fare tracks with the Euclid Avenue track of the Cleveland Electric, when Mayor Johnson ordered the cars stopped, is also recited. The petition all through brings the Mayor in as a prime mover in the alleged subterfuges to secure rights for the companies in which he is accused of being interested.

The petition further states that the ordinance granting the use of the Cleveland Electric tracks to the Low Fare Company is illegal, because it purports to give it the right also to operate over a line on East Fourteenth Street which the Forest City Railway Company placed there illegally, because Mayor Johnson is interested in it. Legally, there is a gap between Euclid Avenue and the "graveyard" grant made to the Low Fare Railway Company.

An immediate hearing is not requested in this petition. The company seems to be willing to allow the courts to take their time in hearing the cases it is now instituting, with the evident idea of fighting them through to a finish when once commenced.

Commenting editorially on the situation in Cleveland, the "Leader" says: "It is for the voters of Cleveland to say when and how the deadlock shall be broken. The farther the litigation goes in the courts the worse conditions become. Complications multiply and no way out is charted by the judges. It is a queer monument to the boasted administrative genius and civic patriotism of the 'best Mayor of the best governed city.'"

TRAFFIC ARRANGEMENT ANNOUNCED BETWEEN OHIO LINES

General B. Kerper, president of the Kerper lines, has announced that plans are being made for a traffic arrangement between the Toledo Urban & Interurban and the Columbus, Urbana & Western, including the Columbus, Magnetic Springs & Northern, by which a through service between Columbus and Toledo will be placed in operation. The Toledo, Urban & Interurban extends from Toledo to Findlay. From the latter point an extension will be constructed south 38 miles, to La Rue, which will soon be the northern terminus of the Columbus, Magnetic & Northern. The Columbus, Urbana & Western is now engaged in securing a right-of-way from Columbus to Delaware to connect with the Columbus, Magnetic Springs & Northern.

Preliminary arrangements are being made by the attorneys for the Columbus, Urbana & Western and the Columbus, Magnetic Springs & Northern, which properties are owned by the same interests, for the organization of a new holding company to take over both traction lines and operate them as one system. This will greatly simplify the plans for the through Columbus-Toledo service. It is expected that the new company will be capitalized at $3,000,000.

The working of extending the Columbus, Magnetic Springs & Northern, north from Magnetic Springs through Richwood to La Rue is well under way. It has been decided to equip the road as a trolley line, but two Strang gasoline electric cars have been ordered to be used in cases of emergency.

The Columbus, Urbana & Western, through W. H. Ogan, its general manager and also the general manager of the Columbus, Magnetic Springs & Northern, is securing a right-of-way up the west bank of the Scioto River from the Columbus municipal storage dam, the present northern terminus of the road to Delaware. It was at first the intention to go up the east bank of the river and bridge at Delaware, but it was found the bridge could be more cheaply constructed and at a better grade below the dam, so it was decided to cross there.

STOCKHOLDERS OF PHILADELPHIA RAPID TRANSIT COMPANY CONFIRM TRACTION AGREEMENT MADE WITH THE CITY

The stockholders of the Philadelphia Rapid Transit Company, at a special meeting, Thursday, July 18, approved the action of the company's officers and directors in ratifying the agreement made with the city for the improvement of existing traction conditions. The shareholders adopted a resolution also providing for a change in section 2 of the company's by-laws, adding three names to the directorate in accordance with the agreement, which requires a representation of the city in the board. The directorate will consist hereafter of eleven members instead of eight, the new directors being Mayor Reyburn, Clarence Wolf and William H. Carpenter.

Later in the day the directors held a special meeting in the Land Title Building, at which the new directors were prseent, to arrange for the carrying out of one of the provisions of the contract, which stipulates that there shall be stamped across the face of all certificates of stock and leases held by the company notice that they are held subject to the terms of the agreement made with the city, except securities held in the fire insurance fund of the corporation, which may be sold to meet fire losses or for the purpose of reinvestment. This action in stamping the stock certificates makes them subject to the three assessments of $5 each, which the company will call to make its capital stock full paid. The directors have until August 1 to make a call for the first assessment, payable next December.

REPORT ON RULES

The rules committee of the American Street & Interurban Railway Association has issued the following data sheet with request for reply. It is signed by the committee which consists of E. G. Connette, chairman; E. C. Faber, E. J. Ryon, F. J. Stout, J. N. Shannahan.

"The committee on Standard code of rules submitted a report to the association at the Columbus convention in 1906, in which report were embraced a code of general rules for the government of motormen and conductors of city roads, a code of rules for the government of motormen and conductors applicable to interurban roads, and a code of rules for the government of motormen and conductors applicable to high speed electric railroads. The complete report of the committee is contained in the twenty-fifth (1906) annual report of the association. These rules have also been issued in pamphlet form and sent to the various street railway companies of the country. If you have not a copy of the rules, kindly inform the secretary of the association, who will be pleased to send one to you.

"Before proceeding further, the committee desires to know if the rules contained in the report which was submitted at Columbus have been universally adopted, and if not, to ascertain the reasons for their non-use.

"Will you please advise Mr. B. V. Swenson, secretary of the American Street Railway and Interurban Railway Association, 29 West Thirty-Ninth Street, New York City, whether or not these rules have been adopted on your road. If not adopted, will you kindly give the reasons why and also any other suggestions which may assist the committee in the preparation of its 1907 report.

"You are especially requested to use the enclosed data sheet in replying to this inquiry. The results of this investigation will form a part of the committee's report to be presented at the Atlantic City convention in October. As the time is limited, you will greatly oblige the committee by sending a prompt reply.

1. Company. 2. City. 3. State. 4. Urban or Interurban System?

5. Have you read the report of the standard rules committee which was submitted to the convention at Columbus, Ohio, October, 1906? 6. If so have you adopted these rules as standard on your lines? 7. If you have not adopted these rules as standard, would you kindly give the committee your reasons for not doing so? 8. If you have not read the report of the committee, will you please send for a copy of the report to the secretary of the association? 9. Have you any suggestion for the consideration of the committee relative to the report submitted at Columbus? If you are using a rule book other than that of the association, will you kindly send us a copy? Will you please mark those sections in this book which are not in the association rule book? By so doing you will greatly facilitate the work of the committee. Kindly put additional data and suggestions on a separate sheet and attach it to the data sheet.

PROGRESS ON THE EAST RIVER BRIDGE

In a communication to William R. Willcox, chairman of the Public Service Commission. Bridge Commissioner J. W. Stevenson sets forth the following in regard to the three East River bridges:

"Certain work is in progress on the Williammsburg Bridge, which by the latter part of this year will result in the operation over the bridge of elevated trains. Upon the completion of the terminal, thirty 8-car elevated trains per hour, which can deliver 25,000 people per hour at the Manhattan terminal, may be operated. This traffic is in addition to the present traffic by the trolley cars.

"In the case of the Manhattan Bridge, which will be completed Dec. 31, 1909, provision is made on the structure for eight railway tracks, four on the lower roadway level and four on the upper. Of these tracks the four on the lower level can be used interchangeably for subway, elevated or surface traffic, and the four on the upper level may be used for elevated or surface.

"The track construction on the Blackwell's Island Bridge will provide for the operation of cars over six tracks, two tracks for elevated railway trains, two tracks for surface, and two tracks for either trolley or subway cars. In determining upon the track plans for this bridge, I have tried to find out the intentions of the transportation companies with regard to their operation over the bridge. So far as I am advised, it is not contemplated that use may be made of any of those tracks except one pair for the operation of surface trolley cars. The rapid development of Queens will require in the immediate future more adequate facilities over this bridge than the transportation companies contemplate furnishing."

NEW SINGLE-PHASE RAILWAY IN CALIFORNIA

An interesting electric railway designed for single-phase operation is now under construction between Visalia and Lemon Cove, Cal., by the Visalia Electric Railroad Company. It will be the first single-phase railway in the country to be operated on 15-cycle current. The line extends from Visalia through Exeter to Lemon Cove, a total distance of 23 miles.

The main sub-station from which the road will receive its power is being built at Exeter, approximately the center of the line. Here three-phase, 60-cycle current at 17,500 volts will be received from the transmission system of the Mt. Whitney Power Company and changed by means of two 450-kw motor-generator sets to 11,000-volt 15-cycle single-phase current for transmission to the transformer sub-stations. These latter sub-stations will be three in number, and will be located, one at Exeter and one 3 miles from each end of the road, making the distances between 7½ miles. Each transformer sub-station will contain two 300-kw 15-cycle transformers for stepping the transmission voltage from 11,000 down to the trolley voltage of 3300 volts.

The pole line will be of the single pole bracket type, and will carry the No. 000 trolley wire by means of a catenary suspension, a 7-16 in. steel messenger cable being used. The 11,000-volt transmission line will be carried on the same poles.

The initial rolling stock equipment will comprise four passenger cars, two of which will be equipped with smoking compartments and one with a baggage compartment. There will also be two trailers, a 50-ton electric locomotive and the standard freight equipment. The current collector will be of the pantagraph sliding-contact type. The passenger cars will be provided with a quadruple equipment of 75-hp motors, with multiple-unit control connections and automatic air brakes. A quadruple equipment of 125-hp motors will be installed on the electric locomotive, with the new automatic Westinghouse E.T. air brake equipment. The sub-station and car equipment will be furnished by the Wesinghouse Company.

The railway will tap a very rich orange and lemon section at Lemon Cove, and a large freight business in handling these citrus fruits is anticipated. Exeter is a shipping center and Visalia a prosperous commercial center, so that a large passenger traffic will result. The overhead system is nearly completed and work has been started on the power stations. It is expected to have the road in operation in about four months. The officers of the Visalia Electric Railroad Company are as follows: President, W. H. Hammond; vice-president, Ben. M. Maddox; secretary, E. E. Baker; engineer and superintendent, James H. Crossett.

OHIO RAILROAD OVERRULED IN FARE CASE

Judge Bigger, of the Common Pleas Court at Columbus, Ohio, has overruled the State Railroad Commission in its finding against the Hocking Valley Railroad Company in the Price case. Complaint was made to the commission that the company was making a reduction of fares between certain points on the line and not others, and that those who did not receive the lower rates were being discriminated against. The commission decided against the road, but the court holds that a railroad company has a right to make lower fares between certain points in competition. The reduced rates on the Hocking Valley are in the nature of a twin ticket and are operative between Logan and Columbus in competition with the Scioto Valley Traction Company. An injunction has been granted against the commission to prevent its enforcing its ruling.

WORK BEGUN ON BROOKLYN BRIDGE TERMINAL

Ground has been broken in City Hall Park for the erection of the temporary terminal for the Brooklyn Bridge. This is an improvement which it is believed will eliminate many of the disagreeable features of the transit conditions which now exist on the bridge during the rush hour. The plans call for the extension of the present terminal across Park Row into City Hall Park. The extension is designed to provide enough platform space to enable the operation of six-car trains across the bridge. With the installation of the through train service and increased switching facilities by the construction of the temporary terminal, traffic will be distributed, according to the destination of the passengers, and the transferring from the bridge cars to the elevated trains on the Brooklyn side will be entirely eliminated. This improvement will also eliminate the congestion on the Brooklyn terminal during the morning hours, inasmuch as passengers using the elevated lines will be transported to Manhattan without being compelled to change cars. The discontinuance of the cable service will mark a new era in the history of the bridge. The cable has been part of the motive power of the structure ever since it was opened for the transportation of passengers to and from Manhattan.

DETROIT ENJOINED FROM PASSING LOW FARE LAW

On an application by the Guaranty Title & Trust Company, of New York, Federal Judge Swan issued a restraining order July 22 to prevent the city officials of Detroit and the members of the Council from enacting the pending street railway law known as the Hally ordinance. The ordinance provides that the Detroit United Railway can use patches of line on which it is alleged franchises have expired only on condition that the entire line or street on which the patch lies must be operated under conditions calling for the sale of five tickets for 15 cents. The ordinance is avowedly aimed to obtain 3-cent fares throughout the city by using the leverage of the expired franchises. The Guaranty Title & Trust Company, owning $25,000,000 of Detroit United bonds, charged that the adoption of the ordinance would effect an unreasonable depreciation of the bonds.

REPORT ON CAR HOUSES

The committee on operating and storage car house designs of the American Street and Interurban Railway Engineering Association has issued a call for car house drawings. The letter says:

"The executive committee of the American Street and Interurban Railway Engineering Association desires to have presented at the next convention a report upon car houses, to consist of a compilation of plans and synopsis of specifications of some of the more recent types. This report will illustrate the best practice in this branch of engineering work, and will be of great value to the members of the American Street and Interurban Railway Association in offering data and suggestions for similar work which its members may have to do. To make the report as comprehensive as possible, it is desired to include car houses of the smaller roads as well as those of the largest urban systems in the country.

"The committee requests your assistance in this work, and asks you to kindly send plans, photographs and descriptions of new car houses, or of any car houses which are of novel construction or possess features of particular interest. The following drawings or photographs are requested: drawing or photograph showing front elevation; plan showing arrangement of tracks, pit room, etc.; cross section showing construction of walls, roof and pits; detail drawings of any features of particular interest; copy of specifications or description of materials used in construction."

The members of the association are requested to send these plans to any one of the members of the committee, who will be glad to acknowledge their receipt, and return such plans as are not used in the report. The committee consists of Fred N. Bushnell, Stone & Webster Engineering Corporation, Boston; N. W. Graburn, master mechanic, Montreal Street Railway Company, Montreal, and R. C. Taylor, superintendent motor power, Indiana Union Traction Company, Anderson, Ind.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED JULY 2, 1907

858,461. Lifeguard for Motor Cars; Benjamin Lev, Cleveland, Ohio. App. filed Jan. 23, 1907. Details of construction of a car fender.

858,493. Brake-Shoe; William S. Weston, Chicago, Ill. App. filed Nov. 8, 1906. Comprising a body portion of cast metal provided at its back with a connector of tougher metal, from the ends of which shallow inserts of relatively slow-wearing metal project toward the face of the shoe.

858,616. Snow-Plow; James W. Mowbray, Stratford, Ontario, Can. App. filed March 20, 1907. The plow consists of a scoop having vertical cutting knives at the sides thereof, so that the plow will not have to displace snow at the side of the track. The usual converging shares are mounted above the scoop.

858,624. Pleasure Railway; John C. Reckweg, Los Angeles, Cal. App. filed Nov. 1, 1906. The trackways are undulating to cause the car to pitch and roll after the manner of a ship at sea.

858,732. Trolley Pole Controlling Device; William Lile, Venice, Ill. App. filed June 28, 1906. Provides mechanism which will permit the trolley pole to drop away from the trolley wire when the trolley jumps the wire, instead of permitting the pole to swing or fly upward under the tension of the spring which keeps it in contact with the wire under general conditions.

858,774. Reinforced Angle-Bar for Rail Joints; Benjamin Wilhaupter, New York, N. Y. App. filed Oct. 6, 1906. An angle-bar for rail joints, provided intermediate it ends with an offset resilient rail clasp, a pendent stiffening girder and an extended base-supporting shoulder located at the top of the girded.

858,793. Railway Traffic Controlling Apparatus; Clyde J. Coleman, Rockaway, N. J. App. filed Nov. 7, 1904. Relates to detail features of construction of a signaling system employing liquid or compressed carbonic acid gas to actuate the signals.

858,882. Rail Splice; William H. Lewis, Sylvester, Ga. App. filed March 8, 1907. The fish-plates are provided with clamping jaws which engage the base of the rail and a plate thereunder which is spiked to the ties.

858,954. Multiple Valve Device for Air Brakes; Silvio Cire, Jersey City, N. J. App. filed Sept. 18, 1906. A multiple air valve device for use in connection with railway air brake apparatus comprising a casing provided at one end with a train pipe connection and at the opposite end with auxiliary air reservoir and brake cylinder connections, and means for manipulating the brake mechanism by regulation of the intensity of the air supply through the train pipe, so as to enable the operator to control at will the operation of the brakes.

858,973. Anti-Creeper; Henry K. Gilbert, Chicago, Ill. App. filed Nov. 14, 1906. Details of a clip to engage the rail and abut against a tie.

858,983. Tie and Rail Clamp; James B. Hinchman, Denver, Col. App. filed Jan. 23, 1907. Relates to means for securing the rails to composition tie.

859,015. Car Construction; Albert H. Sisson, St. Louis, Mo. App. filed Nov. 15, 1906. Relates more particularly to the construction of the side walls of a car at the locations of the

window openings and also to protective sheathings for the decks of the car at the location of the deck windows.

859,018. Transportation System; Franklin S. Smith, Philadelphia, Pa. App. filed Nov. 21, 1906. Relates to railway or transportation systems in which electrical apparatus is placed along the roadway or track so as to be operative through other apparatus fixed to or carried by a car or vehicle to move the same along the track.

859,019. Electric Transportation System; Franklin S. Smith, Philadelphia, Pa. App. filed March 11, 1907. Relates to modifications of the above.

859,046. Tie Plate; Simon Clary, Carnegie, Pa. App. filed Dec. 11, 1906. Details of construction.

859,056. Rail-Bond; Thomas C. Folsom, Tampa, Fla. App. filed Oct. 23, 1906. Consists in providing a rail-bond which shall be securely held in place in a protected position but which may be readily applied and removed when desired.

859,096. Track Switch; John A. Meredith, Riley, Ind. App. filed March 28, 1907. Relates to the construction of a depressible foot lever for engagement with a switch-throwing arm.

859,182. Rail-Spread Detector for Railway Trains; Joseph A. Shires, Denver, Col. App. filed Feb. 16, 1907. One of the wheel axles is made with a telescoping section and an electric alarm device is arranged to be actuated by the elongation of this axle.

PERSONAL MENTION

MR. F. D. REILLEY, traveling auditor for the Indiana, Columbus & Eastern Railway and the Lima & Toledo Traction Company, has resigned his position to accept a position with a mercantile concern in Detroit.

MR. GEO. G. PORTER, who recently resigned as superintendent of shops of the Metropolitan District Railway Company, of London, England, has returned to this country, and at present is located temporarily in Chicago.

MR. L. W. NEEREAMER, formerly in steam railroad service and recently chief clerk in the office of the Ohio State Dairy and Food Commissioner's office, has accepted a position with the Columbus, Urbana & Western Railway Company.

MR. WM. GIDDES, who recently resigned as master car builder of the Tacoma Railway & Power Company and the Puget Sound Electric Railway Company, has been appointed superintendent of shops of the Portland Railway, Light & Power Company.

MR. F. K. PARKE, who has served the board of supervising traction engineers, of Chicago, as auditor and expert accountant for sometime, has been appointed secretary of the board. Mr. L. R. Acton, who until recently has acted as Western manager for Gunn, Richards Company, public accountants of New York, has been appointed auditor and assistant secretary of the board.

MR. F. A. REUS, formerly connected with the United Railways, of Baltimore, Md., has recently been appointed secretary to Mr. P. F. Sullivan, president of the Boston & Northern and Old Colony Street Railway Companies, to succeed Mr. George J. Anderson, who, as previously noted in the Street Railway Journal, has become connected with the Electric Bond & Share Company, of New York.

MR. WILLIAM M. IVINS has been appointed special counsel by the Public Service Commission to assist in the investigation of the Interborough-Metropolitan and Brooklyn Rapid Transit systems. Mr. Abel E. Blackmar, another experienced investigator, has been selected as the regular counsel of the Commission. Both of these appointments were announced by Chairman Willcox at the meeting of the Commission, Tuesday ,July 23.

IN CONNECTION WITH THE CHANGES announced in personnel of the Cincinnati Northern Traction Company, Mr. C. E. Palmer will have charge of the Cincinnati Northern Division of the company, with headquarters at Hamilton, Ohio, and will have the title of superintendent; and Mr. B. M. Brown will have charge of the Dayton and Richmond Division and the Dayton and Union City Division, with the title of superintendent.

MR. CLINTON WHITE, Railroad Commissioner of Massachusetts, has arrived in England on an inspection tour that is expected to cover six or eight weeks. He will give special attention to the methods and devices for ordering and controlling crowds in the underground transit lines of London, and will observe similar conditions on the city lines of Paris, Berlin and other large centers. A part of his inquiry will be directed toward the methods of handling freight and heavy-goods traffic in city streets as well as at terminals.

MR. BION J. ARNOLD, chief engineer; MR. HARVEY B. FLEMING, Chicago City Railway, and MR. GEORGE V. WESTON, assistant chief engineer for the city, members of the Board of Supervising Engineers of Chicago tractions, are on an Eastern tour. They will inspect the Pennsylvania Steel Works and the shops of the William Wharton, Jr., Company, at Philadelphia, also the Brill Manufacturing plant and the new subway of the Philadelphia Rapid Transit Company. Later they will visit and inspect the New York subway and the new tunnels.

MR. CLARENCE P. HAYDEN, who has lately been transferred from the superintendency of the eastern division to the full charge of the western division of the New Hampshire Electric Railway, with headquarters at Salem, N. H., was tendered a banquet recently by his associates in the eastern division. Mr. Burbank of the company, in behalf of the employes of the eastern division, with which Mr. Hayden has been connected for a number of years, presented him with a diamond ring as a testimonial of the popular regard for him. Mr. Hector W. McKay succeeds Mr. Hayden as superintendent of the eastern division.

MR. BENJAMIN FRANKLIN HART, of Philadelphia, is dead. Mr. Hart was for many years vice-president of the company operating the Seventeenth and Nineteenth Streets line, and a director of the companies running the Green Street and Fairmount Avenue Railway, the Thirteenth and Fifteenth Streets Railway and the Gray's Ferry Railway, of Philadelphia, now constituents of the Philadelphia Rapid Transit Company. Mr. Hart was born in Hartsville, Bucks County, on March 22, 1825. He was a descendant of the Hart family, who came to this country with William Penn, and who founded the town of Hartsville.

MR. EDGAR PECKHAM'S many friends in this country will regret to learn that in spite of his great energy his English enterprises in which he has been engaged during the last three years have not proved financially successful. The examination of Mr. Peckham's accounts on June 21 in the London bankruptcy court showed liabilities of £4,592, and assets valued as sufficient to yield a surplus of £9 after payment of all debts. Mr. Peckham went to London in 1904, to represent the Peckham Manufacturing Company, of Kingston, N. Y., and remained with that company until its liquidation in May, 1905. In February, 1905, he became interested in a malleable steel casting company in England. During his residence abroad he has also devoted considerable time to inventing and placing on the market improvements in tracks and gears for electric cars.

MR. E. J. COOK, chief engineer of the Cleveland Electric Railway Company, has been chosen as general manager of the Rochester Railway Company, Rochester, N. Y. Mr. Cook has been closely allied with Mr. Andrews in the work of building up the system in Cleveland for a number of years past, and his appointment to the managership of the Rochester system is in recognition of his services at Cleveland. Mr. Cook graduated from the Stevens Institute of Technology, Hoboken, N. J., in 1886, and after being connected with the company in another capacity for some time, was made superintendent of the properties of the Edison Electric Illuminating Company, Brooklyn, in 1889. A year later he became connected with the Field Engineering Company, of New York, as vice-president and constructing engineer, and in 1894 he went to Cleveland, where he spent a year as constructing engineer of the Cleveland Electric Illuminating Company. As constructing engineer of the Detroit Citizens' Electric Railway Company, Mr. Cook planned and superintended the change of the greater part of the system from horse to electric power. From 1896 to 1900 he was electrical engineer of the Cleveland Electric Railway Company, and for three years following this held the same position with the Cleveland City Railway Company, which was then owned largely by Senator Hanna. In 1903 the Cleveland Electric Railway Company and the Cleveland City Railway Company were consolidated and Mr. Cook became chief engineer of the entire system. Mr. Cook at one time made a specialty of constructing power plants. The Cedar Avenue power house of the Cleveland Electric is one of the recent plants he planned and constructed. Mr. Cook will take his work in the new position on Aug. 1. His successor in the Cleveland company has not been chosen.

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Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8200 copies are printed. Total circulation for 1907 to date 254,550 copies, an average of 8211 copies per week.

The Municipal Ownership Reports

For several weeks past we have been summarizing the reports of the different members of the municipal ownership committee of the National Civic Federation. This week we present the conclusions reached by the majority of the body, with the explanations filed by certain members and the minority report of Walton Clark. In spite of the diversity of views expressed in the longer individual reports, it is gratifying to know that upon many of the topics considered, nineteen of the twenty members of the committee were agreed.

The final report of the committee definitely declares that municipal governments abroad are much more suitably organized for the conduct of business enterprises than those in this country; that the ownership of undertakings of the kind here should, under all circumstances, be limited to those which directly involve the health, safety and transportation of the public or the use of public streets or grounds, and that municipal operation should not be considered unless the exclusion of political influence and personal favoritism from the management can be assured. The second conclusion by no means implies that municipal ownership should be extended to these utilities, as certain members of the committee point out, while the feasibility of the latter essential can easily be left to the sober judgment of any student of American municipal conditions. It is hardly possible to conceive of such a radical innovation where party rule is so firmly established as it is here, especially as the report points out that undoubtedly "municipal ownership would create a large class of employees who may have more or less political influence."

The subject of street railways is, of course, the one in which our readers are most interested, and it would be improper to dismiss the subject without a reference to the valuable statistics upon this subject compiled by W. J. Clark, and of which an abstract was published last week. Under our laws American street railway properties cannot be practically confiscated as has been the case in Great Britain, and we have always maintained that the reason why the stockholders of street railway companies in this country should oppose municipal ownership and operation was because they were experts in railroading and knew the dangers of any such policy, rather than because of their interest in transportation enterprises. For this reason the report referred to is of as much value to anyone who wishes our municipalities to prosper as it is to the street railway companies themselves. The municipal ownership propaganda, up to this time, has been bolstered up largely upon inaccurate ideas of the result which would follow, and upon false premises, and the idea has been fostered very largely on account of its availability for political purposes. With the light which has been thrown upon the subject by the reports of the Federation and by the statistics which will form a part of this report when published, there should be a general recognition that the desirable objects sought can be obtained in a better and cheaper way under private than under municipal ownership.

Operation of Trains on Interurban Lines on Regular Schedules Only

There are interurban systems upon which the same schedule is operated day after day throughout the year.

Special cars and extra cars, if run at all, are sent behind regular trains as a second section of a double header. The trains are seldom delayed and run with the same relation to time as a well-staged play. The trainmen depend upon meeting certain trains at certain hours and places and usually do so.

Some companies believe that this is the best of practice and consequently discourage the operation of special cars at odd times, fast or limited trains, and even make an effort to keep irregularly moving freight or express trains off the line. Their main argument is that the trainmen get so accustomed to the schedule that they go through their work almost mechanically, and thereby the danger of collisions or other accidents is very much reduced.

We must admit that this is true. Trainmen are relieved almost entirely of the necessity of thinking. Dispatching from a central office is practically eliminated and it must be something very much out of the ordinary that will cause two cars to come into collision. Where the earning power of a road is not lessened by operating the trains regularly day after day there is hardly an argument against the practice.

But the movement of people is not regular. On Sundays and on special occasions frequently two or three times the regular number of people want to go over the road. If proper encouragement is given or proper effort is made, often quite a business can be worked up in special theater parties, or special excursions; the receipts can also be increased considerably by handling lodge, church or Sunday-School delegations. But such parties, as a rule, wish to leave at definite times which may not be the exact schedule time; a theater party, for instance, would not want to wait perhaps the greater part of an hour after the show is over before departure. Again, many systems have found that through passengers who would otherwise take steam trains can be induced to patronize the electric line if "limited cars" are run at intervals of two or three hours.

There are, no doubt, instances where the earning powers of a road do not suffer by adhering to a clock-like method of train operation, but the ease with which a road can be operated in this manner and the seemingly lessened chance for accidents may often cause some managements to adhere to the practice at the expense of the earnings of the road.

Voltage of Auxiliary Motors in Power Plants

Considering the increasing use of small motors in power plants for the driving of auxiliary machinery, it is somewhat peculiar that the voltage question remains unsettled in so many instances. It is a common experience in an alternating-current plant to find the exciter-motors running respectively at 110, 550, 220 or 2300, two separate and widely varying potentials being a frequent practice. The conveyor motors may run at 550 volts, the valves may be operated at 110, and 2300 volts may be used on a pump or exciter motor. This variable state of affairs presents certain disadvantages which deserve consideration.

It is undesirable on account of the difficulties of insulation to operate motors of the sizes required to control oil-switch mechanism at voltages of 2300 and upward, and unless the designers are willing to guarantee the motor service for a year or two, it is doubtful if these small machines should be built for over 440 or 550 volts. In direct-current practice in book-binderies, printing establishments and the like, a great deal of trouble has been experienced in operating small motors of ½ hp or ¼ hp down on the ordinary 550-volt commercial service, and in an alternating-current railway plant the insulation requirements in small auxiliary motors are still more severe on account of the peak of the potential wave twice each cycle. The usual potential of 220 volts three-phase is certainly well adapted to the needs of auxiliary motors of small size when first-class guarantees of reliability cannot be secured on the higher potentials, though it has the disadvantage of incurring transformer losses and requiring larger copper allowances in wiring unless a special 220-volt generator is maintained for auxiliary power and lighting service.

Transformer losses are almost inevitable in connection with auxiliary motors if the voltage of the main alternators is 2300, 6600 or 13,200. If rotary converters are constantly in service at the plant the problem may often be very nicely solved by making all the auxiliary motors of the usual 360-volt type or thereabout, so that they can operate on the potential of the alternating sides of the rotaries. In case the main generators are built for 360 volts, with step-up transformers for local distribution and transmission, the auxiliary motor situation becomes much simplified. A more frequent combination, however, is alternators of 13,200 volts, exciter motors of 2300 volts, oil switch and conveyor, valve and pump motors of 220 volts. The larger motors required on the exciters can readily be wound for 2300 volts, and it seems a pity to lose the saving in copper which this potential makes possible in sizes like 25 to 75 kw and upwards. Perhaps the ideal case from the standpoint of the auxiliary motor is 2300 volts at the generators and exciter motors and 220 or 460 volts on all the smaller outfits. It is hard to specify these voltages at random, for all the conditions in the electrical design of the plant must be considered in any proper study of the problem in practice. There is little excuse for the use of more than two or three voltages at the outside at the motors in a combined railway and lighting plant where the generator voltage counts as one, and certainly all motors doing similar work should, in the interests of interchangeability and economy, be supplied at the same potential. The tendency of the modern central station toward supplying current at a single voltage, like 2300, in local distribution, is certain in time to carry favorable weight in the auxiliary motor selection of railway plants.

The Necessity for Practical Brake Shoe Tests

The suggestion of Mr. Sargent in his review of the motor car builders' brake-shoe tests, an abstract of which is presented on another page of this issue, that electric railways in the Middle West and Purdue University co-operate in making service tests of brake-shoes is a timely one and should receive the attention both of railway managements and the university named. Mr. Sargent refers to the value of the previous tests conducted at the Purdue testing laboratory but emphasizes the point that heretofore all tests of this kind have been carried on under conditions which are not present in actual service and that trials under the operating conditions may show quite different results.

Steam road operators were rather slow in realizing the

importance of giving proper attention to the brake-shoe question and operators of electric roads seem to be following in their footsteps. In the days of hand brakes and horse cars, when shoes were changed at six-month periods or even at longer intervals and the entire brake-shoe bill per car was not more than three or four dollars per year there was very little occasion to spend much time in trying to lessen the few dollars which this account involved. But under present conditions when the shoes are sometimes worn out in ten days, and the brake-shoe item is a very prominent one in the car maintenance account, operators would do well to make or authorize a scientific study of the subject.

Our knowledge concerning brake-shoes is, to say the least, very limited, a condition which is evidenced by the fact that there is no uniformity throughout the country as regards brake-shoe practice. One master mechanic prefers a soft shoe without inserts, while another uses a chilled shoe or one with inserts on the same type of wheel. Again, we find the same shoe used on steel tires and on chilled wheels.

The shop tests already made by the Master Car Builders' Association indicate that the softest shoe does not necessarily have the highest coefficient of friction and further research along these lines might prove that the wheel wear per foot-pound of work absorbed is not necessarily a function of the hardness of the shoe. In the light of the information which now exists we can only presume that much of the money spent for brake-shoes by the electric railways throughout the country is simply a penalty for past lack of interest and present paucity of information.

We assume that Purdue University was mentioned in connection with the proposed tests by Mr. Sargent, partly because the M. C. B. tests on brake-shoes were conducted there and partly because it is the custodian of the test car "Louisiana" which was given to the American Street and Interurban Railway Association by the St. Louis electric test commission and was loaned by the association to the university. There are other technical schools of the highest class, however, such as the University of Illinois and the Worcester Polytechnic Institute, which are also provided with test cars and are, perhaps, equally well equipped to conduct studies in technical problems confronting electric railway companies. All of these universities, not to mention Cornell, the Massachusetts Institute of Technology and many others, have in their faculties men competent to devise any special machinery required in fitting up cars for test purposes and for conducting practical researches into railway engineering problems. The field is such a wide one and the questions pressing for solution are so numerous and varied that we do not believe any one of these institutions would object to the assignment to one of an investigation of this kind. There is no lack of material to work upon for all who feel so inclined.

Through Routes in Urban Service

In the establishment of rapid transit trunk lines in large cities the maximum benefit to the largest number of passengers consistent with adequate revenue is the governing consideration. Cities composed of intricate street arrangements cannot be served by such lines in the broadest way without the existence of transfer points to take care of the lateral and through traffic between underground, overhead and surface lines. Boston furnishes an excellent instance of this kind. The tying together of the whole network of subway, tunnel, elevated and surface routes by dozens of transfer points contributes remarkably to the freedom of transportation movement in all parts of the metropolitan district, though at the expense of several changes if a person wishes to make a circuitous journey in the shortest possible time.

The great majority of the traveling public soon learn how to use a system of this kind, and the necessary transfers become accepted as a matter of course. Most of the passengers on a system like the Boston Elevated have no serious objection to making part of a trip on the surface, part on the elevated structure and part in a subway in passing between points not directly connected by fast through cars. Of course, every one recognizes the drawbacks of frequent changes in any kind of transportation service, the operating company, as well as the public, but there is no other way out of the matter if fast schedules are to be maintained through cities of ampler topography.

An operating company does wisely, however, in maintaining a considerable number of through routes supplementary to the faster ones in cases like the above. There is a certain percentage of the public which cares less about making fast time between points than it does about making the journey by a single car, less crowded than those of the high-speed lines and slower in schedule speed because of its roundabout route, increased number of stops and accessibility from all local points. Even in cases where such cars traverse the streets above a subway or beneath an elevated structure there is likely to be no lack of patronage because of the adjacent rapid transit facilities. It seems strange to most people that some persons will deliberately avoid riding over fast routes, choosing the slower schedule instead, but the fact remains that a very considerable number of persons desire such accommodations for one reason or another. Some may be in feeble health and find it more convenient to travel by a circuitous surface route in a simple car than to make the necessary changes from one fast line to another via stairs and platforms; others may prefer an open car ride to a trip in a partially closed train, while still others avoid traveling underground as long as surface routes are available. Whatever may be the reason there is no doubt that a demand exists for a more moderate service than the fastest lines give in large cities, and the establishment of through routes on the surface in such cases is a valuable service to the community.

From the operating standpoint such routes are of enormous value in case there arises congestion and blockades on the real rapid transit routes of the city. Surface parallels to elevated or subway routes furnish outlets of great importance at such times. Under normal conditions the circuitous through route connects sections which might otherwise be reached with great loss of time and no little inconvenience and in a general way serves a traffic which is important in the aggregate though scattering in its origin and destination. The assumption that everyone desires to follow the major avenues of traffic, as Mr. Harriman puts it, is unsafe in a large city, and the profitableness of through urban routes with short-distance riding characteristics proves the wisdom of their establishment.

INTERURBAN RAILWAY DEVELOPMENT NEAR MILWAUKEE

Milwaukee promises to be the terminus of one of the largest and most interconnected interurban railway systems in the Middle West. The lines of the system planned for the region around the city might be considered as forming a half wheel, with Milwaukee as the hub. The several lines radiating will form the spokes and an interconnecting line circling the city 20 or 30 miles out will constitute the rim. The system planned owes its inception to John I. Beggs, president and general manager of the Milwaukee Electric Railway & Light Company. President Beggs takes a personal interest in all of the construction work, and it is through his courtesy that the following account is given.



A GRAVEL CUT MADE DURING THE CONSTRUCTION OF THE OCONOMOWOC LINE



ROCK CUT ON THE OCONOMOWOC LINE WEST OF WAUKESHA BEACH



A ROCK FILL MADE WITH MATERIAL FROM ROCK CUT (MILWAUKEE)

The new lines will not only give the nearby farming settlements direct communication with Milwaukee, but they will afford Milwaukee and Chicago people a convenient means of reaching some of the most attractive spots of a most picturesque and romantic region. The territory for 50 miles or more west and southwest of the city particularly is indeed picturesque. The region is of lakes often of several miles area, lying between irregularly-formed hills and fertile farming lands. The portion around Waukesha is most widely known for its mineral water, which is rich in magnesia and has other valuable medicinal properties. During the Columbian Exposition at Chicago this water was piped to the Exposition grounds, about 90 miles distant.

The country, moreover, is rich in Indian lore, and evidences of those inhabitants just previous to settlement by the whites, as well as occupants of a more remote age, are numerous. The lakes and some of the towns still bear the names given them by the Indians, and arrow-heads and other crude implements are frequently found. At several places there exist mounds and earthworks of the earliest inhabitants made in the shape of serpents, lizards, bears and other animals.

During the summer season the accessible portions of this region are filled with city people and people from the Southern States, who usually extend their stay throughout the heated portion of the year, but some of the most desirable regions, from the standpoint of the pleasure-seeker, have heretofore been very difficult to reach. The new interurban system will put these within easy reach of Milwaukee and the steam roads.

The construction of the prospective network of lines is al-

MAP

SHOWING LINES OF

THE MILWAUKEE ELECTRIC RAILWAY & LIGHT CO.

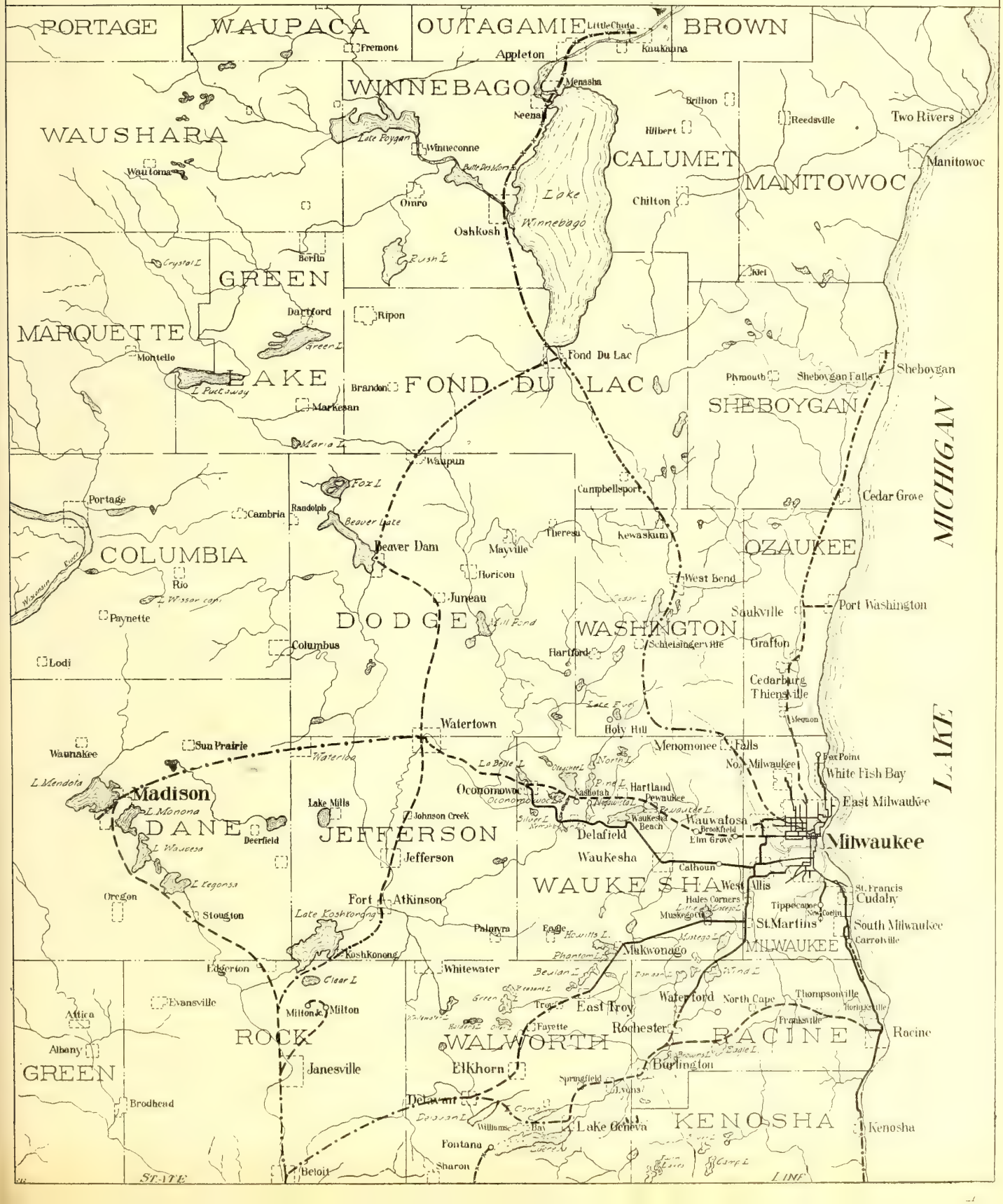
OPERATING ALSO THE

MILWAUKEE LIGHT HEAT & TRACTION CO.

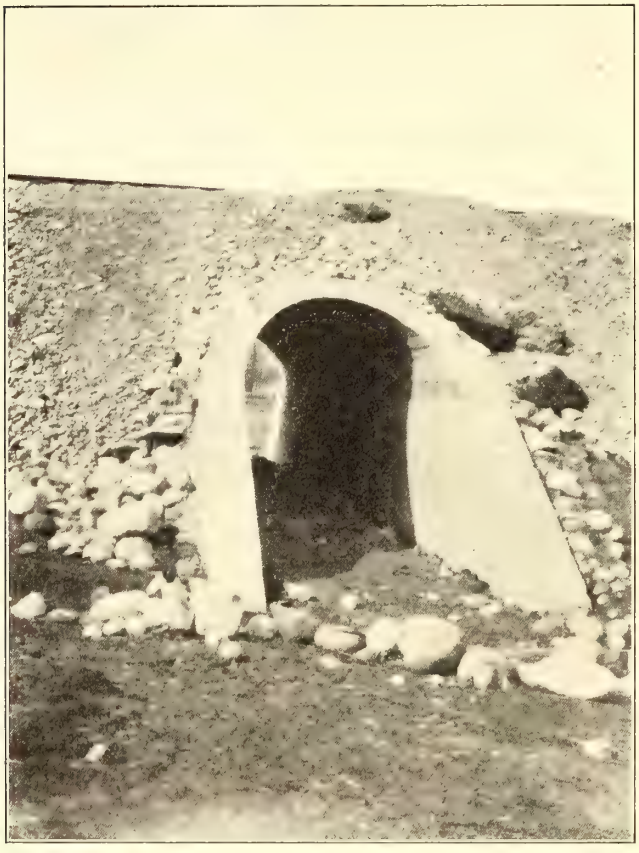
1907

Scale of Miles

——— Lines Constructed and in Operation.
- - - - - Lines Surveyed and Projected
—•—•— Possible Future Extensions
—x—x— Connecting Electric Lines



ready well under way. A line directly west out of Milwaukee to Waukesha Beach and a line southwest to Muskego Lake beyond St. Martins have been in operation for several years. The line to Racine, which was purchased a few years ago, has since been extended to Kenosha. During the past year the construction department of the system has been engaged in building three extensions to the already existing lines. The Waukesha Beach line has been extended 13 miles further west to Oconomowoc, and some work has been done on a further extension of 13 miles to Watertown.



CONCRETE CATTLE-WAY ON THE OCONOMOWOC LINE

In all of the new construction every provision is being made for ultimate double tracking. The concrete waterways and abutments are being built for double track, and the tracks are being placed at one side of the center of the right of way. All of the new extensions are built for alternating-current operation. The old portions of the lines will continue to be operated by direct current, largely because of the fact that summer travel to the lake resorts nearest Milwaukee at times demands the use of a great number of extra cars, which, with direct-current operation, can be drawn from the city equipment. The new cars for the lines are being built by the St. Louis Car Company. They will be 53 ft. 5 ins. long over all, of semi-steel construction, and fitted for operation by either direct or alternating current automatically accommodating themselves to the change from one to the other. The air brake equipment is of the National Brake & Electric Company's new a. c.-d. c. type.



CATENARY CONSTRUCTION ON THE OCONOMOWOC LINE



A TWO-SPAN GIRDER BRIDGE ON THE MUKWONAGO LINE

The Muskego Lake line has been extended 16 miles through Mukowonago to East Troy, and this line will be continued through Elkhorn to Delavan. Nearly all of the grading has been completed between St. Martins and Waterford, a distance of 11 miles, for a line which will eventually be continued to Burlington and Lake Geneva.

In addition to the extension work, the double tracking of the west line has been completed to Waukesha Beach.

THE MILWAUKEE-OCONOMOWOC LINE

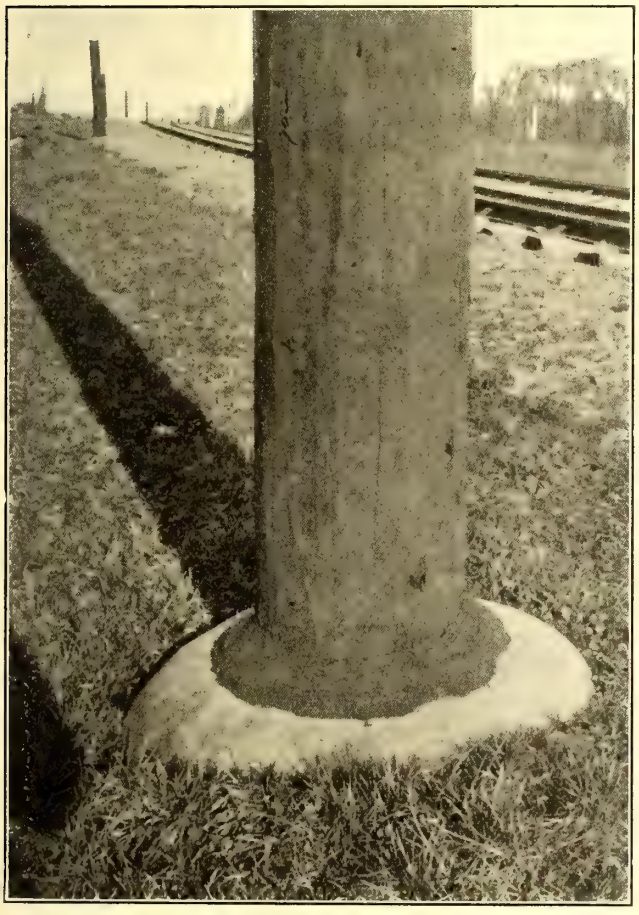
The Oconomowoc extension passes through a most picturesque region. At one elevated point a 7-mile view, the full length of Pewaukee Lake, is obtained, and views of Nagawicka Lake, upper and lower Nemahbin Lakes and

of Silver Lake are equally picturesque. At Delafield, the only town between Waukesha and Oconomowoc, is located St. John's Military Academy, an Episcopal school with about 165 students. There is also being established at this point a State fish hatchery.

The construction on this line is interesting because of the character of the country traversed. For the first 6 miles west of Waukesha Beach the grading averaged 100,000 cu. yds. per mile. There are numerous cuts in gravel from 15 to 40 ft. deep, and just west of Waukesha Beach is a solid rock cut 11 ft. to 12 ft. deep and about 1500 ft. long. It was necessary to blast out all of the excavation of this cut. All of the other cuts were made in coarse gravel, imbedded in which were frequently found masses of boulders weighing a ton or more each, which increased the difficulty of the work.

THE MILWAUKEE-MUKWONAGO LINE

Although the extension from Muskego Lake to Mukwonago passes through a rolling country, the grading averaged



POLE SETTING USED IN BOTH CITY AND INTERURBAN WORK

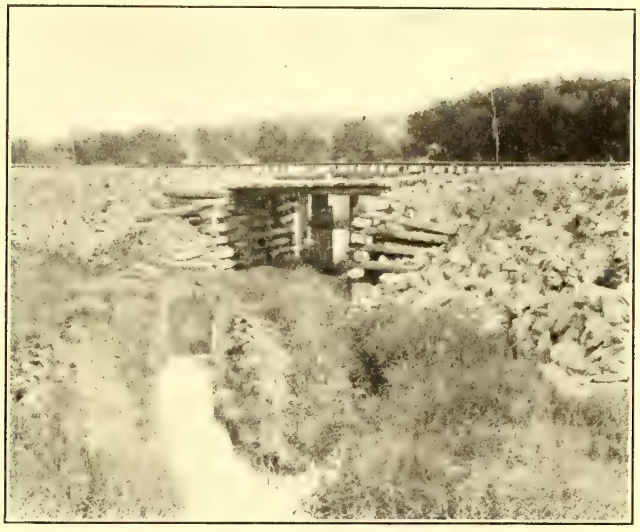
only about 3000 cu. yds. per mile. This is quite in contrast to the work necessary on the Oconomowoc extension, and was occasioned by the fact that the line was built on the grade of the Milwaukee & Beloit Railroad, which was projected and the grade for which was made about fifty years ago. After the bridge timbers had been put in the construction of the road was abandoned. In the intervening time the elements had worn the grade down somewhat and some of it had been partially destroyed by the cultivation of the land; but notwithstanding this, it was put in shape with a small amount of work. Between Mukwonago and Muskego Center the Fox River is crossed by a girder span 160 ft. long, and at another point a double-span structure is employed.

Through-girders were preferred to truss spans because of the less obstruction to the view and the better appearance.

One of the most interesting of Indian formations is found at Pishtaku, on the Mukwonago-East Troy line, 2½ miles west of Big Bend. Several acres of ground are covered by mounds made in the shape of animals.

CONSTRUCTION STANDARDS

For waterways up to 24 ins. tile was used. The tile, however, was always embedded in concrete. All of the larger



A TEMPORARY OPENING FOR WATER-WAY BEFORE BUILDING THE CONCRETE STRUCTURE

waterways are of concrete. Where head room permitted, concrete arches were built, but where room was limited flat-top concrete culverts were employed. The larger openings consist of concrete abutments spanned by steel girders. At several points along the line arch openings for cattle were made, of the type shown in an accompanying reproduction. The roadbed is ballasted with gravel, part of which was obtained from the company's gravel bank east of Waukesha. That for the west end of the line was hauled from a bank along the right of way just west of Delafield.

On all of the new work an 80-lb., 66-ft. rail is employed. Weber rail joints are used, and except on curves the joints are laid opposite. Rails 60 ft. and 62 ft. long have been in service on the interurban lines around Milwaukee for several years without any trouble due to buckling, and long rails are preferred because of the lessened number of joints and bonds required. The rails are anchored at frequent intervals. On tangents the anchors, which are of the Racine type, are placed 200 ft. apart. The joints are bonded with a short soldered bond, manufactured in the shops of the company.

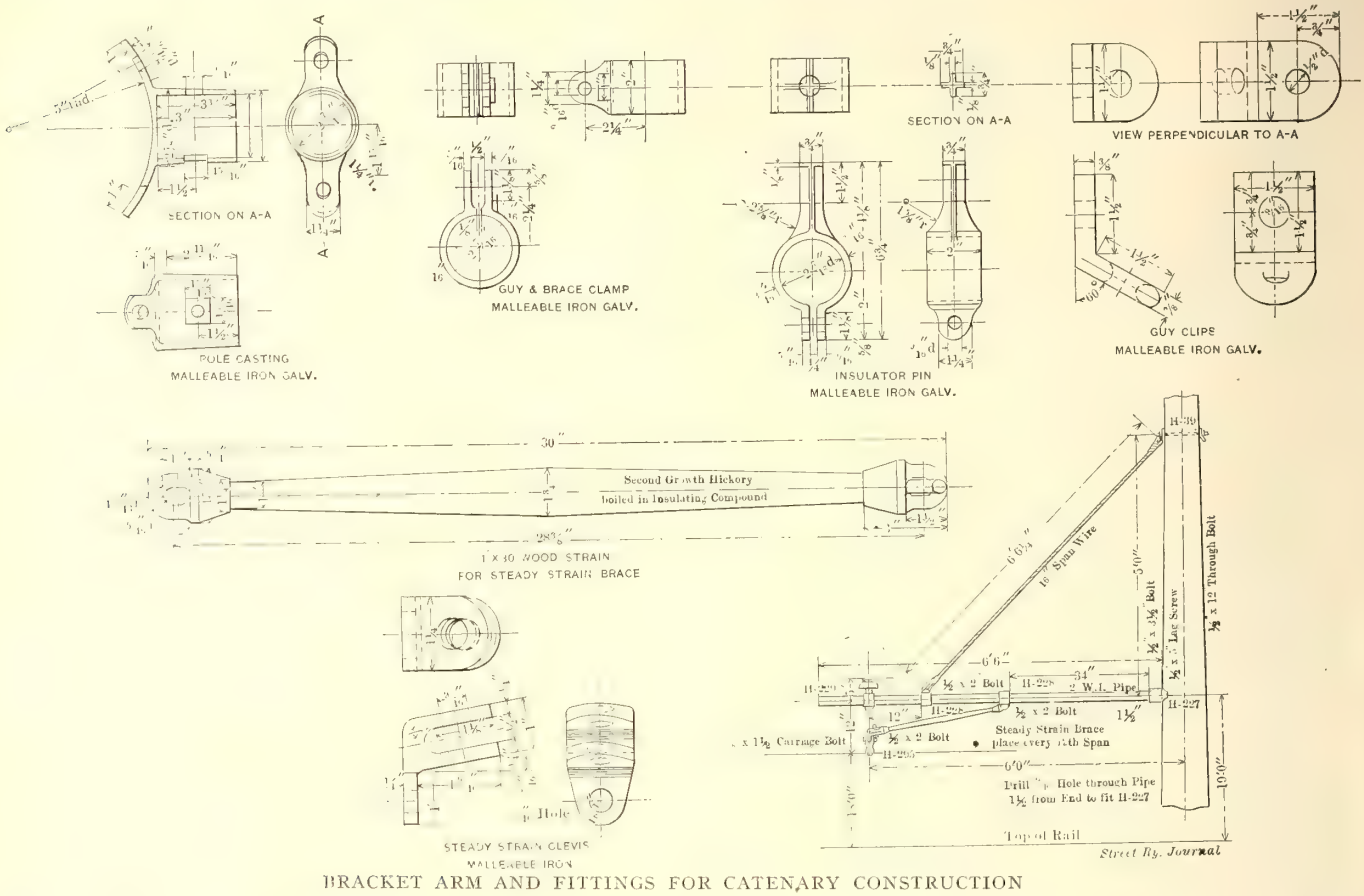
The cedar ties used on straight track are spaced with 16 ins. open space between them, regardless of the width of the tie, which method of spacing is preferred because a uniform amount of bearing surface is obtained, irrespective of the size of the ties. Curves are laid with hewn oak ties, and on sidings sawn oak ties were used.

POLE LINES AND OVERHEAD CONSTRUCTION

The catenary trolley construction for the new work is carried on brackets from a pole line consisting of 35-ft. cedar poles. All of the poles are set 7 ft. in the ground

with about 8 ins. of concrete around the butts. The pole setting was described by Mr. Simmons at the Columbus meeting of the American Street and Interurban Railway Association. Before the concrete has set a wood ring about

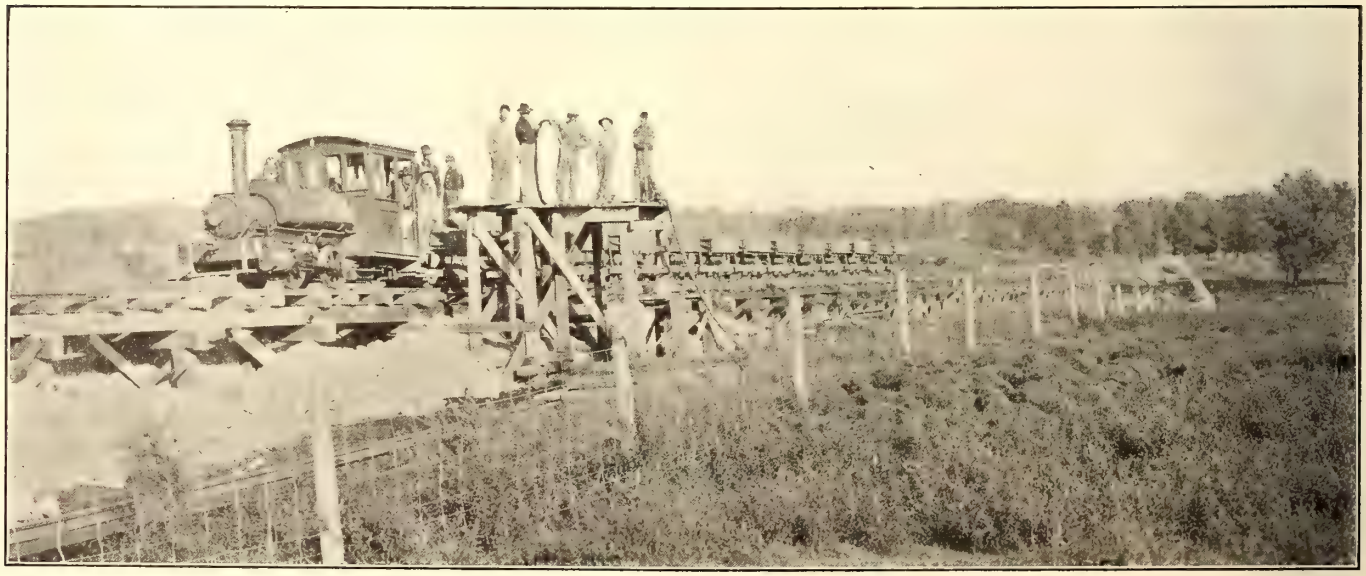
The brackets and all of the fittings and hangers for the catenary construction were designed by the company and manufactured in its shops. The brackets are of 2-in. galvanized wrought-iron pipe. By means of a socket at the



BRACKET ARM AND FITTINGS FOR CATENARY CONSTRUCTION

1½ ins thick and 3 ins. deep is placed around the pole at the top of the concrete. The surface of the concrete is then dressed up smooth and after the concrete has set the

pole end they are secured to the pole by two ½-in. x 5-in. lag screws. The outer end is supported by a 5/16-in. guy wire bolted to the pole a few feet above the bracket. For

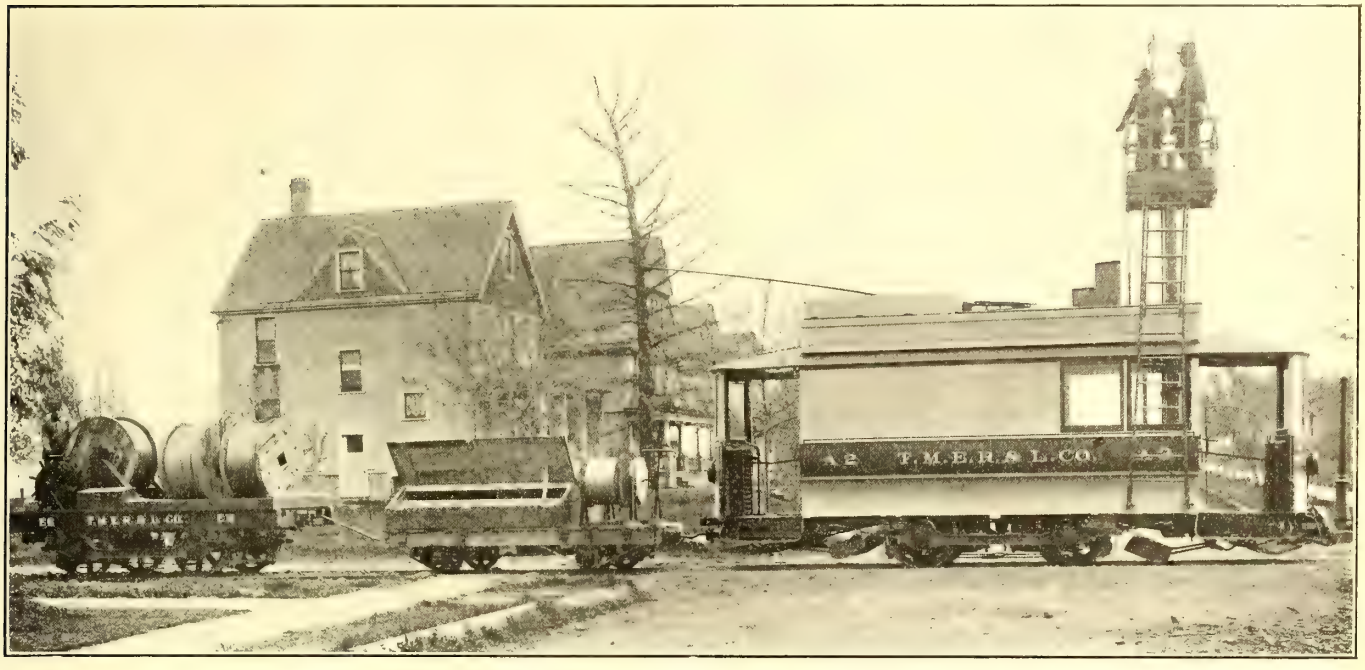


FILLING IN A TEMPORARY TRESTLE FROM ONE OF THE NARROW-GAGE TRAINS

wood ring is removed and the recess occupied by it is filled with a coal tar and asphaltum mixture. This compound adheres to the pole and prevents water from running down into the concrete. The same pole setting is used in the city of Milwaukee. Preservatives for the poles have not yet been adopted.

tangents the pipe brackets are 6 ft. 6 ins. long, but for curves they are of varying length to suit conditions. In some instances the pipes were cut the proper length for curves in the field. On tangents a steady brace is placed every sixth pole. This consists of a long insulator of second-growth hickory boiled in an insulating compound. A

clevice secures it to the bracket. Immediately over the trolley the brace is about 4 ins. above the wire, and, as it has an upward slope towards the pole, non-interference with the trolley is assured. On curves a steady brace is used at each span. In addition, both the messenger supporting the trolley and the trolley are held in position by bridles back-guyed to a messenger. On curves with the poles on the outside this messenger is strung between poles. Where the poles are on the inside, the pipe brackets extend out about 6 ft. beyond the trolley and the messenger, to which the bridles are attached, is supported on insulators near the end of the brackets. The suspending ears and hooks are of peculiar design. The ears, some of which are of brass and some of wrought iron, are made in two parts, which, when forced together with a longitudinal motion, interlock on the wire. They are secured in the locked position by passing a cotter key through them. For getting out the small details of the overhead equipment in quantities and at a reasonable cost, several special jigs, dies and machines were devised and built in the company's shops.



MILWAUKEE METHOD FOR STRINGING TROLLEY WIRE

POWER-DISTRIBUTING SYSTEM

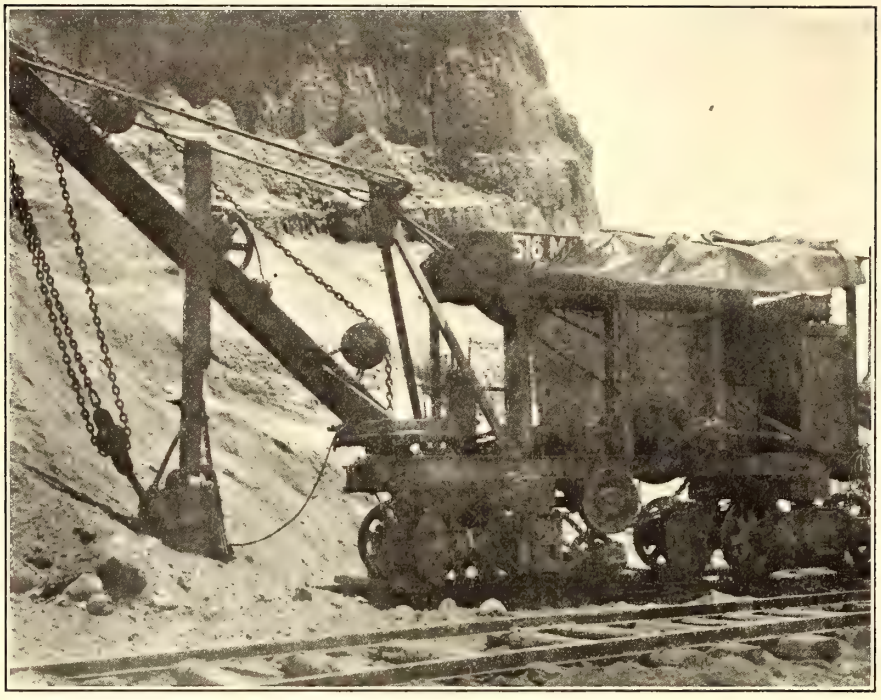
Power for the new extensions is furnished by an alternating current obtained from the Commerce Street plant of the company in Milwaukee. From this station two three-phase cables, each of 100,000 circ. mils, are carried underground to the city limits. Here they are brought up through lightning-arrester houses to a pole line and are carried into a



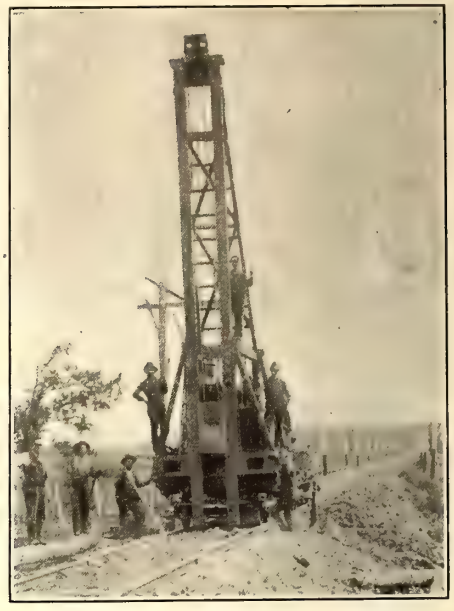
DUMPING A GRAVEL TRAIN, SHOWING HOW THE SIDE DOORS SWING OPEN

rotary converter sub-station at West Allis, which, in addition to this apparatus, contains step-up transformers. The current is stepped-up from 13,200 volts, three-phase, to 33,000 volts and changed to two-phase. From this station one of the two phases is carried over two transmission circuits to a transformer station at Waukesha Beach, 23 miles distant, and two other circuits from the remaining phase go south to a similar sub-station at St. Martins. The 33,000-volt lines, which are of No. 2 copper, are carried on independent pole lines, which follow the right of way, except through towns, where they are carried around the outskirts. The sub-stations are brick buildings, and around them are to be constructed triangular shelters for passengers. Each station contains two 300-kw, single-phase, 33,000 to 3300-volt transformers.

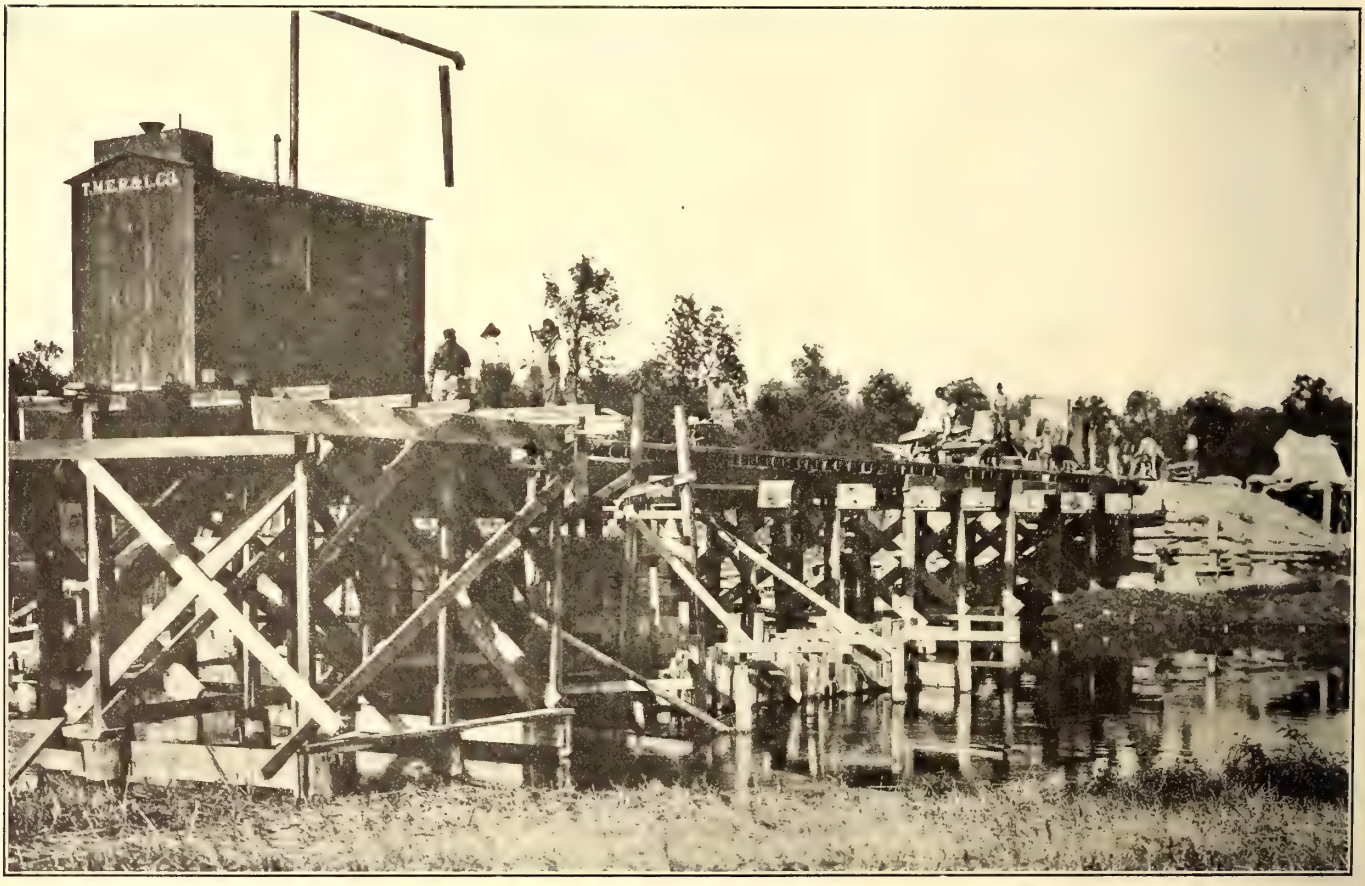
Protective devices for the high-tension lines consist of



ELECTRIC SHOVEL AT WORK IN A GRAVEL BANK



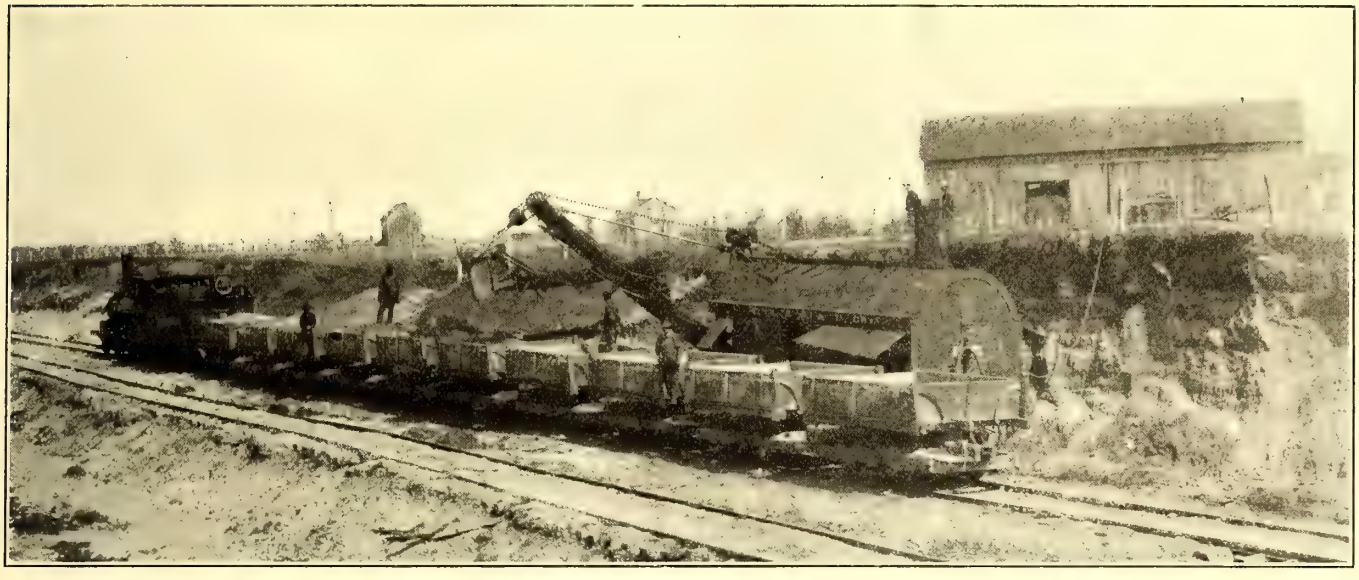
ELECTRIC PILE-DRIVER BUILT IN THE MILWAUKEE COMPANY'S SHOPS AND USED FOR CONSTRUCTION



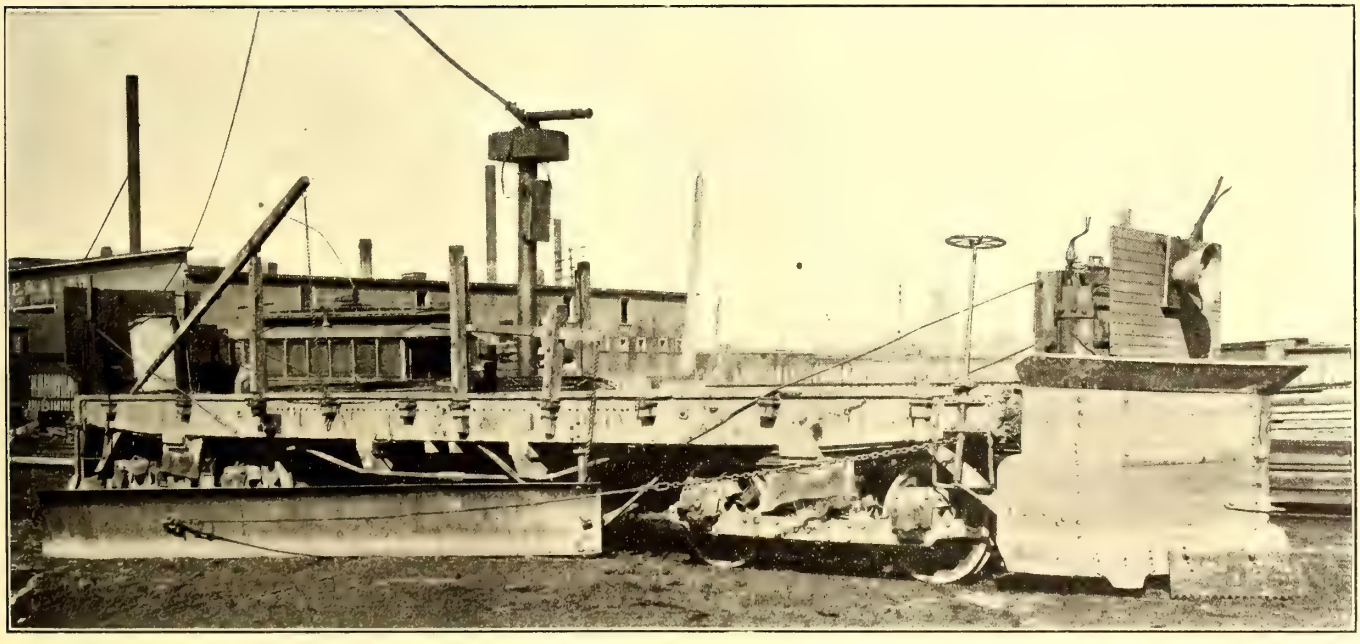
PORTABLE PUMP HOUSE FOR THE STEAM LOCOMOTIVES ON A TEMPORARY TRESTLE



GRADING MACHINE USED IN CONSTRUCTING THE MILWAUKEE INTERURBAN LINES

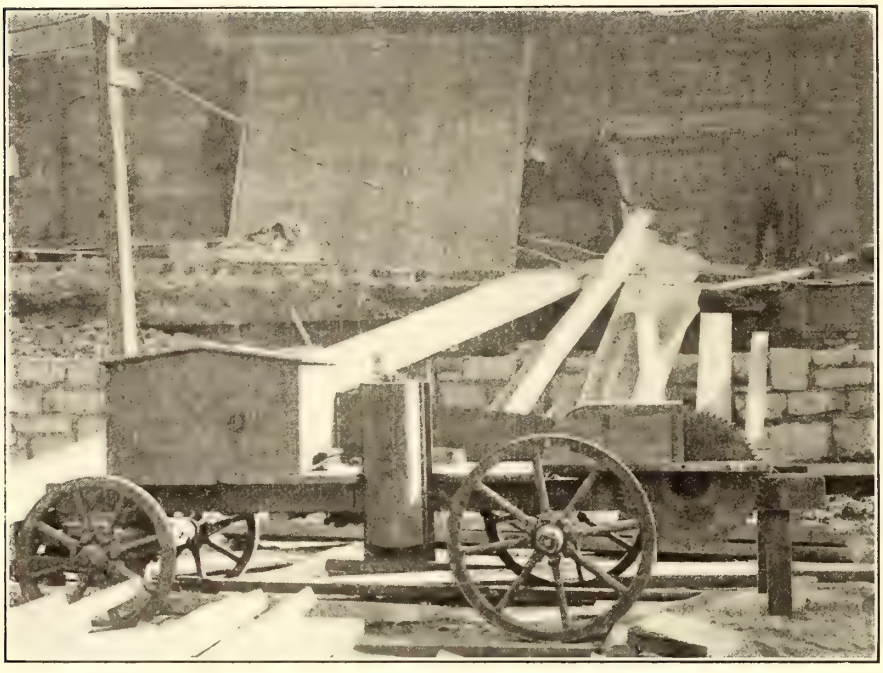


ONE OF THE MILWAUKEE STEAM SHOVELS AT WORK



MILWAUKEE COMBINATION WORK CAR, GRAVEL SPREADER AND SNOW PLOW

automatic oil switches on the 13,200-volt side and on the 33,000-volt side of the line at West Allis operated by inverse time limit relays. At the transformer stations automatic oil switches are placed on both sides of the transformers. These are installed in connection with the instantaneous differential relay by which a short circuit in the transformer opens the switches in both primary and secondary sides. There are also automatic oil switches on the 3300-volt feeders to the catenary trolley operated by direct time limit relays.



PORTABLE MOTOR-DRIVEN CIRCULAR SAW USED FOR SAWING BRIDGE TIMBERS

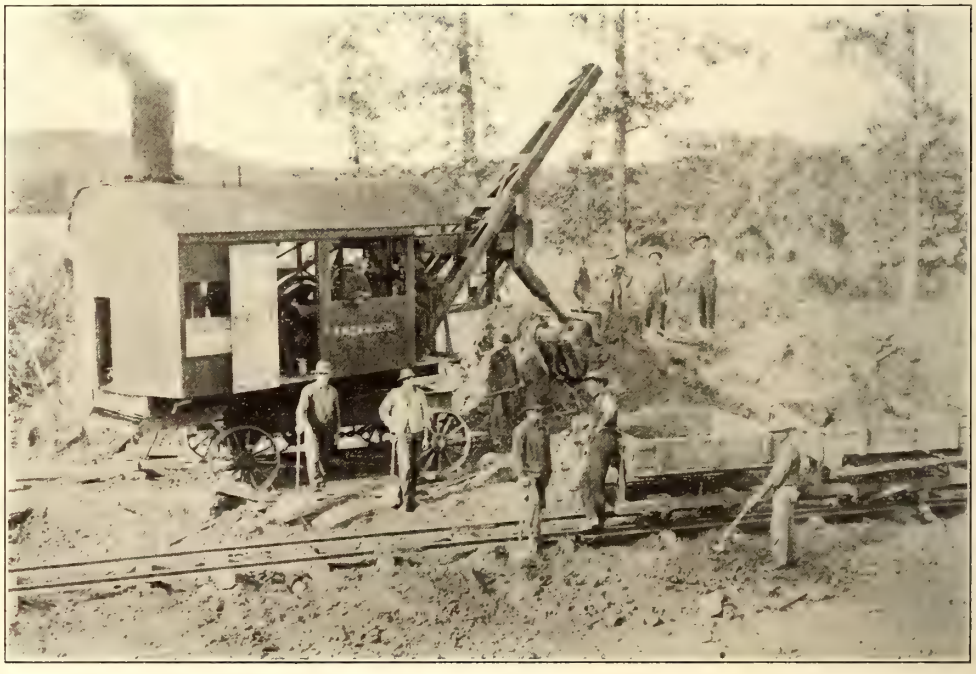
THE CONSTRUCTION DEPARTMENT AND METHODS OF CONSTRUCTION

The lines were built entirely by the construction department of the operating company under the general supervision of Mr. Beggs. The construction department has an organization similar to that of such departments of steam roads, and its equipment is in many respects similar. The equipment includes the following: Four standard gage locomotives; four narrow gage saddle-tank locomotives; one Buffalo Pitts traction engine; one grading machine; two steam shovels; one electric shovel; twenty 10-yd. center-dump cars; one hundred and fifty 5-yd. side-dump cars; ter-dump cars; one hundred and fifty 5-yd. side-dump cars; one hundred 1¼-yd. side-dump cars; one electric derrick car; one electric pile-driver; nine concrete mixing machines, and numerous other devices.

In the construction of new lines stump pullers are employed to clear the way. Where the grading machine cannot be used the preliminary grading is done by using the narrow gage locomotives and cars, a steam shovel being used to fill the cars. The narrow gage track is first carried across places where fills are to be made on temporary trestles. The fills are then made by dumping the cars from the trestles and afterwards all portions of the trestles, with the exception of the mud sills, are removed and the standard gage track is laid.

Where concrete waterways are to be put in the dirt of the fill is held back by temporary retaining walls built up of cross-ties. Delaying building of the concrete structure until the track has been laid has the advantage that all the materials can be hauled to the point required by the construction trains.

After the standard gage track is in place the grade is widened and the road is ballasted by the large locomotives and the center dump and the 5-yd. side-dump cars. These latter cars, although of standard make, have been altered in such a manner as to facilitate the work considerably. The side doors, which originally swung open from the top, have been changed so that the doors are hinged at the bottoms and the tops swing outward. The swing is limited to permit the door to drop no further than the level of the bottom of the car. As changed, the load is dumped far enough to one side to clear the rail. The ballast is frequently leveled off by the use of a work car provided with a plow in front and swinging side plows. This car is also used as a snow plow.



STEAM SHOVEL GRADING FOR A MILWAUKEE INTERURBAN LINE

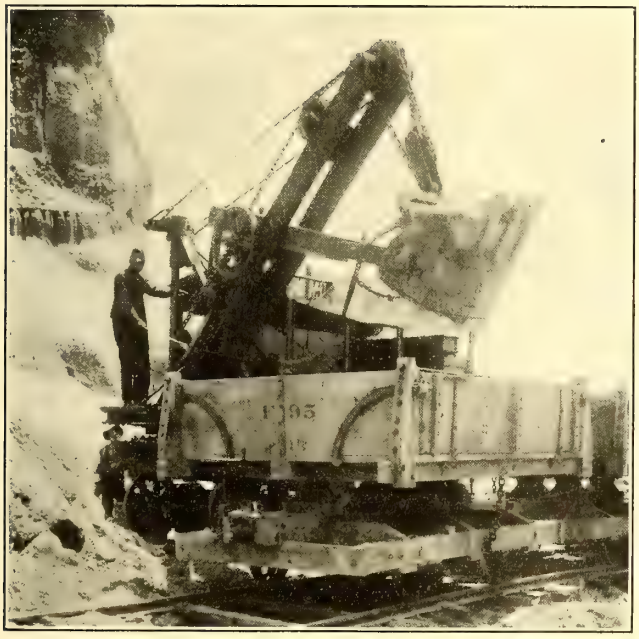
One of the illustrations shows a portable pump house used in supplying the locomotives with water. The centrifugal pump inside is driven by a gasoline engine. As the construction work progresses the house, with all the machinery inside, is put on a car and moved to the most convenient point.

Where it was possible to use the grading machine the

expense of grading per cubic yard was materially lessened. The grading done by the narrow gage locomotives and cars costs approximately 30 to 50 cents per cubic yard. When horses are employed to pull the grading machine the cost is approximately 18 cents per cubic yard, but when it is possible to use the traction engine to pull the grader the cost is reduced to about 9 cents per cubic yard.

An illustration shows how the trolley wire is strung. The train consists of a line car, a tool car and a car carrying the reels of wire. In stringing the wire the reel car is shoved ahead and current to operate the line car is taken from the wire being strung. The wire is first tied up temporarily to the brackets, as shown in several of the construction views. The line car employed is provided with an extra controller, located inside the car near the center. It is provided with operating and reversing shafts, which extend through the roof of the car and are attached to the adjustable platform. The connecting rods between the controller and the handles are arranged to telescope one within the other as the platform is lowered. A ladder attached to the side of the car, which swings outward, permits work on the poles.

Bridge planking and other timbers are sawn in the fields by a portable electric-driven circular saw. The four-wheel truck on which the motor and saw are mounted is put on



ELECTRIC SHOVEL RAISED FROM GRAVEL BANK

a car and hauled to the place where work is in progress. The construction department has two of these outfits.

The grading and much of the other construction work is done by foreign labor, often housed in camps of a more or less permanent character. The department also utilizes ten old-style passenger cars for sleeping quarters and boarding cars for the construction crews.

An idea of the extent of the work done by the construction department during the past year may be obtained from a consideration of the fact that 177 carloads of Portland cement and 790 carloads of miscellaneous materials were used.

Twenty-four employees of the Cincinnati Street Railway Company selected by popular vote have left for the Jamestown Exposition. Each tourist was presented with a ten-dollar bill by the Employees' Association.

PROPOSED RAIL SECTIONS

Interest in the standardization of track construction has led to the suggestion of a number of new sections of rail, two of which are presented in this issue. Fig. 1 shows a section designed by W. A. Underwood, of the Wheeling

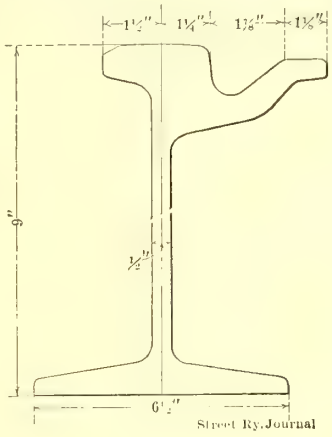


FIG. 1

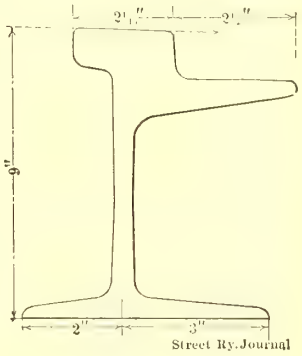


FIG. 2

Traction Company. The object sought in the design of this rail was to bring the weight of the car directly over the supporting web and thus avoid the tendency of the rails to spread. Upon this point Mr. Underwood says: "The section proposed is simply the adaptation of the T-rail section to girder rail requirements. The placing of the head to the right (which is done to some extent in the Lorain section No. 141, and also in the Pennsylvania sections Nos. 241 and 224) is to make the rail center bearing, thereby increasing its stability and riding qualities. The tendency of all side-bearing rails is to cant outward, necessitating the rigid bracing of the rail, and each year as the equipment increases in weight, this fact is brought more forcibly to mind. By moving the point of application of the forces acting on the rail inward, the horizontal component, due to the swinging of the cars, skewing of the trucks, centrifugal action, etc., is considerably overcome. The section proposed should be easier to spike than any 7-in. section and very little harder than most 9 in. If necessary, ⅝ of an inch of the lip could be cut off. As far as I can ascertain, from experienced men consulted, no greater difficulty would be experienced in rolling this section than found in rolling any section which requires a vertical roll. In regard to this question attention might be called to the Pennsylvania Steel Company's section No. 259."

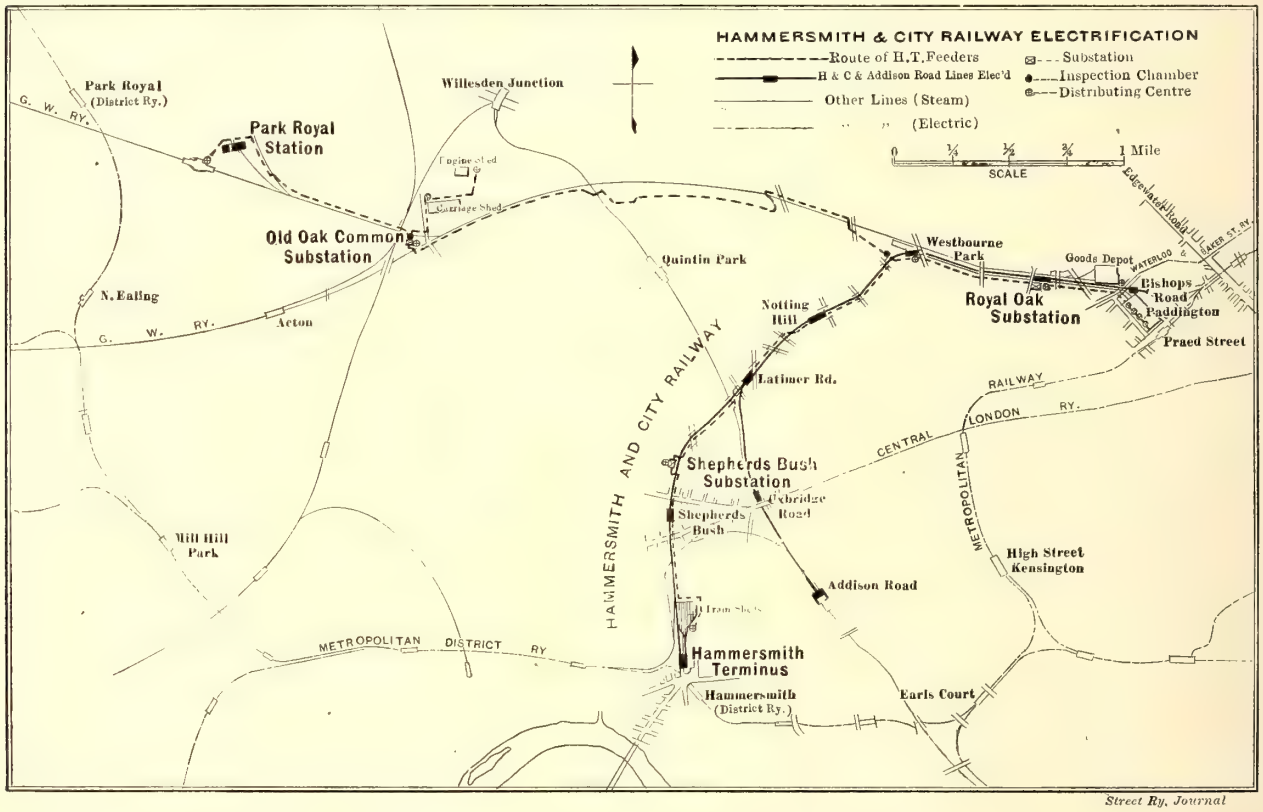
A somewhat similar section, although with a tram-head, has recently been designed by George R. Stewart, president of the Indiana County Railway Company, Indiana, Pa., and is illustrated in Fig. 2. In this rail, however, the bottom flange is extended on the inside of the rail partly to take the strain of the vehicular traffic and partly also to assist in spiking. It is understood that neither of these rails has been rolled, but were designed to fulfil certain operating conditions desired by the designers.

NEW SINGLE-PHASE ROAD IN AUSTRIA

The Austrian Siemens Schuckert Company has recently completed a single-phase line from Vienna to Baden, about 17.4 miles. There are fourteen motor cars, each equipped with four motors, and twelve trail cars. The cars operate over the local tramway tracks at the termini and then use direct current.

THE ELECTRIFICATION OF THE HAMMERSMITH & CITY RAILWAY BRANCH OF THE GREAT WESTERN RAILWAY

The new electric traction system of the Hammersmith & City branch of the Great Western Railway in London has recently been completed. This line is a portion of the intricate system of underground roads used by the steam railroad companies entering London in connection with the District and Metropolitan District railway systems. The electrical equipment was installed partly to meet the requirements of the metropolitan railway act of 1902, which provided that, concurrently with the electrification of part of the Metropolitan Company's inner circle railway, the Hammersmith & City line, owned jointly by the Metropolitan Company and Great Western Company and also the lines of the Great Western Company used in connection with the Hammersmith & City Railway, should be electrified. The extent of the line which has been electrified, and for which power is supplied by the Great Western Company, is shown on the accompanying map.



MAP SHOWING SECTION OF THE GREAT WESTERN RAILWAY EQUIPPED FOR ELECTRIC TRACTION

The system of supply to the trains on these lines had necessarily to be the same as that in use on the trains running over the Metropolitan Company's lines on the inner circle railway between Bishop's Road and Aldgate. The new electric system also provides for the supply of power for arc and incandescent lighting and small motor work throughout the Great Western Company's system in the London district, as well as on the Hammersmith & City Railway. It includes a main generating station, three substations and eleven distributing centers.

Electrical power is generated as three-phase alternating current, with a frequency of 50 cycles and at from 6300 to 6600 volts, and is transmitted at this pressure. In the substations the greater part of the three-phase current is converted by motor generators to 600 volts a. c. for railway use and also for power purposes and arc lighting in the Great Western Company's locomotive sheds, car houses, freight yards and offices and Paddington station. Some current for lighting and power is also distributed at 110 and 220 volts a. c.

POWER STATION AT PARK ROYAL

The present generating station occupies only about one-sixth of the ground available. At the extreme eastern end of the station are the coal pockets, built below ground level so as to be underneath the railway siding which connects with the main line. These pockets are constructed of ferro-concrete and have a total storage capacity of about 400 tons of coal, and have chutes for filling the coal conveyors.

The main building is a steel structure, filled in with brick and roofed with glass and slate, the wooden framework for the latter being lined on the inside with fireproof plaster.

The boiler house, at the east end of the main building, is arranged in three bays and is 115 ft. 6 ins. long x 95 ft. wide and 80 ft. high to the peak of the roof of the center bay. The two side bays are for the accommodation of the boilers, leaving the center bay clear. A set of steel coal bunkers, built between the main stanchions, is provided over the center bay, with a total storage capacity of about 600 tons. Space is provided above the coal bunkers and in a basement underneath the stoking floor for the coal and ash-conveying plant. The feed pumps and accessories and the water-softening and purifying plant are placed in the space between the west wall of the boiler house and the first pair of stanchions. The present chimney is 12 ft. square, internal dimensions, and is 250 ft. high. It is of brick, set in cement mortar up to the level at which the flue enters,

and set in lime mortar above that level. The boiler house is ventilated by louvres.

To the west of the boiler house, and separated from it by a party wall, is the main engine room, which is also arranged in three bays, the two side bays taking the engine sets, and the center bay the condensing plant, which is also above floor level. The switchboards are arranged on galleries extending across the whole width of the engine room at the west end. The engine room floor is paved with red tiles, and the walls are faced with white crystopal tiles. The roof is ventilated by hinged casements in the sides of the lanterns.

COAL-HANDLING PLANT

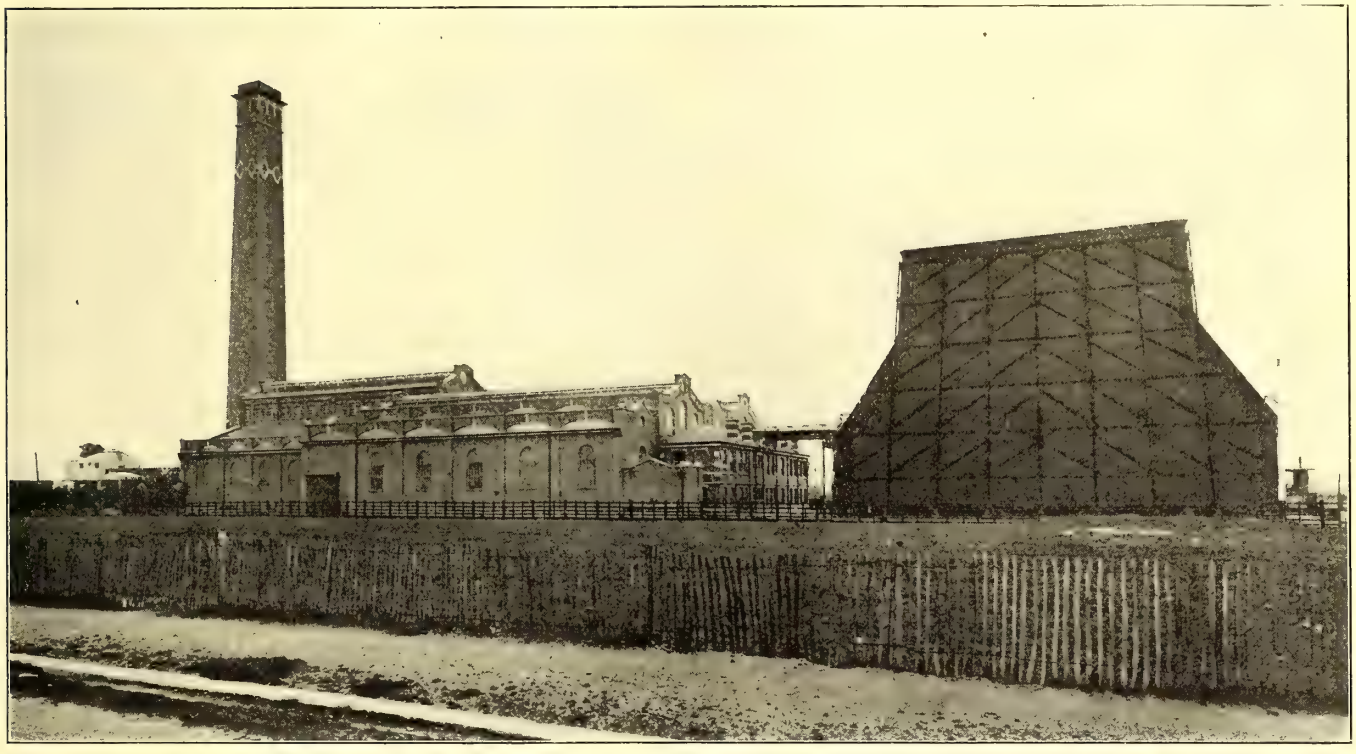
Coal is brought on to the site over a railway siding and dumped into the pockets referred to and thence is fed into the boots of two bucket elevators, which in turn raise the coal to a height of 50 ft. above the boiler house floor level and feed it on to two bucket conveyors for transmission to the boiler house. The two bucket conveyors are carried by means of an overhead gantry as far as the east wall of the boiler house and pass up the inside of this wall and over the steel coal bunkers. On their return the buckets pass into the basement of the boiler house, where ashes are fed into them by means of two traveling fillers. The coal conveyor and elevator plant are arranged in duplicate, and the normal carrying capacity of each set is 50 tons of coal per hour, when also dealing with the ashes. Each bucket conveyor is driven through worm-gear by a 10-hp motor, while the tray conveyor and bucket elevator corresponding to each bucket conveyor are driven through worm-gearing by a single 12-hp motor. These motors, supplied by the Electric Construction Company, of Wolverhampton, are driven by three-phase current at 650 volts, and are of the E. C. C. patent type, the rotor having two windings and the starting up being normally effected by a special starting switch. The same type of motor is used for driving the condenser pumps, the stokers, the drainage sump pumps and two centrifugal pumps, used in connection with the water supply and drainage water.

STEAM-GENERATING PLANT AND ACCESSORIES

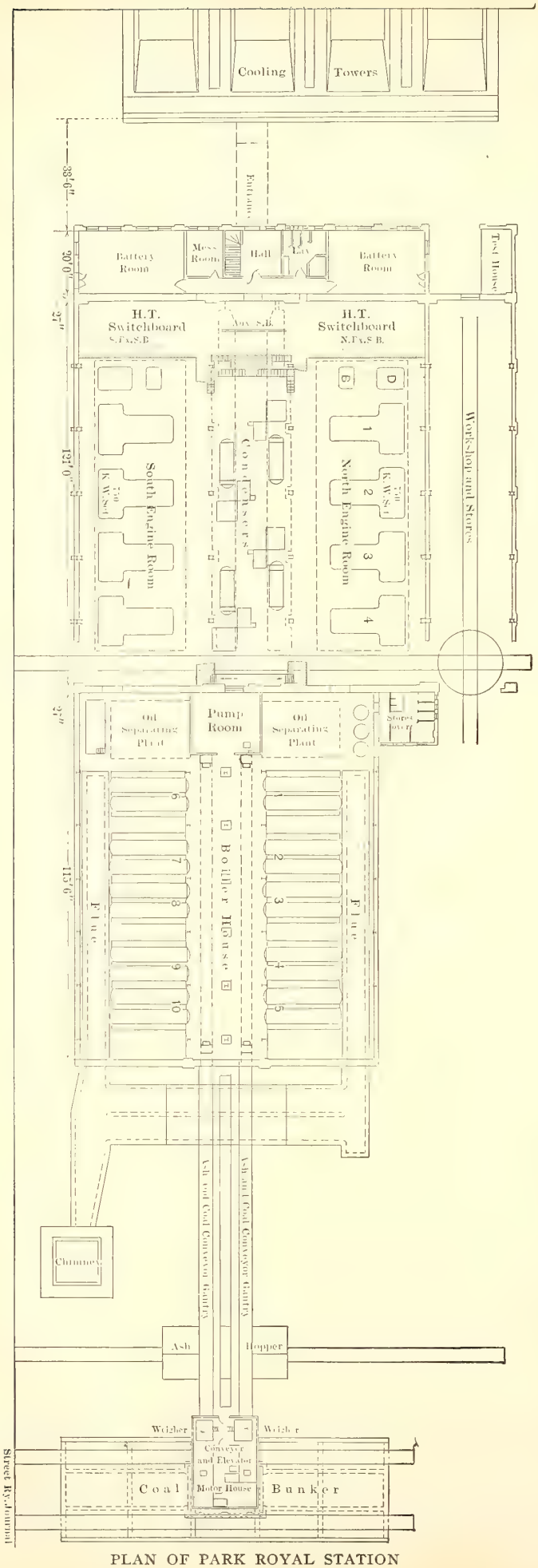
The boiler house contains ten Babcock & Wilcox double-drum water-tube boilers, the five boilers in each side bay being arranged in two batteries of two, and one battery of one boiler. Each boiler has a heating surface of 5764 sq. ft., has a normal evaporative capacity of 19,200 lbs. of water per hour at a pressure of 200 lbs. per square inch, and is equipped with a self-contained super-heater, proportioned so that steam is delivered at a temperature of 550 degs. F. at the boiler-stop valve. The boilers are fitted with mechanical stokers of the B. & W. chain grate type. Each stoker shaft can be driven from either end by a 15-bhp three-phase motor, a clutch being provided at each end for connecting or disconnecting either motor.

In the pump room there are four steam-driven feed pumps of the vertical type, each pump having a capacity of 6000 gals. per hour, delivered against the working pressure of 200 lbs. per square inch. Each feed pump can deliver into either of two 4-inch bus-pipes which are carried round three sides of the pump room. The water carried by each of these two bus-pipes is measured by a Kennedy water meter and passed through a feed heater. To the main bus-pipes are connected two duplicate 4-in. feed pipes which are carried along the front of each block of boilers. Each feed pump is also provided with duplicate suction pipes; one to the hot well tank in the basement, the other to a 5-in. water supply main.

The oil separating and filtering plant for the treatment of the condensed steam from the condensers on its way back to the hot well tank, is also in duplicate. Each plant is capable of separating oil from, and filtering, 8000 gals. of water per hour. Oil-separating batteries operating under 225 volts are used. The batteries discharge into a collecting tank, from which the water is led to a sand filter. The filtered water then passes into the hot well tank below.



GENERAL VIEW OF PARK ROYAL GENERATING STATION, FROM NORTH SIDE



PLAN OF PARK ROYAL STATION

STEAM DISTRIBUTION, CONDENSING PLANT, COOLING TOWERS, ETC.

The main steam pipes between the boilers and the engine sets are arranged on the duplicate system in the boiler house, and on the ring system in the engine room. Each boiler is connected, through a non-return valve and stop valve, to two 8-in. main steam pipes, carried down the side of the boiler house, over the main flues and connected across the end of the boiler house above the pump room. The 10-in. ring in the engine room is teed off the double line in the boiler house through the necessary valves and is itself divided into sections by valves between the branch pipes to the different engines. It will be seen from the plan that the main engines are arranged in pairs with reference to the pipe work, the separate engines of each pair being supplied with steam through 8-in. branch pipes connected to the separators on the engine bed-plates, a by-pass pipe and valve being provided between the separators on each pair of engines for use in case a section of the main ring has to be shut off.

The exhaust steam from the low-pressure cylinder of each main engine is carried by a 20-in. pipe with a "Y" piece, one branch of which leads through an automatic valve to a vertical atmospheric exhaust pipe passing up through the engine room roof, the other branch leading through a valve to a mechanical oil separator, and thence into a condenser. The mechanical oil separator is of the Reavell type, containing expanded metal baffles, and is provided to extract as much oil as possible from the exhaust steam before it reaches the condenser, leaving the remainder to be dealt with in the oil separating and filtering plant, already described, before the condensed water is returned to the boilers.

The condensing plant is placed above floor level in the center bay of the engine room and is divided into four sections, one for each pair of engines, each section consisting of a surface condenser, combined air and force pump and circulating pump. Each surface condenser is designed to deal with 42,000 lbs. of exhaust steam per hour. The air pumps are driven direct by a two-crank compound steam engine, and are of the Edwards type. The circulating pump is of the centrifugal type, designed to deal with 178,000 gals. of water per hour, and is driven by a three-phase 650-volt motor.

The cooling towers, which are of the natural draught wood type, are arranged in four towers, each of which can be divided into two sections. Each cooling tower is 104 ft. long and 21 ft. wide at the base, the height from the base to the water inlet being 24 ft., and to the top of the tower 74 ft. Each tower is designed to cool 145,000 gals: of water 35 degs. F. from 115 degs. F. under ordinary conditions of temperature.

MAIN GENERATING PLANT

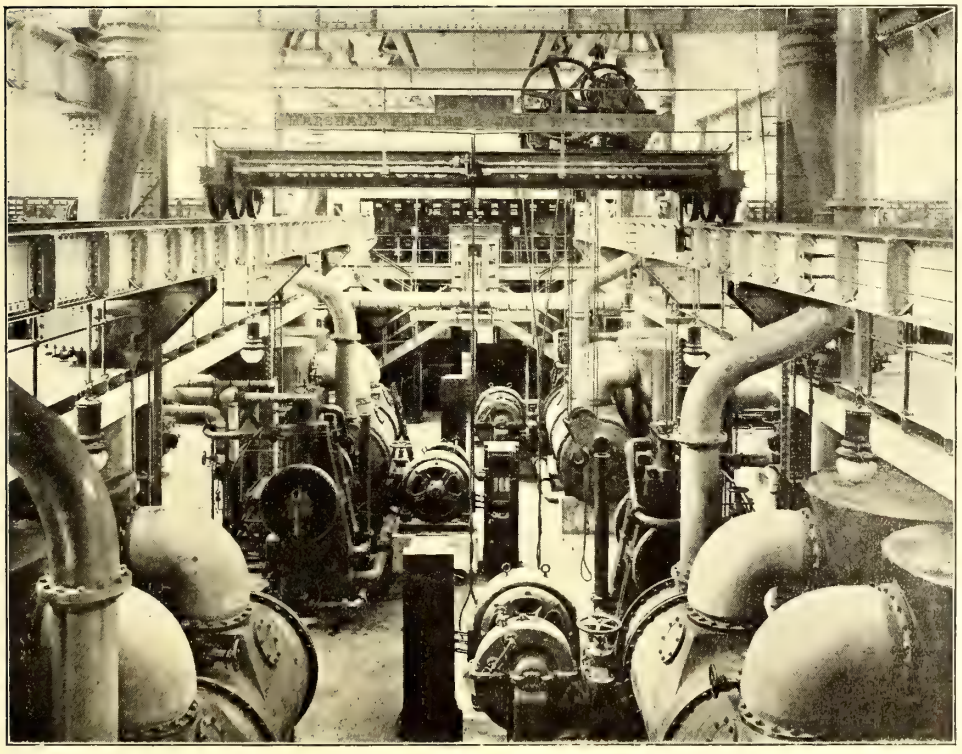
There are eight main generating sets, four in each side bay of the engine room, each set consisting of a Belliss & Morcom engine, driving direct an E. C. C. alternator generating three-phase current at 50 cycles per second and at a voltage of 6300 to 6600 volts, the normal output being 750 kw with an overload capacity of 25 per cent. Each main engine is of the three-crank, triple-expansion, high-speed type, running at 250 r. p. m. The dimensions of the cylinders are 18½ ins., 27 ins. and 40 ins., with an 18-in. stroke. The bearings, cross-head guides, etc., are oiled by forced lubrication, provided by a small pump in the crank chamber, driven off the high-power eccentric strap, and each line of cylinders and valves is lubricated by a separate sight-feed

lubricator. The governor is controlled by an electric motor from the main switchboard gallery for adjusting the speed of the engine during synchronising, and for adjusting the load between the sets running in parallel. An emergency valve, electrically controlled from the switchboard, is also fitted to each engine so that steam may be entirely cut off under emergency.

The main three-phase generators, manufactured by the Electric Construction Company, of Wolverhampton, are of the ordinary rotating field magnet type, the total weight of the magnet wheel and fly-wheel being about 11 tons. The stationary armature is wound in open slots and is star connected, but the center point is not permanently earthed. Screws are provided for sliding the armature sideways for inspection when required.

AUXILIARY PLANT

The auxiliary plant is divided into eight sections of 150-kw capacity, four of which are normally used for supplying d. c. current at about 225 volts for excitation purposes and arc and incandescent lighting and for the overhead Crane motors, and the remaining four sets being normally used for supplying three-phase current at about 650 volts for driving the various three-phase motors throughout the generating station, including those for the stokers, the coal conveyors, the condenser circulating pumps and other pumps. The batteries, which form a stand-by for the excitation supply, are worked in parallel with the generators in the usual way, with motor-driven boosters for charging them from the bus-bars. Each generator with its battery can be worked by itself and used for exciting any or all of the main generators when required.



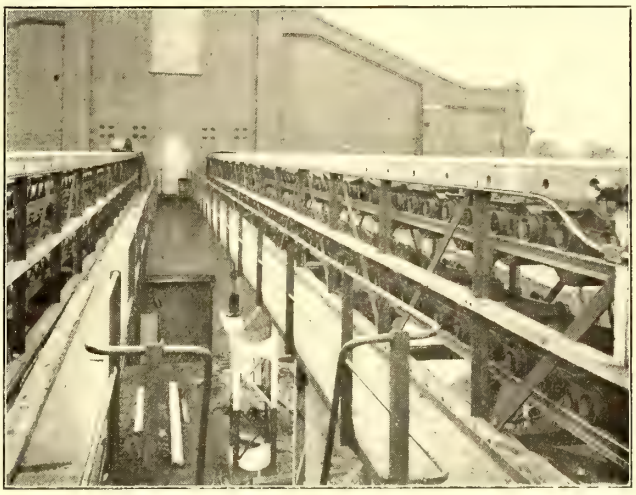
PARK ROYAL—GENERAL VIEW OF CONDENSING PLANT

OVERHEAD CRANES

In each main engine room bay and in the workshop, a 20-ton overhead traveling crane is provided, all three motions of which are worked by series motors supplied with direct current at 220 volts. A 10-ton crane is also provided in the condenser bay, with lifting and lowering motion, driven by a 220-volt d. c. motor.

SWITCH GEAR

The switch gear, all of which was supplied by the British Thomson-Houston Company, of Rugby, includes two main high-tension switchboards, for controlling the 6500-volt three-phase circuits, which are placed one at the west end of each of the main engine room bays, an auxiliary switchboard for controlling the 650-volt three-phase circuits, placed on the same gallery as the main switchboard control panels, and two switchboards for controlling the 220-volt d. c. circuits placed one at the west end of each of the main engine room bays on the floor level immediately under the front of the main switchboard control gallery. The control board is placed on a gallery about 14 ft. above the engine room floor, and slightly in front of the high tension portion of the switchboard. The main switches are worked from the control panels mechanically by rods and cranks. All the instruments are placed on the control panels and are worked from transformers, so that all connections on these control panels are low tension. Immediately in front of the control panels are placed the main generator field regulating resistance columns, the engine governor and emergency valve switches, and also a set of signal columns and indicators by which the switchboard attendant can communicate with the drivers of the engines.



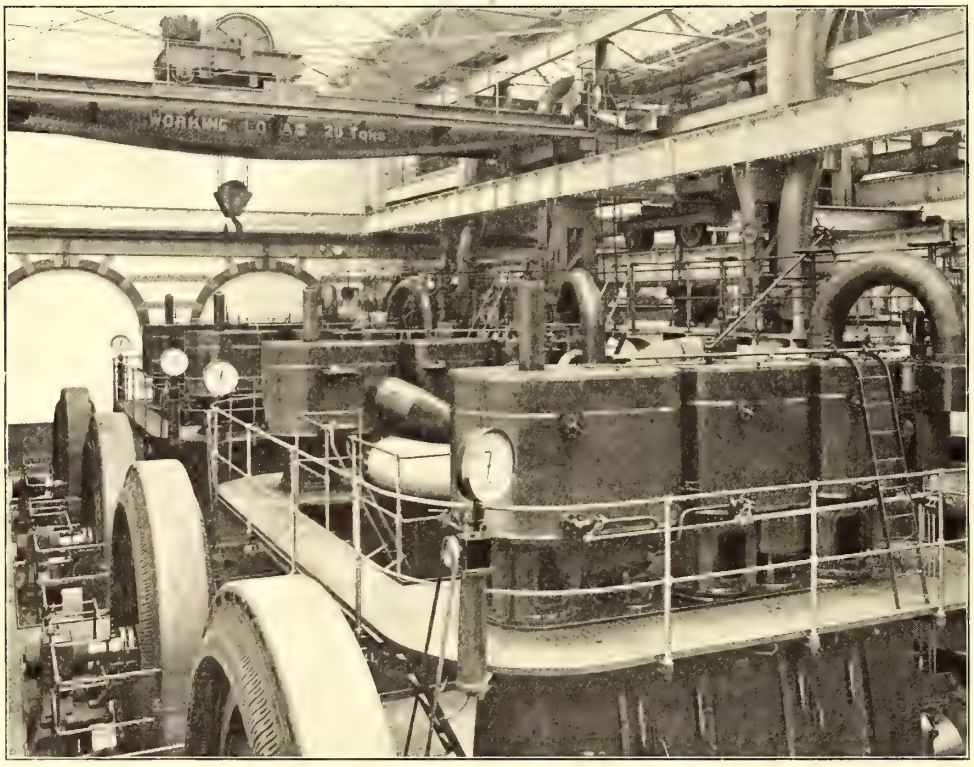
PARK ROYAL—CONVEYOR GANTRY BETWEEN BOILER HOUSE AND DRIVING HOUSE

By means of a system of shafting and cams at the back of each control board, a complete mechanical interlock has been provided in connection with the operating mechanism of the high-tension switches. The interlock is divided into

two halves, corresponding to the division of the synchronising bars into generator and feeder sections. The mechanism of the switch for coupling the two sections of the synchronising bars is arranged so that when the two sections are uncoupled, the two halves of the interlock are also uncoupled, and so that when the two sections are coupled the synchronising bars and interlock act as one unit.

LIGHTING AND POWER CIRCUITS

The general lighting of the main buildings and also of the coal siding and the approach road is carried out by forty "Oriflamme" arc lamps. The lighting installation also includes about 200 incandescent lamps. The feeder cables from the 650-volt a. c. auxiliary switchboard and from the d. c. switchboards are three-core and single cables, respectively, rubber insulated, lead covered and armoured with steel wire. For the branch circuits rubber insulated and braided cable is used, drawn into heavy gage simplex steel conduit. With the exception of the offices, water-tight fittings have been used throughout.



PARK ROYAL—MAIN ENGINES FROM SWITCHBOARD GALLERY FROM NORTH BAY

SUB-STATIONS

The Royal Oak sub-station is equipped with four 400-kw traction motor converter sets, worked in parallel with a battery having a 1-hour discharge rate of 1680 amps. in conjunction with reversible boosters. All the motor converters were specially manufactured for this plant by Bruce Peebles & Company, of Edinburgh. The sub-station also contains two 200-kw motor converters for d. c. lighting and power purposes.

The Shepherd's Bush sub-station is equipped with seven 400-kw traction motor converters worked in parallel with a battery having a 1-hour discharge rate of 840 amps. in conjunction with reversible boosters.

The Old Oak Common sub-station is equipped with one 400-kw and two 200-kw motor converter sets for d. c. lighting and power purposes. All three sub-stations are designed so that they may be developed on the same lines, and Royal Oak being the most representative sub-station is most suitable for a detailed description.

The Royal Oak sub-station is built in three bays and is 109 ft. long x 52 ft. 6 ins. wide and 35 ft. high from floor level to the peaks of the roof in the center bay, with a basement 4 ft. deep. The motor converters and reversible boosters are placed in the center bay, over which a 10-ton handworked traveling crane is provided. One of the side bays contains the high-tension switchboard and the other the low-tension switchboard. At one end of the space reserved for the high-tension switchboard, a transformer room is provided which forms one of the distributing centers and is equipped with static transformers for supplying alternating current at 220 volts for local lighting, including the lighting of the sub-station. The transformer room is equipped with an overhead runway and a set of pulley blocks. Next to the transformer room a workshop is provided which is also equipped with an overhead runway and a set of pulley blocks. Adjoining the same end of the sub-station is the battery room, which forms the basement of a large building used by the Great Western Railway for stationery stores.

Full descriptions of the Peebles-La Cour motor converter have recently been published, and it will be remembered that it consists of a high-tension motor arranged like an induction motor, mechanically coupled to, and also electrically connected with a d. c. generator, connections being made between tappings from the rotor and the d. c. armature. While the machines can be started up on the high-tension side in much the same way as if they were induction motors, they behave when the d. c. machine is fully excited like synchronous machines and are capable of being reversed so as to generate a. c. exactly as in the case of synchronous motor generators. This peculiarity is of special advantage in the present instance for reasons which are explained below. The d. c. generators which are used for traction have compound windings,

The reversible boosters are of the well-known Highfield type, consisting of three machines, the motor, the booster, and its exciter. These booster sets are in duplicate, the continuous capacity of each booster being 130 kw.

The battery consists of 290 cells contained in lead-lined wood boxes, the capacity being 1680 amps. at the 1-hour rate.

The high-tension switchboard is generally similar in construction and design to the Park Royal high-tension switchboards, which have been described above. The incoming high-tension feeders are connected to the center of the board, the traction motor converters being connected to the one end and the lightning converters and the high-tension distributors to the distributing centers at the other end. The

portions of the board which control the incoming feeders and the traction motor converters are provided with duplicate bus-bars, as well as with a set of synchronising bars. The main high-tension feeder switches are provided with time limit overload and instantaneous reverse current relays, and the high-tension distributor switches are provided with overload relays. All the high-tension motor switches are provided with overload relays. Ample room is provided for extensions of the high-tension switchboard as additional motor converters are installed.

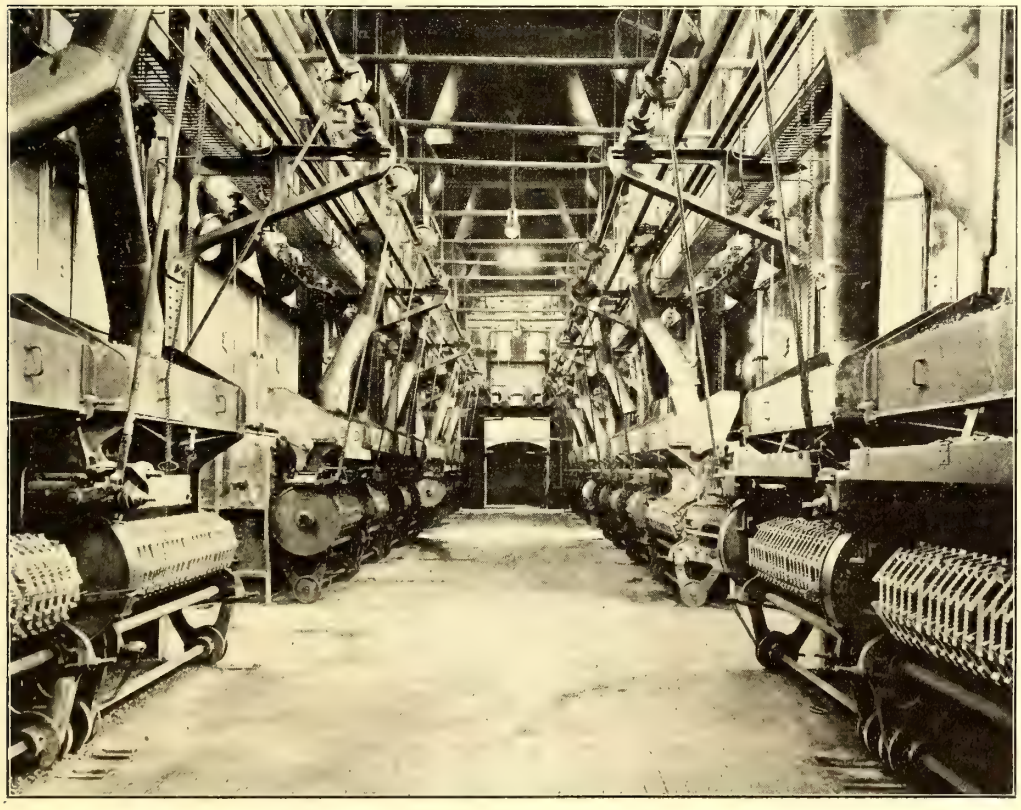
The low-tension switchboards, also of the British Thomson-Houston type, placed on the opposite side of the sub-station to the high-tension switchboard are divided into four sections, one for controlling the traction circuits, a second for controlling the lighting circuits, a third for a milking booster and its connections to the battery room, and the fourth for controlling the Highfield reversible boosters.

The motor converters are normally started up from the high tension side, the rotors being provided with slip rings and with starting resistances which are placed in the high-tension switchboard basement and which are controlled by handles which can be operated from the floor level near each machine. The 400-kw traction motor converters can also be started up from the d. c. side from the battery, and for this purpose a common d. c. starter is provided, worked from the low-tension switchboard gallery.

A feature of special interest is the method of using the battery, not only to equalize the load on the motor converters and therefore on the main high-tension generators by taking the peaks of the traction load, but also, in cases of emergency, for maintaining both the alternating and direct-current lighting supply. The battery is connected through one of the reversible booster sets to the traction board, being connected between the positive bus-bar and the equalizer bar, with the result that the total current returning from the track to the generators and the battery passes through the generator series windings, which are provided with diverter resistances. In the negative bus-bar a main diverter resistance is provided, through which the total returning from the track passes, and the series winding on the booster is connected across a variable proportion of the main diverter resistance. It is arranged so that when the high-tension supply to the sub-station is interrupted, the battery can run the motor converters reversed, taking current on the d. c. side and delivering high tension alternating current to the high-tension switchboard, from which it is trans-



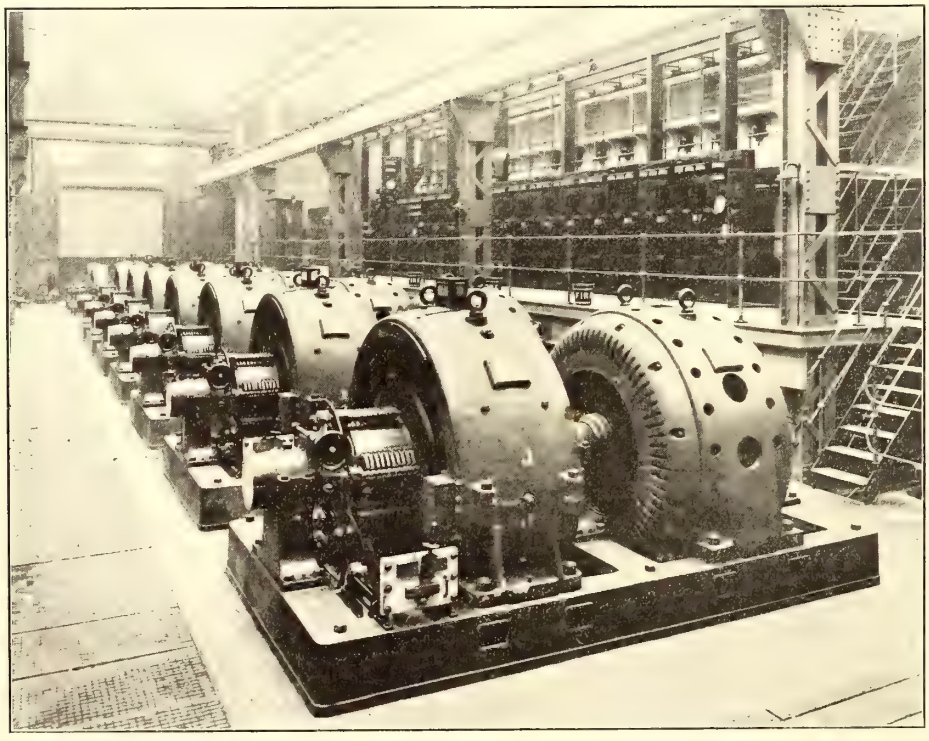
PARK ROYAL—NORTH MAIN CONTROL BOARD



PARK ROYAL—GENERAL VIEW OF BOILER HOUSE FROM STOKING FLOOR

mitted, as before, to the lighting distributing centers. As soon as the motor converters are reversed from the battery, a reverse relay in the positive bus-bar of the traction board operates a change-over switch, which short circuits the series windings of the generators and alters the connections to the series winding on the booster, so as to produce level compounding with variations of the load instead of over compounding. In case the traction load is too great to be maintained by the battery under these conditions, it is arranged that a maximum automatic circuit breaker, connected between the battery and the track feeders shall open should the current from the battery exceed a predetermined amount. A resistance is connected as a shunt across the terminals of this circuit breaker, so proportioned that when the circuit breaker is opened sufficient current can be supplied to the trains to keep the lamps alight until the power for driving the trains can be supplied again.

The negative bus-bar of the traction switchboard is connected to earth through a resistance which allows about 100 amps. to pass when the positive side of the system is earthed, owing to accidental connections to the conductor rails on the track or in any other way. An earth recording voltmeter is provided to give a continuous record of the potential of the negative with reference to earth, and means are also provided for testing the leakage current from the positive and negative conductor rails.



SHEPHERD'S BUSH SUB-STATION—MOTOR CONVERTORS AND HIGH-TENSION SWITCHBOARD

DISTRIBUTING CENTERS

There are eleven distributing centers in which the 6500-volt three-phase current from the sub-stations is stepped down to either 220 or 110-volt three-phase current for the lighting and power circuits. Each center consists of a brick chamber, the usual dimensions being about 20 ft. x 12 ft. x 9 ft. high, and each, as a rule, contains six transformers. The two groups of transformers in each distributing center are, therefore, only connected in parallel on the low tension side.

CABLES

Between the generating station, the sub-stations and the distributing centers about 37 miles of high-tension three-core cable, and about 14 miles of low-tension concentric cable have been laid, in addition to between 3 and 4 miles of single low-tension cable used in the form of jumper cables in connection with the conductor rails. All of the cables were supplied by Siemens Brothers & Company, of Woolwich.

Each high-tension feeder between the generating station and the sub-stations has three cores of .15 sq. in. sectional area, insulated with paper, lead sheathed and armored with galvanized wire. The high-tension distributors are similar cables of .05 and .0125 sq. in. sectional area. The low-tension direct-current and alternating-current cables are concentric paper insulated, lead covered cables, no armoring being provided on these cables as was done on the high-tension feeders in order to meet the requirements of the Board of Trade.

The trunk multi-core and the branch telephone cables are also paper insulated and lead covered.

All the high-tension three-core, low-tension concentric and telephone cables are laid in Howard asphalt troughing, supplied by the Howard Asphalt Troughing Company, of Manchester, a separate trough being used for each cable. These troughs are filled in with bitumen and covered with a layer of asphaltic concrete, ironed over all the troughs, which are placed side by side so as to form a waterproof covering. The trenches in which the troughing is placed are excavated about 2 ft. deep and have a 4-in. layer of concrete laid on the bottom to form a bed for the troughing. Where the cables have to cross under any railway lines, a trench is excavated which is floored with concrete, and brick walls are built up on the side, on the top of which are laid old rails covered with concrete and damp-proof course to form a floor for the sleepers and rails. In this way all weight and pounding from the passing trains is kept off the cables. The culverts so formed are provided with ventilating inlets and outlets and inspection manholes at convenient points. The number of culverts in which the cables pass under the rails is twenty-nine. The route chosen for the feeders has, as far as possible, been at the side of the line, so that any repairs, examination or jointing can be done with greater ease. In certain places, however, more particularly between Westbourne Park, Royal Oak and Shepherd's Bush, it has been necessary to lay the feeders in the 6 ft. way. At points where the cables are laid across railway bridges, the cables have been laid on steel plates fixed to the bridge girders, the ends of the plate being built into the concrete bed of the cable trench at each end of the bridge, but left free for a few feet between the bridge structure and the anchoring point, so as to minimize, as far as possible, the effect of vibration.

All the laying and jointing had to be done without interfering with the traffic, and great care had to be taken to

avoid accidents. It is satisfactory to be able to state that not a single life was lost in carrying out this part of the work.

There is one point of special interest in connection with the way in which the cables were jointed. The usual method of jointing the cables after they are laid was departed from, as it was considered that a much better joint would be made if more space was given to the jointer than is possible after the cables are laid and where there are a number placed side by side. The method adopted in the present instance was to leave the last 20 ft. or 30 ft. of each length of cable unlaid until the end had been jointed to the next length of cable to be laid in the same trough. The ends of the two cables to be jointed were laid on a temporary platform placed over the trench and protected by a jointer's tent, or by a special arrangement of tarpaulins where the clearance was limited, and all jointing was done where there was ample room, and things could be kept clean. Where the cables were laid through the subway underneath the main lines between Wesbourne Park and Royal Oak, the length of cable were so arranged that the joints came opposite the refuges provided in the walls of the subway where the jointing could be done with safety.

TRACK WORK

As has been explained above, the system adopted for supplying current to the train-collecting shoes is the same as that already in use on the Metropolitan and District Railways.



ATTACHING BONDS WITH HYDRAULIC PRESS

There are two insulated conductor rails, the positive being 3 ins. above rail level and 16 ins. outside the running rail, and the negative conductor being 1½ ins. above rail level and in the center of the track. The two conductor rails are of an inverted channel section, resting at intervals not exceeding 10 ft. on iron-capped porcelain insulators. The insulator is fixed to the tie by small clamps and coach screws. This design leaves the conductor rail and insulator free to move up and down relatively to each other when trains are passing, owing to the spring in the tie and in the roadbed.

The rails, which are 44 ft. 6 ins. long, weigh 102.8 lbs. per yard and have a cross-sectional area of 10 sq. ins. They



VIEW OF CONDUCTOR RAILS AT JUNCTION AT CAR SHEDS AT HAMMERSMITH

are made of special quality of steel having a conductivity equal to 15 per cent of that of copper. The conductor rails are fished by a joint plate bolted on the underside and are bonded by four laminated copper strip bonds which are practically protected by the sides of the conductor rails and the joint plate. At intervals of about 130 ft. the conductor rails are anchored by means of special insulators having a groove in the iron cap in which a bolt engages which passes through the flanges of the conductor rail, the anchor insulator being secured to the tie by semi-circular clips. The bond terminals were expanded into the conductor rails by means of hydraulic presses which were of two types. One type consisted of a combined press and pump, shown in the accompanying view, which was used when the trains were not running and which could be readily moved by means of runners along the surface of the rail and have the centers of the rams quickly adjusted to the bond terminals. The other type consisted of a specially designed press worked by a separate pump and so arranged that it could be used on the positive conductor rail without removing it when trains passed.

Steel inclines 13 ft. long (1 in 50) made from a bent section of the ordinary conductor rail are normally used at facing ends and steel inclines 4 ft. 6 ins. long (1 in 9) at trailing ends. At sidings and points where the collecting shoes may pass over the rails in either direction at a medium speed, steel inclines 8 ft. long (1 in 25) are fitted to each end of all rails. At cross-overs where the speed is less, cast-iron inclines (1 in 8) are fitted.

At switches and crossings the different lengths of conductor rail are connected together by rubber insulated, lead sheathed and armored cables buried direct in the ground, each end of the cable being sealed in a specially designed porcelain terminal cap from which a solid copper rod projects. To this projection two flexible copper bonds are

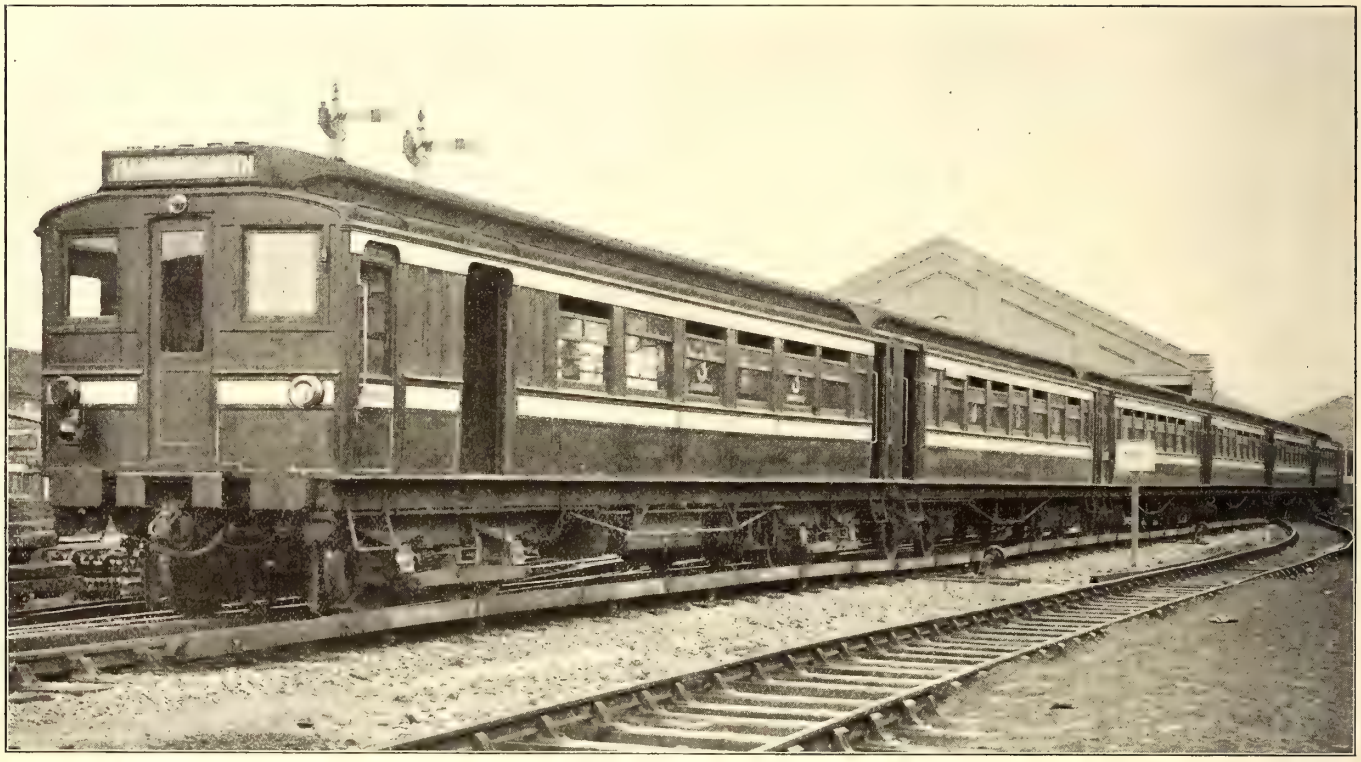
clamped, the other ends of the bonds being expanded into the conductor rail. Any jumper cable can in this way be at once disconnected by the removal of two bolts in the clamp.

Both positive and negative conductor rails are insulated from earth throughout their whole length, but at each sub-station the negative is connected to earth through a resistance. On the occurrence of an earth on the positive, the potential of the negative conductor rail may drop to about 600 volts below earth when a current of about 100 amps. passes through the earthing resistance.

The conductor rails on the "up" line can be connected electrically on one end of the line to the other, and those on the "down" line can be similarly connected from one end to the other. Cross-bond pillars are placed at various points of the line, usually near a station, for the purpose of connecting the conductor rails of the "up" line with those of the "down" line. Each cross-bond pillar contains a double-pole switch worked by rodding from a lever placed in the nearest signal cabin, the signalman being in telephonic communication with one of the sub-stations. The switch, when closed, connects the two positive conductor rails together and the two negative conductor rails together, so that the "up" and "down" lines are worked in parallel.

The section insulators for the conductor rails on the "up" and "down" lines are placed opposite each other in all cases. The section insulator is placed beyond the cross-over between the "up" and "down" lines at a railway station, so as to leave rather more than a train's length between the end of the cross-over and the ends of the section insulator. This allows trains to be shunted from one line to the other without taking the train on to a dead section insulator or on to the faulty section of the line. The section insulator consists of a 315-ft. length of conductor rail (in the positive and in the negative) which is separated from the conductor rails on the same line at each end by a 3-in. gap, which is filled in with a hardwood block. Under normal working conditions both ends of the section insulator on the negative and one end on the positive are connected to the conductor rails by heavy copper straps which bridge the hardwood insulating block and which are easily removable. A section pillar is placed opposite the insulating wood blocks at the other end of the section insulator in the positive conductor rail, and contains two single-pole switches, one switch for the "up" line, and the other for the "down" line. Each switch is so connected to the conductor rails that, when closed, it bridges the insulating wood block at the end of the section insulator in the positive conductor rail.

The cross-bond and section pillars are of cast iron with locked doors. The switches in the section pillars are worked by hand. Interlocking tablets are provided in the signal cabin in the case of a cross-bond pillar, and in the pillar in the case of a section pillar, so arranged that when a key is withdrawn the switch is left locked in the open position and cannot be again closed until the key is inserted. When the switches are in the closed position the keys cannot be withdrawn.



TYPICAL TRAIN OF SIX CARS

ELECTRIC TRAINS

For the service between Hammersmith, Kensington (Addison Road), Aldgate and Whitechapel, twenty electric trains have been provided by the Great Western and Metropolitan Railways. The cars are of the closed vestibule type, with doors only at the ends and sides of the vestibules, the car frame being stiffened by a partition half way along its length. Each train is composed of six cars, approximately 52 ft. long x 8 ft. 9 ins. extreme width. Only the front and rear cars of a train are motor cars. Each motor car is equipped with two motors. The train has a total seating capacity of 320 passengers, with additional room for about 160 passengers standing, making a total passenger load of 30 tons, while the train itself, unloaded, weighs about 174 British tons with electrical equipment complete. The side frames and roof of the cars are of wood, built on steel underframe, while the seats and other interior fittings are

made as nearly fireproof as possible, the floors being of Paris patent plastic cement.

The electrical equipment is of the Sprague-Thomson-Houston multiple-control type, supplied by the British Thomson-Houston Company, of Rugby, and similar to the Sprague General Electric in this country. Positive and negative train cables have been fitted throughout the train, as well as the 10-core multiple-control cable to avoid interrupting the supply of current to the motors and to the lights in the train where gaps occur in the conductor rails. A switchboard is fitted in the driver's compartment on each motor car between the driver's compartment and the luggage compartment, and all the terminals and cables at the back of the board are readily accessible by opening a door in the luggage compartment. The motors are of the G. E. 76 type. The eight motors are capable of accelerating a fully loaded train at the rate of 1.6 ft. per second, with a track voltage of 600, the momentary maximum current per motor not exceeding 320 amps., while the average maximum is about 280. The motors are capable of attaining a train speed of 40 ft. per second within 40 seconds of the start, and the energy consumed on the trip from Hammersmith to Aldgate and back does not exceed 75 watt-hours per ton-mile. Westinghouse air brakes are fitted throughout the train, as well as hand brakes in the motor cars.

By means of a change-over switch each car can be lighted separately by flexible cables from the trolley wires in the shed without making the shoes or other main circuits alive.

TELEPHONE SYSTEM

A very complete system of telephonic communication has, of course, had to be provided throughout the system of electrical supply. At the generating station and at each of the three sub-stations an exchange switchboard is installed, and each of the distributing centers, railway stations, signal cabins and section switch pillars can communicate direct with one or other of the four exchange switchboards, and can thence be plugged through to any of the remaining switchboards. In addition to the exchange switchboards, three telephone instruments are installed at the generating station and at each of the three sub-stations for direct communication between the main high-tension switchboards.

CONSTRUCTION

The buildings for the generating station, sub-stations, distributing centers and inspection chambers have been provided under the supervision of the Great Western Railway Company's engineers who were also responsible for the trench work in connection with the system of cables. The whole of the rest of the work in connection with the generating station, sub-station, distributing centers and cable work was carried out to specifications prepared by Messrs. Kennedy & Jenkin, acting as consulting engineers to the Great Western Railway Company, and under their supervision.

The rolling stock was constructed by the locomotive department of the Great Western Railway, and the carriage and wagon department of the Metropolitan Railway Company, according to specifications of Messrs. Kennedy & Jenkin, and of Thomas Parker, acting as consulting engineer to the Metropolitan Railway Company.

Messrs. Chamberlain & Hookham, Elliott Brothers, Everett, Edgcumbe & Company, Ltd., Evershed & Vignoles, Ferranti Ltd., Nalder Brothers & Thompson, Ltd., and the British Thomson-Houston Company, Ltd., all supplied instruments in connection with one or other of the various switchboard contracts.

REPLY OF MR. SPRAGUE

At the meeting of the American Institute of Electrical Engineers on May 21, when the paper on "Electric Trunk Line Operation" was read by F. J. Sprague, the author promised to contribute later to the proceedings his reply to the various points presented by different speakers. This reply has just been submitted.

Mr. Sprague takes up the comparison of the performance of a d. c. and a 25-cycle a. c. motor, shown in Fig. 1 on page 908 of the issue mentioned. He states that the d. c. motor selected for the comparison was the GE-69 B and the a. c. motor was the GEA-603. He justifies the selection of these two motors for the comparison as they are not only of similar weight, but are of almost exactly the same dimensions. Both are of the largest practical size which should be put on a truck with a 33-in. wheel running in the open on a standard railroad. As explained in the text, gear and transformer weights were eliminated. A similar d. c. motor when equipped with commutating poles weighs about 400 lbs. more, but in view of its extraordinary freedom from sparking, it can with perfect impunity be steadily operated at an increase of potential which would much more than offset the increased weight.

So far as 15-cycle motors are concerned, he believes that the weight of the transformer will generally offset the saving of weight in motor capacity on 25-cycles. In the comparison used by him of the weights of 15- and 25-cycle quadruple motor equipments, the former were given by the Westinghouse, and the latter by General Electric Company. In some weights recently secured by him of 15- and 25-cycle equipments made by the former concern there is an excess of total weight of a quadruple equipment of nominal 75 hp greater than that given in the paper.

In comparing the New York Central and New Haven locomotives he believes that twenty-three of the former could do the work of thirty-five of the latter. Assuming a duty of 200 miles per day, the difference in weight, 1081 tons, would correspond with an excess of 216,200 daily locomotive ton-miles on the New Haven system. The additional cost necessary to secure the same motor capacity would be about $400,000, which at $15 per kilowatt would pay for a synchronous converter addition of 26,667 kw. The cost of the New Haven overhead construction, according to Mr. Wilgus' figures, was over $50,000 per mile, much less than that of the 1200-volt third-rail system. The 1200-volt third-rail system, unhampered by special conditions, would have worked out cheaper than the present a. c. installation, be safer, and have fewer experimental features.

Mr. Sprague disagrees with Mr. Storer that ability to sustain torque while standing still is not a desideratum and calls attention to pusher service where the second locomotive is frequently called upon, when the leading locomotive pulls up on signal to hold the train with full head to steam against slackened draw-bars, and to prevent it being pulled in two when the leader starts again.

To meet the requirements of the Stone & Webster organization in Boston, a modern eight-story fireproof building has been purchased. This building is centrally located in the business section of the city at 147 Milk Street, and on the corner of Milk and Batterymarch Streets, diagonally opposite the Exchange Club. Title to this building has been taken in the name of the Stone & Webster Engineering Corporation.

REVIEW OF THE MASTER CAR BUILDERS BRAKE-SHOE TESTS

At the June meeting of the Master Car Builders' Association F. W. Sargent, chief engineer of the American Brake Shoe & Foundry Company, presented a very interesting review of the brake-shoe tests made by the association during the past twelve years at the Purdue University testing plant.

Mr. Sargent's report was prepared at the request of the committee on brake-shoes and formed a portion of the brake-shoe committee's report.

As an introduction to the discussion of the tests, Mr. Sargent gave some very interesting facts regarding brake-shoes and some reasons for expecting the results obtained in the tests. This introduction and other portions of the report which are of special interest to the electric railway master mechanic are presented in the following abstract:

The value of a brake-shoe depends upon the manner in which it performs the work required, and in the study of the subject there are three points which must be considered in the selection of a brake-shoe. These are:

First, the frictional effect or retarding power of the shoe when pressed against the wheel;

Second, the durability and wearing qualities of the brake-shoe and its ability to stand up to the work required; and

Third, the effect of the brake-shoe upon the wheel against which it is pressed.

The brake-shoes in general use on railroads in this country can be classed under the following heads: (1) Plain cast-iron shoes; (2) cast-iron shoes with inserts in the wearing face; (3) cast-steel shoes; (4) composite shoes.

Under the first head is the product of local foundries throughout the country turning out iron castings, the shoes ranging from soft, tough machinery mixture to the hard, brittle and often mottled iron from an all-scrap mixture of shop refuse.

As a general rule, very soft cast iron is not desired in the brake-shoe on account of its supposedly short life, but it is very important that the casting be strong enough to stand up in service. There is, however, a great lack of uniformity in cast-iron brake-shoes, and often in the same shoe, as indicated by both friction and service records.

Shoes under the second head include those which are cast from a hard iron mixture against chill blocks in the mold, which form hard areas at intervals along the wearing face and at the ends of the brake-shoe; also those shoes which have a soft iron body cast about inserts of harder and tougher metal disposed along the wearing face. These cover usually shoes that are made under patents, and more care is exercised in the selection of cast-iron mixtures from the fact that such shoes are structurally much weaker than an integral casting of unchilled iron.

Under the third head are cast-steel shoes used exclusively on locomotive driving-wheels, and are particularly valuable where thin shoes are necessary, which cannot be made to give satisfactory service with cast-iron body, the toughness and strength of the mild steel rendering this metal very useful for this shoe.

The fourth head covers types of brake-shoes which do not rely upon cast iron or mild steel for frictional qualities and durability. They are made up usually with an iron or steel shell enclosing non-metallic insertion.

BRAKE-SHOE FRICTION

Brake-shoe friction is the resistance to breakage, crushing or distortion, or all three of these, of interlocking projections or particles on or between the face of the brake-shoe and the tread of the wheel, when the brake-shoe is forced against the surface of a moving wheel. The amount of friction is dependent upon the load pressing the shoe against the wheel and the speed of rubbing contact.

The retarding effect of the brake-shoe is expressed in terms of the mean coefficient of friction, which is the average effect of the brake-shoe to retard the wheel, divided by the pressure with which the shoe is forced against the wheel. In the M. C. B. reports the results of the frictional tests are given in terms of the mean coefficient of friction expressed in per cent of the braking load. An examination of the reports of the M. C. B. test committee shows some interesting features in regard to the friction of brake-shoes that are worth considering.

The record of test on chilled wheels shows each brake-shoe in the order of its hardness, the softer shoes being at the top of the scale and the extremely hard shoes at the bottom. The face of the chilled wheel is inflexible and hard, its projections rigid, and, while rounded, offer a fixed and determined resistance to the passage of the brake-shoe, the particles of which are ground between the two surfaces, with the friction dependent upon the intimacy of contact.

On the steel-tired wheel the brake-shoes arrange themselves in a different order, the friction being influenced apparently by the action of the metal in the brake-shoe upon the steel tire. The element of ductility in the steel tire permits its projections to bend over and flatten under the shoe, diminishing the interlocking of particles, making a sliding rather than a grinding action between the two surfaces.

In the case of insert shoes which offer sharp projections or cutting edges to dig into the tire, the friction is increased in proportion to the cutting effect, whereas in shoes of a ductile metal, such as soft steel, wrought or malleable iron, the projections on the shoe face tend to flatten out, the shoe to polish, and a sliding action results against the steel tire, reducing the friction. With such shoes, however, when the temperature rises to a point at which the metal begins to flow, it frequently happens that lumps form on the face of the shoe, which become highly heated and burn, causing hard spots which cut into the tire. When this happens, the friction is largely increased.

With shoes of heavily chilled areas where there is very little grinding, the sliding action over the steel tire is emphasized and friction is reduced. Such shoes occupy practically the same stand on the steel-tired wheel under similar conditions of load and speed as on the chilled wheel; whereas shoes with hard cutting inserts take a higher position on the steel tire than on the chilled wheel, and shoes of very soft or moderately hard cast iron are usually found to take a lower position on the steel-tired wheel than on the chilled wheel, the load and speed being the same.

It is this change in position which occurs with the various shoes when applied on the chilled or steel-tired wheel that may have considerable influence in determining the proper selection of a brake-shoe for each class of service. As an example, take the shoe with wrought-iron inserts, No. H-96, which meets the M. C. B. specification on the chilled wheel, but fails to meet the same specification on steel-tired wheels. Also the shoe with the hard white iron insert, No. 51-'01, which meets the specification on the steel-tired wheel while failing the same specification on the chilled wheel. Charts Nos. 1 and 2 show this change of position in the friction lines of the different shoes under similar conditions of braking load and speed of wheel on both the chilled wheel and steel tire.

Chart No. 3 shows some friction curves of brake-shoes on steel tire at a speed of 65 miles an hour, in which it will be noticed that the softer shoes fall quite rapidly with increased loads as compared with the more durable shoes, but the curves of all the shoes with increase of load tend to flatten and converge.

This peculiarity has been observed in the Berlin-Zossen tests made in Germany in 1902 in connection with cast-iron shoes on steel tires, where it was found that the coefficient of friction was very nearly constant at speeds between 45 and 60 miles an hour, but as the speed decreased below 45 miles an hour the brake-shoe friction rapidly increased, as shown by the following table:

68 miles an hour, average coefficient of friction.....0.06
62 miles an hour, average coefficient of friction.....0.055
47 miles an hour, average coefficient of friction.....0.062
31 miles an hour, average coefficient of friction.....0.075
15 miles an hour, average coefficient of friction.....0.108
5 miles an hour, average coefficient of friction.....0.149

The convergence of the curves of the different shoes toward a common meeting at some higher speed or load indicates the effect of heat upon the structure of the shoe face. Under conditions of low rate of heating each particular material holds up in proportion to the strength of the particles forming the wearing face. The hard chilled or tough ductile surfaces polish over and slide, where the open or granular structure or the composite material in the filled shoes make more intimate contact with the wheel face and hold better.

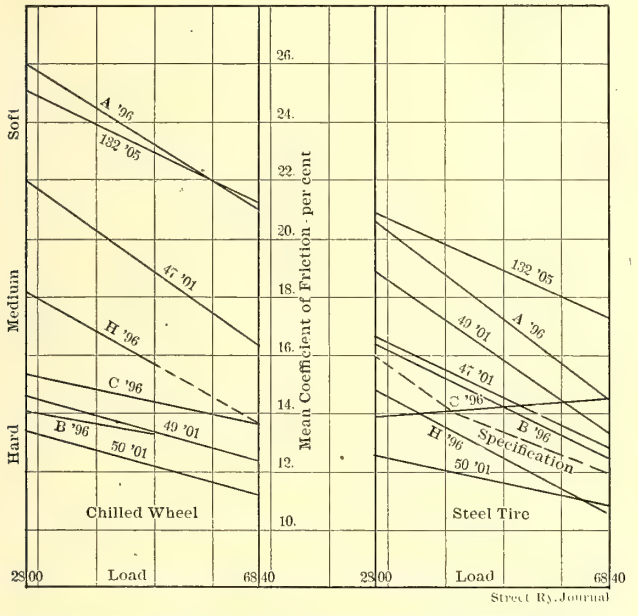


CHART NO. 1.—SHOWING LOCATION OF VARIOUS SHOES ON CHILLED AND STEEL-TIRED WHEELS—SIMILAR CONDITIONS OF LOAD AND SPEED

Laboratory Number	Description of Shoe
A-96	Soft cast iron.
B-96	Hard cast iron.
C-96	Soft cast steel.
H-96	Soft cast iron, wrought-iron inserts.
47-1901	Medium hard cast iron.
49-1901	Cast-iron body, white-iron inserts.
50-1901	Hard cast-iron body, chilled ends, sofe cast-iron inserts.
132-1905	Hard cast iron, expanded steel inserts.

As the intensity of heat generation increases by the continued application of the shoe or by the extra pressure or work done in a given time, the whole structure of the face of the shoe undergoes a change. Unchilled cast iron crumbles, composite filling decomposes by the destruction of the bond, and these shoes lose their grip on the wheel. The chilled areas are softened and toughened, give closer contact and more friction as the chill is driven out, while the shoes of wrought and ductile material soften and stick to the wheel, holding up in friction by a more intimate contact.

From this it would appear that a brake-shoe combining in its wearing face the grinding qualities of cast iron and the tough, ductile flowing properties of mild steel, would produce average results in which the extremes of both metals were neutralized and utilized to best advantage. Such a shoe appears to be indicated in the performance of No. 132, Chart No. 3 (submitted by the C. R. R. of N. J. in 1903), at least so far as frictional effect on the steel-tired wheel is concerned, having a high-retarding effect at low speeds and holding up well under extreme conditions of

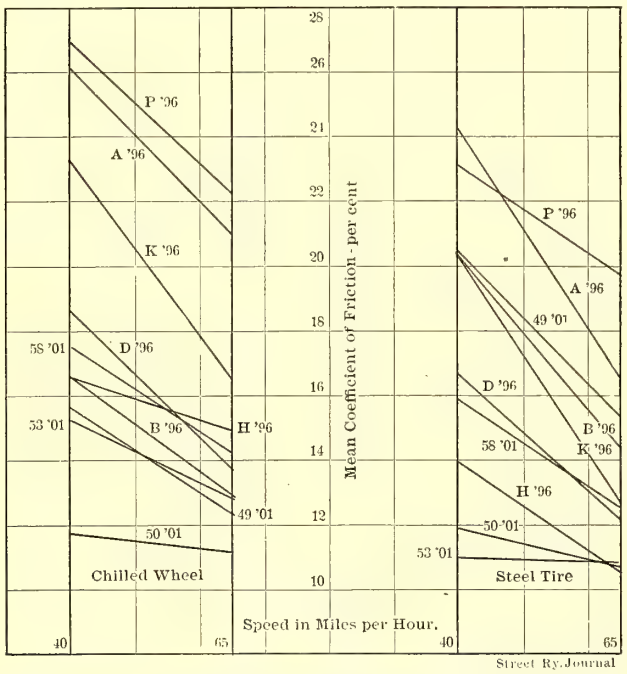


CHART NO. 2.—SHOWING POSITION ON CAST-IRON AND STEEL-TIRED WHEELS UNDER SIMILAR CONDITIONS OF LOAD AND SPEED

Laboratory Number	Description of Shoe
A-96	Soft cast iron.
B-96	Hard cast iron.
D-96	Hard cast steel.
H-96	Cast-iron body, wrought-iron inserts.
K-96	Cast-iron body, wood plugs.
P-96	Cast-iron shell, composition filling.
49-1901	Cast iron, white-iron inserts.
53-1901	Cast-iron body, chilled ends, pockets with asphalt composition filling.
58-1901	Cast iron, expanded steel insert.

speed and pressure, due to the composite structure of unchilled cast iron and mild steel.

Chart No. 4 illustrates graphically the record of test on twelve varieties of plain cast-iron shoes, as follows:

PLAIN CAST-IRON SHOES.

A — 1896, Very soft cast iron, from P. R. R., Altoona.
B — 1896, Hard cast iron, wheel mixture, Ramapo Iron Works.
47 — 1901, Medium cast iron, unchilled, Lappin Brake Shoe Co.
79, 80, 81 — 1903, Cast iron shoes, Michigan Central Ry.
129 — 1905, Special hard cast iron, Southern Pacific Ry.
175 — 1906, Soft cast iron, Wheeling & Lake Erie R. R.
178 — 1906, Medium cast iron, Wheeling & Lake Erie R. R.
205 — 1906, Medium cast iron, Lake Shore & Mich. So. Ry.

These samples represent a variety of product ranging from extremely soft cast iron to very dense, close-grained, unchilled cast iron, and may be taken as representative of the extremes to which the metal may run in what are known as plain cast-iron shoes. The shoes shown in the lower

limits, Nos. 79, 80, 81 and 129, are undoubtedly very hard shoes from an all-scrap mixture, or made up with an admixture of steel in the charge, which accounts for their low position in the scale. They are, however, representative of much of the metal in the plain cast-iron shoes of the present day, made up of low-grade raw material. It will be noticed that the specification on both steel-tired and chilled wheels is such as to preclude acceptance of this material. The specification will also throw out shoes of a mottled structure, which are but a very slight degree removed as regards friction records from those noted at the bottom of the scale.

The M. C. B. report of service tests made in 1895 gives some interesting figures concerning the relative wear of different shoes, where each shoe was tested against shoes A-96 of soft cast iron, and the figures are, therefore, directly comparable, and are shown in the following table:

M. C. B. Report of Road Test, 1895.

	Cast-iron wheel. Durability of our shoe as compared with A-96 shoe.	Steel-tired wheel. Durability of our shoe as compared with A-96 shoe.
A-96 — Soft cast iron.....	1	1
B-96 — Hard cast iron.....	1.16	0.94
J-96 — Hard iron, 50 per cent of face chilled	1.82	3.70
H-96 — Cast iron, 40 per cent of face wrought iron inserts.....	3.23	3.33
I-96 — Forty per cent of wearing face hard steel inserts.....	3.23	4.79
C-96 — Soft steel.....	5.90	2.40
D-96 — Hard steel.....	10.00	3.23
L-96 — Pressed steel.....	9.09	3.45
M-96 — Wrought iron.....	9.09	3.45
Malleable iron, average of E. F. and G.....	1.37	1.50

The foregoing records were obtained by wearing out completely in service a number of shoes and comparing their durability with the soft cast-iron shoe "A" in each test. We find, on inspection of this table, that the hard cast-iron shoe B-96, although showing an average of at least 50 per cent less friction than the shoe A-96, has practically the same rate of wear on both the cast-iron and steel-tired wheels. This point is of especial interest in view of the general impression that hardness in the cast-iron shoe means greater durability with proportionate loss of friction, although it has been stated that it is possible to greatly increase the durability of the plain cast-iron brake-shoe without materially reducing the frictional effect. This may be so, but this record does not show it.

It may appear in future tests, and, in fact, does appear in the case of the cast-iron shoes of the 1901 report (see Table No. 2), that a comparatively soft cast-iron shoe can be made which will show high friction as well as comparatively low rate of wear. Take, for instance, shoe No. 47-1901, which was intended to be heavily chilled and consequently was cast against chill blocks, but failed to show any more than a light skin chill, and this chill was not in contact with the wheel in any of the tests on record. The metal in this shoe was very dense, yet soft and tough, and could be drilled readily.

It may appear that the close-grained metal of the all-scrap mixture, which is hard and brittle, will wear more rapidly against both the cast-iron and steel-tired wheel than a softer metal with greater toughness and resilience, and that the more rapid fall in friction of these softer shoes and tougher and harder holding brake-shoes with increase in the rate of heat generation, is not the result of greater wear, but of the smoothing over and reduced rate of grinding because of greater ductility and tougher metal. This fact has been indicated in the case of steel rails, and in the case of cylinder bushings, eccentric straps and other cast-iron parts which at times have been subjected to unlubricated rubbing.

The extra hard brake-shoes with heavy chills are from three to four times more durable than ordinary plain cast iron, depending upon the amount of hardness present, and usually under similar conditions of work, so far as noted, give practically similar results on both chilled wheel and steel tire. Shoe J-96 of 1895 test, shows up well in durability on the steel-tired wheel, and I cannot account for the low record on the chilled wheel, unless it is that some parts of this shoe were lost by breakage in service.

There are three shoes in the 1901 record, namely, Shoe No. 50, Shoe No. 55, and Shoe No. 53, which rely entirely upon the hardness of the chilled portion for durability. These show practically similar results on steel-tired and chilled wheels, with the exception of the last one, No. 53, the friction and wear of which is largely reduced by the lubricating effect of the asphalt bond of the filling.

Brake-shoes with hard and tough inserts generally show in service tests from three to five times greater durability than plain cast-iron shoes, and this is indicated in the records of two shoes, H and I of the 1895 test, and shoes Nos. 49, 51, 57 and 58 of the 1901 report.

The crucible insert shoe, I-96, shows higher durability on the steel-tire than on the chilled wheel, which agrees with the general record in service on locomotives, which averages from four to five times the durability of a plain cast-iron shoe.

Shoes with white iron inserts, No. 49 and No. 51, show considerably higher durability on the chilled wheel than on the steel tire. This may be accounted for by the increase in heat at the face of the shoe, produced by the cutting effect of the insert on the tire.

The record of shoes with wrought metal inserts, No. H-96, and the shoes with soft steel in the shape of expanded metal, Nos. 57 and 58-1901, show practically a close agreement in wear on both chilled wheels and steel tire.

The record of shoes of steel or wrought iron shows very high durability on the chilled wheel, where they apparently glaze over and become very hard on the wearing face; while on the steel-tired wheel the durability is very much reduced by the tearing off of metal from the face of the shoe, which clings to the tire. The record of these shoes agrees with the service recorded, which runs from four to five times the durability of the plain cast-iron shoe.

Malleable iron shoes seem to approximate, so far as the records go, plain cast iron when warmed up, and wear about the same on both wheels.

Ordinarily, service records show for the various shoes the following averages as compared with plain cast iron; but, as before indicated, the trade name of the brake-shoe signifies nothing more than the type of the shoe, and records of wear of such shoes are valuable for comparison only when the exact structure of the shoe tested is known:

Heavily chilled shoes, three to four times as durable as plain cast iron.

White iron insert shoes, three to four times as durable as plain cast iron.

Chilled shoes with soft inserts, three to four times as durable as plain cast iron.

Hard iron, expanded metal inserts, two to four times as durable as plain cast iron.

Wrought iron or steel insert shoes, three to four times as durable as plain cast iron.

Cast-steel shoes, four to five times as durable as plain cast iron.

Cast-iron shoes with crucible inserts, chilled ends, four to five times as durable as plain cast iron.

Certain shoes met the M. C. B. requirements on one wheel while failing specification on the other. For example, the shoes which are practically plain cast-iron shoes, Nos. 47, 52 and 56, together with the shoes with expanded metal, Nos. 57 and 58, which have no large areas of insert, are suitable for service on either wheel, whereas the hard insert shoes, Nos. 49 and 51, are satisfactory only on the steel-tired wheel. Here they can be used to advantage, especially if the inserts are so located as to contact with the tire beyond the limits of rail wear, and by the cutting action of the inserts tend to maintain the original outline of the wheel tread.

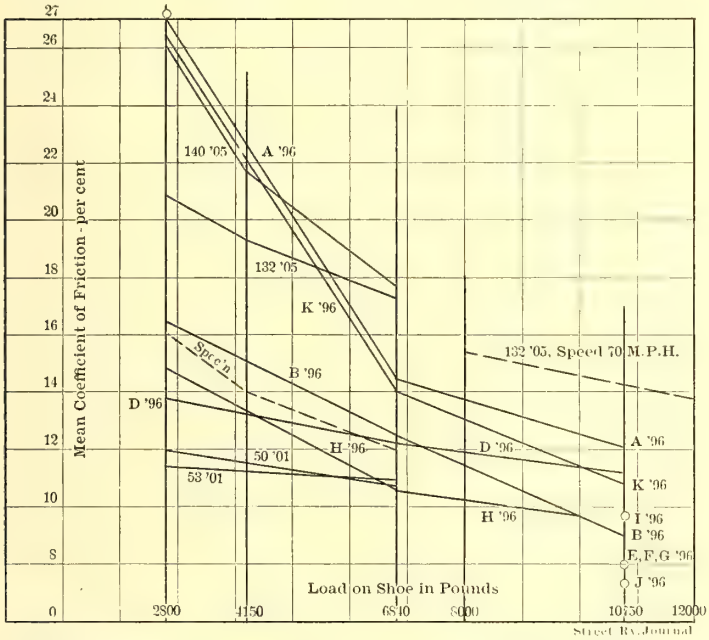


CHART NO. 3.—RECORD OF TESTS ON STEEL-TIRED WHEEL, SPEED 65 MILES PER HOUR; LOAD, 2808 TO 12,000 LBS.

Laboratory Number	Description of Shoe
A-96	Soft cast iron.
B-96	Hard cast iron.
D-96	Hard cast steel.
E. F. G.-96	Malleable iron.
H-96	Cast iron, wrought-iron inserts.
I-96	Cast-iron body, crucible-steel inserts.
J-96	Hard iron, 50 per cent of face chilled.
K-96	Hard cast iron, wood inserts.
50-1901	Hard cast iron, chilled ends, soft cast-iron inserts.
132-1905	Hard cast iron, expanded steel insert.
140-1905	Malleable iron shell, composition filled.

While the standard M. C. B. Christie brake-shoe is undoubtedly the most efficient design ever devised for the brake-shoe on account of distribution of metal and ease of application, it is a particularly weak design for the cast-iron shoe. Where the structure is further weakened by inserts or by chilling strains, the M. C. B. Christie unflanged shoe is actually unsafe to use on heavy and high-speed equipment. New shoes have failed with the application of the high-speed brake, and partly worn shoes are sure to go. Broken shoes are a source of danger, and worn brake heads are very expensive, as also the scrapping of shoes which are less than half worn out in order to avoid failure in service. This defect of structural weakness has long been noticed in the cast-iron shoes, and various means have been devised to overcome the trouble by the insertion of strips of wrought and tough metal along the back of the shoe, the body metal being cast about the strips.

The most satisfactory and universally adopted reinforcement is known as the steel back, which is formed of a plate 3/16 in. thick mild steel, freely perforated for anchorage of the body metal. The Christie lug is reinforced by means of a strip of similar metal surrounding the key way core, the ends being tucked under the steel back, which is raised slightly at the center of the shoe. The steel back and wrought lug are placed in the mold and the body cast about them. The body metal, which may crack, cannot get away from the steel back, and cracks cannot disable the steel back shoe, as the back cannot be broken.

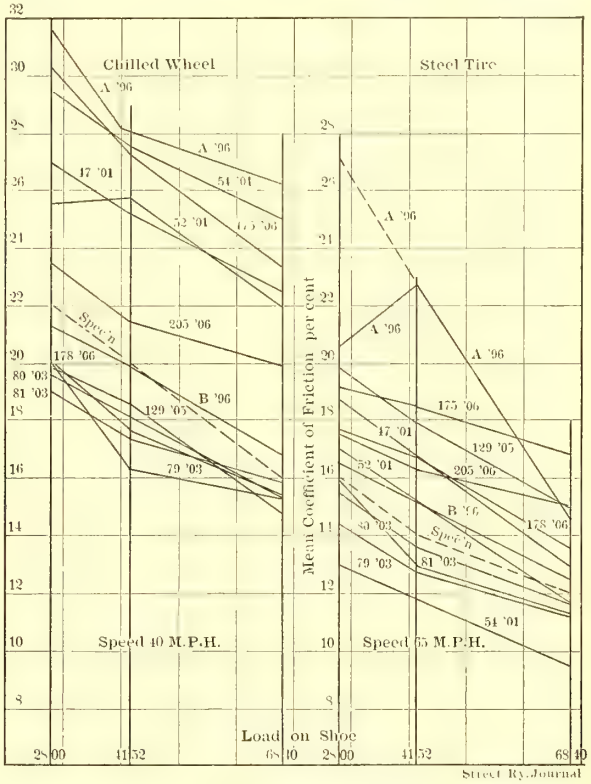


CHART NO. 4.—PLAIN CAST-IRON BRAKE-SHOES, UNCHILLED

Laboratory Number	Description of Shoe
A-96	Soft cast iron.
B-96	Hard cast iron.
47-1901	Medium hard cast iron.
52-1901	Soft cast iron, soft cast-iron insert.
54-1901	Soft cast iron, soft cast-iron insert.
79-1903	Hard cast-iron brake-shoe.
80 & 81-1903	Hard cast-iron brake-shoe.
129-1005	Hard cast iron.
175-1906	Cast-iron brake-shoe.
178-1906	Hard cast-iron shoe.
178-1906	Hard cast-iron shoe.
205-1906	Medium cast-iron shoe.

It is this reinforcement which has made possible the continued use of the M. C. B. standard brake-shoe, and has increased the average life of this shoe at least 50 per cent, in many cases doubling the service obtained from the same weight of metal by continuing the shoe in service until worn down to the steel back. Some idea of the advantage of the steel back in increasing the durability of the plain cast-iron brake-shoe is shown in the following record, which is but one of a number of reports of similar nature by railroads which have adopted the steel back as a standard.

WEAR OF THE WHEEL TREAD BY THE BRAKE-SHOE

Practically no evil effect is noticeable on the cast-iron wheel by any of the brake shoes noted, except with those of cast steel or wrought iron, which at times may score the chilled wheel when there is a piling up or bunching of the metal on the face of the shoe, forming a high spot where the pressure is concentrated and the face of the shoe is

highly heated and burned. Another trouble with shoes of ductile metal is the glazing over and hardening of the shoe face against the chilled wheel, which apparently forces a greater amount of heat into the wheel than would be the case with a cast-iron brake shoe. This point needs further investigation.

Cast-iron shoes with a continuous longitudinal insert of wrought iron or steel have been known to groove cast-iron wheels, especially if there is a low chill in the wheel, by the continuous drag and the hardening effect of the wrought metal; but in the case of the shoe where the wrought inserts are limited in area and entirely surrounded by cast iron which apparently coats the face of the insert, the injury to the chilled wheel is not apparent, nor is there any marked reduction in the friction of the shoe over that of the ordinary cast iron.

All brake shoes wear the wheel to some extent, whether cast iron or steel tired, so far as my observation goes, except in the type of shoes mentioned, there is no appreciable wear of the chilled wheel by cast-iron shoes with chilled areas or with hard inserts, or with soft inserts, which are not continuous along the face of the shoe.

On the steel tire, however, conditions are different, and care must be taken in the selection of brake shoes to avoid scoring the wheel, particularly outside the limits of rail wear. There appears to be hardening of the face of the steel-tired wheel by the rolling action on the rail which prevents to some extent wear by the brake shoe, or at any rate, the scoring by the brake shoe is rolled out and not in evidence over that portion of the wheel tread; but irregularities in the texture of the shoe face may be shown by scoring on the outer tread or flange of the steel tire where it does not come in contact with the rail.

The unflanged shoe is undesirable on steel-tired wheels especially because of its change of position across the face of the wheel, increasing the wear of the tire over the limits of rail wear and against the flange.

Shoes with wrought inserts are undesirable for use on steel-tired wheels on account of the cutting effect of the wrought insert and its tendency to pick up tire metal and score the wheel tread.

Shoes with hard inserts or chilled areas are in extensive use on small diameter steel-tired wheels, and best results are obtained by the use of such shoes bearing all across the tread of the wheel and flange.

The puestion of extra braking effect secured by the flanged shoe over the unflanged shoe is one which should be investigated by the Brake Shoe Committee, as well as the question of wear of wheels by such shoes and the greater mileage obtained from the tire by the use of the flanged shoe. It has been demonstrated by service tests and is the experience of quite a number of railroads, that the use of the flanged shoe on steel-tired wheels means reduced cost in wheel maintenance as regards tire turning and more service obtained from the steel tires, as well as reduced cost in brake-shoe maintenance.

The tendency of the unflanged brake shoe to pull to one-side and wear off the wheel is a source of expense to the railroad. Such shoes concentrate a wearing action against the flange at one end of the brake beam, while the shoe on the other end is being pulled off the wheel and must be scrapped very early in its life. The braking pressures is increased at one side of the truck and reduced on the other, resulting in increased tendency to sharp flanged wheels as well as loss in brake-shoe metal. All this is avoided by the use of a flanged shoe, and where the cast-iron body is supported by a steel back the flanged shoe can not fail to show a considerable saving over an unreinforced unflanged shoe for the same type of wearing face.

From the records of test which have already been presented by the reports of the Brake Shoe Committee, there is sufficient information at hand to enable those interested to form a very close estimate of the fitness of almost any type of brake shoe that may be presented for the service required. By examining the structure of the body metal and noting the extent and character of the insert, one can locate its place very closely in the friction scale and decide as to its probable life and durability, and effect upon the

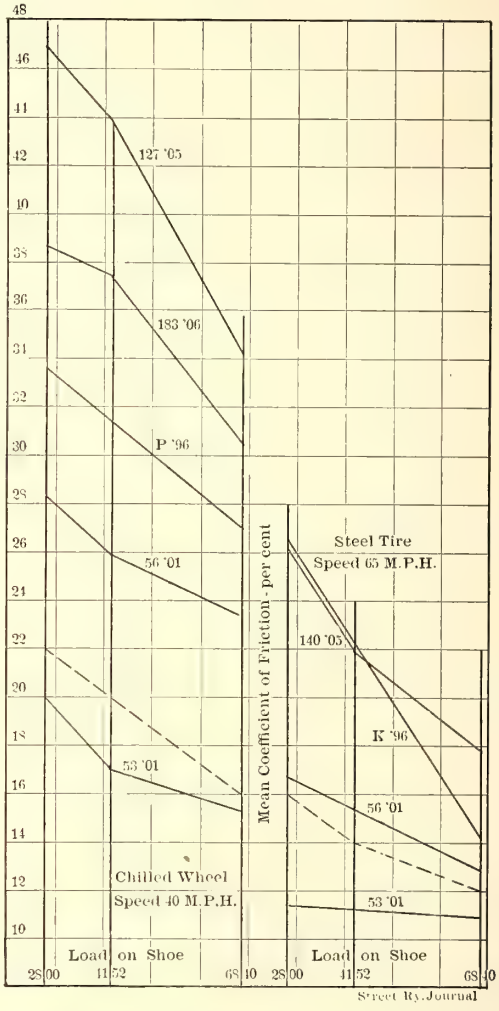


CHART NO. 5.—RECORD OF TEST OF COMPOSITE BRAKE-SHOES

Laboratory Number	Description of Shoe
K-96	Hard cast-iron body, wooden plugs.
P-96	Cast-iron shell, composition filling.
53-1901	Hard cast-iron body, chilled ends, pockets filled with asphalt composition.
56-1901	Cast-iron body, cork inserts.
127-1905	Pressed-steel shell, composition filling.
140-1905	Malleable-iron shell, composition filling.
183-1906	Pressed steel shell, composition filling.

wheel tread. By this it is not to be understood that the M. C. B. tests are complete or should be discontinued, for there is plenty of work to be done in connection with the M. C. B. testing machine in the line of investigation which will undoubtedly better the brake shoe and improve the braking of railway trains, as well as reduce expense in brake shoe maintenance.

The brake shoe tests should be continued to determine the maximum load on shoe and speed of wheel possible, say for instance, 12,000 to 15,000 pounds load on the M. C. B. unflanged shoe at a speed of eighty miles an hour, in

WEAR OF BRAKE SHOES ON CAST IRON WHEELS.

Speed constant at 20 miles per hour; pressure of shoe on wheel, 2808 pounds; Revolutions of wheel during application, 190; equivalent distance run during application, 1,641.5 feet.

No. of Shoe.	Trade Name of Shoe.	Description of Shoe.	Area of Shoe Face in Square Inches.	Percentage of Shoe Face.			Comparative Durability Million Feet—Pounds of Work Done per 1 Pound of Wear.	Shoe Tested Made By	Shoe Tested Furnished By	Number of Shoe.	Mean Coefficient of Friction.
				Insert.	Chill.	Unchilled Cast Iron.					
175	Plain Cast Iron	Unchilled cast iron; no inserts; soft iron	45	0	0	100	80.8	Griffin Wheel Co.	W. & L. B. R.R.	175	30.3
205	Plain Cast Iron	Unchilled cast iron; no inserts; soft iron	47	0	0	100	92.0	American Brake Shoe & Foundry Co.	L. S. & M. S.	205	23.5
179	Pittsburg Malleable	Malleable iron shell; composition filling	44	Mal. I. 36	Comp. 64	0	114.3	Pittsburg Brake Shoe Co.	W. & L. B. R.R.	179	36.8
161	Streeter	Cast iron body; white iron inserts	51	32	0	68	146.6	American Brake Shoe & Foundry Co.	H. V. R.R. Co.	161	21.8
186	Congdon	Cast iron body; wrought steel inserts	47	13	0	87	162.5	American Brake Shoe & Foundry Co.	D. M. & N. Ry.	186	24.1
209	"U"	Cast iron body; tapered ends chilled	54	0	13	87	172.0	American Brake Shoe & Foundry Co.	L. S. & M. S.	209	24.7
183	Pittsburg Steel	Pressed steel shell; composition filling	45	Steel 22	Comp. 78	0	173.8	Pittsburg Brake Shoe Co.	D. M. & N. Ry.	183	38.7
178	Plain Cast Iron	Unchilled hard cast iron	48	0	0	100	227.7	American Brake Shoe & Foundry Co.	W. & L. B. R.R.	178	20.0
172	Hard Insert—Seaton	Cast iron body; wrought steel inserts	45	12	0	88	258.2	J. Seaton Foundry, Topeka, Kan.	A. T. & S. F.	172	22.8
215	Congdon	Cast iron body; wrought steel inserts	47	16	0	84	270.9	American Brake Shoe & Foundry Co.	D. S. S. & A.	215	20.9
163	"U" Dia. "S"	Cast iron; ends chilled; soft steel inserts	53	30	13	57	350.1	American Brake Shoe & Foundry Co.	A. T. & S. F.	163	21.7
200	Streeter	Cast iron body; white iron inserts	45	37	0	63	367.0	American Brake Shoe & Foundry Co.	L. S. & M. S.	200	22.7
158	Streeter	Cast iron body; white iron inserts	51	32	0	68	407.2	American Brake Shoe & Foundry Co.	H. V. Ry. Co.	158	22.5
220	Congdon	Cast iron body; wrought steel inserts	48	25	0	75	504.7	American Brake Shoe & Foundry Co.	C. & A. Ry. Co.	220	26.5
194	Congdon	Cast iron body; wrought steel inserts	47	40	0	60	554.6	American Brake Shoe & Foundry Co.	L. S. & M. S.	194	26.5

order to bring out which type and what material is best suited for these severe conditions of heat generation.

We have very little knowledge of brake-shoe effect under conditions of low speed and load. From the trend of friction curves it would appear that many of the shoes which give satisfactory service at speeds of forty to sixty-five miles per hour and with loads of 2808 to 6840 pounds, can not be used in the emergency application at lower speeds than say thirty-miles per hour without grave danger of sliding wheels. The coefficient of friction at the rail varies from 20 to 30 per cent. We know very little about this factor, but with a brake shoe working under a braking load of 90 per cent and showing a mean coefficient of friction of 25 to 30 per cent at forty miles an hour, we have the possibility of sliding the wheel at a lower speed. Many of the shoes in test show a much higher coefficient of friction than 30 per cent at forty miles an hour, and we should know where their record goes down to say five miles per hour; or in other words, the friction curves for the various shoes noted and on hand for test should be extended to show their record at speeds from five to eighty miles an hour and with loads from 2000 to 15,000 pounds, covering at least the typical shoes of accepted practice at the present time.

It does not appear that a high coefficient of friction is necessary or desirable under low conditions of speed and load, but it is of vital importance, where the speed is high and the loads heavy, that the shoes show all the friction possible; and while we should not neglect the question of the best brake shoe for conditions of low heat generation, we must first of all consider the extreme conditions. This question is considerably simplified by the fact that there appears to be an equalizing of the frictional effect of the hard and soft shoes under conditions of high speeds and loads, or at least a tendency toward that, which should be confirmed by further tests, and the question reduces not so much to the friction as to the structure of the shoe to stand the racket, so to speak, at the upper limit of service. The methods of reinforcement, notably with the steel back, provides for this to a large extent, as may be indicated by the good service rendered by steel-back plain cast-iron shoes in high-speed brake train service throughout the country.

The M. C. B. record of shoe tests, while most important and valuable, will remain incomplete until checked up by service tests. The brake-shoe testing machine records results under ideal conditions—a steady wheel moving true with a constant uniform braking load and perfect contact between shoe and wheel, with clear, dry surface in contact under practically uniform climatic conditions.

In actual service we have the reverse, namely: an unsteady wheel pounding along over uneven track, more or less elasticity in brake beams and brake connections, and fluctuation in braking pressure, coupled with the varying contact between wheel and shoe with extremes of climatic conditions from cold to hot and wet to dry.

The test wheel is uniform in its bearing against the shoe, and always moving in the same direction, the projections tend to bend away from the shoe and the surface of the wheel to polish up and smooth over and afford a better contact than in the case of the wheel in service conditions. With the ordinary car wheel the unflanged brake shoe covers that part of the wheel not in contact with the rail, as well as that part of the wheel which is in contact with the rail; so that there are two distinct surfaces under the shoe. The side motion of the brake shoe is continually varying the amount of contact between the shoe and these two surfaces, while

the inequalities of track condition and the pounding of the wheel can not but fail to break the grip of the shoe on the wheel, all of which means that the actual coefficient of friction from the service tests is much less than that indicated in the shop test.

To make the records complete, therefore, some connection should be made between shop and service tests, and to my mind this can be done without very much trouble and expense. The management of some of the electric roads in the West, in the vicinity of Purdue University would, I believe, be much interested in conducting a service test of brake shoes with a heavy electric car in interurban service, using unflanged M. C. B. Christie type of brake shoes on 33-in. wheels, and I believe a series of tests could be arranged using brake shoes previously tested on the M. C. B. machine, and after service stops has been made, returned to the machine for further test. It would not be necessary to test all the various types of brake shoes, but say three different kinds of shoes illustrating those in general use on locomotives, steel-tired coach wheels and chilled wheels.

The exact relation between shop and service tests with the shoe could readily be determined, and would undoubtedly be of great value. The work could be done without serious interference or expense in connection with some of the electric lines in the Middle West, and would prove of great value to those operating electric railroads, who would undoubtedly heartily co-operate with the M. C. B. committee in providing apparatus and track for conducting such test. It seems to me that this is one of the most important questions that can be brought before the brake-shoe committee, and, once started, I am confident that the subject would not be dropped until the question of flanged and unflanged shoes would be settled, as well as the most suitable and efficient material for the purpose.

In conclusion, I beg to state that I feel safe in saying that those interested in the manufacture of brake-shoes will cooperate to the fullest extent in supplying whatever brake-shoes are necessary for service and shop tests and assist in every way in the effort to obtain more light on the subject.

The questions to be decided concerning brake-shoes in the future may be noted as follows:

First—Extending the records of test to cover speeds of from 5 miles to 80 miles per hour under loads from 2000 lbs. to 15,000 lbs.

Second—The comparative durability or wear of brake-shoes under similar conditions of service.

Third—The comparative effect of various brake-shoes upon the wheel tread, both as regards wear of wheels under the shoe and heat effect produced by the shoe upon the wheel.

Fourth—The comparative merits of the unflanged and flanged brake-shoe to note the advantage, if any, and better braking effect obtained with the flanged shoe, which would seem to be indicated in service, as well as better effect on the wheel.

With these questions settled, the brake-shoe story will be complete until some new metal stronger, tougher, but still retaining the grinding and non-cutting qualities of unchilled cast iron, has been obtained.

As an appendix to his report Mr. Sargeant submitted the table shown on the preceding page.

Two hundred and two interurban trains are dispatched from Columbus every day in the week, besides a number of specials and extras. Eight interurban lines enter the city, two are building and two others are in prospect.

NATIONAL CIVIC FEDERATION—REPORT OF COMMITTEE ON INVESTIGATION OF PUBLIC OWNERSHIP

The final report of the conclusions of the committee on investigation of the National Civic Federation Commission on Public Ownership and Operation was made public July 29. This committee, of which Melville E. Ingalls, chairman board of directors Big Four Railroad, is chairman, made a thorough investigation of municipal and private workings of gas, electric light, water and street railway plants, both in the United States and England. It is worthy of note that of the committeemen, all but one, Walton Clark, of Philadelphia, who presents a separate paper giving his views, sign the report. Charles L. Edgar, of Boston, and W. J. Clark, of New York, present a statement of minor exceptions. The conclusions reached give in detail the opinions of the committee on all the various questions connected with the public ownership problem, and present a number of practical and important recommendations on the subject.

The members of the committee who sign the report are:

Melville E. Ingalls, chairman.

Dr. Albert Shaw, editor of the "Review of Reviews," vice chairman.

Edward A. Moffett, secretary.

Edward W. Bemis, superintendent of waterworks, Cleveland, Ohio.

William J. Clark, general manager of the foreign department of the General Electric Company.

Prof. John R. Commons, of Wisconsin University.

Charles L. Edgar, president of the Edison Electric & Illuminating Company, of Boston.

Walter L. Fisher, president of the Municipal Voters' League, of Chicago.

Prof. Frank J. Goodnow, of Columbia University.

Prof. John H. Gray, of Northwestern University, Illinois.

Timothy Healy, president of the International Brotherhood of Stationary Firemen.

Daniel J. Keefe, president of the International Longshoremen's Association.

Milo R. Maltbie, member of the new Public Service Commission for the Greater New York.

H. B. F. Macfarland, president of the Board of Commissioners of the District of Columbia.

Frank J. McNulty, president of the International Brotherhood of Electrical Workers, Springfield, Ill.

Prof. Frank Parsons, president of the National Public Ownership Leage, Boston.

J. W. Sullivan, editor "Clothing Trades Bulletin," New York.

Talcott Williams, editorial writer of the "Press," Philadelphia.

Albert E. Winchester, superintendent of the South Norwalk, Conn., electric works.

THE COMMITTEE REPORT

The report made public by Mr. Moffett, the secretary, says:

"It is difficult to give positive answers of universal application to the questions arising as to the success or failure of municipal ownership as compared with private ownership. The local conditions affecting particular plants are in many cases so peculiar as to make a satisfactory comparison impossible, and it is very difficult to estimate the allowance that should be made for these local conditions. For instance, in making deductions from the financial con-

ditions of Wheeling, as affected by its gas plant, as compared with those of Atlanta and Norfolk with their private plants, allowance must be made for the presence of natural gas in Wheeling. Again, in comparing the public waterworks of Syracuse with the private waterworks of Indianapolis from the point of view of the success or failure of municipal operation, geographical conditions must be taken into consideration. The situation at Syracuse is extremely favorable to the establishment of an efficient plant with comparatively little effort on the part of its management. At Indianapolis the conditions are unfavorable. In Syracuse the water flows to the city by gravity; in Indianapolis it must be pumped. So we might go through the various cities here and abroad that have been visited and show that the results were affected favorably or unfavorably by special conditions applicable to each city.

"Further, the difficulty of reaching satisfactory results by the comparative method is not confined to special or local conditions. It is true, as well, of much broader questions. Thus any attempt to compare municipal with private electric light plants in the United States would be fruitless if allowance were not made for the fact that in most cases such municipal plants are confined to street lighting and may not do commercial business. Allowance must be made also for the fact that many municipal plants have had a struggle to exist in the face of unsympathetic public opinion. Again, in England consideration must be given to the fact that the municipal electric light and street railway plants have permanent rights, while the rights of the private companies operating these particular utilities are limited as to the length of their existence, many street railway franchises expiring twenty-one years after they were granted.

"Finally, not only must it be borne in mind that the social and political conditions which characterize the two countries find expression in their private and public systems, but we must consider the difference in the nature of the two peoples which causes them to adopt different ideas and views as to the expediency of certain things. In other words, a measure of success in the municipal management of public utilities in England should not be regarded as necessarily indicating that the municipal management of the same utilities in this country would be followed by a like measure of success. Conditions are quite different in the two countries.

"There are some general principles which we wish to present as practically the unanimous sentiment of our committee.

"First, we wish to emphasize the fact that the public utilities studied are so constituted that it is impossible for them to be regulated by competition. Therefore, they must be controlled and regulated by the government; or they must be left to do as they please; or they must be operated by the public. There is no other course. None of us is in favor of leaving them to their own will, and the question is whether it is better to regulate or to operate.

"There are no particular reasons why the financial results from private or public operation should be different if the conditions are the same. In each case it is a question of the proper man in charge of the business and of local conditions.

"We are of the opinion that a public utility which concerns the health of the citizens should not be left to individuals, where the temptation of profit might produce disastrous results, and therefore it is our judgment that undertakings in which the sanitary motive largely enters should be operated by the public.

"We have come to the conclusion that municipal ownership of public utilities should not be extended to revenue-producing industries which do not involve the public health, the public safety, public transportation, or the permanent occupation of public streets or grounds, and that municipal operation should not be undertaken solely for profit.

"We are also of the opinion that all future grants to private companies for the construction and operation of public utilities should be terminable after a certain fixed period, and that meanwhile cities should have the right to purchase the property for operation, lease or sale, paying its fair value.

"To carry out these recommendations effectively and to protect the rights of the people, we recommend that the various States should give to their municipalities the authority, upon popular vote under reasonable regulations, to build and operate public utilities, or to build and lease the same, or to take over works already constructed. In no other way can the people be put upon a fair trading basis and obtain from the individual companies such rights as they ought to have. We believe that this provision will tend to make it to the enlightened self-interest of the public utility companies to furnish adequate service upon fair terms, and to this extent will tend to render it unnecessary for the public to take over the existing utilities or to acquire new ones..

"Furthermore, we recommend that provision be made for a competent public authority, with power to require for all public utilities a uniform system of records and accounts, giving all financial data and all information concerning the quality of service and the cost thereof, which data shall be published and distributed to the public like other official reports; and also that no stock or bonds for public utilities shall be issued without the approval of some competent public authority.

"We also recommend the consideration of the sliding scale, which has proved successful in some cases in England with reference to gas and has been adopted in Boston. By this plan the authorized capitalization is settled by official investigation, and a standard rate of dividend is fixed, which may be increased only when the price of gas has been reduced. The subway contracts and their operation in Boston and New York are also entitled to full consideration.

"In case the management of public utilities is left with private companies, the public should retain in all cases an interest in the growth and profits of the future, either by a share of the profits or a reduction of the charges, the latter being preferable as it inures to the benefit of those who use the utilities, while a share of the profits benefits the taxpayers.

"Our investigations teach us that no municipal operation is likely to be highly successful that does not provide for:

"First—An executive manager with full responsibility, holding his position during good behavior.

"Second—Exclusion of political influence and personal favoritism from the management of the undertaking.

"Third—Separation of the finances of the undertaking from those of the rest of the city.

"Fourth—Exemption from the debt limit of the necessary bond issues for revenue-producing utilities, which shall be a first charge upon the property and revenues of such undertaking.

"We wish to bring to your consideration the danger here in the United States of turning over these public utilities to the present government of some of our cities. Some, we know, are well governed and the situation, on the whole,

seems to be improving, but they are not up to the government of British cities. We found in England and Scotland a high type of municipal government, which is the result of many years of struggle and improvement. Business men seem to take a pride in serving as city Councillors or Aldermen, and the government of such cities as Glasgow, Manchester, Birmingham and others includes many of the best citizens of the city. These conditions are distinctly favorable to municipal operation.

"In the United States, as is well known, there are many cities not in such a favorable condition. It is charged that the political activity of public service corporations has in many instances been responsible for the unwillingness or inability of American cities to secure a higher type of public service. This charge we believe to be true. However, there seems to be an idea with many people that the mere taking by the city of all its public utilities for municipal operation will at once result in ideal municipal government through the very necessity of putting honest and competent citizens in charge. While an increase in the number and importance of municipal functions may have a tendency to induce men of a higher type to become public officials, wo do not believe that this of itself will accomplish municipal reform. We are unable to recommend municipal ownership as a political panacea.

"In many cases in the United States the people have heedlessly given away their rights and reserved no sufficient power of control or regulation, and we believe that corruption of public servants has sprung, in large measure, from this condition of things. With the regulations that we have advised, with the publication of accounts and records and systematic control, the danger of the corruption of public officials is very much reduced."

The committee sums up its more important conclusions as follows:

"Public utilities, whether in public or private hands, are best conducted under a system of legalized and regulated monopoly.

"Public utilities in which the sanitary motive largely enters should be operated by the public.

"The success of municipal operation of public utilities depends upon the existence in the city of a high capacity for municipal government.

"Franchise grants to private corporations should be terminable after a fixed period and meanwhile subject to purchase at a fair value.

"Municipalities should have the power to enter the field of municipal ownership upon popular vote under reasonable regulation.

"Private companies operating public utilities should be subject to public regulation and examination under a system of uniform records and accounts and of full publicity."

On the general broad subject of municipalization, the committee reports that the general expediency of either private or public ownership is a question that must be determined by each municipality in the light of local conditions. "What may be possible in one locality may not be in another. In some cities the companies may so serve the public as to create no dissatisfaction, and nothing might be gained by experimenting with municipal ownership. Again, the government of one city may be good and capable of taking charge of these public utilities, while in another it may be the reverse. In either case the people must remember that it requires a large class of able men as city officials to look after these matters. They must also remember that municipal ownership will create a large class of employees who may have more or less political influence."

EXCEPTIONS

Messrs. Charles L. Edgar and William J. Clark present the following exceptions to the committee's report:

"We the undersigned dissent from the report of the investigating committee as follows:

"First—The report says:

" 'There are no particular reasons why the financial results from private or public operation should be different if the conditions are the same. In each case it is a question of the proper man in charge of the business and of local conditions.'

"We dissent from the implication in this paragraph that the conditions are or are likely to be the same.

"Second—The report says:

" 'We are of the opinion that a public utility which concerns the health of the citizens should not be left to individuals, where the temptation of profit might produce disastrous results, and therefore it is our judgment that undertakings in which the sanitary motive largely enters should be operated by the public.'

"We dissent from this conclusion as having been proved by our investigation. In our opinion, privately operated water systems were, especially as regards their consideration for the public health, as properly and successfully managed as the publicly operated water systems.

"Third—The report says:

" 'We have come to the conclusions that municipal ownership of public utilities should not be extended to revenue-producing industries which do not involve the public health, the public safety, public transportation, or the permanent occupation of public streets or grounds, and that municipal operation should not be solely for profit.'

"This sentence is so drawn that to a casual reader it implies that the opposite is advisable. From this we strongly dissent.

"Fourth—The report says:

" 'To carry out these recommendations effectively and to protect the rights of the people, we recommend that the various States should give to their municipalities the authority, upon popular vote under reasonable regulations, etc.'

"The words 'under reasonable regulations' were put into the report at the suggestion of Charles L. Edgar, and were intended by him to mean such regulations as would compel deliberate consideration not only by the people, but by their representatives, and would consequently prevent the superficial attractiveness of the scheme from overriding the 'sober second thought' of the people. We strongly dissent from any definition of 'regulations' which does not cover these points.

"Fifth—The second and fifth conclusions in the latter part of the report, being merely repetitions of previous statements, are, of course, subject to the same dissents."

MR. CLARK'S PAPER

Walton Clark, third vice-president of the United Gas Improvement Company, in a separate paper, sets forth his agreement with the other members of the committee that "companies entrusted with franchises and charters for the operation of so-called public service industries should be subject to regulation." He dissents, however, from the statement of the committee regarding waterworks, saying:

"Recognizing the almost supreme importance of an adequate and cheap supply of pure water, I dissent from one of

the recommendations of my associates, in effect that waterworks should be operated by public bodies. I dissent for the reason that my study of the report of the waterworks expert employed by your committee, and my personal investigations, lead me to the conclusion that the water companies have made the more intelligent efforts toward adequacy and purity of supply, and that, all conditions considered, the result of their efforts has been and is a better and cheaper water supply and service than that maintained by the municipal waterworks department."

Mr. Clark also dissents from the statement, speaking of politics in Glasgow, Manchester and Birmingham, that these conditions are distinctly favorable to municipal operation, if by this is meant a municipal ownership that may be favorably compared with private ownership, in the character of its results and in benefit to the city and citizens served. "My knowledge of the question," says Mr. Clark, "is had from personal investigation, and from a study of the reports of the experts employed by this Commission, and of the writings of members of the Commission. It leads me to the conclusion that the city and citizens of Glasgow, Manchester and Birmingham, as well as of the other municipalities investigated, are not so well served by their public service trading departments as the cities and citizens of London, Newcastle, Sheffield, Dublin and Norwich are by companies operating similar trading industries, and that there is no element of blessing in the municipalization in the former cities to compensate for the indifferent character of the service rendered."

On the general subject of municipal ownership, Mr. Clark says the investigation in which he has taken part has convinced him that municipal ownership has not proved equal to private ownership, in benefits to the consumer, citizen or city. He does not agree that the way should be left open for any municipality to undertake any trading operation, without special authorization by the legislature of the State wherein it is located. "I cannot believe," Mr. Clark declares, "that the prescribed remedy for any ill should be a worse ill, and I cannot recommend that a municipality suffering, or believing that it suffers, under public administration of a public utility, should be given the right to engage in the operation of such utility for itself, without such a course of procedure as will make sure that the sober second thought of the people shall have ample opportunity for development and expression, before the community is committed to municipal ownership with the accompanying dangers and difficulties, of which you are warned in the majority report.

"Because I believe that the general credit of municipalities should be conserved for the benefit of public and necessary improvements, from which, in the nature of things, private enterprise is excluded; and because I believe that a municipality should not, in any event, engage in any trading enterprise that will not pay its own way, and have the confidence of the citizens as financially sound, I think that municipalities should be prohibited by statute from making investments in trading operations, except with money borrowed on mortgage, or otherwise, the loan being secured by a lien on the plant in which it is invested, and on the right to operate the same, and on this only."

Mr. Clark dissents from the opinion that a city should have the right to purchase at its option the property of public service corporations for operation, lease or sale. He bases his opposition on the belief that it is practically impossible to secure private funds for investment in an enterprise subject to purchase by a municipality, at any date to be selected by the municipality, and because he believes that the impossibility of so securing private investment may, and often will, work a social harm to a community.

"I believe in State regulation and protection of public service companies," Mr. Clark continues. "I do not understand that your committee was charged with the duty of recommending to you a form of regulation. I know that your committee made no special study on this subject. Therefore I am not prepared to propose any detailed plan of regulation.

"Finally, regretting to be in any degree in conflict of opinion with my associates, I may still satisfy my sense of duty to my fellow-citizens and my sense of obligation to you for the honor of a share in this important work, by recording the conviction I am under at the close of this investigation.

"I am convinced that the condition of the British people, individually or collectively, has not been improved by the municipalization of the industries we have investigated.

"I believe that political and social conditions in the United States are less favorable to the success of municipal ownership than are the same conditions in Great Britain.

"I find this conclusion strengthened by our investigation into municipalized industries in the United States.

"I am convinced that, under American conditions, the system of private ownership of public utilities is best for the citizens and the consumers.

"I recommend State regulation and protection of public service companies, provided by statute, and as far as possible automatic in its application and operation."

THE HEALTH OF EMPLOYEES IN THE NEW YORK SUBWAY

Two years ago George A. Soper, Ph. D., was engaged by the New York Rapid Transit Commission to conduct an investigation into the sanitary conditions of the New York subway, with particular reference to the effect of the air upon the health of the employees. This investigation was made in 1905 and has resulted in two reports, one of which was published in abstract on page 906 of the STREET RAILWAY JOURNAL for May 25, 1907. In this report the author stated that the general air of the subway, although disagreeable, is not actually harmful, except possibly for the presence of iron dust, and that this latter point was then under special consideration.

The second report covering the effect of iron dust and the general health of the subway employees is summarized by Dr. Soper in the last issue of the "Technology Quarterly," and was based upon an investigation conducted in 1905-06. Physical examinations were made of a sufficient number of subway employees to determine the condition of the average man. Especial care was taken to look for early signs of diseases of the lungs, which exist to an excessive extent among persons engaged in dusty occupations. The condition of the air and the work of the men were also compared with the conditions which exist in such vocations as stone cutting, knife grinding, metal polishing and similar occupations in which a high mortality occurs.

An examination of the air in the subway showed the presence of a great deal of iron dust, as well as fragments of many kinds resulting from the wear and tear of the subway and the clothing of the passengers. The proportion of iron in the dust was large, however, and it was estimated that 25 tons of iron and steel were ground off the wheels,

brake-shoes and rails every month in the 21 miles of the subway. All of this does not float in the air, some of the pieces are so large that they fall immediately to the track and much becomes greasy and adhered to different surfaces with which it happened to come in contact. The amount of dust which would be breathed was not enough, however, to be injurious solely on account of its bulk and was considerably less than that in an iron foundry or an iron mill, the figures being, respectively, 72 to 100 hg., 14 mg. and 2.25 mg. per cubic meter. Little of this reaches the lungs which are protected in various ways against the entrance of dust particles from the air. Autopsies upon five employees were made.

The principal conclusions reached by the author concerning the various subjects dealt with in this investigation follow:

CONCLUSIONS

1. The air of the subway, as judged by analyses and by careful studies of the health of the men, was not injurious.

2. The most objectionable feature of the air was the dust, which consisted chiefly of angular particles of iron. It was possible, also, that injurious bacteria might sometimes be associated with these metallic particles. Lack of strict enforcement of the city ordinance against spitting, and the want of skillful care in cleaning the subway, made this danger greater than it need be.

3. The odor and heat of the subway, although very disagreeable, were not actually injurious to health. The strong draughts and changes of temperature which occurred at the stations were the most objectionable atmospheric conditions, so far as health was concerned.

4. The employees submitted by the company for physical examination were a particularly robust lot of men. From their excellent physique it appeared that they had been carefully selected, a fact which was explained when it was found that a large majority of the men had previously been engaged in railroading, where capacity to do hard manual labor was required. It was fair to assume that the employees examined represented a fair average of all those who came in close contact with the passengers, so far as resistance to disease was concerned.

5. There had been very little sickness among the employees during their period of subway employment, judging by the accounts which the men gave. No information with respect to this matter was obtainable from the operating company. Many of the men claimed to have gained weight since they had been working in the subway— a fact due, apparently, less to any peculiarly healthful property of the air than to the easier work repuired.

6. Most of the men spoke of drowsiness. This was perhaps to be explained by the comparative darkness of the subway, the nonotony of the work, and fatigue to the eyes. The drowsiness was never sufficient to keep the men from performing their duties properly.

7. A large number of employees complained of yellow stains which came upon their underclothing, as they supposed, from their sweat. This caused considerable inconvenience. The stains probably resulted from iron particles upon the body which were acted upon by the sweat. Investigation excluded the probability that the sweat itself was discolored.

8. Careful physical examinations showed that an excessive amount of dry pleurisy, without pain or other physical discomfort, existed among the men. Pleurisy occurred to the extent of 53 per cent among the employees and to the extent of 14½ per cent among persons not engaged in subway work. The cause of the dry pleurisy was not at first apparent, but upon investigation it appeared to have been in no way due to the subway. Nine per cent of the men had medical histories which accounted for their condition, and 28 per cent had worked for many years under conditions known to be favorable to the occurrence of this disease. The pleurisy had no visible effect upon the health of the men and was not likely to be injurious to them in the future.

9. Congestion and inflammation of the upper air passages were prevalent. Rhinitis and pharyngitis in acute or chronic form occurred in about 70 per cent of the men examined. Laryngitis was less common, occurring in about 55 per cent. These figures are somewhat above the normal considering the degree of severity represented. No case of bronchitis was discovered. The prevalence of the minor respiratory affections noted was due, apparently, more to the previous employments of the men than to their present surroundings, althougr the excessive use of the voice required of the conductors seemed likely to aggravate these affections.

10. Analyses of the sputum, urine and sweat of the men showed that iron dust was given off only in the sputum. This sputum was derived mostly from the mouth and throat, where most of the iron particles drawn in with the inspired air were caught.

11. The findings at autopsy threw no light upon the possibly evil effects of the dust. The men whose bodies were examined had worked too short a time in the subway for information of value in this direction to be obtainable. Iron was found in the lungs of all, but to an extent which had produced no evil consequences.

RECOMMENDATIONS

Certain specific recommendations seemed to be required, under the circumstances:

1. Care should be taken that persons employed in the subway are free from respiratory disease or a tendency toward it. This rule should be extended to all grades and positions and made to apply, also, to the women who operate the news stands.

2. Thorough physical examinations, especially of the respiratory apparatus and heart, should be made of all employees when they are first engaged and at yearly intervals subsequently.

3. While the dust was not proved to have produced harmful results, sanitary considerations require that it should be prevented, as far as practicable,, from getting into the air. To this end (a) sand and a sawdust should not purposely be scattered on the stairways and platforms, as at present; (b) sweeping and cleaning should be done in a more strictly sanitary manner, preferably in accordance with the recommendations of the advisory board of the Department of Health; and (c) investigations should be made to determine whether it is feasible to reduce or collect much of the iron dust.

4. The city ordinance against spitting should be enforced to the letter. Although some progress has already been made in preventing it, spitting is still practiced occasionally on the platforms and on the roadbed. Not only passengers, but employees are offenders in this direction.

The Sandusky-Fremont branch of the Lake Shore Electric is now in operation. It makes possible through Cleveland-Toledo cars via Sandusky without doubling on the route.

ESTIMATED COST OF ELECTRIFYING THE BERLIN RING AND STADTBAHN

Dr. W. Reichel, professor at the Berlin Technical High School and also well known as a railway engineer, recently completed an elaborate study demonstrating the desirability of electrifying a number of Berlin steam suburban lines, the Stadtbahn, a connecting line extending through the city, and the Ringbahn, a connecting belt line around the city. Included in Dr. Reichel's essay are the following figures covering the estimated first cost, wages, maintenance and depreciation. It is assumed that 152 kms. (94.25 miles) are to be electrified. Two 30,000-kw. stations are provided, but one of these is considered principally as a reserve. The estimate based upon the use of alternating-current motors.

INSTALLATION COST

Two 30,000-kw. power stations, each containing six 5,000-kw. turbo-generators at $87.50 per kw.	$7,250,000
Fourteen sub-stations, 100,000 K. V. A. capacity at $7.50 per K. V. A.	750,000
City track (12.4 miles) with tubular poles	
Remaining track (111.6 miles) with lattice poles	900,000
Transmission wires (10,000 to 20,000-volts) 12.4 miles	125,000
Bare feeders (40,000-volts) 12.4 miles	200,000
120 trains consisting of four new motor cars and rebuilt trailers	12,600,000
Miscellaneous	50,000
Total	$20,000,000

Considering the cost of the proposed electrification, Dr. Reichel does not think the estimated cost too high to be impracticable from an economical standpoint, citing, as an instance, the Leipzig railway terminal, which cost over $30,000,000. He states that this estimate includes the cost of considerable additions to the rolling stock which would have to be made whether electrification took place or not.

OPERATING COST

The author states that it is impossible to forecast the operating expenses exactly, but an approximation is attempted by assuming that 39,000,000 kms (24,180 train miles) would be operated. Last summer the actual train km were 26,000 (16,120 train miles).

EMPLOYEES

600 motormen and trainmen (including pension allowance)	$450,000
Car cleaners	100,000
Switchmen and signalmen (including general maintenance	600,000
Truckmen and miscellaneous	100,000
General management	125,000
Total	$1,375,000

COST OF POWER

170,000,000-kw-hours, coal, oil, wages and maintenance	$1,000,000
Maintenance and lubrication of trains	875,000
Maintenance of transmission system, including transformers	42,500
Track maintenance throughout	332,500
Total	$2,250,000

DEPRECIATION

Power house electrical machinery and cars, 4 per cent of $20,000,000	$800,000
Track, 4 per cent of $7,500,000	312,500
Buildings, ½ of 1 per cent of $27,500,000	137,500
Total	$1,250,000

GRAND TOTAL

Employees	$1,375,000
Power, material, etc.	2,250,000
Depreciation	1,250,000
Total	$4,875,000

In figuring the cost of operation, the power plants are valued at $35,000,000.

To find whether the electrified line would pay, the total annual cost of $4,875,000 for 39,000 train-kms must be compared with the income from 300,000,000 passengers. If the average fare from each passenger is 2¼ cents, the annual income would be $6,750,000. This is equivalent to $1,875,00 on $35,000,000 + $20,000,000, or $55,000,000, which gives 3½ per cent. If the usual reduced rate tickets were sold, however, the income per passenger would drop to 1¾ cents and the total income would be reduced to $5,250,000. The interest rate would then be so low (.7 per cent) as to make the electrification impracticable. Dr. Reichel, therefore recommends that no reduced rates should be given, following the practice of the Berlin elevated railway; the system would then pay.

THE FIRE PROBLEM OF CAR HOUSES

BY P. J. McKEON

Many of the fires in street railway car houses which have been so prevalent lately are the inevitable result of a too frequent neglect of the fire danger. Conditions in many car houses are left to take care of themselves, or the responsibility for the fire safety of the buildings is put on a man who is already preoccupied with his usual duties, and, moreover, can hardly be expected to be familiar with the special necessities of fire prevention. For instance, an examination of a car house which was destroyed by fire during the last twelve months reveals a brick division wall between two bays, but with the openings not protected. If this wall had been made a fire stop, at least half of the building could have been saved. In another case the nearest hydrant to the fire was some 500 ft. away. In an existing car house with which the writer is acquainted the only way for the firemen to get upstairs is by a single iron ladder hidden away in the building so that only those who are acquainted with the premises know where it is located.

The problem of car house protection is especially troublesome because the use of electricity involves a source of fire that is difficult to regulate and which calls for a high degree of care and attention in construction and inspection. Moreover, the necessity for repair work, such as painting and carpentery, and the cleaning operations, introduce many fire causes, while the presence of numerous employees means another source of danger.

Operating necessities call for large open structures, and this feature, joined with the inflammable quality of the cars, seriously complicates the putting out of a fire. The average car house exceeds 100 ft. x 100 ft., or 10,000 sq. ft., and a fire in this area quickly gets beyond the control of the firemen unless they arrive promptly after it has started. The smoke fills the building rapidly, and it is difficult for the firemen to get close enough to it to direct their hose streams. The fire is thus enabled to get a start and in a few minutes will spread throughout the building and the firemen are forced to fight it from the street, which means that it is only a question of minutes before the whole structure will collapse. The large area as a handicap to firemen is supplemented by the construction of the cars. They are simply huge wooden crates with considerable hollow space made

by the seats and the compartments. The openness of the cars creates a natural draft which helps the action of the fire, while the amount of varnished woodwork in a car hastens the spread of the flames. A car not only burns quickly and fiercely, but it is difficult to extinguish. Hose streams, except at a short distance, are broken by the framework and lose their effectiveness. To put out a fire, the whole car has to be pulled apart and the fire extinguished piecemeal.

In the improvement of car houses from the fire standpoint, the cutting down of the area of the building is a prime essential. This is advocated by the insurance interests as an underwriting measure, but it is also a necessity as an assistance to the firemen. The proposal is sometimes opposed by managers on the ground of operating necessities, but a study of car house design will invariably show ways of increasing fire safety without interfering with the running of the cars. Automatic sprinklers are now coming into extended use and will soon come to be considered as indispensable for car houses as they are in mills and department stores. Their use, however, often tends to a neglect of other precautionary measures which should not be overlooked. These latter include the proper construction of the building with a view to stopping the spread of fire, care and maintenance with a view to removing the preventable causes of fire, and an efficient system of fire inspection. A fire in a car house means a loss that cannot even partially be covered by insurance, and this makes it all the more necessary for street railway companies to follow the principle of self-protection against fire.

MEETING OF STANDARDIZATION COMMITTEE

A meeting of the committee on standards of the American Street and Interurban Railway Engineering Association was held at the Hollenden Hotel, Cleveland, on July 26 and 27. The meeting was called by the chairman, W. H. Evans, of the International Traction Company, of Buffalo, who announced the subjects assigned to the committee to be considered at this meeting were as follows::

1. "Standard Axles, Journals, Journal Bearings and Journal Boxes."

2. "Standard Brake-Shoes, Brake-Shoe Heads and Keys."

3. "Standard Sections of Treads and Flanges of Wheel."

The meeting was also attended by the sub-committee on standard rails of the way committee of the Engineering Association, on account of the close relation of rails and special work with the most desirable flange and tread of wheel to adopt. The members of the standardization committee in attendance were Messrs. W. H. Evans, of Buffalo; R. C. Taylor, of Anderson, Ind.; J. M. Larned, of Pittsburg; H. W. Blake, of New York, and C. B. Fairchild, Jr., of Cleveland. Messrs. Wallerstedt, Benedict and Fleming found it impossible to be present. The way committee was represented by Fred G. Simmons, of Milwaukee; Charles A. Clark, of Buffalo; Julian Griggs, of the Scioto Valley Traction Company, of Columbus, and E. O. Ackerman, of the Columbus Railway & Light Company, Columbus. H. H. Adams, president of the American Street and Interurban Railway Engineering Association and B. V. Swenson, secretary of the American Street and Interurban Railway Association, were also in attendance.

Upon invitation a number of representatives of the principal manufacturers of trucks, journal boxes, brake-shoes, motors, wheels, etc., were present. Among those who took part in the discussion were the following:

Representing the brake-shoe industry, F. W. Sargent, chief engineer, and J. S. Thompson, engineer of the Chicago office of the American Brake Shoe & Foundry Company; A. G. Olberding, president of the Columbia Brake Shoe & Foundry Company.

Representing the cast wheel manufacturers, P. H. Griffin, general manager of the New York Car Wheel Works, and J. B. Rhoades, president of the National Car Wheel Company.

Representing the steel wheel manufacturers, N. B. Triste, of the Schoen Steel Wheel Company, and E. Sidney Lewis, of the Standard Steel Works.

Representing the electrical manufacturers, E. D. Priest, of the General Electric Company, and N. W. Storer, of the Westinghouse Electric & Manufacturing Company.

Representing the journal box manufacturers, A. H. Weston, of the T. H. Symington Company.

Representing the truck builders, Walter S. Adams, of the J. G. Brill Company.

Representing the manufacturers of rails and special work, Victor Angerer, of Wm. Wharton, Jr., & Company; William C. Cuntz, of the Pennsylvania Steel Company, and E. B. Entwistle, of the Lorain Steel Company.

On Friday morning the subject of axles was continued. On Friday afternoon, journals, journal boxes, brake-shoes, heads and keys were taken up. On Saturday morning the subject of wheels was considered, and on Saturday afternoon the whole subject was reviewed.

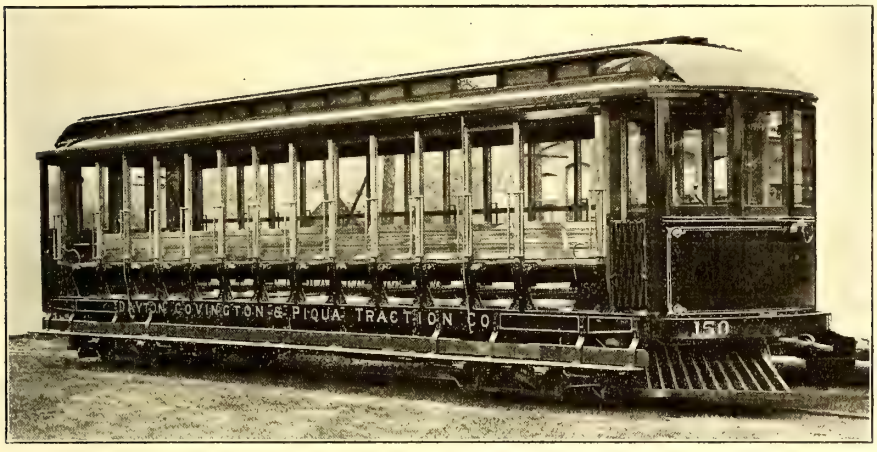
The work of selecting standards was very materially advanced by the discussion, but it was decided not to take final action on the recommendations of the committee until after another joint meeting to be held by the committee and the representatives of the manufacturers on Sept. 13 and 14 in New York. A detailed account of the decisions reached at the Cleveland meeting will be published in an early issue of this paper.

Through the courtesy of a number of supply men in Cleveland, those who attended the meeting were entertained Friday evening at White's restaurant, near Elyria, at a dinner. The guests were conveyed by a special car on the Cleveland & Southwestern Railway, furnished through C. N. Wilcoxen, general superintendent of the company.

The last link of the trolley system joining New York to Lewiston and Bath, Maine, was forged on Sunday, July 20, when, as previously stated in the Street Railway Journal, the Atlantic Shore Line Railway was opened between York Beach and Kennebunk. Two years ago the Atlantic Shore line, which had built a road from Sanford, Kennebunk, Cape Porpoise and Biddeford, purchased the Portsmouth, Dover & York Electric Railway, and all became known as the Atlantic Shore Line, with two divisions. Plans were made at once to connect the two divisions and at the same time supply the missing link in the trolley system. To do this it was necessary to build a road 15½ miles long. The work was started a year ago. A physical connection has been made with the Boston & Maine Railroad at Wells depot, so that freight cars can be shifted to the electric road. The line from York Beach to the junction of the old line at Kennebunk is just 16½ miles long. The company has three electric locomotives which are used for hauling freight and express. The power for this new link of road is obtained from a waterpower at Old Falls, in Kennebunk, of 2000 hp, and a lesser one at Stanford. There is also a steam plant of 500 hp at Kennebunk, besides the steam plant of the old western division at Kittery Point.

NEW CARS FOR THE DAYTON, COVINGTON & PIQUA RAILWAY

The Wason Manufacturing Company has recently delivered to the Dayton, Covington & Piqua Railway a number of open-vestibuled cars, one of which is shown in the illustration. The short platforms indicate that none but the motorman and conductor will stand on these places. Attention is called to the style of grab handle used, which, in addition to keeping down the over all dimensions of the car, affords a safer and more convenient hold than the single type of grab handle. It is not always that both vestibules and bulkheads are furnished in cars of this class, but when they are, as in the present case, the passengers are protected the more in inclement weather. The steam car roof was adopted because it is considered to afford better protection than the usual monitor deck. Mahogany forms the interior finish; ceilings are of maple. The trucks are the builder's 21-A type with 4-ft. wheel base; the motors are of 50-hp capacity each. The chief dimensions follow: Length over end posts, 35 ft. 2 ins.; over vestibules, 41 ft. 6 ins.; width over sills, including sheathing, 7 ft. 1 in.; size of side sills, 5½ ins. x 8¼ ins.; end sills, 3¾ ins. x 8½ ins.; sill plates, 8 ins. x ¾ in.



CAR FOR DAYTON, COVINGTON & PIQUA COMPANY

The line over which the cars described will run is one of the network of interurban roads converging at Dayton. Covington is in the neighborhood of 25 miles from Dayton, and midway between these points is the company's power station at West Milton; from Covington to Piqua is another 8 miles. At West Milton is also located an amusement park, owned by the traction company, to which property many additions have been added this year. At Piqua, electric railway connections can be made with various points north, including Toledo via Lima and Findlay.

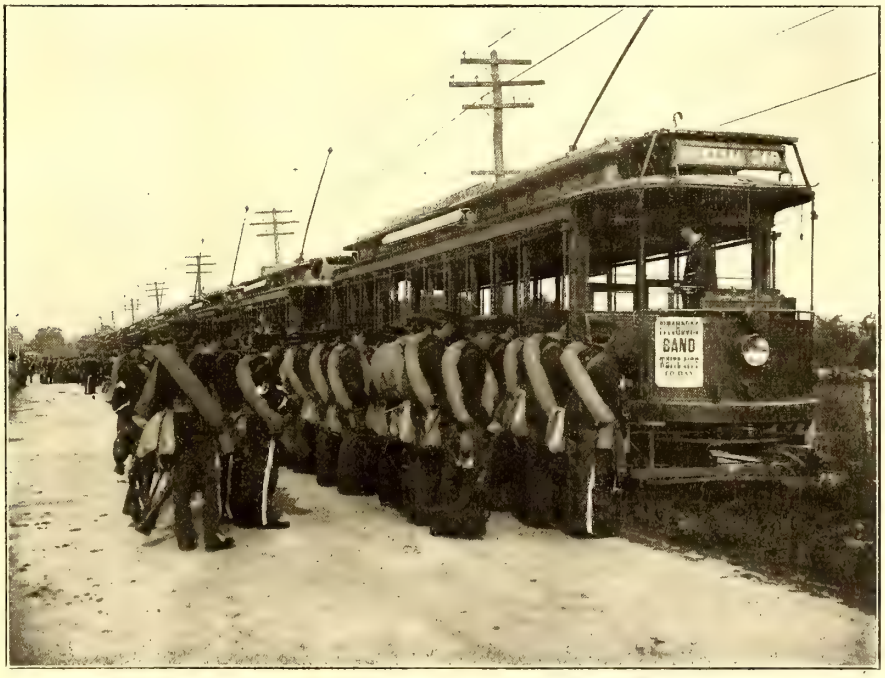
It is reported that the City Council has agreed to the combining of all lines owned by the Canadian Railway, Light & Power Company in Rio de Janeiro.

A TOURIST BUREAU IN BOSTON

A general tourist information bureau has been established in the Old Colony Bookstore Building, corner of Washington and School Streets, Boston, under the management of Thomas P. Patrick and Robert H. Derrah, both of whom are well known in railway circles. Mr. Derrah began his railway carreer with the West End Railway Company sixteen years ago in the office of Henry M. Whitney, where he remained for ten years. He was also passenger agent of the Boston & North and Old Colony Street Railways. His street railway guide has been a standard publication for many years. Mr. Patrick was connected with the Southern Pacific and other steam railroads as traveling passenger agent for fifteen years. This office will furnish information regarding trolley, steam, steamship lines, summer hotels, seashore and country resorts, etc.

HANDLING TROOPS ON THE BOSTON & WORCESTER RAILWAY

The handling of troops on the Boston & Worcester Street Railway plays quite an important part in the company's business. Last season 110 carloads of soldiers were dispatched over the lines, consisting of three entire regiments, and the majority of other regiments in camp at the time. The cars used for this service were built by the J. G. Brill Company and contain the builder's "Narragansett" double-step feature which tends greatly to facilitate the handling of just such crowds as mentioned. Seven new cars of this type have just been put on the lines and are generally similar to those illustrated, although they have the added comfort of spring-cane cushions. The cars are mounted on the 27-FE1 truck and measure over the bulkheads 37 ft. 5¼ ins., and 44 ft. 3¼ ins. over the vestibule sheathing.



HANDLING TROOPS ON THE BOSTON & WORCESTER RAILWAY

A PLAN FOR NOTIFYING PASSENGERS WHERE THERE ARE VACANT SEATS

The Cleveland Electric Railway Company has announced through its organ, "The Trolley," that the question will be taken up by the company of facilitating the loading of open cars by means of a series of signals indicating to passengers the location of empty seats. The delay caused by passengers scanning a car for seats has always been a source of annoyance in the operation of open cars, and the result of the Cleveland experiment will be watched with interest.

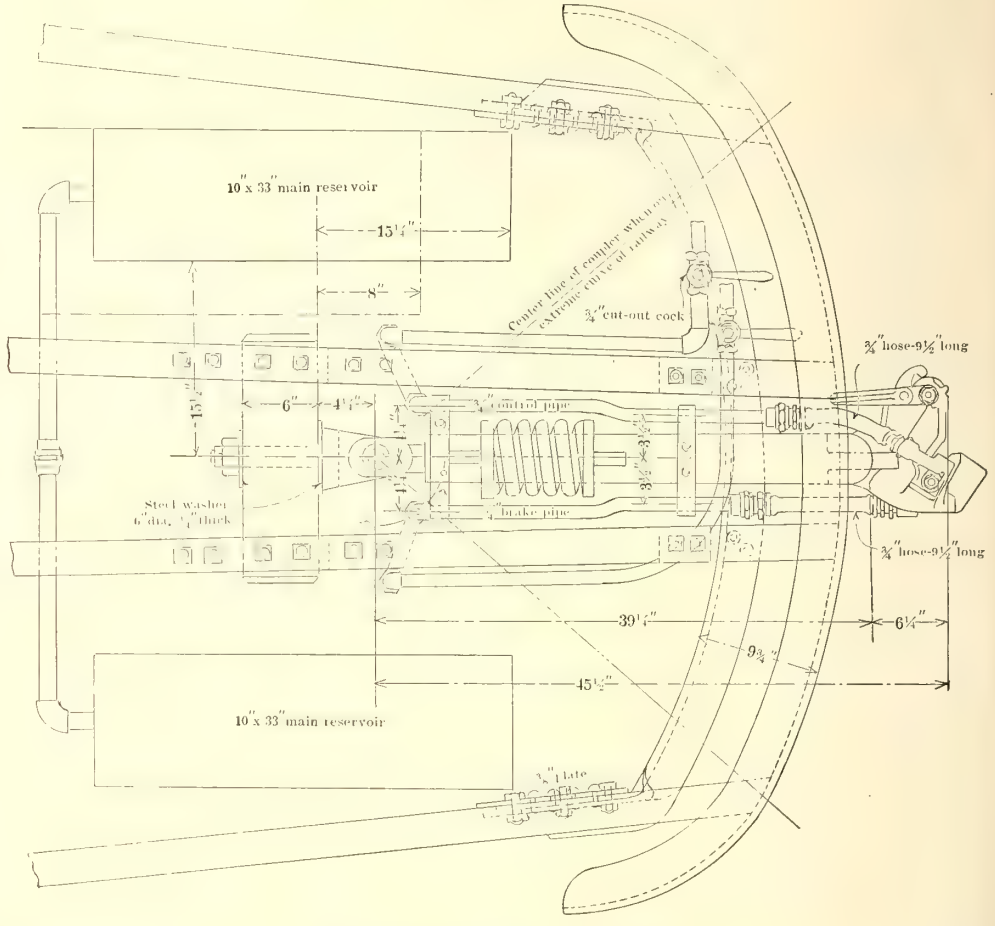
The decision to consider a plan of this kind is the result of a competition recently conducted by the company in which a prize of $25 was offered for the best practical suggestion for service betterment. The suggestion that won the prize follows:

"During the summer months, when open cars are run, much time is lost while prospective passengers look for seats. Frequently passengers walk on the street almost the full length of the car and then finally crowd into a row already fully occupied, while there are seats in neighboring rows. To overcome this, have each row of seats plainly numbered, where the numbers can be read from the street. Make it the duty of the conductor, as the car approaches a transfer point, to note in which rows there are vacant seats, and then let him notify passengers by numbers where the vacant seats are located. This will save time and will prevent much unnecessary standing, especially by women, who cannot climb along the running board after the car is in motion."

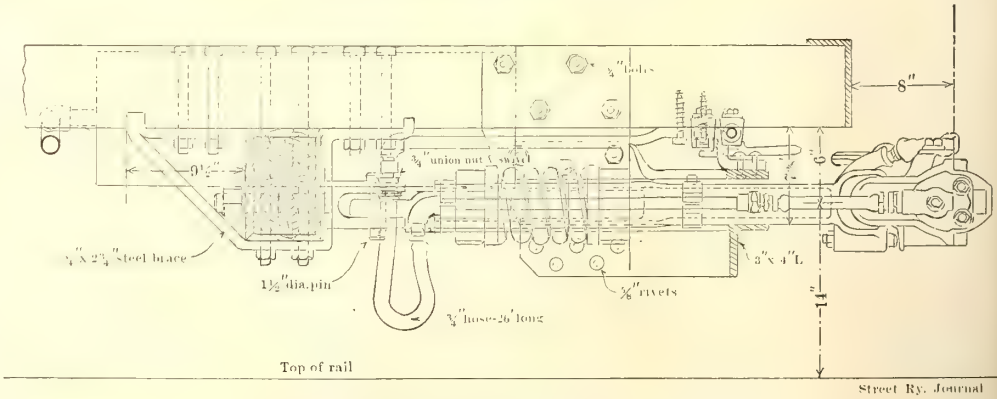
It is announced that the Manhattan Transit Company, of New York, will begin in September the operation of a line of gasoline autobuses from the Cortlandt Street Ferry across the Brooklyn Bridge to the Flatbush Avenue station of the Long Island Railroad. The company will also run a line on Fifth Avenue, from 125th Street to Fourteenth Street, and thence across town on both East and West Fourteenth Street, and from Fourteenth Street down Broadway to the City Hall and across the Brooklyn Bridge to the Brooklyn Borough Hall. The company is to start with twenty 'buses.

AUTOMATIC CAR AND AIR COUPLER

An account was published in the Street Railway Journal for June 29 of the combination car and air coupler recently designed for electric traction service by the Westinghouse Air Brake Company, and exhibited at the Lake Champlain convention of the Street Railway Association of the State of New York. It is possible in this issue to present side elevation and plans of the coupler, indicating its construction.



PLAN OF CAR AND AIR COUPLER

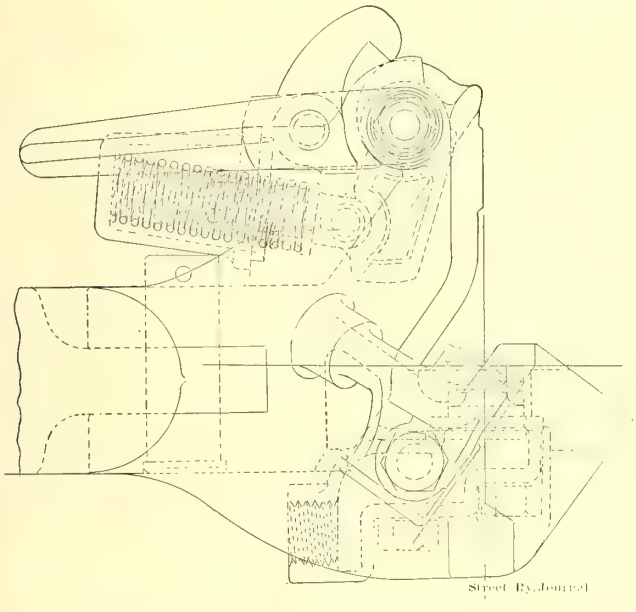


SIDE ELEVATION OF CAR AND AIR COUPLER

As stated previously, the coupler is suitable for the short radius curves and sharp changes in grade encountered in electric traction work. It is of cast steel and as shown is hollow to provide for one of the air couplings, the other being on the top of the draw-head. The heads are coupled by two cams, each of which engages with the surface of the opposite coupler so that a double positive locking is secured.

The heads of the draw-bars are so pointed that even if they are out of alignment 6 ins. or 7 ins. on a horizontal plane or 1½ ins. in a vertical plane, they will come together and automatically lock into each other. The air connections are provided with the usual rubber gaskets which are not subject to sliding wear, but to direct compression. The other features of the coupler and the places in which it is in use, including Boston and New York City, were published in the previous issue referred to.

The coupler possesses all the advantages of an automatic



DETAIL PLAN VIEW OF COUPLER

coupler, such as a saving in time and the elimination of danger to employees. Other special advantages claimed for it are that the car and air connections are made and unmade simultaneously, that cars varying in height can be coupled or uncoupled on straight or curved track, and when coupled all slack is eliminated; that the air connections are always accessible, and that if the lock on one coupler should become disarranged the other will prevent the cars from becoming uncoupled except in the usual manner.

ILLINOIS TRACTION COMPANY BEGINS INTERURBAN SLEEPING CAR SERVICE

The Illinois Traction Company has put in service two interurban sleeping cars between Bloomington, Ill., and St. Louis via Decatur and Springfield. The cars were built in the shops of the company in Bloomington. They are of attractive design and are well equipped in every particular. The floor of the car is double and is packed with mineral wool to deaden the sound. The windows are of double plate, and the wiring is carried in conduits. The interior of the car is very interesting. All old ideas and methods in the arrangements of berths have been obliterated. Each double berth is a stateroom in itself. There are two chairs in each section, and the combination of the two make up the lower berth. The upper berth is secured by lowering the frame from the upper part of the car. There is a space of 12 ins. between the curtain and the edge of the couch. The curtains are of wood covered on the inside with flowered cretonne, and on the outside with cloth. They roll up by means of spring rollers and are completely hidden from view during the day. There is a four-lamp series of incandescent bulbs for each berth. There are twenty berths, ten on each side, and in addition there are four comfortable chairs in the smoking room. The sleepers are now making alternate trips between Bloomington and St. Louis, one leaving each city every night.

QUARTERLY MEETING OF NEW YORK STATE ASSOCIATION

The next or fifth quarterly meeting of the Street Railway Association of the State of New York will be held at Kingston, N. Y., Sept. 21, 1907. The subjects selected for discussion are: "Interurban Rules," "Express Rates and Service," "Collection and Registration of Interurban Fares." These are particularly live subjects just at the present time, and it is thought there will be a large attendance.

PROGRESS ON THE NEW BOSTON POWER HOUSES

The Stone & Webster Engineering Corporation, of Boston, reports that work is progressing rapidly on the Boston Elevated Railway Company's power stations at Charlestown, Lincoln Wharf and Cambridge. The Charlestown power station is an extension of the present station with room for two 2700-kw vertical engine driven units, and eight 600-hp boilers. Only half of this equipment is being put in at present however. The building walls are up and the roof is on, and the chimney, 12 ft. in diameter by 200 ft. high, is practically completed. Four Babcock & Wilcox boilers have been erected and are nearly ready for brickwork and piping connections. The erection of the piping is already under way. All machinery foundations are in place, and the main driving shaft of the engine and the armature spider for the generator have arrived and will be placed within a few days. Work upon the engine, which is being built by McIntosh, Seymour & Company, of Auburn, N. Y., is being pushed forward as fast as possible. It is planned to have this station in complete operation about Nov. 1.

The extension to the Lincoln Station will contain 5400 kw in apparatus made up of two units of 2700 kw each. The engines are of the vertical Corliss type, made by the William Tod Company, of Youngstown, Ohio. The base plates and shaft for the first engine have arrived and are now being erected. The spider for the first generator is also on the ground, and the work of building up the armature will proceed as soon as the shaft is placed in its bearings. It is expected that the second engine will come forward in August. There will be eight 600-hp Babcock & Wilcox boilers in this new portion of the station. The chimney, 13 ft. in diameter by 250 ft. high, is completed and awaits the flue connections.

Owing to delays in securing permits to build from the Cambridge city authorities, work on the Harvard Square power station was not started until seven weeks after the other two jobs, and the station is, therefore, not so far advanced. The foundations are in, the structural steel erected, and the masons are at work on the brick superstructure, which will be pushed forward as rapidly as possible, and the building got ready for machinery about Aug. 15.

In addition to the above work, the Stone & Webster Engineering Corporation has in hand a wharf and a 5000-ton elevated coal pocket with tracks, conveyors, etc., for the Boston Elevated Railway Company. Plans are nearly completed for this work, and construction will be started as soon as the material can be obtained.

LEGAL DEPARTMENT*

SAFETY AND HEALTH APPLIANCES

The case of Beaumont Traction Company vs. State in the Court of Civil Appeals of Texas (103 S. W. 238), is a recent illustration of a class of decisions holding that it is within the police power of a State to enact that a street railway company shall provide its cars with appliances that are reasonably necessary for preserving the health of employees operating them. This case passed upon a statute requiring the equipment of cars with vestibules during the winter months for the protection of motormen from the weather, and it was held that the law was constitutional. The court cites and relies upon State vs. Whitaker (160 Mo. 59), in which it was held that a statute directing companies owning or operating electric street railways to provide their cars with screens for the protection of motormen during certain cold months, and applying to every part of the State alike, is not unconstitutional as class legislation, simply because it applies only to electric cars, and not to cable cars. In the course of its opinion in the Whitaker case the Supreme Court of Missouri observed:

Learned counsel urge, however, that courts "are not required to shut their eyes to matters of common knowledge or things in common use." Conceding this, is it not generally known that on a cable car the gripman stands back near the center of the car, in a box which protects the lower half of his body, and is protected by the roof of the car in rainy or snowy weather, and that this grip car is constantly used by passengers in getting on and off the train, whereas the motorman on an electric car stands in front, with his attention necessarily given to the means of controlling the motive power and the brake, and is much more exposed to the cold and inclement weather of our winters than the gripman on the cable car, and are we to assume the Legislature did not consider this difference, or their finding that there was such a distinction was contrary to the fact beyond a reasonable doubt? We think not. It cannot be questioned that in the exercise of its police power the Legislature may enact laws to protect the health and safety of our citizens by all reasonable regulations and when a given subject is within that power, the extent to which it is to be exercised is within the discretion of the Legislature. It is not insisted that it is not a wise and most humane provision for the protection of those whose avocation requires them to stand in front of a rapidly moving car on a bitter cold day, often with the mercury below zero, but merely that it does not apply to all who may suffer in similar callings.

We think the Legislature had the right to make the classification it did, and we have no power to hold it contravened the Constitution in so doing.

These decisions are similar to those in which special regulations of hours of labor for laborers in mines are held valid under the police power. Classifications and distinctions which are merely arbitrary are properly condemned as denying the equal protection of the laws. But when a legislative measure aiming at the conservation of the safety and health of a class of workmen may be seen to have some special and apparently substantial relation to the physical conditions under which their work is performed, the statute will usually be upheld as constitutional.

The Supreme Court of the United States has held that legislation restricting hours of labor by employees of bakeries is not within the police power, because the conditions under which they work are not extraordinary. Whether a given statute will be treated as valid or invalid, must, of course, depend upon the circumstances of the case. In many localities motormen of street cars are subjected at times to greater extremes of cold than bakers are to extremes of heat. It is believed that "vestibule" and "screen" legislation for the protection of employees of trolley cars will generally be held within the police power.

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LIABILITY FOR NEGLIGENCE.

KENTUCKY.—Carriers—Injury to Passenger—Setting Down Passenger — Contributory Negligence — Evidence — Sufficiency.

1. A passenger on a street car at night informed the conductor that he desired to alight at a certain street, but he was carried by, and the conductor then refused to back the car or to permit the passenger to remain on the car until it returned to the desired street, but instructed plaintiff to walk to a certain light, which he pointed out, and then turn in a certain direction, stating that such course would take the passenger to his destination, and the passenger, while following such directions, walked upon a trestle and fell through it, whereby he was injured, not having known, owing to the darkness, that he was on a trestle when he fell, held, that the carrier was liable, as it was its duty to see that the passenger got safely to the desired street.

2. The evidence was sufficient to sustain a finding that the passenger was not guilty of contributory negligence.—(Kentucky & I. Bridge & Ry. Co. vs, 100 S. W. Rep., 328.)

MASSACHUSETTS.—Street Railways—Injury to Persons Crossing Track—Contributory Negligence.

A verdict was properly directed for a street railway company, where plaintiff sued for injuries received by being struck by a car while crossing the track to board a car going in the opposite direction, where he could have seen the approaching car had he looked.—(Fitzgerald vs. Boston Elevated Ry. Co., 80 N. E. Rep., 224.)

MASSACHUSETTS.—Carriers—Injuries to Passenger—Contributory Negligence.

1. A street car passenger was knocked from the running board of a car by the sudden starting of the car after it had slowed down. He was accustomed to ride on cars and knew that the car would not stop until it reached a particular point. After the car had slowed down he reached for a package, and as he clasped it there was a plunge forward of the car. There was no defect in the car or tracks, and there was no evidence of incompetency of the servants. Held insufficient as a matter of law to show negligence on the part of the company.

2. A street car passenger was, without negligence on the part of the company, knocked from the running board where he was standing, and a fellow passenger in a collision with him was knocked off and injured. Held, that the fellow passenger could not recover from the company for the injuries received.—(Sanderson vs. Boston Elevated Ry. Co., Atchison, vs. Same, 80 N. E. Rep., 516.)

MASSACHUSETTS.—Courts—Federal Courts—Authority of Decisions of State Courts—Street Railways—Injury to Person at Highway Crossing—Contributory Negligence—Question for Jury.

1. Upon the question of the care required of a traveler on a highway on approaching a street railway crossing, the local decisions are persuasive in a Federal Court.

2. A buggy in which plaintiff was driving was struck by a street car on defendant's line upon a highway crossing. When plaintiff passed a building 33 ft. from the track, he could see along the track in the direction from which the car came but 60 ft., because of an intervening building; while at a distance of 20 ft. from the track he could see 1200 ft. At some point after passing the building not precisely shown, he looked up the track and did not see nor hear any car approaching. There was evidence tending to show, and which justified a finding, that the car was being run at excessive speed. Held that, under the law of Massachusetts as established by decision, the question of plaintiff's contributory negligence was one for the jury.—(Milford & U. St. Ry. Co. vs. Cline, 150 Fed. Rep., 325.)

MASSACHUSETTS.—Street Railways—Injuries to Lineman — Warning — Contributory Negligence — Evidence — Opinion Evidence—Facts or Conclusions—Notice—Custom—Surroundings—Appeal—Exceptions—Necessity.

1. Plaintiff, a telegraph lineman, incumbered by a hand line attached to a coil of wire, was directed to climb a crooked telegraph pole, located between the double tracks of defendant street railway. Before he started to ascend he saw defendant's car, which afterwards struck him, approaching at a distance of 150 ft., and appearing to be going at about 10 m. p. h. Plaintiff did not notice that the pole slanted toward the track on which the car was running, but relied on his foreman to notify the car to stop or notify him of any impending peril while he was on the pole. This the foreman did not do, and, as plaintiff

climbed to the center of the curve of the pole, the roof of the car struck his hips and threw him to the ground. Held, that plaintiff was entitled to rely on his foreman to protect him from danger, though the foreman was not in any manner connected with defendant, and that plaintiff was, therefore, not guilty of contributory negligence as a matter of law.

2. Where plaintiff, a telegraph lineman, was struck and thrown from a curved telegraph pole by a passing street car as he was ascending the pole, his answer, when asked why he went up the side of the pole that he did, that it "was the safe side to go," should be construed to mean that he so understood it at the time, and was therefore admissible as a reason for his act.

3. In an action for injuries to a telegraph lineman by being struck by a street car while he was climbing a telegraph pole, evidence as to a custom of giving notice of danger to linemen by men on the ground was admissible, as bearing on the issue of plaintiff's due care, though the action was not against plaintiff's employer.

4. In an action for injuries to a telegraph lineman by being struck and thrown from a pole by defendant's street car, evidence that flags were stationed to notify people, and particularly cars, that there was dangerous construction going on, was admissible to show the surrounding conditions.

5. An objection to the court's charge cannot be reviewed on exceptions, where no exception was taken thereto. —(Ahearn vs. Boston Elevated Ry. Co.,80 N. E. Rep., 217.)

MASSACHUSETTS.—Carriers—Street Car Passengers—Duty of Conductor.

Though a street car conductor's duty towards an alighting passenger is not discharged by merely waiting a reasonable time before starting the car, and he must exercise reasonable care to see that the passenger is off the car before starting it, he is not bound to see that the passenger has alighted, being required only to exercise the highest degree of care consistent with the proper transaction of the company's business.—(Millmore vs. Boston Elevated Ry. Co., 80 N. E. Rep., 445.)

MASSACHUSETTS.—Municipal Corporations—Street Alterations—Closing to Travel—Barriers—Contributory Negligence.

Where a city and a street car company, while paving a street at a crossing, placed suitable barriers to warn the public that the street was closed to travel, they were not liable to plaintiff, who passed such barriers on a bicycle and was injured by falling over an obstruction onto the street car tracks.—(MacFarlane vs. Boston Elevated Ry. Co., Same vs. City of Cambridge, 80 N. E. Rep., 447.)

MASSACHUSETTS.—Carriers—Street Railroads—Injuries to Passengers—Negligence.

Plaintiff, a street car passenger, was required to transfer from one car to another, because of repairs being made by another street railway company in the street. As plaintiff stepped down from the car, the ground under her sunk in somewhat and she was thrown to the ground. Plaintiff testified that when she started to alight it appeared to her that everything was all right, and there was nothing with reference to the character of the street to show that the conductor should have known that the ground was defective. Held, that such facts were insufficient to show negligence on the part of the carrier.—(Rose vs. Boston & N. St. Ry. Co., 80 N. E. Rep., 580.)

MICHIGAN.—Street Railroads—Injuries to Travelers—Contributory Negligence—Failure to Look—Question for Jury.

1. One who steps or drives on a railroad immediately in front of an approaching street car and is struck, when, had he looked before so attempting to cross, he must have seen the proximity of the car and appreciated the necessary consequences of his act, is chargeable with negligence as a matter of law.

2. Where, at the time plaintiff turned to cross a street car track, the car by which he was struck was more than 200 ft. away, and at the time of the collision was running at an unusual, if not an unlawful, rate of speed, whether plaintiff was negligent in failing to look a second time as he was about to drive on the track was for the jury; plaintiff not being required to refrain from crossing because the car was in sight.—(Wider vs. Detroit United Ry., 111 N. W. Rep., 100.)

MISSOURI.—Damages—Mental Anguish—Fright—Carriers—Injuries to Trespassers—Children—Appeal—Instructions—Prejudice—Willful Injury—Bill of Exceptions—Motion for New Trial—Contents—Trial—Argument of Counsel—Curing Error.

1. In an action for mere negligence there can be no recovery for mental anguish and fright, where there is no bodily hurt.

2. Plaintiff, a girl of six years of age, was put aboard defendant's street car for transportation to another town, with a memorandum as to where she was going, pinned to her dress. The conductor, on ascertaining that she had no fare, ejected her on the outskirts of the town and left her by the side of the track. The conductor informed the conductor of the car going in the opposite direction that he had better take up the plaintiff and take her back to the street where she boarded the car. The day was bleak and wintry and when the conductor of the latter car found plaintiff she was very cold and frightened. Plaintiff was thereafter taken to her parents by a stranger. Held, that the conductor's act in ejecting plaintiff was willful and inhuman, and justified a recovery for fright and mental suffering, though plaintiff suffered no bodily hurt.

3. In an action against a street car company for the ejection of a child on a bleak winter day for failure to pay fare, an instruction making the defendant's liability to depend on whether it was guilty of "gross and reckless carelessness" was favorable, and not prejudicial, to defendant.

4. Where, in an action against a street car company for ejection of a child for failure to pay fare, the jury were required to find that the act was willful and malicious, and that it was an act of inhumanity, in order to entitle plaintiff to recover, and were also charged that, if the act was wanton and malicious, it would "justify" exemplary damages, the fact that the jury did not find examplary damages did not establish that it did not find, in support of a verdict for plaintiff, that the conductor's act was malicious and inhuman.

5. Objections to argument of counsel, made in a motion for a new trial and supported by affidavits, without being incorporated in a bill of exception, cannot be reviewed on appeal.

6. In an action for injuries, a statement by plaintiff's counsel that certain testimony might be said to be manufactured of the same stuff as dreams are made of, and characterizing it as a baseless fabric of a dream, was not objectionable.

7. In an action for ejection of a child from a street car, plaintiff's counsel in argument referred to the child as having been thrown off the car, and to the conductor's treatment of her as inhuman and oppressive. On objection the court stated that there was no evidence that the child was "thrown off," whereupon counsel stated that he withdrew the statement, and did not wish to charge the conductor with having used personal violence in putting her off. Held, that any error in the statement made was cured.—(Harless vs. Southwest Missouri Electric Ry. Co., 99 S. W. Rep., 793.)

MISSOURI.—Trial—Question for Jury—Street Railroads—Injuries to Pedestrian—Instructions—Conformity to Evidence—Personal Injuries—Actions—Evidence—Sufficiency.

1. In an action against a street railroad for the death of one run over by a car, if the facts bearing on the question of contributory negligence admit of different constructions and inferences, the question must be left to the jury.

2. In an action for the death of one run over by a street car, the presumption is that decedent was in the exercise of due care and looked and saw the car.

3. In an action for the death of one run over by a street car, the motorman testified that decedent did not "seem to notice anything," and the conductor testified that he did not see her look, and the court instructed that if decedent, as she started across the tracks, saw the car, and it was at such a distance as not to imperil her, if not running in excess of the speed prescribed by ordinance, and she did not know it was running at a speed in excess of that prescribed by ordinance, and in the exercise of ordinary care in looking and listening would not have so known, and the car was in fact exceeding the speed mentioned, decedent had a right to cross the tracks, relying on the car being properly run, and that, using ordinary care in doing so, she was not negligent. Held, that in view of the presumption that decedent was using ordinary care, and notwithstanding the testimony of the motorman and conductor, the instruction was not objectionable as based on facts not in evidence and resting on conjecture.

4. In an action for the death of one run over by a street car, evidence held sufficient to sustain a finding that decedent could have crossed the track in safety if defendant's car had been run at the rate prescribed by ordinance.

5. In an action for the death of one run over by a street car, it was proper to refuse an instruction that the motorman was under no obligation to slacken the speed of his car or stop the

same because decedent was approaching the track, but that he had a right to proceed on the assumption that decedent would remain off the track in a place of safety, as the instruction ignored the fact that it was the motorman's duty to slacken the speed or stop the car upon seeing decedent in a place of danger, even though she might have been guilty of contributory negligence at the time.—(Powers vs. St. Louis Transit Co., 100 S. W. Rep., 655.)

MISSOURI.—Master and Servant—Injury to Servant—Contributory Negligence—Proximate Cause—Care Required of Employee—Evidence.

1. Where, in an action for the death of a motorman operating a car in a collision between his car and another car, the evidence showed that the deceased motorman could have seen the track for more than 700 ft. from a designated point, and that the accident occurred about 150 ft. therefrom, the presumption of due care on his part is overcome, and his contributory negligence established.

2. In an action against a street railroad for the death of a motorman in a collision with another car, based on the negligence of the railroad in commanding the motorman to make the run within a specified time, it appeared that the car was on time when the collision occurred, and was at that time running at the ordinary rate of from 5 to 6 miles an hour. Held, that the negligence, if any, on the part of the railroad in fixing the schedule for the running of the car, was not the cause of the accident.

3. A motorman operating a car on a single track is not relieved from the duty of exercising care in avoiding danger from a collision with another car operated on the same track and running in the opposite direction, irrespective of the question of the order the railroad gave to the motorman with respect to the running time of his car.

4. In an action against a street railroad for the death of a motorman in a collision with another car operated on the same track and running in the opposite direction, evidence examined, and held not to show negligence on the part of the railroad arising from its failure to give the motorman warning of the other car, or in failing to provide a rule by which the motorman would know of the presence of the other car.

5. An action against a street railroad for the death of a motorman in a collision with another car operated on the same track and running in the opposite direction, occurring shortly after the latter car had left the end of the line, based on the company's negligence in commanding the motorman to make his run within a specified time, and in failing to give him warning of the other car or to provide any rule by which he would know of the presence of the other car, cannot be sustained on the ground that the railroad negligently spaced the two cars that collided, for a uniform spacing of street cars is impracticable.—(McGahan vs. St. Louis Transit Co., 100 S. W. Rep., 601.)

NEW YORK.—Damages—Personal Injuries—Measure of Damages—Loss of Earnings.

The amount earned by one while working for a bookmaker in placing bets on horse races, in violation of Pen. Code, Sec. 351, immediately prior to an accident resulting in his personal injury incapacitating him from continuing in such work, cannot be considered in fixing the amount of his damages.—(Murray vs. Interurban St. Ry. Co., 102 N. Y. Sup., 1026.)

NEW YORK.—Carriers—Injury—to Passenger—Actions—Evidence—Weight and Sufficiency—Damages—Pleading—Issues—Proof and Variance—Loss of Earnings or Services—Trial—Misconduct of Counsel—Interruptions—Matters Not Sustained by Evidence.

1. In an action against a street car company for injuries received by being thrown from the car step, evidence examined, and held insufficient to sustain the finding that the servants of defendant were negligent.

2. Where a husband, in an action for injuries to his wife, alleged that her services, which he lost, consisted of keeping house for him, it was error to allow him to prove that she assisted him in his duties as janitor.

3. In an action by a husband for loss of services of his wife, the loss of wages by his daughters, who remained at home to perform the duties of his wife, was not proper proof of the reasonable value of the services of the wife.

4. In an action by the husband for loss of services of his wife, due to injuries, the wife was asked on cross-examination concerning the complaint in an action she brought against the defendant for the same injuries, and the husband's attorney stated, after the objection of the defendant's counsel, that the action had been dismissed owing to an error in the complaint, such conduct was improper, and calculated to prejudice the defendand in its right to cross-examine the witness without her being assisted by her counsel in explaining a verified declaration inconsistent with her testimony.

5. In an action against a street car company for personal injuries, it was error for the plaintiff's attorney to state, without any evidence to justify it, that defendants "had millions of capital," and "thousands of employees," and had failed to produce a passenger who saw the accident, and to dwell unduly on the fact that the conductor on the car did not give his right name on entering the employ of the company, referring to him as the man who committed a crime on entering that corporation.—(Keenan vs. Metropolitan St. Ry. Co., 103 N. Y. Sup., 61.)

TEXAS. — Witnesses — Cross-Examination — Scope — Evidence—Admissibility of Explanatory Facts—Street Railroads—Care Required—Sufficiency.

1. In an action for injuries to one run over by a street car, it appeared that there was an ordinance forbidding a greater rate of speed than 10 miles an hour, and the motorman testified that at the time of the accident he was running about 7 or 8 miles an hour, and on cross-examination he was asked whether the cars would run 10 miles an hour. Held that such cross-examination was proper.

2. Where, in an action for injuries to one run over by defendant's street car, the motorman testified that at the time of the accident he was running about three-fourths of the maximum speed of the car, it was proper to permit one who had tested the speed of defendant's cars to testify for plaintiff as to their maximum speed.

3. A street car company has no right to the exclusive use of that part of the street where the tracks are laid, and the company is bound to observe ordinary care to avoid injuring persons on and along its tracks.

4. In an action for injuries to one run over by a street car, evidence considered, and held sufficient to sustain a finding that plaintiff was not guilty of contributory negligence, and that her injuries were caused by the negligence of defendant.—(San Antonio Traction Company vs. Haines, 100 S. W. Rep., 788.)

TEXAS—Street Railroads—Injuries to Persons on Track—Negligence—Trial—Instructions—Inconsistent Instructions—Error Cured by Other Instructions—Evidence—Opinion Evidence—Matters Directly in Issue—Right of Way for Tracks—Exclusive Use—Instructions.

1. The failure of a motorman, upon discovering the perilous position of a person upon the track, to use all reasonable means within his power to avoid running him down, does not render the street railway company liable for injuries resulting from the collision, unless the use of such means would have avoided the collision.

2. In an action for injuries sustained in being run down by a street car, the court instructed that, if the motorman after the discovery of the perilous position of plaintiff did not use every means within his power, consistent with the safety of the car, to avoid a collision, then the street railway company was liable. There was evidence tending to show that the motorman did not discover plaintiff's peril in time to have avoided the collision, even had he used the means in his power to do so. Held, that the instruction was erroneous; and the error was not cured by the further instruction that the failure of the motorman, upon discovering the plaintiff's perilous position upon the track, to use all means within his power, consistent with the safety of his car, to avoid running him down, did not render the company liable, unless the use of such means would have prevented the collision.

3. In an action for injuries received in a collision with a street car, testimony "that the motorman tried to stop the car" is objectionable, as being merely the opinion or conclusion of the witness.

4. A street railway company has no right to the exclusive use of any part of the street upon which its track is laid, and all persons have equal right to use the same for travel over and across the street; and in the operation of its cars the company must use that care which a man of ordinary prudence would exercise under like circumstances.

5. Where, in an action for injuries received in a collision with a street railway car, there was an issue of contributory negligence, an instruction that a street railway company has no

right to the exclusive use of any part of the street upon which its track is laid, and that all persons have equal right to the use of the same for travel over and across the street, and that the street car company is bound to use ordinary care with respect to the particular circumstances, was proper.—(San Antonio Traction Company vs. Kumpf et al., 90 S. W. Rep., 863.)

TEXAS.—Evidence—Res Gestæ—Statements Before Accident—Opinion Evidence—Contribution—Joint Wrongdoers—Appeal—Record—Failure to Present Error—Ruling as to Evidence—Opinion Evidence—Management of Train—Trial—Objections to Evidence—Instructions—Applicability to Issues.

1. The remarks of a street car conductor made in the presence of passengers while the car was within a few feet of the railway crossing where the accident occurred and within a few seconds of the time when it occurred that "I will go to the front and see that every thing is all right so we will get across the railroad," and "I must go through to the front of the car and look out for headlights and engines," are admissible as a part of the res gestæ, in an action brought for injuries received in a collision between the street car and a railway train.

2. In an action for injuries received in a collision between a street car and a railway train, the railway conductor was asked: "When a street car is approaching a crossing, when will it appear that it is going to stop? When would it become apparent that there was danger of a collision when the street car was coming on M Street, like this?" Held, that the question was objectionable, as calling for an opinion of the witness.

3. In an action for injuries received in a collision, a witness for the railway company, who had made a test at the scene of the collision for the purpose of testifying, was asked whether or not it would be possible for a man standing 30 ft. from that crossing, as he stood, listening for the train, not to hear it as it approached the crossing. Held, that the question was objectionable, as calling for an opinion of the witness.

4. Where the negligence of a traction company, and that of a railway company both appear to have been the proximate and concurrent causes for collision, neither is entitled to contribution, as against the other in the event of either being held liable to a person injured.

5. Alleged error in the admission of testimony will not be considered where the record does not disclose what objection was made thereto.

6. In an action for injuries received in a collision, it is competent for an experienced railroad man to testify as to whether or not a street car can be stopped in a much shorter space than a steam locomotive or a number of cars.

7. In an action for injuries received in a collision between a street car and a railway train, a witness was asked to state whether or not, in his experience as a railroad man, when a railroad train is approaching a crossing, and a street car is approaching the same crossing, so that it would appear that one or the other must stop, he ever knew the train to stop to let the street car pass. The question was objected to on the ground that the witness had shown that he did not see the car until it had passed, and therefore he could not answer the question. Held, that the objection was inapplicable and properly overruled.

8. In an action for injuries received in a collision between a street car and a railway train against both the traction company and the railway company, there being no issues between the two defendants, and neither of them seeking a judgment against the other, an instruction on behalf of the traction company that, as between themselves that company owed the railway company the duty to exercise such care to avoid the collision as a person of ordinary prudence would exercise with reference to a similar matter, was properly refused.—(Northern Texas Traction Company et al. vs. Caldwell, 99 S. W. Rep., 869.)

WASHINGTON.—Street Railroads—Injuries to Persons on Track—Care Required—Instructions—Appeal and Error—Review—Failure to Present Question Below—Instructions.

1. Where a motorman sees a man ahead of him near the track or approaching it, and there is nothing to indicate any inability on his part to care for himself, the motorman has a right to assume that the other will act as a prudent man would and it is not incumbent on the motorman to stop the car until he sees that the other is in a position of apparent danger.

2. In an action against a street railroad for injuries to one struck by a car, it was not error for the court to fail to embody the "last chance" doctrine in the instructions on contributory negligence.

3. Ballinger's Ann, Codes & St. sec. 4993, provides that the court shall charge the jury on the law of the case. Held, that, where a party failed to request any further or more specific instructions than those given by the court, he could not be heard to complain on appeal that the charge did not cover a certain phase of the case.—(Duteau vs. Seattle Electric Company, 88 Pac. Rep., 755.)

CHARTERS, FRANCHISES AND ORDINANCES.

ILLINOIS—Municipal Corporations—Debt Limit—Constitutional Provisions—Effect—Special Taxes—Nature of Property—Public Property—Granting of Use of Streets—Power to Grant Franchises.

1. Hurd's Rev. St. 1905, p. 438, c. 24, known as the "Mueller Law," giving every city in the State the power to own and operate street railways, provides, in order to obtain funds with which to acquire and equip them, that the city may issue street railway certificates not constituting the obligation of the city, but payable solely out of the revenues from the street railway property for the acquisition of which they were issued, and, to secure their payment, may convey by way of mortgage or trust deed all street railway property. An ordinance of the city of Chicago of Jan. 18, 1906, supplemented by an ordinance of May 28, 1906, makes provision for the issue of $75,000,000 in street railway certificates secured by a trust deed, providing that in case of default in the payment of the certificates "there shall be a sale of all the property * * * mortgaged," and the purchaser at such foreclosure sale shall have the right to construct and operate the street railways thereby mortgaged for twenty years after the sale. Held, that the trust deed giving the right to the purchaser at a foreclosure sale to maintain and operate street railways constitutes a security on valuable property of the city not derived from the issue and sale of the secured certificates, and hence the certificates, when issued and sold, and the trust deed given to secure them, constitutes an increase of the city's debt within the meaning of Const. 1870, Art. 9, Sec. 12, providing that no municipal corporation shall become indebted in the aggregate exceeding 5 per cent of the assessed value of its taxable property.

2. Street railway certificates secured by a trust deed giving the right to take the street railway property and operate a street railway in the city streets, if the city defaulted in the payment of the certificates, would be chargeable upon the property of the city and not upon that of individuals, and hence the principle involved in special assessments, the warrants for which do not constitute indebtedness of the city within the meaning of the constitutional inhibition, does not apply.

3. The mortgaging by a city of the right to use its streets for street railway purposes, to secure the payment of such street street railway certificates, is not a grant of their use as a gratuity, so as to bring the act within the rule that a court of equity will not interfere with the city in making grant of the use of its streets as a gratuity.—(Lobdell et al. vs. City of Chicago et al., 81 N. E. Rep., 354.)

INDIANA.—Eminent Domain—Compensation—Persons Entitled.

Act 1901, Sec. 5, authorizes the street railway companies to exercise the right of eminent domain, and provides that the company shall deposit with a designated officer a description of the rights and interests to be appropriated, and that such lands, rights, and interests shall belong to the company, to use for the purpose specified by making or tendering payment. The section further provides that, if the parties cannot agree upon the compensation, notice shall be served by delivering a copy of the instrument of appropriation, or, if the owner be a nonresident of the county, that he may be served by publication, and that upon the filing of the act of appropriation and delivery of such copy or publication three appraisers shall be appointed on the application of either party, who shall return their assessment of damages. Held, that the filing of the instrument of appropriation with the designated officer was a seizure and appropriation of the land therein described and constituted the final act of taking, upon which title passed, and all damages resulting from the taking thereupon vested in the then owner of the land as a personal claim.—(Ft. Wayne & Southwestern Traction Company vs. Ft. Wayne & Western Railway Company et al., 80 N. E. Rep., 837.)

INDIANA.—Muncipal Corporations—Control of Streets—Moving Buildings.

Act March 6, 1905, Sec. 267, provides that every city and town, except when otherwise provided by law, shall have ex-

clusive power over its streets, and by Sec. 269 they are given exclusive power by ordinance to control their streets. Sec. 270 provides that whenever there is a grant of power in an act, and no method is provided for the exercise of the power or authority, the method may be prescribed by ordinance. Acts 1891, p. 68, c. 55, Sec. 5472, authorizes the use of electricity as a motive power for street cars where the consent of the city had been had, but provides that nothing in the act shall take away from Common Councils of incorporated cities the exclusive powers exercised over their streets and highways. Held, that a city ordinance regulating the matter of moving buildings on streets occupied by street railways requiring a person desiring to move a building which would necessitate the raising or removing of the railway's wires to first obtain a license from the city, and to give a 24-hour notice to the company, and declaring that upon a compliance with these requirements it should be the duty of the company so to raise or remove its wires as to allow the building to pass, was a valid exercise of the police power, relieving the party desiring to move a house from any liability to the street car company.—(Indiana Railway Company vs. Calvert et al. (No. 20,819), 80 N. E. Rep., 961.)

LOUISIANA.—Street Railroads—Repair of Roadbed.

1. The appellant is held to repair its roadbed, as it is not safe and in good repair.

2. It is under obligation to maintain its roadbed.

Whatever may be the responsibility of other contractors, if there be, primarily appellant is responsible, and must make needful repairs, when demanded, because of the bad and dangerous condition of the track.—(City of Shreveport vs. Nelson. Same vs. Southern Paving & Construction Company et al., 43 S. Rep., 389.)

MAINE.—Municipal Corporations—Use of Streets—Leaving Horse Unhitched—Contributory Negligence—Street Railroads—Operation—Injury to Animal on Track—Contributory Negligence—Negligence of Company—Sufficiency of Evidence.

1. It is not negligence per se to leave a horse attached to a carriage in the street unhitched.

2. But, when one leaves a horse attached to a carriage, unhitched, unimpeded by any weight, and unattended by any person near enough to control him by the voice or to reach him before he can escape, in a city street in which there is an electric car line, at a time when the conditions are such that cars may reasonably be expected to run with snow scrapers, calculated to frighten horses both by sound and sight, he is guilty of such negligence as will prevent his recovery in an action against the railway company, if the horse, frightened by the noise or action of the scrapers, runs in front of a car and is injured by it. And this is true, although the horse had never been afraid of the electric cars, and had never run away, though left unhitched.

3. The evidence in the case is held to be insufficient to warrant a finding by the jury that the defendant was guilty of negligence.—(Moulton vs. Lewiston, B. & B. Street Railway, 66 Atl. Rep., 388.)

MARYLAND.—Street Railroads—Duty to Pave Streets—Bridges—Subrogation—Benefit of Original Obligation.

1. A railroad company entering a city and crossing a street at grade, an ordinance was passed providing that the grade of the street be raised so as to enable the railroad company to construct its railroad tracks under the street, and the change of grade, made in pursuance of the ordinance, was accomplished by the construction of a bridge. By a previous ordinance of the city a street railway company was granted the right to lay double tracks upon this street on the condition that the owners thereof should keep the portion of the street covered by its tracks and two feet on either side thereof in repair. With respect to a second street of the city, another street railway company was by ordinance authorized to construct double tracks upon the same, on the same condition as to repair as that imposed in the first grant of authority. A bridge connecting portions of that street and forming the only means of passage from one portion to another had at that time been constructed by the city. Neither the charters of these two street railway companies nor the ordinances of the city made any reference to bridges as distinguished from streets, and under the respective grants of authority to use such streets the two street railway companies laid their tracks upon these two bridges. Held, that the two bridges were parts, respectively, of the two streets, within the meaning of the word "streets" as used in the ordinances imposing on the owners of the street railways, as a condition of their right to use the streets, the duty to repair the same.

2. Where street railway companies were under obligation to the city to keep in repair the portion of two bridges occupied by their tracks and two feet on either side, and thereafter a railroad company became liable to the city to maintain and make all needed repairs on both bridges by virtue of ordinances granting certain privileges, the obligation of the street railway companies was not thereby discharged, and the railroad company, having made all such needed repairs, was entitled to recover from the street railway company succeeding to the rights and obligations of the original companies that portion of the cost of repairing the bridges for which the street railway company would have been liable had the bridges been repaired by the city.—(Northern Central Railway Company vs. United Railways & Electric Company, 66, Atl. Rep., 444.)

MINNESOTA.—Eminent Domain—Delegation of Power—Railroads—Carriers—Who Are—Corporations—Incorporation Classes—Eminent Domain—Delegation of Power—Private Corporations—Statutory Provisions—Necessity of Municipal Franchise.

1. Petitioner's articles of incorporation authorized it to purchase, lease, build, own, and operate suburban street railways extending from the limits of the cities of St. Paul and Minneapolis to and into outlying cities, towns, and villages within the State of Minnesota—one line beginning at the easterly limits of St. Paul, and running thence in a northeasterly direction through the village of North St. Paul, by White Bear Lake, to the city of Stillwater; another line beginning at the southerly limits of St. Paul, and extending thence in a general southeasterly direction to South St. Paul; another line beginning at Camden Place, in Minneapolis, and running thence in a northwesterly direction to the city of Anoka; another line extending from the Western limits of Minneapolis at a certain point, and running thence in a westerly direction through the village of Hopkins to Lake Minnetonka—the routes for such lines to be designated as shall be determined upon by the company. Among its other stated powers is the right to own and operate by electric or steam power such steamboats, launches, or other boats as may be determined upon by the company upon the lakes of Minnesota, and power to purchase and own stock or stocks of suburban or other street railway companies, and to purchase or lease railways within the State, and to lease, construct, and operate electric or other power stations for the purpose of furnishing electric light or power.

Held, as determined by the main purport of its articles, such corporation is a work of internal improvement and a common carrier, and, its articles having been executed in compliance with title 1, c. 34, Gen. St. 1894, was entitled to exercise the right of eminent domain conferred by Sec. 2592 thereof, even though the incorporators declared in the articles that they proposed to incorporators under the provisions of title 2.

Such corporation is none the less a common carrier, as defined by Sec. 379, Gen. St. 1894, though its articles do not in terms prescribe that one of its powers is to carry freight.

In determining under what title the corporation was organized, the fact that the organizers denominated the proposed improvement a "street railway" is not controlling, since it conclusively appears from the articles that it was not the purpose of the company to construct and operate street, but interurban, railways from place to place.

2. The right to exercise the power of eminent domain, conferred upon a corporation organized under title 1, c. 34, Gen. St. 1894, was not abrogated, but recognized, continued, confirmed, and re-enacted, by the provisions of the revised laws.

3. Sec. 2915, Rev. laws 1905, authorizing a railroad company to cross the tracks of another such company at points of intersection, and to acquire such easement by condemnation, confers such right on all railroad corporations organized under the former statutes, as well as those organized under the revised laws.

4. The crossing of streets and alleys incidental to constructing a railroad from place to place does not constitute the occupancy of such streets or alleys for the purpose of operating a railway thereon, within the provisions of Sec. 2841, Rev. laws 1905; and a railroad company has the right to acquire by condemnation, under Sec. 2916, Rev. laws 1905, a right of way over the streets and alleys of cities and villages, and over private property within such limits, without securing a franchise from the municipal authorities.—(In re Minneapolis & St. P. Suburban Ry Co. Minneapolis & St. P. Suburban Ry. Co. vs. Manitou Forest Syndicate et al., 112 N. W. Rep., 13.)

LONDON LETTER

(From Our Regular Correspondent.)

For some months W. Arrol & Company's workmen have been doing the preliminary work for the widening of Blackfriars bridge made necessary because the London County Council Tramways will eventually cross this thoroughfare. The occasion of the sinking of the first caisson was taken advantage of for a ceremony carried out in the presence of the city bridge house estates committee and others. As already stated, the bridge when completed will be 30 ft. wider, the distance between the parapets being 105 ft. and the roadway 73 ft. A foot path of 16 ft. will be on either side. The tramway lines will be laid on the extended or western side of the bridge. Such work as the London County Council Tramways have at present in hand is progressing rapidly, and the new system on Holloway Road at Highbury Station to the Archway Tavern is nearly completed, Holloway Road having been in an impassable condition for some months. The work also from the Angel, King's Cross is now well advanced, and a start has been made with the extension of the London County Council Tramways from Tooting Broadway which, when completed, will connect the London County Council system with the system of the London United Tramways Company which goes via Wimbledon, Malden and Surbiton to Hampton Court. The Council has also given notice to the Hackney Borough Council that it will proceed with the electrification of the tramways in Mare Street, Hackney, to Ball's Pond Road. It has become evident to the Council that the facilities for repair work are insufficient, and in a recent Highways Committee Report the Council expresses a desire to have authorized an expenditure of about £104,000 for the establishment of a repair depot. It is not proposed, however, to spend all that money at once, and the first section, which would be capable of dealing with a thousand cars, can be built at an established cost of about £51,400, with about £16,000 for the necessary tools.

A question of morals has come up in the London County Council in connection with the tramways, the highways committee having previously refused to accept for display on its cars any advertisements relating to whisky or other alcoholic beverages. A series of advertisements has now been offered by a firm of whisky distillers representing an income to the Council of £500 per year, and it is interesting to note that the highways committee has recommended the acceptance of these advertisements. It would appear that advertisements of this nature have been accepted on the boardings round the Council's surplus lands, and the Council now thinks that if careful discretion be exercised, such advertising need not be excluded from the cars, although the Council states that it has not lost sight of the importance of exercising a close supervision over the character of the advertisements to be accepted.

The interesting statement has just been made that the London County Council intends to try a surface contact system on the line from Aldgate to Bow Bridge, for the electrification of which it already has powers. Difficulties are connected with this, owing to the fact that the Whitechapel & Bow Railway is underneath the roadway and the roof of the tunnel is so close to the surface of the road that the cost of the usual conduit system as employed in London would be prohibitive. Examination has therefore been made of a number of the surface contact systems, and tentative arrangements have been made with the owners of the G. B. system, which has been in operation in the city of Lincoln for more than a year, by which a royalty would be paid to the owners in the event of the system being used on this section. The city of Lincoln has recently taken over the G. B. system, so that the Council's engineers are satisfied that should they adopt the G. B. system it would prove satisfactory on this route. The Aldgate to Bow Bridge line is about 3 miles long, making 6 miles of single track, and the estimate of the total cost of electrifying this route on the surface contact system is £66,000, whereas if the conduit system were adopted the expenditure would be £92,000. It was originally intended to adopt the overhead system on this route but the Stepney Borough Council absolutely rejected such a proposition.

While on the subject of the London County Council's tramways, it may not be amiss to make mention of the complete change of front of the ordinary cab driver, who is now meeting more severe competition all around. We have frequently referred in this column to the motor omnibus and also to the putting on the streets of London of a large number of motor cabs, most of which are now equipped with the taximeter. These taximeter cabs have sprung into immediate popularity, and now are rarely idle. The taximeter motor cab's charge is 8d. per mile, while the ordinary horse cab still holds to the 1s. for the first mile and 6d. for each extra mile. There are hundreds more taximeter motor cabs on order for the streets of London, so that it would appear as if the horse cab would be in dire straits before long. Notwithstanding repeated refusals on the part of the horse cab drivers and the cab owners to have anything to do with taximeters or to reduce their fares, it would appear that they are extremely anxious that the taximeter should be extended to the horse cab vehicle as well, and have applied to the Home Secretary to be put on the same basis as the taximeter motor cabs. No definite statement has yet been made by Mr. Gladstone except in so far that the whole question of the use of taximeters is under the consideration of the Home Office, and it is extremely probable that before long London transportation, so far as public vehicles for hire are concerned, will be regulated rigidly by a definite scale of prices registered by taximeters. This will undoubtedly be a step in the right direction, as public sentiment for a long time has been in favor of some better method of regulating prices than an animated argument with a cab driver.

The London County Council electricity supply bill, to which we have frequently referred in this column, and which was a bill for the purpose of affording rights to the London County Council to supply not only the county of London but a large surrounding district with cheap electric power, has now been definitely thrown out of Parliament. It will be remembered that it was referred to a hybrid committee of the House of Commons which heard a large amount of evidence for the Council at numerous sittings, but without even waiting to hear the opponents' case it found the preamble not proved and the bill was consequently thrown out. The London County Council, at a subsequent meeting, reported deep regret at the bill having been thrown out, thereby, according to its opinion, depriving London of an opportunity of cheap electricity for some time to come. This, of course, means nothing, but it seems quite certain that it will be some considerable time before any bill dealing with the supply of electricity in London will have any chance in the present Parliament. The hybrid committee gave no reason for its action, but it is generally supposed that the committee did not like the idea of the Council delegating the committee's powers to a company and letting in private enterprise. In the circumstances, it is almost unnecessary to give any of the interesting evidence which was produced before the committee, but a few statements made by J. H. Rider, chief electrical engineer to the London County Council, may be interesting. Briefly, the scheme was to have a large station at Barking, where there was carriage for coal and an abundant supply of water. The area to be covered was 451 square miles, of which 117 were within the county of London and 334 outside. Estimates had been prepared showing an expenditure necessary of £4,500,000, and power was to be transmitted by trunk cables to thirteen central stations within the county and eight plants outside, and there were to be three kinds of supply for which varying prices were to be charged. It is also interesting to recall that in 1905 the chief bill introduced at that time was the Merz bill, commonly known as the Administrative County Scheme, but it never reached its third reading owing to blocking measures before the close of the session. In 1906, the London County Council bill and two private schemes were promoted. The London County Council bill was the only one allowed to go to committee and was thereafter rejected by Parliament. In the present session the bill which has just been thrown out was introduced and afterwards modified, so as to put the risk on private enterprise though to keep the control in the hands of the Council. The total expense incurred more than £150,000, has therefore been wasted, and so far as electricity is concerned London is where it was.

A rather interesting decision was recently given in Carlisle in favor of a solicitor who took the view that an electric car should stop for a passenger at any point desired, and without any regard to the fixed stations which have become general since the adoption of electricity as a motive power. This gentleman, on a car refusing to stop for him, summoned the driver, and strange to say has succeeded in getting a legal decision in his favor, so that hereafter any one in Carlisle can compel any of the electric cars to stop at any point. It is not likely, however, that this will affect other towns, as under the Tram-

ways Act of 1870, power is given to municipalities to make regulations as to the stopping of their tramway cars at specified places.

Another interesting decision which has recently been given by the House of Lords is in relation to the powers of a railway company to use motor omnibuses as accessories. The case is that of the Mersey Railway Company, which, by means of tunnels, connects the city of Liverpool with Birkenhead and its suburbs. This railway has always had a precarious existence, although it has been generally improved and its financial prospects greatly enhanced since it was electrified some years ago. In order to get still more traffic the company inaugurated a system of motor omnibuses in Birkenhead from outlying points to its various stations. The corporation of Birkenhead, however, having a system of electric tramways, opposed this motor omnibus traffic, and last year got an injunction against the railway company prohibiting it from running omnibuses on the ground that it was outside the company's statutory powers. This injunction was removed by a court of appeal some time later, but the original injunction has now been restored by the judgment of the House of Lords. No efforts were being made by the Mersey railway to compete with the system of tramways. It is also true that a number of railway companies throughout England are operating motor omnibuses, so that the decision does not appear to be altogether an impartial one.

While not desiring to enter into figures in this column regarding the business of the British Electric Traction Company, which operates a very large proportion of the tramways in England not owned by municipalities, it is interesting to notice from the remarks of Sir Charles Rivers Wilson, who presided at the general meeting, how strong a position this company takes in the question of fares, in that it maintains that tramway fares in this country are now on far too low a basis. The company's various undertakings carried during the past year over 300,000,000 passengers, while the receipts were only a penny and a fifth a passenger. Sir Charles contends that the policy of carrying passengers about 2½ miles for a penny is wrong, and that the company is suffering from an ever increasing agitation for a reduction of fares. The company's fares are not so low as those charged by the municipalities of some of the big cities, but regarding the character of the service he contended that the fares were too low and foreshadowed a general advancement in the charges before long.

It is interesting to note that since the opening of the new Hampstead tube described last month, the omnibus service from Hampstead to Oxford Street has been discontinued. This is not the first of the omnibus routes that has been changed since the new state of affairs in London, but this particular route is interesting as it forms direct connection with the past, being one of the routes taken by the old passenger mail coaches from London to the far north.

The name of the Twopenny Tube, which has been familiar to Londoners now for several years, will no longer be actually correct. As foreshadowed last month in this column, the various companies operating in London have been considering increasing their fares, and the Central London Railway Company has now inaugurated a new method of charging. The old twopenny fare will only serve passengers hereafter for about two-thirds of the journey, say, from the Bank to Lancaster Gate, and passengers desiring to go further than that will now have to pay 3d. instead of 2d. This increase of fare will, of course, necessitate a complete change in the system of collection, as hitherto a uniform ticket has been supplied which was immediately dropped by the passengers into boxes when passing through the gates at the start of their journey. Hereafter passengers will have to reserve their tickets, which will be given up at their destination. For some time the traffic of the Central London Railway has been falling off, and this is an effort to increase revenue. The result will be watched with interest. The change seems to be one more proof that the American system of a uniform fare does not suit London.

Like every other city operating electric tramways, Cardiff has not escaped the difficulty of corrugated rails, and some time ago purchased a machine for grinding the rails so as to remove the corrugation if possible. The machine was not an entire success, and Mr. Ellis, the tramway manager, has constructed a machine which, from reports received, gives promise of being effective. The difficulty with most machines for grinding rails has been with the carborundum wheel. Mr. Ellis' cutting surface is carborundum, but he has adopted the plane principle. He says that he can place his apparatus on the market at a cost averaging £30 per car, with the additional advantage of needing no extra service, as the driver of the car can work it without inconvenience and the work of levelling the rails can go on whenever desirable.

Sheffield has recently had delivered to it fifteen new cars which have been constructed by the United Electric Car Company, Ltd., of Preston, and which are somewhat new in city work, Sheffield, it is supposed, being the first of the large cities to adopt this type. The cars are all equipped with vestibule ends, so that both motormen and conductors have complete protection from the weather. It has long been a subject of dispute as to whether or not a glass front increases the chance of an accident in stormy weather, but in Sunderland, Bolton and other places where vestibule cars have been given a trial it has not been proved that the liability to a collision is increased.

The extension of the system of the London United Tramways Company from Wimbledon to Tooting and from Wimbledon to Summerstown, has now been completed and is open to traffic. The Tooting terminus of this system is only a few hundred yards distant from the Tooting terminus of the London County Council Tramways, and an arrangement has been made between the company and the Council by which there will be an interchange of traffic over the two systems, and the actual work of making the physical connection is now being undertaken. The whole ramification, therefore, of the London United Tramways Company's system, which extends to New Malden, Kingston, Surbiton, Long Ditton, Hampton Court, Acton, Ealing, Southall, Hanwell, Shepherd's Bush and Hammersmith, will be joined with the London County Council's system at Tooting and will undoubtedly add to the popularity of both lines.

The Halifax Corporation tramways committee has decided to allow its Parliamentary powers to make tramway extensions to Elland, Stainland, Kipponden, Rishworth, Cragg Vale and Wainstalls to lapse. These extensions and other works would, if carried out, have involved a capital expenditure of about £190,000. The decision of the committee will cause disappointment in the districts concerned, the inhabitants of which have from time to time urged the extension to be made.

At a special meeting of the Morecambe Town Council to consider the question of the purchase of the horse tramways, at present owned by the Morecambe Tramway Company, the finance and general purposes committee recommended that the system be electrified, and Parliamentary powers obtained. Mr. Gardner, manager of the Chester Corporation tramways, estimates the cost of purchase and reconstruction for electrification at £46,093. After allowing for the fluctuations between summer and winter traffic at Morecambe, he estimates an annual income of £10,390, and a balance of £3,689 for reserve and renewals. It would be necessary to spend a sum of £10,000 in additional plant at the electricity works. The report of the committee was approved.

A. C. F.

THE LONG ISLAND RAILROAD AND ELECTRIFICATION

The Long Island Railroad has been granted the right to build an important cut-off near Long Island City, which means the elimination of all grade crossings on the way from Jamaica to Woodside, and the installation of electric power. The reconstruction and electrification of the line from Jamaica to Woodside, it is said, will require at least another year to complete, but it is expected that late in 1908, or at the latest early in 1909, electric trains will be sent into the Pennsylvania terminal. The lines which are next on the company's program to be equipped with electrical power are those to Whitestone Landing and Port Washington. The double tracking of the Port Washington branch is proceeding as rapidly as the necessity of condemning right of way in a good many places will allow. This double track will extend as far as Great Neck, between which point and Flushing the work is now under way. Double tracking is also under way on the Oyster Bay branch between Roslyn and Glen Head, but the company has not yet announced when this line will be electrified. On the main line the electric power is already used as far as Belmont Park, and when the Glendale cut-off has been completed the electric installation will be carried on to Garden City and down around the loop through Hempstead Gardens to Valley Stream. From the latter point back to Jamaica the line is already electrically equipped, so there will be a loop of electrical railroad from Jamaica through Belmont Park, Garden City and Valley Stream back to Jamaica again.

AFFAIRS IN CHICAGO

The first hearing in the Union Traction reorganization case was heard before the arbitrators, Judge P. S. Grosscup and Prof. John G. Gray, on Friday, July 26, at Chicago. Representatives of the bondholding interests in the north and west systems argued against diminishing the present bond par values or the revenue therefrom. Judge Grosscup's court room was crowded when the hearing opened. There were present representatives not only of the companies interested—the Chicago Union Traction Company, the North Chicago Street Railroad Company, the West Chicago Street Railroad Company, the North Chicago City Railway Company, the Chicago West Division Railway Company and the Chicago Passenger Railway Company—but also various bondholders and stockholders in the several companies.

Ninety-two lawyers had been officially notified of the hearing and about half that number were present. At the beginning of the discussion Judge Grosscup announced that the primary purpose of the meeting was to hear objections against the proposed plan of reorganization.

"At the same time," said Judge Grosscup, "I will hear anything that interested parties may have to say against the receivers of the Chicago Union Traction Company turning over the property of the corporation to the proposed Chicago Railways Company. Prof. Gray and myself have conferred in regard to the method of procedure in listening to the different objections and we have decided to listen to the objections to the reorganization plan first and then hear replies from those who are in favor of the plan. After that we will listen to the closing statements from those representing both sides. We will not confine the speakers to the regular rules of judicial procedure, our purpose being to allow the widest possible latitude to those desirous of being heard."

Judge Grosscup called for a list of the interests present. Practically every creditor of the Union Traction interests responded.

Attorney Henry Crawford interposed an objection to the hearing as soon as the list had been completed. He questioned the right of the arbitrators to act. Judge Grosscup decided against Mr. Crawford by saying that the arbitrators did not act as having the power to compel their actions, but as agents of the City of Chicago.

The burden of each and all the attorneys arguing was that neither the par value nor the interest of the existing bonds should be depreciated in reorganization.

THE CLEVELAND SITUATION

To serve as a basis for the settlement of the street railway question in Cleveland the committee on political action has submitted the following to the Cuyahoga County League of Republican Clubs for consideration:

First.—All the street railways of Cleveland and its immediate suburbs should be dealt with as one general system, and transfers should be given from company to company and line to line, so that a ride for a single fare can be had from one part of the city or suburbs to any other part. No new franchise or franchise extension should be granted to any company without this provision.

Second.—A committee of three men for each of the existing companies, each committee consisting of one person appointed by the incoming Mayor, the second by the company, and the third member by the first two, should appraise the property of each company and report its actual present value to the Council.

Third.—The Council should grant to each of these companies a twenty-year franchise over all its existing lines on the following terms:

Fourth.—Universal transfers, as above explained, the company to be allowed a cumulative dividend of 6 per cent per annum on the actual appraised value of the property, one-half of all additional profits to go to the city to be used toward the reduction of fares. Particular provisions to be made for future extensions, subways and rapid transit facilities. The additional capital required for these purposes to receive an annual dividend of 6 per cent based on the actual cost of construction. This actual cost to be ascertained by a commission consisting of an engineer selected by the city, an engineer appointed by the company, and a third appointed by these two or by the Circuit Court, in the event of disagreement; the city to have the right to appeal to the courts from the finding of the commission.

Fifth.—The books of each company are to be kept according to a system prescribed by the city, and to be open at all times for inspection by the City Auditor, a committee of the Council or the city's accountants. Reports to be made to the city monthly and annually.

Sixth.—The rate of fare to be seven tickets for a quarter at the beginning, with reduction to three tickets for 10 cents, eight tickets for a quarter, etc., as soon as is justified by the amount of the city's share of the profits.

Seventh.—Six per cent of the gross receipts each year to be set aside for maintenance and repairs, and 8 per cent of the gross receipts set aside for renewal, construction and depreciation; any unexpended portion of these funds to pass to the general treasury of the city at the expiration of the franchise; any additional sums devoted to this purpose to be paid out of the profits of the company.

Eighth.—The city to have the right to purchase the property at the end of twenty years at its actual value at that time, to be determined as above indicated.

Ninth.—Each company to be required to clean, sprinkle and pave its right of way.

Tenth.—The city to reserve all police powers, including the right to require the operation of additional cars and the right to make all needful regulations necessary for providing adequate service and accommodations for the public.

Eleventh.—All franchises and extension of franchises to expire at the same time.

The report is given to the club as a basis only, and it is expressly stated that the committee feels that it will act as a stimulus to the settlement of the trouble, though many of the original provisions may be changed before it is found entirely satisfactory.

Ordinances were introduced at the last meeting of the City Council giving the Low Fare Railway Company three separate and distinct grants on the Central Avenue-Quincy Street route. One of these provides for portion on Central Avenue between East Fourteenth Street and East Fifty-Fifth Street, and a second completes this from East Fifty-Fifth Street to East Eighty-Fifth Street, the end of the line. The third gives the company the right to use East Fifty-Fifth Street from Central Avenue to Quincy Street, and Quincy Street to the end of the line.

The generating machinery of the new companies was out of repair all last week and no cars were operated. Just when the company will be able to put the plant in operation is a question. Service was promised every day in the week, but it did not materialize. It is said that franchises may be in jeopardy, because the company has failed to give service for so long a time. As a result of this mishap, the bid price of the Forest City on the stock exchange dropped from 97 to 70⅜, although the price asked held up to 99. During the past week the price of Cleveland Electric has advanced from 45¼ to 53, with an active demand for it. Quite a large number of shares changed hands during the week at 49, but after that the offerings were small, owners feeling that it is better to hold to it for a time at least.

BELIEVES 2-CENT LAW APPLIES TO INDIANA TRACTIONS

Contrary to the legal opinion of Attorney-General James Bingham, the Indiana Railroad Commission has held that the 2-cent fare law, passed by the last General Assembly, applies to interurbans as well as to steam roads, and a suit will be instituted soon against some traction company to determine whether or not the law applies to interurbans and thus settle a matter that involves, in a way, the constitutionality of the 2-cent fare law itself. In a formal opinion given the Commission several months ago the Attorney-General held that the law applied only to the steam roads, and that there was no similarity between the steam and the electric roads substantial enough to warrant the application of the 2-cent fare law of the railroad to the operation of interurbans.

Immediately, prominent lawyers in the city raised the question as to the constitutionality of the 2-cent fare law if it did not apply to interurbans. They pointed out that the tendency of the higher courts of the State had been recently to class the steam and the electric railroads together, and that every new opinion involving this point made the analogy and similarity between these two transportation agencies close and closer. The Commission itself is said to feel that the Attorney-General is wrong, and that the law applies to the electric roads exactly as to the steam roads. The members think that that was the intention of the Legislature, and that the law makes the application very plain to all railroads.

AMERICAN TRACTION'S REPORT

The annual report of the American Light & Traction Company for the twelve months ended June 30 shows net earnings of $2,312,965, an increase of $483,589 and a final surplus after allowing for larger dividend payments and also funds set aside for construction reserve of $422,256, a decrease of $103,274. The total surplus now stands at over $2,600,000.

The income account, with comparisons, is as follows:

	1907	Increase
Net earnings	$2,312,965	$483,589
Preferred stock dividend	854,172	139,275
Common stock dividend	354,937	105,386
Total dividends	$1,209,'109	$244,661
Surplus	$1,103,859	238,928
Reconstruction reserve	681,600	342,200
Final surplus	$422,256	*$103,274
Previous surplus	2,235,147	525,530
Total surplus	$2,657,403	$122,256

The condensed general balance sheet, as of June 30 last, compares with the figures as of Dec. 31, 1906, as follows:

Assets—	1907	Increase
Investment account	$26,671,756	*$67,913
Treasury stock	1	.....
Earnings receivable sub. companies	2,827,246	441,913
Bills receivable sub. companies	1,626,812	51,275
Certificates indebtedness sub. cps.	1,705,169	*3,015
Accounts receivable	53,941	*9,618
Managers' stock contracts	225,000	*2,500
Interest and dividend received from temp. investment	5,822	5822
Temporary investment	211,332	185,176
Cash	425,774	*68,681
Total	$33,752,853	$532,394
Liabilities—		
Preferred stock	$14,236,200	.....
Common stock	15,000,000	.....
Bills payable	500,000	.....
Depreciation on managers' stock contracts	10,202	3,141
Miscellaneous expenses anticipated	13,094	4,592
Dividends accrued	314,954	16,903
Reconstruction reserve	1,021,000	340,500
Undivided earnings	2,657,403	167,258
Total	$33,752,853	$532,394

* Decrease.

The directors have declared the regular quarterly dividend of 1½ per cent on its preferred stock and a quarterly dividend of 1½ per cent on its common stock, payable Aug. 1. This is an increase of one-quarter of 1 per cent over the previous disbursement on the common stock, which was made on May 1 last.

THE TRANSIT INQUIRY IN NEW YORK

After a conference with William M. Ivins, who is to conduct the investigation of the Public Service Commission into the merger of local transit corporations, William R. Willcox, chairman of the Commission, announced Monday, July 29, that the first hearing would be held in the Aldermanic Chamber at the City Hall on Thursday afternoon at 2 o'clock. Chairman Willcox said that, in all probability, the traffic facilities of the various corporations involved, as these affect the traveling public, would be the subject of a thorough investigation at the outset, and that other matters in relation to the merger would be taken up in the order of their importance.

At the meeting of the Commission Mr. Bassett reported on behalf of the committee appointed to consider forms of reports on wrecks and accidents, such as the railroad companies within its jurisdiction are required to make to the Commission under the new law. The order, which was adopted and will go into effect on Aug. 5, directs the corporations to report every accident resulting in death or serious injury to any person, any collision resulting in serious damage to cars, any derailment of a passenger train, whether in the subway or on the elevated or suburban lines. The railroad companies concerned also are directed to report any serious interference with or stoppage of traffic.

The reports must be made by telephone immediately after any such accident between the hours of 8 in the morning and 11 at night. Any accident occurring after 11 o'clock must be reported at 8 o'clock the next morning. All telephone reports must be followed within three days by written statements to the Commission. This written statement must contain the following information:

(a) The name of the corporation owning the road.
(b) The name of the corporation leasing or operating the road.
(c) The date and hour of the accident.
(d) The precise location of the accident.
(e) The number and description of the car involved in the accident.
(f) The names and places of residence of employees in any way connected with the occurrence.
(g) The names and addresses of passengers or other persons killed or injured.
(h) The names and residences of employees killed or injured, and the extent of the injury.
(i) The circumstances attending and the supposed causes of the accident, with the names and residences of all witnesses who saw the accident or can give any facts in references to the same.

It is announced that Abel E. Blackmar, counsel to the Commission, had appointed as assistant counsel at a salary of $3,500 Albert E. Walker, of 32 Liberty Street, and that the appointment had been confirmed. Mr. Walker, who is a native of Massachusetts and an Amherst graduate, has been practicing law in this city since 1899, and has made a special study of transportation and franchise matters.

It was announced on Tuesday that Theodore P. Shonts, president of the Interborough Rapid Transit Company, will be the first witness before the Public Service Commission when its investigation of the Interborough-Metropolitan merger and the Brooklyn Rapid Transit Company is begun the latter part of the week. President Vreeland and Oren Root, Jr., manager of the New York City Railway, and Vice-President E. P. Bryan and Manager Hedley of the Interborough are among the officials asked to attend. A thorough investigation is under way of the Engineering Department of the old Rapid Transit Commission, which came to it as a legacy from that body when it went out of existence. Chief Engineer George S. Rice, who has occupied that place since William Barclay Parsons quit to become consulting engineer for the Interborough, had about 300 engineers under his jurisdiction in the Rapid Transit Commission's regime. When that body went out of existence many of these men were transferred, mostly at their own request, to other departments. As a result a reorganization of the engineering staff has become necessary. Chairman Wilcox said the investigation was purely preliminary to effecting this reorganization.

EARNINGS OF THE ST. LOUIS COMPANY FOR SIX MONTHS

The report of the United Railways for the first half of this year indicates a large increase in traffic and gross earnings with increased expenses. As a result, while the gross earnings show an increase for the period, the net earnings exhibit a decrease. The report for June shows a large increase in gross earnings, but with a decrease in net earnings, owing to increased expenses. The reason for the greater expenses this year, affecting the net earnings and net income, is in the application of big appropriations to betterment and reconstruction work. The gross earnings for the first six months were $337,981 larger than in the corresponding period of 1906, while the expenses increased $405,256, and the net earnings decreased $67,275. The charges decreased $4,453, and the net income on June 30 this year was $62,822 less than on the same date in 1906. The gross earnings of June showed an increase of $62,116, the expenses an increase of $44,121, the net earnings a decrease of $844, and the net income a decrease of $18,839. Nevertheless, the company had, at the end of the first half year net earnings of $1,761,576, and the net income of $375,266. The June transactions closed with net earnings for the month of $362,836, and a net income of $131,984. The following tables show the increases or decreases for the first six months of this year as compared with the cor-

responding period of 1906, and the increases or decreases for June this year as compared with the same month of 1906. Gross earnings include "other income," and expenses include taxes and depreciation:

SIX MONTHS		
Gross earnings	$5,287,612	*$337,931
Expenses	3,526,036	*405,256
Net earnings	$1,761,576	†$67,275
Charges	1,386,310	†4,453
Net income	$375,266	†$62,822
JUNE REPORT		
Gross earnings	$961,189	*$62,116
Expenses	598,353	*44,121
Net earnings	$362,836	†$17,995
Charges	230,852	†844
Net income	$131,934	†$18,839

* Increase. † Decrease.

The management finished its new car shops, for building and repair work, several months ago, but has been able to use them only for minor work. General Manager McCulloch had hoped to turn out two or three new cars every week in the past three months, but operations were delayed because of difficulty in getting machinery and material. Contracts which required delivery on Jan. 1 are now being fulfilled. Capt. McCulloch expects to run the shops at their full capacity in a week or two. Several rainy days in July had the effect of keeping down the holiday earnings, but it is expected that the summer record will show an average of $100,000 receipts for every Saturday, Sunday and holiday.

THE CONSOLIDATED COMPANY'S ORDER FOR EQUIPMENT

In the last issue of the STREET RAILWAY JOURNAL was briefly noted an order for equipment placed by the Consolidated Company, which embraces all the electric railway lines in Connecticut and Rhode Island under the control of the New York, New Haven & Hartford Railroad. According to official sources this order includes invoices of more than $600,000, embracing 103 closed cars at $5,000 each, making a total of $515,000; fourteen snow-ploughs, which cost $35,000, and motors, trucks, wheels, heaters and brakes in odd lots, which will bring the total to about $75,000 additional. Following is a list of the cars ordered and their specifications, with the line upon which they will be used: New Haven line, sixteen double-truck, 30-ft. closed cars; Hartford line, twenty-four double-truck, 30-ft. closed cars; Bridgeport line, ten double-truck, 30-ft. closed cars; South Norwalk line, three double-truck, 30-ft. closed cars; Derby line, ten double-truck, 30-ft. closed cars; New Britain line, two double-truck, 30-ft. closed cars; Milldale line, two double-truck, 30-ft. closed cars; Waterbury line, eleven 30-ft. closed cars; Stafford Springs line, four 30-ft. closed cars; New York & Stamford line, twelve 30-ft. closed cars; Norwich line, one 33-ft. closed car; Middletown line, eight 33-ft. closed cars; Rhode Island lines, 30-ft. closed cars. Connecticut system total, 103 closed cars.

From the Wason Car Manufacturing Company the officers of the New Haven concern have ordered fourteen snow-ploughs, as follows: Derby line, three; Waterbury line, two; Hartford line, three; Bridgeport line, Milldale line, Stafford Springs, New York & Stamford, Middletown and Norwich lines, one each.

Considerable special equipment has also been ordered, the following makers having been selected to furnish the goods: Bodies from Wason Company; brakes from Allis-Chalmers Company; heaters from Consolidated Electric Company; motors for most all lines, Westinghouse Company; motors for New Haven, Hartford, Stafford Springs, New York & Stamford and Rhode Island lines, from General Electric Company; fare registers from New Haven C. R. Company; trolleys from Sterling Meaker Company; trucks from Standard Motor Truck Company; wheels from Schoen Rolled Steel Company.

THE PLANS FOR THE GALVESTON-HOUSTON INTERURBAN LINE

Stone & Webster, of Boston, have announced the plans for the proposed interurban electric railway between Galveston and Houston, about which there have been many rumors recently. They say their idea is not only to increase the rapid transit facilities between the cities of Galveston and Houston but to assist in the local development of the systems in each city. A company called "Galveston-Houston Electric Railway Company" has been organized to construct and operate the road. In order to make the three properties—the two terminal companies and the interurban—as homogeneous as such an interwoven system naturally should be, another company has been formed—namely, Galveston-Houston Electric Company—which will acquire all of the capital stock of the interurban company, and which will have an authorized capitalization of preferred and common stock equal in amount to the aggregate of the preferred and common stocks authorized by the two terminal companies. It has been made optional to the stockholders of both the Houston Electric Company and the Galveston Electric Company to exchange their holdings, share for share, for stock of the Galveston-Houston Electric Company. The preferred stock of both the Galveston Electric Company and Houston Electric Company is non-cumulative, while the preferred stock of the Galveston-Houston Electric Company is cumulative. No preferred or common stock will be issued by the latter company in excess of the amount of Houston Electric Company and Galveston Electric Company stock surrendered for exchange. Surveys have been made and considerable preliminary work has been done toward the construction of the interurban. The territory between the cities is practically level, with a stretch of open water which will have to be bridged, just north of Galveston. The line will run on a private right of way, and actual construction will be begun as soon as various further preliminaries have been attended to.

EARNINGS OF IOWA INTERURBANS FOR THE YEAR 1906

The interurban railways of Iowa have filed their annual reports for the year ending Dec. 31, 1906, with the executive council of the State for taxation purposes. The following is a short synopsis of these several reports:

The Boone Suburban Railway Company reports 4.70 miles of main line track; total gross earnings, $6,990.33; gross earnings per mile, $1,487.30; total operating expenses, $3,690.30; operating expenses per mile, $785.17; total net earninggs, $3,300.03; net earnings per mile, $702.13.

The Cedar Rapids & Iowa City Railway & Light Company reports 27.63 miles of main line track, same as in 1905; total gross earnings, $100,997.73; gross earnings per mile, $3,655.36; total operating expenses, $64,217.18; operating expenses per mile, $2,324.18; total net earnings, $36,780.55; net earnings per mile, $1,331.18.

The Cedar Rapids & Marion Railway Company reports 15.65 miles of main line track or 1.44 greater than in 1905; total gross earnings, $160,050.30; gross earnings per mile, $10,226.85; total operating expenses, $103,364.07; operating expenses per mile, $6,604.73; total net earnings, $56,686.23; net earnings per mile, $3,622.12.

The Interurban Railway Company of Des Moines reports 64.58 miles of main track, or 35.7 more miles than in 1905; total gross earnings, $198,579.22; gross earnings per mile, $3,074.93; total operating expenses, $104,388.94; operating expenses per mile, $1,616.43; total net earnings, $94,190.28; net earnings per mile, $1,458.50.

The Iowa & Illinois Railway Company reports 33.072 miles of track; total gross earnings, $112,156.04; gross earnings per mile, $3,391.27; total operating expenses, $85,558.28; operating expenses per mile, $2,587.03; total net earnings, $26,597.76; net earnings per mile, $804.24.

Mason City & Clear Lake Traction Company reports 14.62 miles of main line track, same as in 1906; total gross earnings, $48,535.90; gross earnings per mile, $3,319.83; total operating expenses, $47,962.10; operating expenses per mile, $3,280.58; total net earnings, $573.80; net earnings per mile, $39.25.

The Oskaloosa & Buxton Electric Railway Company (first

report) reports 2.3 miles of main line track; total gross earnings, $1,030; gross earnings per mile, $447.92; total operating expenses, $506.88; operating expenses per mile, $220.38; total net earnings, $523.12; net earnings per mile $227.44.

Tama & Toledo Electric Railway reports 2.75 miles of main line track, the same as in 1905; total gross earnings, $12,558.43; gross earnings per mile, $4,565.70; total operating expenses, $8,176.37; operating expenses per mile $2,973.23; total net earnings, $4,382.06; net earnings per mile, $1,593.47.

The Waterloo, Cedar Falls & Northern Railway Company reports 54.73 miles of main line track, the same as in 1905; gross earnings, $170,043.88; gross earnings per mile, $3,106.96; total operating expenses, $89,657.31; operating expenses per mile, $1,638.18; total net earnings, $80,386.57; net earnings per mile, $1,468.78.

The total mileage for all nine companies is 220.032; total gross earnings, $810,941.83; average gross earnings per mile, $3,697.45; total operating expenses, $507,521.43; average operating expenses per mile, $2,447.77; total net earnings, $303,420.40; averag enet earnings per mile, $1,249.68. The total actual valuation of all property of all nine companies is $4,001,473, and the total taxes of all companies paid in 1906 was $18,549.74, so the earnings of the nine companies were in the neighborhood of 7.1 per cent on the total reported valuation. The total mileage for all companies in 1906 is 39,554 greater than for the year 1905. The total gross earnings of all companies are $146,431.48 greater, the total operating expenses are $87,536.27 greater and the total net earnings are $58,895.21 greater than for the year 1905. In 1905 the companies earned more than 7.5 per cent on a reported actual valuation of $3,056,821.

ILLINOIS TRACTION SYSTEM'S PLANS FOR THROUGH LINES

The plans for connecting Chicago and St. Louis by electric railway as proposed by William B. McKinley, president of the Illinois Traction System, have been outlined by him. The road already has been pushed north to Seneca, which is thirty miles from Joliet and Yorkville, from one of which places an entrance into Chicago will be made. The road is to have its own terminal in St. Louis and will build a $2,500,000 bridge from Venice, Ill., across the Mississippi River into St. Louis. In return for the city franchise the bridge gives accommodations for foot and team traffic. The cars now run to East St. Louis, and through express and fast freight service enable St. Louis wholesale houses to reach all of the rich territory of central and southern Illinois. Orders which the Illinois storekeepers send to St. Louis in the afternoon are filled and received in Springfield, Decatur, Bloomington, Champaign and Danville, near the Indiana line, before noon of the next day. In addition to the short stretch on Chicago's outskirts work must be finished on fifty-five miles to connect Eureka and Ottawa and pass through Streator. The Chicago-St. Louis trains will go over this route, passing several miles east of Peoria over a time saving cutoff. The line will be 283 miles long. The fare will be 1½ cents per mile. Another stretch of work of interest is the few miles to connect the Indiana interurban lines with those of Illinois at Danville. When this is finished a continuous trip will be possible from St. Louis through Illinois, Indiana, Ohio and Michigan to Port Huron. When the Chicago connection is completed the system will operate 700 miles of interurban lines. It now has 415 miles, besides 125 additional miles of city lines at Danville, Urbana and Champaign, Decatur, Bloomington, Peoria, Jacksonville and the Tri-Cities.

NEXT CONVENTION OF NATIONAL ASSOCIATION OF RAILROAD COMMISSIONERS

The next convention of the National Association of Railroad Commissioners will be held in Washington, D. C., on Oct. 8, 1907. As a result of the resignation of Hon. John S. McMillin, president of the association, who was a member of the Railroad Commission of the State of Washington, it was deemed advisable, for various reasons, to change the meeting place of holding the next convention to Washington, D. C., Oct. 8, 1907, instead of Seattle, Wash., July 29, 1907. Hon. C. C. McChord, chairman of the Railroad Commission of Kentucky, will preside at the next convention.

TO LOOK INTO NEW YORK RIVER TUNNELS

A number of resolutions were adopted by the Public Service Commission at its open meeting on Wednesday, July 31. Commissioner McCarroll introduced a resolution in anticipation of the opening of the Brooklyn subway, which Chief Engineer Rice said would occur about Nov. 1. The resolution was as follows:

"Resolved, That the chairman designate a Commissioner to consider the matter of providing adequate facilities for the handling of passengers at Borough Hall, Brooklyn, by the time operation of the Brooklyn subway begins."

Commissioner McCarroll also offered the following resolution:

"Resolved, That a Commissioner be designated by the chairman to co-operate with the counsel in preparing a form for annual report under paragraph 46 of the Public Service Commission Law."

Commissioner Bassett was designated in pursuance of this resolution.

In connection with a general investigation of the engineering department of the Commission, which is being conducted quietly by the Commissioners themselves, in order to determine the general efficiency of that department as left over by the old Rapid Transit Board, Commissioner Bassett offered the following resolution:

"Resolved, That Engineer Rice be requested to report to what extent he has heretofore inspected the tunnels and subways of the Hudson & Manhattan Railroad Company and the New York & Jersey Railroad Company (the so-called McAdoo tunnel lines), what portions the city of New York has the privilege to purchase, and what means, if any, are adopted to ascertain the actual cost thereof."

Commissioner Maltbie was designated to investigate the condition of the so-called Steinway tunnel in pursuance of the following resolution which he introduced:

"Resolved, That a Commissioner be named by the chairman to investigate and report upon the status of the subway and tunnel constructed by the New York & Long Island Railroad Company (commonly known as the Steinway tunnel), and to ascertain what rights and franchises are held by this company."

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 41 Park Row, New York.]

UNITED STATES PATENTS ISSUED JULY 16, 1907

859,950. System for Automatic Signaling; Isidor Kitsee, Philadelphia, Pa. App. filed Feb. 11, 1907. Relates more particularly to a railway signal to enable crews of trains or cars traveling either in the same or opposite directions to readily determine the location of each other with respect to the danger zone.

860,010. Guard Rail Clamp; William C. Boswell, Chattanooga, Tenn. App. filed Oct. 8, 1906. A guard rail clamp having guard rail and track rail clamping blocks and means formed in one of the blocks to receive and hold the head of a fastened bolt.

860,114. Trolley Harp; Charles A. Atkinson, Richmond, Ind. App. filed Oct. 20, 1906. The harp is made in the form of a separate section and is so pivoted as to have a vertical oscillatory movement at the upper end of the pole.

860,143. Pleasure Railway; Rocco Mega, New York, N. Y. App. filed April 19, 1907. A pleasure railway comprising an inclined roadway, a circular vehicle body rolling on the roadway, and a plurality of gravity carries suspended within the vehicle body at points intermediate between its axis and the periphery whereby they swing clear of the roadway.

860,206. Alarm and Signal Mechanism; Ellsworth E. Flora and Robert J. Zorge, Chicago, Ill. App. filed Oct. 11, 1906. Provides means for positioning a torpedo in the path of a train when a switch is left in improper relation.

860,229. Trolley Stand; James H. McPherson, Haverhill, Mass. App. filed Jan. 31, 1907. Provides a trolley stand in which the upward pressure caused by the lifting spring upon the trolley wheel is decreased as the pole is lowered, and means for

adjusting the leverage through which the spring acts so that it may be caused to exert its maximum effect in pressing the trolley wheel upward while in a predetermined position, and to exert its minimum effect in pressing it upward in another position.

860,243. Slack Adjuster; Augustus Parker-Smith, New York, N. Y. App. filed Nov. 30, 1906. Relates to means for taking up the slack in the braking mechanisms occasioned by the wear of the brake shoes, in systems where kick springs are used to hold the brake shoes clear of the wheels when brakes are released.

860,249. Slack Adjuster; William H. Sauvage, New York, N. Y. App. filed Nov. 21, 1906. See above patent.

860,279. Brake Shoe; Frederick K. Caswell, Los Angeles, Cal. App. filed June 14, 1906. Comprises a shell embodying a back member, side and end members folded to form walls, indentations or creases extending inwardly from the side members and a body or filling embraced by the shell.

860,320. Brake Rigging; Augustus Parker-Smith, New York, N. Y. App. filed Jan. 4, 1907. The "dead" lever is fulcrumed on the car body instead of on the truck.

860,431. Car Fender; Gustaf M. Anderson, Hyde Park, Mass. App. filed Sept. 25, 1906. Means for maintaining the fender at a constant elevation from the track.

860,438. Device for Removing Ice From Rails; James W. Blacksten, Newark, Ohio. App. filed Jan. 28, 1907. A device for removing ice from rails comprising a yielding carrier frame in which is journaled an ice-crushing wheel having a diagonally-toothed tread, said teeth having sharp angular edges and arranged at an inclination of approximately 45 deg. to the sides of the wheel.

860,526. Trolley Wire Hanger; Walter G. Clark, New York, N. Y. App. filed June 20, 1906. Relates to trolley-wire hangers of the class known as doubt catenary suspension. Construction in which the side bars and spreaded bars of the hanger are easily adjustable so that it can be quickly made to fit varying conditions.

860,558. Railway Track Construction; Henry B. Nichols and George B. Taylor, Philadelphia, Pa. App. filed March 2, 1906. The ties are short blocks and the invention consists in the means for anchoring the ties to a concrete road bed.

860,561. Art of Railway Signaling; Wesley T. Oviatt, Stratford and Edward F. Latimer and William Grunow, Jr., Bridgeport, Conn. App. filed Aug. 2, 1906. A system for erecting the movement of railway cars or trains over a railway either in the same or opposite directions, whereby cars or trains may enter a definite section of the roadway from either end thereof and in and desired number, the first car to enter such section effecting the operation of signals at both ends of the section giving definite indication, and the succeeding cars giving additional indications to show the number thereof.

PERSONAL MENTION

MR. SAMUEL McCLINTOCK HAMILL, prominent in the General Electric Company and president of the Schenectady Trust Company, is dead.

MR. F. W. BROWN, formerly with the Pere Marquette and the Michigan Central Railways, has been appointed general passenger agent of the Michigan United Railways Company.

MR. L. E. HOLDERMAN has been appointed superintendent of the Terre Haute, Indianapolis & Eastern Traction Company. Mr. Holderman formerly was superintendent of the electrical department of the Eastern Wisconsin Railway & Light Company, of Fond du Lac.

MR. SIMON B. STORER, whose resignation from the Niagara Falls, Lockport & Ontario Power Company was mentioned in a recent issue, announces the opening of an office as consulting electrical engineer at 732 University Block, Syracuse, N. Y. Mr. Storer will specialize in power transmission, power contracts, commercial investigations and reports.

APPOINTMENTS announced by the Brooklyn Rapid Transit Company include that of Mr. Albert Maxwell as chief clerk to the general superintendent in place of Mr. T. J. Cunningham, who will retain connection with the company, and Mr. I. B. Clarke as supervisor of motormen for both the surface and elevated lines of the system. Mr. Clarke has hitherto had charge of the training and work of the elevated motormen only.

MR. O. A. HALE, a prominent merchant and capitalist of San Jose, Cal., died at the Hahnemann Hospital, in San Francisco, on July 20, from an attack of appendicitis. Mr. Hale was president of the San Jose-Los Gatos Interurban Railway Company and the Peninsula Railroad Company, of San Jose. He was not only deeply interested in electric railway development in the vicinity of his city, but was an influential factor in the progress of several California industries.

MR. WILLIAM SEIBERT, district superintendent in charge of the eastern division surface lines of the Brooklyn Rapid Transit Company, of Brooklyn, N. Y., has been appointed general superintendent of the surface lines of the company, reporting to Mr. W. S. Mendon, superintendent, who succeeds Mr. Dow S. Smith, resigned. Mr. Seibert has been connected with the Brooklyn Rapid Transit Company and its constituents since 1885, when he was appointed as a conductor on the Nostrand Avenue line. Recognition of his worth came first in his promotion to the place of starter at Prospect Park. Then he became night depot master. His next step was promotion to the position of day depot master at Flatbush. Following this came the important appointment to the position of division superintendent at Bergen Street. Later he was transferred to the still more important post of superintendent of Ridgewood and East New York. With the organization about two years ago of the lines of the company into two divisions, the Eastern and the Southern, representing respectively the lines in East Brooklyn and those in South Brooklyn, Mr. Seibert was selected for the position of superintendent of the Eastern division.

MR. J. S. HAMLIN, who has for the past eighteen months been sales agent of the car equipment division of the Ohio Brass Company, of Mansfield, Ohio, died very suddenly at his home in Mansfield, Friday, July 26. Mr. Hamlin started his railway career with the Chicago street railways in the days of horse car. Later he became master mechanic of the South Side Elevated Railway, Chicago, and from there went to the Indiana Union Traction Company as superintendent of motive power. Subsequently he entered the service of the Christensen Engineering Company, of Milwaukee, and while with this company installed air-brake systems in London and Paris. Later he became Chicago agent of the St. Louis Car Company. As previously stated, it was about eighteen months ago that he accepted the position of sales agent with car equipment division of the Ohio Brass Company. During his connection with this company Mr. Hamlin built up this line of business to a marked degree, having been active in the development of the Tomlinson coupler and other new specialties. Mr. Hamlin was only 42 years of age. He leaves a widow, son and daughter. The remains were interred at Sandwich, Ill., the birthplace of Mr. Hamlin.

MR. J. M. YOUNT, assistant master mechanic of the Pittsburg Railways Company, has been appointed assistant to Mr. W. D. Wright, master mechanic of the Rhode Island Companies, of Providence, R. I., controlling the electric railway lines operating in Providence, Pawtucket, Central Falls and adjoining towns. Mr. Yount began his street railway career in Indianapolis in 1896, with the Citizens' Street Railway Company, whose service he entered after graduating with the degree of electrical engineer from Purdue University. He remained with the Citizens' Company about two and a half years, and then entered the employ of the Metropolitan Street Railway Company, of New York, with which he was connected for about a year. He next entered the employ of the Jersey City, Hoboken & Paterson Street Railway Company as assistant to Mr. H. H. Adams, the master mechanic, under whom he served for more than a year. Subsequently he was appointed master mechanic of the North Jersey Street Railway Company, controlled by the same interests. When the consolidation of the street railway companies of New Jersey was effected in 1902, under the title of the Public Service Corporation of New Jersey, Mr. Yount was made superintendent of rolling stock of the company in charge of the North Jersey division. Later he became connected with Mr. J. H. Fogarty, of New York, whom he represented as sales agent. In April, 1906, he was appointed to the position from which he has just resigned.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement, "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. ‡ Including Rapid Railway system, Sandwich, Windsor & Amherstburg Railway, and Detroit, Monroe & Toledo Short Line Railway.

Company.	Period.	Total Gross Earnings.	Operating Expenses.	Net Earnings.	Deductions From Income.	Net Income, Amount Available for Dividends.
AKRON, O. Northern Ohio Tr. & Light Co.	1 m., June, '07	182,242	100,807	81,434	43,550	37,885
	1 " " '06	159,733	92,152	67,581	40,018	27,563
	6 " " '07	849,257	513,405	335,852	252,735	83,117
	6 " " '06	751,941	480,088	271,853	239,753	32,100
CHAMPAIGN, ILL. Illinois Traction Co.	1 m., June, '07	307,119	*176,109	131,010	.....	.....
	1 " " '06	239,988	*135,397	104,591	.....	.....
	6 " " '07	1,706,317	*974,882	731,435	.....	.....
	6 " " '06	1,362,870	*776,443	586,427	.....	.....
CHARLESTON, S. C. Charleston Consolidated Ry., Gas & Elec. Co.	1 m., June, '07	62,785	37,190	25,594	13,516	12,078
	1 " " '06	55,612	32,144	23,468	13,017	10,452
	4 " " '07	235,644	147,048	88,595	54,067	34,529
	4 " " '06	210,487	128,144	82,343	51,917	30,426
CHICAGO, ILL. Aurora Elgin & Chicago Ry. Co.	1 m., May, '07	116,415	61,872	54,543	26,414	28,129
	1 " " '06	102,533	55,730	46,803	24,939	21,864
	11 " " '07	1,196,047	651,826	544,221	291,311	252,910
	11 " " '06	1,062,666	585,350	477,317	269,079	208,238
Chicago & Milwaukee Elec. R.R. Co.	1 m., June, '07	96,991	33,826	63,165	.....	.....
	1 " " '06	84,555	27,255	57,300	.....	.....
	6 " " '07	434,508	194,355	240,154	.....	.....
	6 " " '06	331,873	143,793	188,080	.....	.....
CLEVELAND, O. Cleveland, Painesville & Eastern R.R. Co.	1 m., June, '07	27,387	*14,972	12,414	7,213	5,202
	1 " " '06	27,257	*14,247	13,011	7,108	5,903
	6 " " '07	123,186	*68,477	54,710	43,276	11,434
	6 " " '06	113,888	*66,102	47,786	41,205	6,581
Cleveland, Southwestern & Columbus Ry. Co. (Incl. Ohio Central)	1 m , June, '07	67,965	40,265	27,701	.....	.....
	1 " " '06	59,058	31,777	27,281	.....	.....
	6 " " '07	338,687	205,182	133,505	.....	.....
	6 " " '06	289,277	173,160	116,117	.....	.....
COLUMBUS, GA. Columbus Elec. Co.	1 m., May, '07	30,063	*18,809	11,255	10,080	1,175
	1 " " '06	24,825	*13,251	11,574	8,762	2,812
	12 " " '07	329,349	*182,842	146,507	111,170	35,337
DALLAS, TEX. Dallas Elec. Corp'n.	1 m., May, '07	89,532	*66,523	23,009	18,148	4,861
	1 " " '06	83,369	*55,010	28,359	15,660	12,699
	12 " " '07	1,058,952	*769,674	289,278	195,032	94,245
	12 " " '06	996,462	*615,004	381,458	183,445	198,013
DETROIT, MICH Detroit, Jackson & Chicago Ry.	1 m., June, '07	35,674	*27,014	8,660	15,012	†6,352
	5 " " '07	164,626	*131,597	33,029	75,062	†42,033
‡Detroit United Ry. Co.	1 m., June, '07	603,601	*344,428	259,173	116,968	142,205
	1 " " '06	554,937	*323,457	231,480	105,296	126,184
	6 " " '07	3,122,701	*1,946,142	1,176,559	679,003	497,556
	6 " " '06	2,777,877	*1,678,069	1,099,808	604,743	495,065
DULUTH, MINN. Duluth St. Ry. Co.	1 m., May, '07	69,316	35,018	34,298	17,641	16,657
	1 " " '06	63,884	33,020	30,864	17,513	13,352
	5 " " '07	313,305	166,340	146,965	88,007	58,958
	5 " " '06	289,238	162,210	127,029	87,519	39,509
EAST ST. LOUIS, ILL. East St. Louis & Suburban Co.	1 m., May, '07	178,988	95,535	83,453	.....	.....
	1 " " '06	159,183	79,022	80,161	.....	.....
	5 " " '07	814,750	449,198	365,552	.....	.....
	5 " " '06	733,138	375,868	357,270	.....	.....
EL PASO TEX. El Paso Cos.	1 m., May, '07	40,537	*31,299	9,238	5,004	4,234
	1 " " '06	31,666	*21,625	10,042	3,793	6,248
	12 " " '07	435,659	*329,461	106,198	51,851	54,347
	12 " " '06	322,533	*218,216	104,317	45,096	59,221
FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co.	1 m., May, '07	101,012	60,566	40,446	.....	.....
	1 " " '06	87,328	55,847	31,481	.....	.....
	5 " " '07	461,971	284,757	177,213	.....	.....
	5 " " '06	398,959	250,527	148,432	.....	.....
FT. WORTH, TEX. Northern Texas Tr. Co.	1 m., May, '07	84,608	*51,567	33,041	10,401	22,640
	1 " " '06	71,485	*42,695	28,790	9,942	18,848
	12 " " '07	947,549	*599,240	348,308	121,338	226,971
	12 " " '06	720,553	*440,259	280,294	119,660	160,634
GALVESTON, TEX. Galveston Elec. Co.	1 m., May, '07	31,468	*19,548	11,920	4,167	7,753
	1 " " '06	37,721	*16,519	11,201	4,167	7,035
	12 " " '07	341,624	*202,959	138,665	50,000	88,665
	12 " " '06	279,642	*177,421	102,221	50,000	52,221
HOUGHTON, MICH. Houghton County St. Ry. Co.	1 m., May, '07	20,775	*11,116	9,659	3,974	5,685
	1 " " '06	18,212	*11,500	6,713	3,966	2,747
	12 " " '07	241,034	*150,810	90,224	47,140	43,084
	12 " " '06	205,679	*144,334	61,345	45,642	15,703
HOUSTON, TEX. Houston Electric Co.	1 m., May, '07	54,137	*38,181	15,955	8,417	7,538
	1 " " '06	49,176	*29,624	19,553	7,692	11,861
	12 " " '07	626,604	*404,201	222,403	95,185	127,217
	12 " " '06	551,997	*341,837	210,161	101,331	108,829
KANSAS CITY, MO. Kansas City Ry. & Lt. Co.	1 m., May, '07	498,497	277,468	221,029	151,980	69,049
	1 " " '06	461,181	252,796	208,385	141,016	67,369
	12 " " '07	5,724,780	2,909,136	2,815,644	1,765,870	1049774
	12 " " '06	5,162,869	2,596,500	2,566,369	1,644,524	921,845
LEXINGTON, KY. Lexington & Interurban Rys. Co.	1 m., May, '07	46,649	30,816	15,833	.....	.....
	1 " " '06	46,640	31,009	15,630	.....	.....
	5 " " '07	204,221	138,565	65,656	.....	.....
	5 " " '06	184,134	133,337	50,796	.....	.....
MILWAUKEE, WIS. Milwaukee Elec. Ry. & Lt. Co.	1 m., June, '07	332,192	155,797	176,395	100,529	75,866
	1 " " '06	300,793	146,401	154,392	76,993	77,399
	6 " " '07	1,861,926	936,302	925,624	568,694	356,930
	6 " " '06	1,671,660	840,212	831,448	514,405	317,043
Milwaukee Lt. Ht. & Tr. Co.	1 m., June, '07	77,830	30,364	47,466	56,695	†9,229
	1 " " '06	65,750	24,461	41,289	28,007	13,282
	6 " " '07	344,534	158,710	185,824	209,921	†24,097
	6 " " '06	293,240	123,046	170,194	145,961	24,233
MINNEAPOLIS, MINN. Twin City R. T. Co.	1 m., May, '07	496,711	235,986	260,725	115,142	145,583
	1 " " '06	448,104	209,263	238,841	110,592	128,249
	5 " " '07	2,317,873	1,148,373	1,169,501	576,175	593,326
	5 " " '06	2,070,018	998,838	1,071,180	549,425	521,755
MONTREAL, CAN. Montreal St. Ry. Co.	1 m., June, '07	325,252	175,031	150,221	55,786	94,436
	1 " " '06	287,595	152,835	134,760	52,034	82,727
	9 " " '07	2,494,888	1,585,598	909,290	389,614	519,675
	9 " " '06	2,193,785	1,367,193	826,592	319,008	507,584
NEW ORLEANS, LA. New Orleans Ry. & Lt. Co.	1 m., May, '07	470,901	261,047	209,854	154,806	55,048
	1 " " '06	495,661	271,935	223,727	167,562	56,165
	5 " " '07	2,452,811	1,279,149	1,173,662	761,481	412,180
	5 " " '06	2,573,502	1,292,495	1,281,007	834,264	446,743
NORFOLK, VA. Norfolk & Portsmouth Tr. Co.	1 m., May, '07	216,919	140,084	76,835	.....	.....
	1 " " '06	142,086	95,777	46,309	.....	.....
	5 " " '07	845,932	551,247	294,686	.....	.....
	5 " " '06	637,464	417,276	220,188	.....	.....
PEEKSKILL, N. Y. Peekskill Lt. & R. R. Co	1 m., June, '07	16,513	7,990	8,523	.....	.....
	1 " " '06	15,219	7,065	8,154	.....	.....
	6 " " '07	75,824	43,714	32,110	.....	.....
	6 " " '06	65,976	35,984	29,992	.....	.....
PHILADELPHIA, PA. American Rys. Co.	1 m., June, '07	264,986	.....	.....	.....	.....
	1 " " '06	247,230	.....	.....	.....	.....
	12 " " '07	2,855,335	.....	.....	.....	.....
	12 " " '06	2,610,449	.....	.....	.....	.....
PLYMOUTH, MASS. Brockton & Plymouth St. Ry. Co.	1 m., May, '07	9,772	*6,862	2,910	1,814	1,096
	1 " " '06	8,793	*6,175	2,618	1,833	785
	12 " " '07	114,868	*73,054	41,814	21,673	20,141
	12 " " '06	103,461	*72,029	31,432	21,457	9,974
ST. LOUIS, MO. United Railways Co. of St. Louis	1 m., June, '07	961,189	*598,353	362,836	230,852	131,984
	1 " " '06	899,073	*554,232	344,841	231,696	113,145
	6 " " '07	5,287,612	*3,526,036	1,761,576	1,386,310	375,266
	6 " " '06	4,949,631	*3,120,780	1,828,851	1,390,763	438,088
SAVANNAH, GA. Savannah Electric Co.	1 m., May, '07	48,332	*34,643	13,688	11,973	1,715
	1 " " '06	53,174	*30,694	22,480	11,020	11,460
	12 " " '07	597,231	*381,750	215,481	138,350	77,131
	12 " " '06	609,734	*369,463	240,271	129,634	110,637
TACOMA, WASH. Puget Sound El. Ry. Co.	1 m., May, '07	148,273	*89,440	58,833	30,680	28,153
	1 " " '06	112,155	*73,937	38,218	24,450	13,768
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., May, '07	173,990	*106,632	67,358	47,397	19,961
	1 " " '06	167,847	*93,855	73,992	42,243	31,749
	5 " " '07	834,881	*490,132	344,749	229,111	115,638
	5 " " '06	784,391	*420,494	363,897	211,451	152,446

Street Railway Journal

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Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1907 *to date* 262,550 *copies, an average of* 8204 *copies per week.*

Standardizing Equipment

The work of standardization was considerably advanced at the Cleveland meeting of the committee on standards, a report of which appears elsewhere in this issue. The task laid out for completion before the Atlantic City convention is vast in its proportions and is especially difficult because of the great variety in practice in different parts of the country. Moreover, many of the companies have not yet exchanged rolling stock with each other to any extent, so have not yet experienced quite so acutely as others the desirability of uniformity in the dimensions of those parts capable of standardization. In this respect the subject of standards differs from that of the steam railroad companies. Nevertheless, under the able administration of Chairman Evans, order seems gradually rising out of chaos. Long sessions with the manufacturers disclosed many points upon which agreement could be reached, and while the work has not advanced far enough to warrant the final adoption of any proposed set recommendations an excellent start has been made. This work is to be supplemented by a second meeting to be held during the early part of September, at which it is hoped that the suggestions made at Cleveland will be crystallized around certain definite recommendations.

The Brass Foundry

In many distant parts of the country the high freight charges and the difficulty of getting prompt deliveries have lead to practices which would not be feasible under ordinary conditions. Many of these "home-made" appliances and methods have been described from time to time in these columns and have proved useful to those who, on account of their location, are thrown largely on their own resources. A recent letter bearing upon this subject makes the inquiry as to the proper method of conducting a brass foundry.

A road operating but a very few cars, say less than a score, might find it unprofitable to organize a brass foundry, but as the number of cars increases above fifty or thereabouts the advantage of making one's own castings where a road is some distance from the base of supplies is frequently apparent. On one road operating some seventy cars a small brass foundry was installed in a corner of the shop and trolley wheels, bearing shells, handles for the mechanical operation of reversers, spiral rings, brass fittings for the car interiors, window catches and other appliances have been turned out, if not for less than the market price, at least more quickly than could have been obtained otherwise. One of the shop carpenters makes the original patterns in wood; these are then duplicated in aluminum if the product is to be repeatedly used, and the road becomes independent of the weather changes which are liable to cause shrinkage or other distortion in the wooden patterns.

It is not even necessary in small brass foundries for the labor expense to be continuous; that is, the man in charge can be utilized on other work part of the time, and when the days for pouring off come around, one of the shop employees can be pressed into service to help operate the brass furnace. This is the plan followed in the case above mentioned, the foundryman devoting his time to babbitting bearings when he is not at work on the flasks or the brass furnace equipment. The scrap of the brass foundry can be reclaimed profitably in these days, even to the metalliferous

sand on the floor beneath the point where the furnace discharges into the pouring ladle. Provision for proper ventilation is an important point to secure in small foundries as well as adequate lighting, but the expense of doing these things is a small matter if care is taken to shut off power when it is not needed. Elaborate equipment is not necessary, but the foundry work should be done by an experienced man commanding first-class wages, for the foundry is no place for the costly experiments of incompetent employees.

Delta vs. Star Transformer Connections

The relative advantages of delta and star transformer connections frequently come up in the selection of three-phase power house and sub-station equipment, both with and without a grounded neutral connection. No hard and fast line can be drawn between the sizes best adapted to each style of connection, and a proper decision can only be made with local conditions in mind, influenced by the characteristics of delta and Y windings as modifying the price, weight and reliability of the capacities demanded.

With the delta connection the pressure across the terminals of one phase is the same as that of the circuit to which they are connected, but in case of a Y connection, each winding furnishes only 57.7 per cent of the line or bus potential. The current in one leg of a delta winding is 57.7 per cent of the line current, while in a star system each leg carries 100 per cent line current. For a given transmission voltage the star connection theoretically allows the use of smaller transformers, although the actual saving is not large, and the installation is not subjected to over 58 per cent of the voltage, normally. The size of the wire must be increased, but in small transformers, where the insulation takes up a considerable portion of the volume of the coil, and where the wire is of small cross-section, the star connection probably gives a better mechanical construction. Less insulation is required when the neutral is grounded or than when the delta connection is employed. With the grounded neutral there is less strain on the apparatus in case the line grounds.

As the sizes of transformers increase, the insulation advantages of the star connection become of less moment, and the flexibility of the operating arrangement tends to become important. If the transformers are connected in delta and one coil breaks down, the voltage relations are not seriously disturbed, and the transformers will keep in service. The faulty one can then be disconnected and three-phase current at full line potential obtained from the other two. In a three-transformer Y system, in case of the failure of one unit, the tendency is for the entire system to break down, though with a grounded neutral operation will be possible in many cases. Generally speaking, therefore, the reliability desirable in heavy power work seems better served by the use of the delta winding, though in very high potential practice the Y should be considered seriously on its merits as applicable to the conditions so far as known.

Limitations of Through Service

The extension of through car service in electric railway work shows little sign of abatement in sections of the country where high-speed operation is feasible, and in the last few years there has been a remarkable enlargement of through car facilities even in populous regions like Eastern Massachusetts, where the roads, in the main, occupy the highways between the cities and towns connected. It is important, however, to bear in mind the limiting conditions of through service, in order that the expansion of such facilities in the future may proceed along lines calculated to develop the maximum traffic.

The mere condition of a continuous track connection between two distant cities is by no means all that is necessary to encourage through riding, and the operation of cars from terminus to terminus without change does not in itself insure the development of heavy travel. In some communities the through service furnished is encumbered by such slow schedule speeds that the advantages of lower fares than rival steam lines charge are insufficient to persuade persons whose time is valuable to take the trolley. Often the physical limitations of the route preclude fast running. Whatever the conditions may be that choke swift movement between important centers, it is becoming more and more important for the electric railway manager to be able to look at the service from the standpoint of the prospective passenger, as well as from the railroad point of view. It is not enough to figure on a certain traffic induced by one or two paramount advantages over competitors; cleaner service and cheaper fares are strong points in favor of the electric railway in about all localities where it has been introduced, but these do not offset with all classes of riders the time element, the factor of safety in travel, the comfort and the reliability of competitive lines. The mistake of looking at the attractions of the service separately has often been made, and nothing is more certain than that the purchasing public will weigh a large number of conditions in the long run before it settles upon any one line of transportation in the face of keen competition.

It sounds like repeating platitudes to enumerate the essentials of a successful through service, but it is constantly being demonstrated that only that service which offers the most attraction for the price charged will win out in the continued patronage of the public. In some parts of the country the choice of facilities is exceedingly limited, but in others it is so broad that every time a man patronizes a railroad a choice between several is exercised. It is safe to say that no single condition settles the problem in the minds of the public as a whole. Some will be reached by the convenience of the stops, others by the frequency of the service, others by the transfer privileges accorded, and so on. The longer the run, however, the more important certain factors become, notably the total time required for the journey, the competitive fares and schedules of other lines, and the comfort of the rival facilities. Some of the conditions of travel are necessarily antagonistic—convenience in stops must often be sacrificed to speed requirements, and the longer the run, the less is the allowable number of inter-terminal stops. Compromises are essential in the shorter runs, but as the service broadens out to cover points a hundred or two miles apart without change of cars, it is clear that speed and comfort will go far to offset the inconvenience of a single stop in small towns and two or three in the larger centers, except, of course, in cities where the population runs up into the scores of thousands. On

such runs as this the traffic cannot be captured simply by a difference of 25 or 50 per cent in fare over that of competing steam lines unless the difference in fare is worth more to the passenger than the extra time required to cover the route. The value of time is so great in these days of shortened hours of labor and intensified human production that unless the long-distance through trolley car makes a schedule reasonably close to that of local steam trains, or even better, it cannot expect to secure as large a share of the travel as would be the case with a little faster service. Thus if it "spoils a forenoon" to go from A to B by through trolley at a cost of 50 cents in 2.5 hours, the rival charge of $1 from A to B on the steam line competing by a run of 1 hour will look insignificant to the man whose time is worth over 33 cents an hour. Pleasure travel is another matter, of course.

It may be safely assumed that a fast schedule is the prime essential—safety, of course, included—of all through runs over the longer distances between terminals. High-powered equipment may or may not be necessary, but the track must permit sustained running at good average speeds with comfort to those on the cars. It costs money to maintain such tracks, but with careful management the work should be afforded under reasonably good traffic. By cutting down all superfluous stops and slowdowns and making prompt changes of cars at junctions the need of high maximum speed can be diminished. A sustained high average speed is the key to the situation in competitive through travel.

The Size and Capacity of Car Shops

In the design of new power plants or the extension of existing stations, the problems of building size and machinery capacity seldom suffer from the lack of careful study on the part of the management of each system. To a certain extent this is true of car-shop designs, but there is still need of a broader appreciation of the possibilities of future growth in many instances. It is a chronic complaint, even among master mechanics in comparatively new shops, that the different departments soon are cramped for space, and the result is invariably either a reduced repair output or a performance of work under discouraging handicaps.

Of course, there is a practical limit to the size of car shops which should be afforded by a particular system, and doubtless it is sometimes necessary to pare down the dimensions somewhat below those which seem ideal to the shop executives. But the usual experience of being hard pressed for room soon after the shops are finished and sometimes before all the machine tools are set up, indicates the need of building larger structures and allowing more floor space per department than seem absolutely necessary with a liberal eye toward the future. With the old wooden car houses and shops the space question could be solved easily enough as time passed, provided the company owned enough land at the site. As brick and steel came into vogue the cost of enlargements and extensions increased, and now, as concrete, reinforced or in block form, is rapidly coming into favor, the expense of alterations leading toward more capacity is plainly a serious matter. In many cases it is next to impossible to enlarge a shop along the symmetrical lines which we see in so many of the broadly conceived power-plant designs.

Extensions of storage tracks and inspection pits are easier problems to solve than the enlargement of machine, forge, store and winding departments. If the worst comes to the worst, storage space for cars can be arranged elsewhere on the system and inspection pits provided beneath one or more of the old storage tracks. By the use of a little finesse in rearrangement, the paint shop's ministrations can be extended over a wider area. New storage bins and racks may be added in various parts of a group of shop buildings, but unless the storeroom is located in a place where symmetrical expansion is possible without sacrificing its centralization of access, the operating convenience of this important branch of the shop is sure to be greatly hindered. Motor-driven machine tools with individual outfits independent of the usual line-shaft and group-belting facilitate the extension of the machine shop, but unless the enlargement of the machine room floor space proceeds along lines symmetrical with respect to the hoisting facilities, pits and tracks already in place, the cost of handling work and the delays in preparing for repairs are certain to increase beyond desirable bounds.

In the forge shop and winding departments it is highly desirable that truck parts and armatures, field coils and contactor equipment shall be transferred between the car and the shop division with the least delay and with the least possible obstruction to other operations. Expansion of the forge shop into adjacent rather than adjoining quarters tends to interfere with the work in other parts of the establishment, unless the new quarters are on the opposite side of the leading in track layout. In the most carefully planned shops for electric railway repairs full attention is, or should be, given to avoiding idle or return travel as cars and parts journey from point to point.

Shop size, as evidenced by floor area per department, is not the final factor which settles the speed and cost of repairs. A satisfied force of men provided with plenty of labor-saving machine tools will produce a far greater output than a poorly paid and ill equipped force in larger quarters. The use of home-made contrivances for facilitating repairs in simple, but effective, ways is a powerful agent in the reduction of shop costs. It is a mark of clean, honest loyalty to a company's best interests that in so many shops, particularly on small roads which cannot afford extensive facilities, the shop force takes pride in making economical repairs and a progressive interest in doing first-class work under obstacles which would daunt a poor mechanic or one without the desire to do his best all the time. The recommendations of the master mechanic should always be carefully considered in reference to extensions either of plant or equipment, and their advisability discussed as thoroughly as a request of the chief engineer for a new generating unit. Floor space rarely is wasted when a first-class master mechanic takes command in an electric railway repair shop. If the desired areas work out as much too costly, nothing is lost in explaining the whole situation from the viewpoint of the management. Larger shops than at first seem necessary are a serious need at the present time on many well-operated properties.

THE PITTSBURG & BUTLER STREET RAILWAY CO.—I.

BY M. N. BLAKEMORE

The prevailing inclination toward higher speeds on interurban electric railways calls for a roadbed and equipment closely approximating standard steam railroad practice. This has been exemplified by the measures adopted by the Pittsburg & Butler Street Railway Company, whose single-phase equipment was placed in regular service on May 1.

The total length of the road is approximately 39 miles, of which about 6 miles include the trackage of the Pittsburg Railways Company, which secures the entrance into Pittsburg. Except for this part of the road, and about 3 miles in the borough of Etna, and also through the towns of Valencia and Mars, the route is over a private right of way. In Butler, the cars use the tracks of the Butler Passenger Railway Company, an affiliated concern.

Butler is the county seat of Butler County, has a population of about 28,000 persons and is an aggressive and prosperous town. Besides the local business it boasts of several large manufacturing concerns, among which is the Standard Steel Car Company, employing several thousand hands. The other towns which are connected by this road have a varied population, but with the opening of the electric road the population is expected to increase considerably, owing to the excellent facilities offered. The cities of Pittsburg and Allegheny have a population of 321,616 and 129,896, respectively, so that a large amount of travel on the road is assured.

The country traversed by this line, while largely agricultural, is rich in coal and oil and on this account is well populated. While the Baltimore & Ohio Railroad connects many of the towns in this district and parallels the electric road a great distance of the way, it has been the aim of the Pittsburg & Butler Street Railway Company so to plan its route as to serve the principal localities as well as the more remote ones, and at the same time to follow the most direct route between Pittsburg and Butler, the two terminals of the road. This procedure necessitated a great deal of structural work along the line and involved many new engineering features, as the country covered is extremely hilly.

As the road has adopted the single-phase railway system as designed by the Westinghouse Electric & Manufacturing Company, by whom it was also installed, there are many radical departures from the customary street railway practice and the installation presents, on the whole, many interesting features which it is intended shall be described in this article.



POWER STATION OF PITTSBURG & BUTLER RAILWAY AT RENFREW, SHOWING DAM

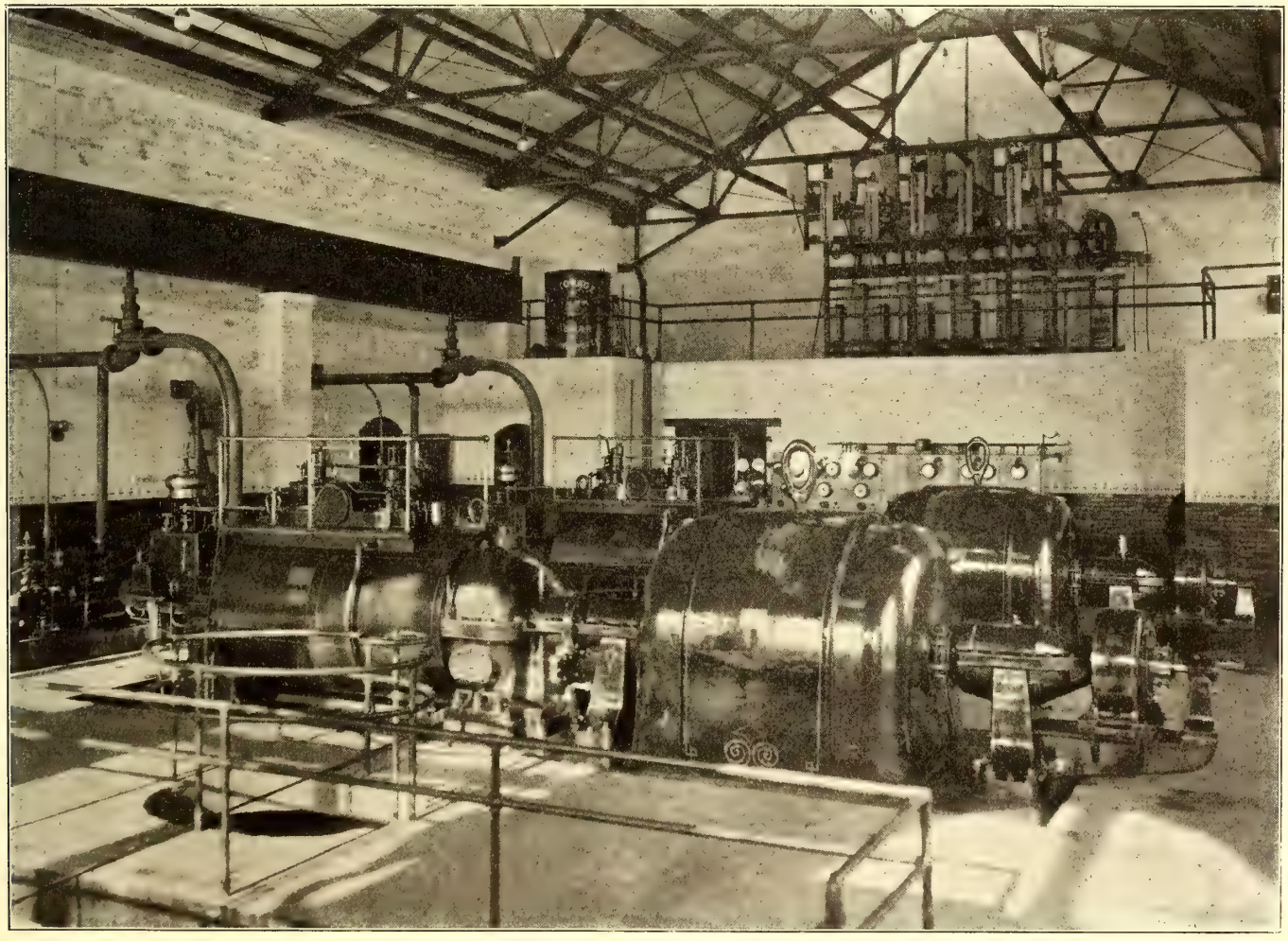
POWER HOUSE

The situation of the power house, at the confluence of the Connaquenessing and Thorn Creeks, about 6 miles from Butler, affords ample water supply to meet all present and future requirements of the plant. It is also adjacent to the tracks of the Bessemer & Lake Erie Railroad and a spur of the Baltimore & Ohio Railroad has been run along the side of the power house, thus giving facilities for the handling of the coal, which is dumped through an open trestle into an extension of the boiler room floor on the outside of the building into which it can be taken through suitable doors which have been provided for that purpose.

The power house, as illustrated in the accompanying engraving, is of pleasing design and is built of pressed brick and measures 105 ft. 10 ins. wide x 98 ft. 7 ins. long. It is divided longitudinally into the boiler and turbine rooms, which measure 49 ft. 0 in. and 52 ft. 0 in. in width respectively. Ample light and ventilation are afforded by means of a skylight which extends the entire length of the boiler and turbine rooms. The illumination at night is supplied by means of Nernst lamps, receiving their current from step-down transformers in the high-tension transformer room. In addition to this, large windows are provided on all sides of the plant. The roof of the building, which is covered by Bangor slate, is supported by means of a light steel framework, which in turn rests upon the brick walls of the power house. One end of the turbine room has been partitioned off into a toilet room provided with lockers and shower bath, while the remaining part forms the high-tension room for the raising transformers. The ceiling of these two rooms forms the floor of the high-tension switching gallery. A 30-ton Whiting crane serves the ma-



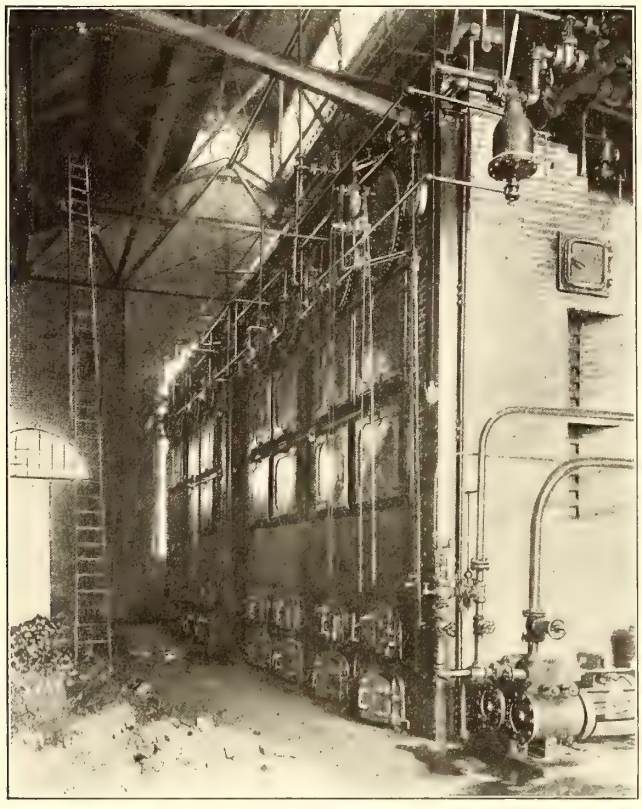
PANORAMIC VIEW OF BUTLER



INTERIOR OF POWER STATION OF PITTSBURG & BUTLER RAILWAY

chinery in the turbine room. This crane runs on a 50-lb. rail, supported upon a 35-in. steel girder, which is mounted upon brick pilasters forming a portion of the station walls.

The foundations of the building are of concrete, the aver-



BOILER ROOM

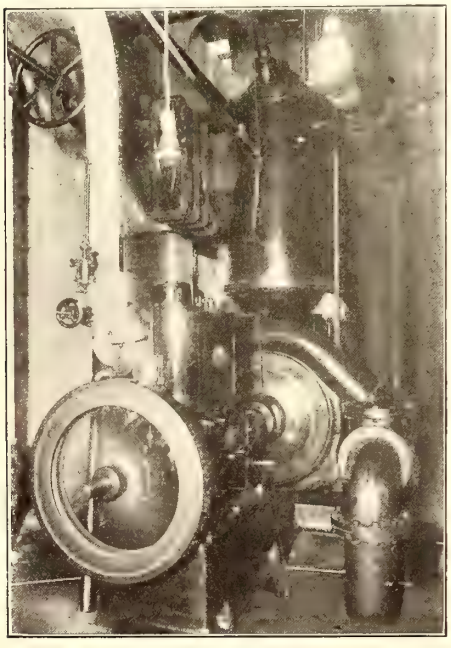
age thickness of which is about 24 ins. The base, however, varies from 3 ft. to 6 ft. at the pilasters. On the boiler room side the pilasters have been extended so as to form the foundations for the railroad siding of the Baltimore & Ohio Railroad, to which reference has already been made. One point worthy of notice is the ample space provided in the boiler room. Contrary to usual practice, a large unobstructed space has been left at the rear of the boilers which allows ample room for cleaning or repairs. A large amount of headroom has also been provided above the boilers, which affords ready access to the valves and fittings.

Running the entire length of the building, under the boiler room floor, and in front of the boilers, is a concrete tunnel, varying in height from 5 ft. 4 ins. to 6 ft. 4 ins., and 5 ft. 0 in. in width, which has been provided for handling the ashes and refuse from the boilers. This tunnel is supplied with a narrow-gage track upon which a small ash car may be run. When loaded, the ashes are pushed to the end of the tunnel and are there raised by means of an elevator to the surface, where they are hauled to the dump.

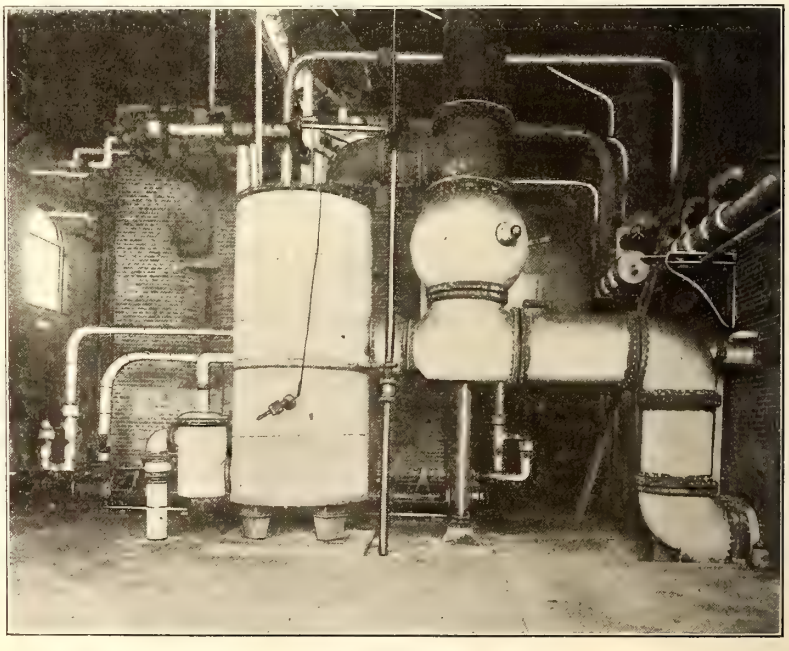
The stack is built of Kellogg radial hollow tile and stands 125 ft. in height above the under side of the breeching. The stack rests upon a concrete base 16 ft. in diameter and 16 ft. deep. The external diameter at its base is 14 ft. 10 ins., while the internal diameter is 10 ft. 6 ins. The internal diameter at the top of the stack is 9 ft. 0 in.

In order to secure an ample supply of water a concrete dam has been constructed near the power house site. The condensing and boiler-feed water is carried through a concrete tunnel to the power house. The water enters an intake some distance above the breast of the dam through a settling basin containing movable screens which prevent foreign substances being carried through the tunnel. This basin is filled with coke which thoroughly filters the water, thus insuring its cleanliness. The intake tunnel, measuring 2 ft. 6 ins. x 2 ft. 6 ins., extends the entire length of the building below the condenser room floor, thus materially cutting down the length of pipe to the condensers and other apparatus, which would otherwise be required.

A discharge tunnel, 2 ft. square, running parallel to the intake tunnel, also extends the full length of the condenser room. From the power house this tunnel extends to a point near the creek where it divides, one branch going above the breast of the dam, while the other empties below the dam. Each of these branches is controlled by means of a 30-in. gate valve. Under normal conditions, when the creek is high, the outlet above the breast of the dam is closed, the

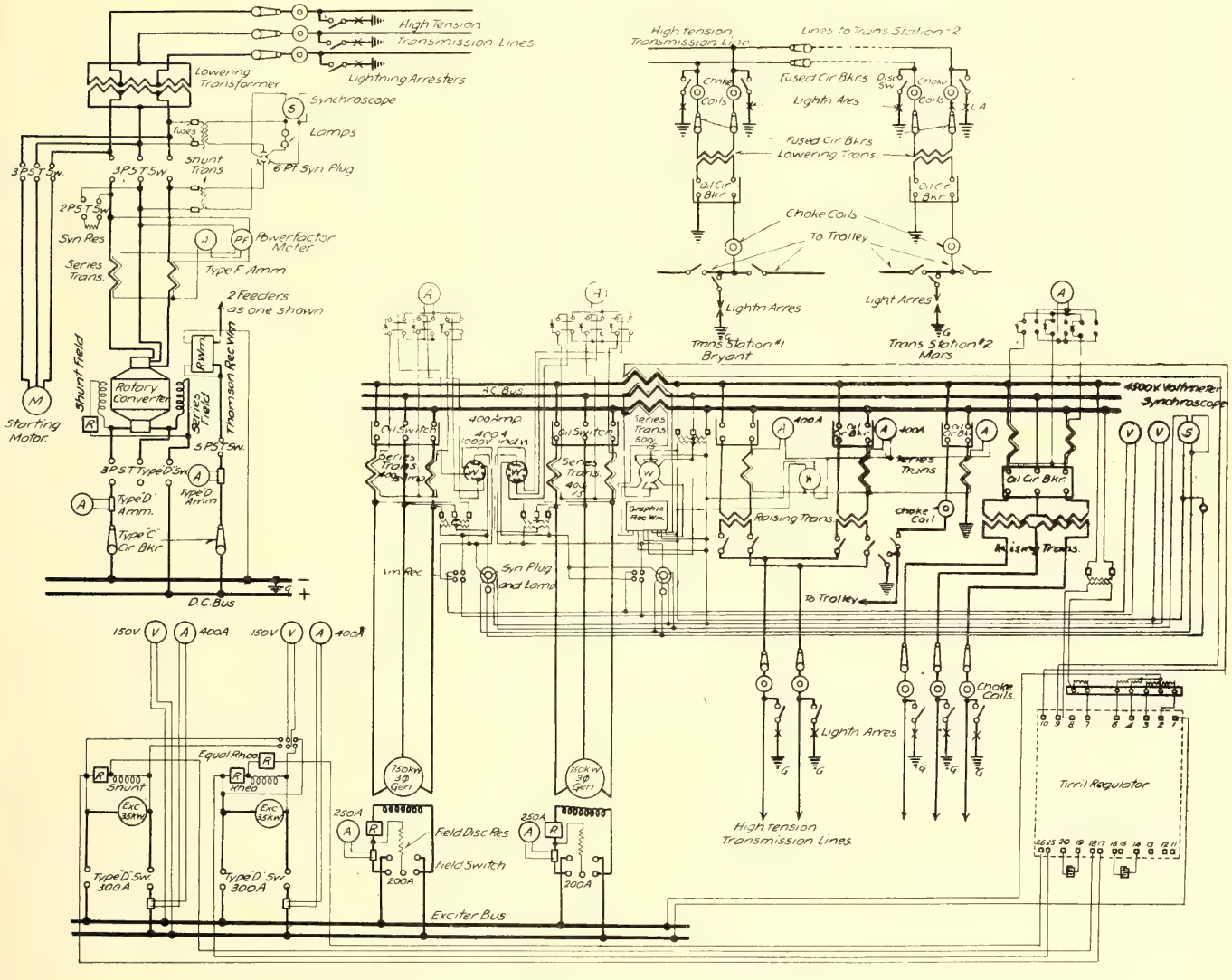


CONDENSER OUTFIT



INTERIOR OF BOILER ROOM, SHOWING HEATER AND PIPING ARRANGEMENT

condensing water emptying below the dam. When the creek is low, the upper outlet is opened, the lower one being closed and the condensing water then empties above the dam, and it eventually re-enters the intake tunnel again and in this manner it is used an indefinite number of times, the creek forming a large cooling basin for the discharge water. In connection with the intake and discharge tunnels, it is to be noted that both of them form an integral part of the power house foundations and are provided with pockets for the collection of sediment and foreign particles.



SCHEMATIC DIAGRAM OF CONNECTIONS OF SYSTEM

Each of these pockets has a manhole rendering it accessible for cleaning.

BOILERS

The boiler plant at present consists of four 350-hp Babcock & Wilcox water-tube boilers set in batteries of two boilers each. Provision, however, has been made for an additional battery of boilers to take care of the future extensions of the turbine plant. They are designed for a working pressure of 160 lbs. per sq. in., and each boiler has a total heating surface of 3500 sq. ft. The boilers are of the double-deck type and have 4-in. tubes. They are provided with a superheater capable of superheating the steam 125 degs. F. when working under normal pressure. At present firing is done by hand, but provision has been made so that stokers can be installed if it is decided to do so at a later date. The contents of the ash pits are deposited by gravity into chutes terminating over the narrow-gage railway in the ash tunnel above referred to.

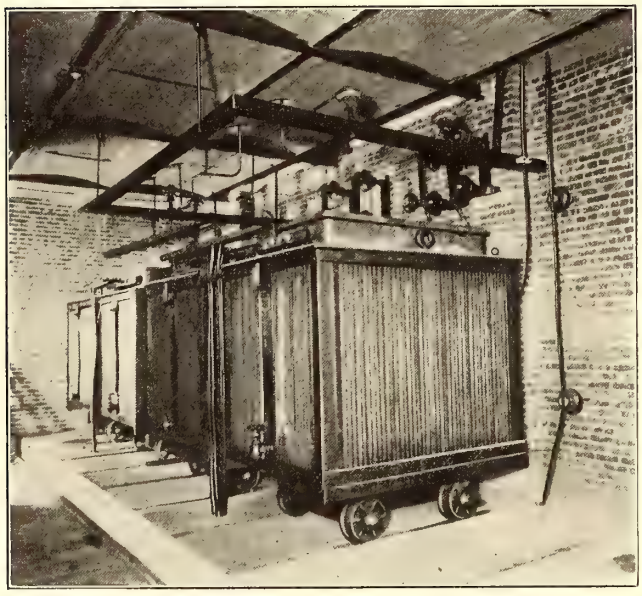
Each battery of boilers is supplied with an independent Epping-Carpenter 12-in. and 7 x 12-in. feed pump, and is fed by duplicate feed-water pipes, so arranged that either pump can be used to feed either or both batteries of boilers. This system of water supply is the only one which is duplicated in the power plant, but it has been found advisable to do so in this instance in order to insure a constant supply of water to the boilers in case of accident to one set of supply pipes. Each feed line is equipped with a Worthington water meter.

The boiler gases are conveyed to the stack through a 13-ft. 2-in. x 5-ft. 8-in. flue, which extends along the rear of the boilers about 10 ft. from the ground. Passing through the end of the boiler room it makes connection with the stack above described. No attempt has been to localize the gases from individual boilers, but all discharge into the common flue. Each boiler, however, is provided with a Ford automatic damper regulator. Each individual boiler is also supplied with a Williams feed-water regulator, by which the boiler feed-water supply is controlled.

PIPING

Two complete systems of piping are provided in the plant, one for saturated and the other for superheated steam.

The superheated steam is carried from each boiler through a 6-in. heavy steel pipe, which is provided with screwed male and female flanges. Each of these supply pipes is provided with a 6-in. stop and check valve, which controls the supply of steam to the 10-in. header running along the



INTERIOR HIGH-TENSION ROOM, SHOWING 500-KW OIL-INSULATED, SELF-COOLING TRANSFORMERS

boiler room wall. From this header the supply for the steam turbines is conveyed through a 6-in. steel pipe. The saturated steam passes through a 2½-in. stop and check valve on each boiler, through a 2½-in. pipe to the main 6-in. header, mounted beside the 10-in. super-heated steam header above described. Both of these headers are supported by means of cast-iron brackets supplied with roller bearings to provide for the expansion and contraction of these pipes. The expansion and contraction of all other piping is taken care of by means of long bends.

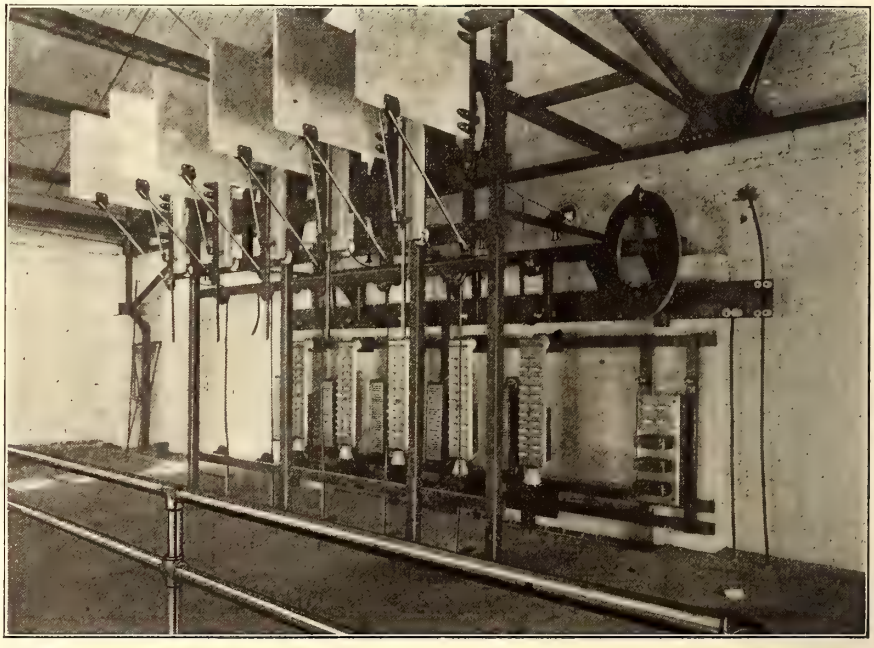
If, for any reason it is desired to connect the superheat and saturated steam headers, this can be accomplished by means of a 6-in. pipe connection which has been provided between these lines, the same being controlled by a suitable gate valve. The piping is so arranged that if it is desired the plant can be run on the unit system, each individual bank of boilers supplying steam to its own turbine. Ordinarily, however, this procedure is not resorted to. The auxiliary machinery is operated entirely from the saturated steam line.

HEATERS

In the boiler room adjacent to the feed-water heaters, there has been installed a 2000-hp Bonar vertical open heater, through which exhaust steam from all the auxiliaries passes. A special arrangement of piping has been provided by which the steam can be by-passed around the heater in the event of its being desired to clean or repair it. The exhaust from each steam turbine is taken care of by an 18-in. pipe supplied with suitable check valves. These pipes in turn discharge into a 30-in. main exhaust pipe, which is fitted with a 30-in. atmospheric relief valve. When operating non-condensing, the exhaust from the turbines also discharges into this Bonar heater, or it can be discharged to atmosphere through a 30-in. exhaust pipe fitted with a suitable exhaust head and drain.

CONDENSER

In the condenser room there have been installed two Epping-Carpenter 7½-in. and 8½-in. x 10-in. service pumps. The object of these pumps is to supply water to the heater, or to a storage tank located some distance from the power house. They also supply the gland water for the steam turbines, and the jacket water for the dry vacuum pumps. These pumps receive their supply either from the discharge tunnel or from the intake tunnel direct, depending upon whether the turbines are operating condensing or non-condensing. The condensers in the plant are of the Alberger Condenser Company's manufacture. The volute centrifugal pump forming a portion of these condensers is operated by means of a 6½-in. x 8-in. Westinghouse Junior engine receiving its supply of steam from the saturated steam header. The engine is connected to the pump by means of a flexible coupling. Each condenser is served by means of a 30-in. pipe provided with a suitable valve. The discharge from the condensers is carried through a 10-in. pipe into the discharge tunnel. In order to maintain a positive vacuum in the condensers, each is supplied with a dry vacuum pump and with condensing water at a temperture of 70 degs. F. they are capable of maintaining a vacuum of 28 ins. The condensers each have a capacity of 15,000 lbs. of steam per hour; all piping for these condensers is located below the turbine room floor with the exception of the air-discharge line from the dry pumps.



HIGH-TENSION SWITCHING APPARATUS AND LIGHTNING ARRESTERS IN POWER HOUSE

The live steam lines are connected to the Holly system for the extraction of the condensed steam in these pipes, and to effect its return to the feed-water heater. The trap is located in the condenser room, while the reservoir, for securing sufficient head, is located above the boilers. In like manner, the exhaust piping is provided with returns to a Bundy trap, placed in the condenser room which pro-

vides for the return of the condensed steam to the Bonar heater.

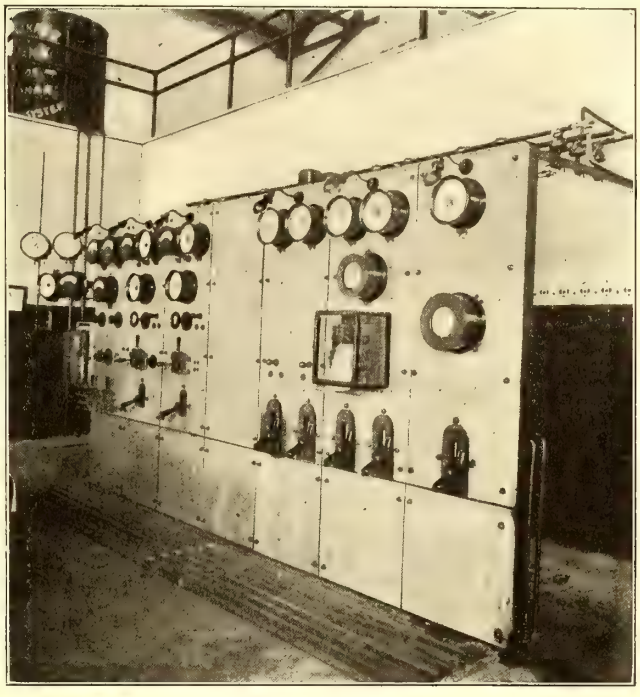
FLANGES AND VALVES

All of the live steam piping in this plant is of extra heavy steel, provided with male and female flanges screwed and peened. The low-pressure piping, as well as pipes conveying the water supply, are of cast iron with standard flanges. Chapman valves are used throughout.

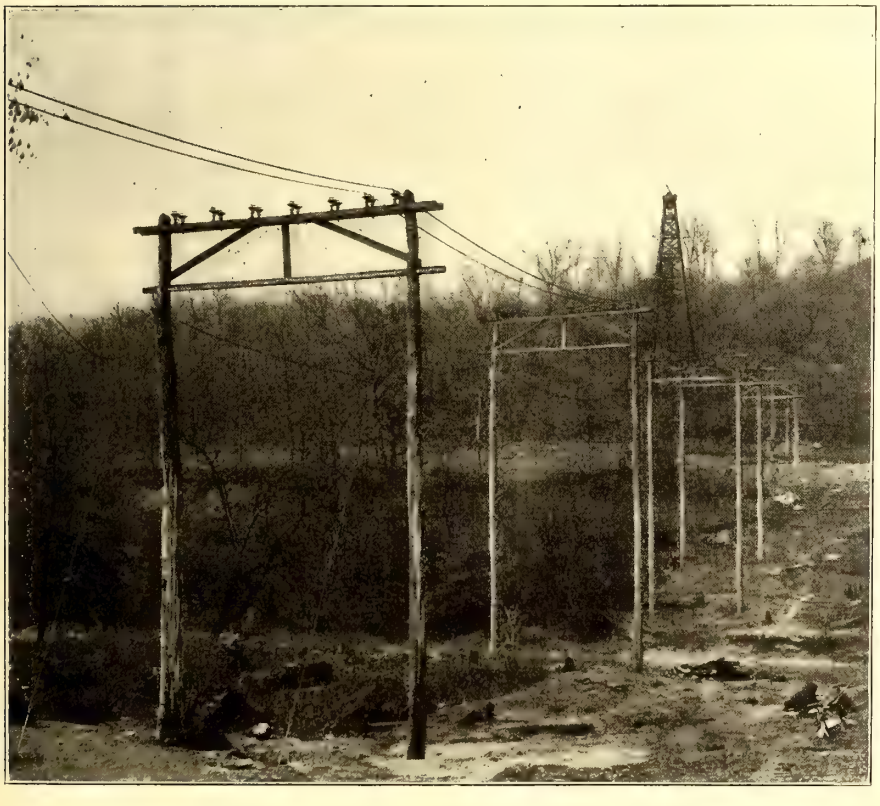
TURBINES

The steam plant at present, as illustrated in the engraving, consists of two 1125-hp multiple expansion, parallel flow, Westinghouse-Parsons steam turbines, each adapted for driving a direct-connected, 25-cycle alternator at 1500 r. p. m. Each unit is mounted upon a bed-plate of adequate rigidity, which in turn is supported on concrete foundations independent of those of the power house. The overall length of each unit, including generator and turbine, is 34 ft. 10 ins., while the width is 7 ft. 4 ins. and the height above the engine room floor level 8 ft. 10 ins.

The turbines are designed to operate with dry saturated steam, 150 lbs. gage pressure per square inch at the throttle, with pressure in the exhaust pipe of 28-in. vacuum. They are guaranteed to have a continuous overload capacity of 50 per cent and will further withstand 100 per cent overload momentarily. The lubrication of the main bearings is effected entirely by gravity with a continuous oil-circulating system, including a cooling reservoir in the bed-plate and a feed reservoir in the governor gear case. The circulating oil pump is directly driven from the turbine through a worm-gear on the turbine shaft. In addition to this rotary pump there is an auxiliary duplex direct-acting steam pump adjacent to each turbine, by which oil from the turbines, after having been used for a certain period is pumped into a Bonar filtering system. In addition, this also furnishes oil to the turbines during the periods of starting and stopping when the rotary pump is not in service. The oil-storage tank is mounted on the high-tension switching gallery, while the filters and small steam pump for raising the purified oil from the filters to the oil reservoir are in the condenser room. There is also a check valve provided with each turbine by which the lubricating oil can be by-passed around the strainer in the event this should become clogged with any foreign substance.



SWITCHBOARD



HIGH-TENSION LINES LEAVING POWER HOUSE

GENERATORS

Connected to each steam turbine by means of a sleeve coupling is a 750-kw, 3300/6600-volt, three-phase, 25-cycle Westinghouse alternator of the revolving field type. The armatures are star-connected so that single-phase current can be taken from any two terminals. The advantage of this type of winding is that a small amount of polyphase power can be secured at the same time that single-phase current is being obtained. This type of winding has an additional advantage in that if anything should occur to one of the single-phase windings, current can still be maintained by throwing the load over to another leg of the armature winding. The generators have been temporarily wound for delivering 3300 volts, but provision has been made so that they can be reconnected for 6600 volts when extensions of the road make this step necessary.

The winding of the generators has been so proportioned that with constant speed and excitation with 100 per cent power factor, the regulation will be practically constant when used in connection with an automatic regulator. The machines have a guaranteed overload efficiency of approximately 95 per cent, and will stand an overload of 50 per cent

for 1 hour, and an overload of 100 per cent momentarily.

On the division wall of the turbine room there has been installed a Westinghouse air pump, operated from the saturated steam header. This pump furnishes compressed air for cleaning the generators and other apparatus in the plant.

SWITCHBOARD

The switchboard is shown in the engraving and is located on the turbine room floor of the power house in close proximity to all machinery, and is made up of seven blue Vermont marble panels. The connections of the various circuits are indicated in the diagram reproduced on page 211. All of the instruments on the board are of the latest standard deadbeat type.

TRANSFORMERS

At present only four 500-kw oil-insulated, self-cooling transformers have been installed, although provision has been made to accommodate six transformers of this capacity. The arrangement of the high-tension room is clearly shown in the illustration. The transformers are wound for a ratio of 6600/22,000 volts, although at present they are operated with a primary voltage of 3300 volts. The low tension leads from the switchboard are conveyed to a point in front of the transformers where they are carried up to the transformer terminals. The high-tension bus-bars are located above the transformers, the wires being supported on insulators, which in turn are mounted on a suitably treated wooden framework. The disconnecting switches for the high-tension side of the transformers are mounted on the wall back of the transformers and are so arranged as to enable the operator to disconnect any transformer readily in case of a breakdown, or if repairs are necessary. From the high-tension bus-bars the wires lead up through large circular holes cut in the cement roof of the high-tension room.

For the ready handling of these transformers they have been mounted on wheels which run on short pieces of track connecting to a small car, which can be run in front of any transformer to enable its being removed to another position. Two of the transformers are connected in multiple for supplying single-phase current to the two static sub-stations along the line. The remaining two transformers are connected in open delta for supplying three-phase current to the rotary sub-station at Butler.

HIGH-TENSION LINES

In the gallery there is mounted the necessary number of high-tension fuse circuit breakers which control the outgoing high-tension feeder lines and are separated by means of large blue Vermont marble barriers. Behind the wooden framework on which these circuit breakers are mounted are located the lightning arresters and choke coils. Disconnecting switches are provided between the outgoing lines and the lightning arresters so that the latter may be disconnected from the line to allow for inspection and repairs. All of the high-tension framework is of especially treated wood and is so spaced and located as to afford ready access to all of the apparatus.

The outgoing feeder lines pass through the building in 12-in. terra cotta pipe, placed in an inclined position, thus preventing rain and snow from collecting at these points and gradually entering the building by way of the sides of the tubes or conducting wires. The anchorage for the high-tension wires at the power house is provided for by means of a suitable framework mounted adjacent to the exit of the wires from the building. A suitable covering has been placed above this bracket, thus effectually protecting the openings from the weather.

GAGE BOARD

A blue Vermont marble gage board has been placed on the wall of the turbine room, and on this has been mounted a clock recording steam-pressure gage, a pyrometer, a steam gage, and two vacuum gages, each connected to its own condenser.

In the next and concluding portion of this article, the equipment of the Pittsburg & Butler Street Railway, outside of the power station, will be described.

OVERCOMING CONDENSER TROUBLE AT BROCKTON

A. H. Warren, writing for the "Public Service Journal," published in the interest of Stone & Webster, of Boston, relates some condenser troubles at the power station of the Brockton & Plymouth Street Railway Company, and tells how they were overcome. This station, which was completed early in 1900, was provided with two Blake vertical condensers piped to pump salt water. Owing to a galvanic action set up by the salt water between the metals in the condensers, the condenser bases caused much trouble and expense until a remedy was recently tried which proved effective. In January, 1901, it was discovered that the iron studs in No. 1 condenser, which held the auxiliary cylinder in place, had been badly eaten. Angle-irons were made and fitted to supplement the studs. In October, 1901, the old iron studs were drilled out and replaced by bronze studs.

In July, 1902, it was found that the valve deck of No. 2 condenser base was badly eaten and useless; so a new cast-iron base was installed. This old base was repaired by boring out the valve deck and valve chamber and fitting a Tobin bronze lining, and the relined base was put under No. 1 condenser in January, 1903, and the base then removed from No. 1 was lined with Tobin bronze. In March, 1903, this second relined base was put under No. 2 condenser, replacing the all cast-iron base which had been installed in July, 1902.

By February, 1904, a hole had been eaten through this No. 2 base at the bottom, where it rests on the foundation. This hole was drilled and plugged. By December, 1904, the walls which separate the auxiliary suction chamber in this same base were destroyed, opening a clear passage through the auxiliary cylinder to the atmosphere. The auxiliary cylinders were taken out and the holes through the valve decks and main plungers covered with bronze plates, thus doing away with the auxiliary cylinders.

The frequent and expensive repairs had all been due to the eating away of the iron of the bases. As a remedy it was decided to introduce metal plugs or pencils, in the hope that the galvanic action would be attracted to these pencils. The pencils were of zinc, about 6 ins. long, and were introduced in the suction chamber of No. 2 condenser. This was in December, 1904, and although this condenser has been in almost constant service since, and was at that time badly eaten away in places, it has given no further trouble, and the deterioration of the iron seems to have ceased absolutely. The pencils, on the other hand, are eaten away quite rapidly, requiring renewal, but at a trifling expense.

The old lined base under No. 1 condenser has recently been replaced by a cast-iron base with several zinc pencils.

HANDLING TRAFFIC IN BOSTON OLD HOME WEEK

The Boston Old Home Week celebration, which was held during the week of July 28 to Aug. 4, imposed unusually severe and varying traffic conditions upon the system of the Boston Elevated Railway Company. With thousands of visitors entering the city the service to and from the North and South stations had to be strengthened, the regular morning and afternoon peak traffic to and from the business district had to be handled, and the service leading to special sections where parades and illuminations were in order was necessarily heavy in volume of traffic and frequency of cars. At times large areas of the business district were entirely shut off to permit the passage of parades, and cars had to be diverted from accustomed routes and new routes established through the crooked and devious thoroughfares of the city proper. The service given during this period, however, reflects great credit upon the Boston Elevated; there were no blockades of any consequence, and enough cars were provided at points where the public gathered in mass to meet every reasonable demand for accommodation, though division of routes and the concentration of rolling stock upon tracks leading to points of public interest necessarily lengthened the time of transit somewhat. The subway and elevated lines were, of course, of the greatest value in providing routes through the city absolutely independent of street obstructions and surface congestion in general. Heavy riding began on the evening of Saturday, July 27, when the general illumination of streets, parks and business houses was inaugurated. Throughout the entire week the company's private branch telephone exchange at the Milk Street headquarters was of the utmost facility in the movement of cars.

On Sunday, July 28, heavy riding occurred from 3 to 11 p. m., most of this being inward bound to the city in contrast with the usual outward flow of traffic at this time in the week. A band concert on the Common, with an address by Vice-President Charles W. Fairbanks, together with the evening illumination, furnished the attraction for many thousands of extra inward passengers. The service on lines focussed on the center of the city was increased about 25 per cent. On account of the short headway employed on the elevated division, the extra traffic there was handled mainly by adding more cars than usual to the trains. On Monday, July 29, an extra car service of 10 to 15 per cent was provided at the main steam railroad terminals throughout the day. At night an electrical parade in the Back Bay, lower West End and Cambridge districts attracted spectators from all parts of the metropolitan district. Service was increased about 100 per cent on this occasion. Between Massachusetts Avenue and the Public Garden via Huntington Avenue the route of the parade overlapped the inward flow of traffic, and to give the parade the right of way, and at the same time provide car service for persons wishing to enter the subway from the west via the south side of the Back Bay, cars were diverted down Tremont and Boylston Streets and Columbus Avenue, the inward bound Huntington Avenue track being free for the parade, which consisted of about twenty electric car floats operated by Boston Elevated crews. Cars followed and preceded the parade closely, and the tracks inbound were not closed for over half an hour. Cambridge, Allston, Brighton, Newton and Brookline cars were handled as usual through Copley Square and passed into the subway with accumulated Huntington Avenue cars directly after the parade. At junction points the street inspectors passed the cars over the lines as fast as was feasible without regard to their origin. At the close of the parade the crowds poured into the Back Bay and subway lines. This traffic was handled by the accumulation of a large number of extra cars behind and also laterally related to the parade. Movement was free between Harvard Square and the Back Bay.

On Tuesday morning, July 30, a veteran firemen's parade in the Back Bay and central business district was held, and the inbound distributed service increased about 10 per cent. The business district was closed to vehicles of all kinds from Boylston Street to Adams Square. Through car service north and south was diverted mainly through Beach Street and along the Atlantic Avenue water front. New routes were made up to handle this business and the frequency of the schedules maintained by set-backs at the ends of routes. At the conclusion of the parade extra outbound service was afforded. In the evening a large number of extra cars were run to Jamaica Pond for an illumination and, as on other evenings, the electrical display in the heart of the city, and band concerts required extra facilities inbound and later outbound. On Wednesday morning, July 31, occurred a civic parade headed by Lieutenant-General Nelson A. Miles, with about 10,000 participants. This required about 2 hours to pass a given point, and the central business district was closed and cars diverted in the same general manner as on the preceding day. As this parade was not scheduled to start until 11 a. m., the inbound pleasure traffic in the forenoon was more evenly distributed than on the day before. Outward bound cars were very lightly loaded, but these were run to their terminals, reversed and brought back to the city to handle the flow of traffic outward at the conclusion of the parade; it is estimated that the latter was viewed by 500,000 persons. The absence of confusion in the car service was noteworthy. In the evening occurred the formal dedication of the new Longfellow Bridge across the Charles River between the West End of Boston and Cambridge. The new rapid transit line connecting with the Cambridge subway will pass over this bridge. The occasion was the scene of a competitive fireworks display, which attracted a large extra traffic and the car lines centering on the new bridge and Harvard Bridge were increased in service 150 to 200 per cent. New routes were placed in operation with these points as objective, and extra cars from other divisions of the system were sent to the river. The homeward travel after the exercises was handled in the reverse way.

The plans for the balance of the week were not materially different in scope from those already outlined. A large number of special cars for children were operated on Thursday, Aug. 1, and plans were made for diverting cars in the business section on account of an automobile parade. The latter did not interfere with the regular service to any extent, however. The plans for car handling during the military parade of Saturday, Aug. 3, were in general similar to those in effect during the civic parade on July 31. A prominent feature of the week's service was the widespread use of dasher posters on the cars advertising the principal events reached by specific lines.

During the eight days beginning Saturday, July 27, which was the day the increased travel began, the company transported 7,195,000 paying passengers. It is estimated that in addition to these paying passengers, 4,317,000 passengers were transported on free transfers, making the grand total of passengers carried 11,512,000.

WHEEL PRACTICE AT KANSAS CITY

The fact that almost every line of the Metropolitan Street Railway, Kansas City, is built over steep grades necessitates more attention being given to the wheel question than is accorded it by most of the companies operating the street railway systems in cities of equal size where the tracks are comparatively level. Through the courtesy of Charles N. Black, general manager, and George J. Smith, master mechanic, of the system, the following notes on wheel practice are made available.

In order to have definite data regarding the wearing qualities of different kinds of wheels, Mr. Smith has devised a system of records by means of which an individual record is kept of each wheel. When the wheel is scrapped its mileage can be obtained by simply a glance at the record.

WHEEL RECORD

On receipt of a shipment of wheels every one is stamped with an individual number. This relates to wheels which are not numbered by the maker. When wheels are removed from a car the foreman having charge of the work reports the fact to the shop office on a form which contains blank spaces for the car number, the date, the individual numbers of the wheels put on, and of those removed, whether or not the wheels put under the car were old or new ones, the kind of wheels, whether steel or chilled iron, and the cause for the removal of the old wheels. There

Form 419 Car No. . . . . .

NOTE.—Report should be made to Master Mechanic same day wheels are changed.

METROPOLITAN STREET RAILWAY COMPANY.
WHEEL REPORT

_____ 190__

Wheels Put On	Wheels Removed	New or Old	Kind	Cause of Removal

12355

Foreman.

KANSAS CITY WHEEL REPORT

are also received from the division superintendents monthly trip sheets showing total trips made by each car on their respective divisions, from which the monthly mileage of the cars is obtained. The wheel record which is made up from the data on the foremen's reports and the monthly mileage reports is kept in the form of a loose-leaf ledger, with separate leaves for each car. The leaves or sheets contain ten vertical columns, each one for one wheel. The columns are headed by the wheel numbers and below are spaces for the dates of removal of the wheels and when they were put under the car, the car from which they were removed, the cause of the removal, and the back mileage, if any. Below are spaces for the mileage for each month as obtained for the car from the monthly reports of the division superintendents. The space for back mileage is necessary because it frequently happens, for some reason or other, that a wheel is removed from one car before being worn out and is at a later date mated and placed under another car. In such an event the old mileage is carried forward. When the wheel is scrapped the total mileage is computed and is kept for future use.

In addition to the wheel record a separate index of the wheels is kept. At the time the wheels are received and numbered each number, with a brief description of the wheel, is entered in the index, and when the wheel is placed under a car the car number is entered opposite the wheel number. The index enables the past record of any wheel to be obtained by simply referring to the sheets of the wheel record, which is kept by car numbers, as indicated by the index. At the present time the wheel record sheets are made to last two years, but as the smaller per cent of the wheels are not in service a whole year the new sheets will be made to last only twelve months. To keep the record for 600 cars less than two hours' time per day of one man is required.

CHILLED WHEEL PRACTICE

The wheel record enables the company to determine definitely whether or not wheels fulfil the guarantee of the makers. At one time the company had an individual guarantee with the makers which required that every wheel make a certain mileage. The wheel record showed that while the average mileage was far above the guaranteed mileage of each wheel, several wheels fell below the minimum figure and for these the company was allowed credit. The variation of mileage obtained was, in some instances, 300 per cent. Some wheels ran 25,000 miles, while others ran three times this amount. At the present time the company has an average guarantee for each shipment, the maker allowing new wheels when the mileage falls short.

The average life of chilled iron wheels is about 40,000 miles. The records show the rather unaccountable fact that the life of plate wheels is considerably in excess of that of spoke wheels. The mileage obtained is probably lower than is gotten in other cities, and this is due largely to the fact that the wheels are subjected to very rough usage because of the excessive grades. It is not unusual to find fifteen or twenty flat spots on the wheels in that portion of the circumference that can be seen from one point. The mileage would be considerably less were it not for the fact that the flat spots are kept ground out. The grinding is accomplished by removing the wheels from the car and placing the axle in a grinder similar in many respects to a wheel lathe. Considering the conditions encountered, the absence of disagreeably flat wheels on the cars in the city is very noticeable, and some companies which operate in comparatively level cities would do well to follow a similar practice in grinding wheels.

At the Columbus convention the discussion regarding the width of treads indicated that it was a rather widely spread opinion that wide treads were the cause of much chipping and breaking of rims, due to the fact that rims were broken by the paving. Mr. Smith has found that since widening the treads from 2½ ins. to 3 ins. there has been a decrease in the number of broken rims and a very marked decrease in the chipping of flanges. The latter is attributed to the fact that the wide rims do not let the wheel down far enough in passing over special work to permit the flanges to strike the bottom of the throats of the frogs. Practically no trouble is experienced by broken flanges in the city. One reason which is regarded as largely responsible for this is that the track is set accurately to a gage of 4 ft. 8½ ins. on curves as well as on tangents, and that the wheels also are set to the same gage. This reduces the liability of the inside of the flanges striking special work and of binding or riding on the flanges when Trilby rails are employed. At the present time the flanges

on chilled wheels are 1 1/16 in. wide by 7/8 in. deep. On future orders, however, the flanges will be only 3/4 in. deep, as it has been found that after two or three months of service the flanges increase in depth about 1/8 in. Decreasing the depth of the flanges will decrease the liability of them wearing deep enough to be injured by special work. It is thought that a brake-shoe might be designed to keep the height of the flange down, but it is regarded as a more certain method to reduce the height in the first place.

STEEL WHEEL PRACTICE

The company has in service practically all of the cars used on the intramural railway at the Louisiana Purchase Exposition and which were equipped with all-steel wheels of M. C. B. cross section. It has been found that the treads are too wide for city service. As the wheels are set to gage, practically all of the wear is up next to the throat, and after a time the rim gets so high that it strikes special work and high spots in the paving. The difficulty has been overcome by turning the rim about 3/16 in. lower than the inner portion of the tread when the wheels are being turned up. Practically no trouble at all is experienced with sharp flanges on the steel tired wheels, and, as a result, when wheels are turned it is usually necessary only to true up the treads. Generally the inner portion of the tread of the smaller wheel is not turned down. In order to benefit it at all by turning at least 1/8 in. of metal would have to be removed. It is found more economical to turn the large wheel and then finish the other one by grinding the tread in the same machine as is used for grinding the chilled wheels. The saving of the 1/8 in. of tire adds considerably to the life of the tire. The M. C. B. section of the tires was for a time the cause of exasperation on the part of residents of a certain street in the city and considerable worry on the part of the railway company. After rains the wheels in traveling over a section of track laid with Trilby rails made an unusually loud and piercing sound. It was at first thought that the wheels would have to be abandoned, but investigation and experiment showed that the noise was caused by the cars riding on the inside of the flanges, which bore against the inside of the throats of the rails. After turning off an eighth of an inch or more of metal from the back of flanges of the wheels of several cars it was found that the noise ceased, and since that time all of the tires of the M. C. B. section have been treated similarly.

Metropolitan Street Railway Company. **Car No.**_____

WHEEL RECORD.

WHEEL No.									
KIND									
PUT ON									
REMOVED									
FROM CAR									
CAUSE OF REMOVAL									
BACK MILEAGE									
190									
January Mileage									
February "									
March "									
April "									
May "									
June "									
July "									
August "									
September "									
October "									
November "									
December "									
TOTAL "									
January "									
February "									
March "									
April "									
May "									
June "									
July "									
August "									
September "									
October "									
November "									
December "									
GRAND TOTAL "									
DISPOSITION									

DETAIL WHEEL REPORT, INCLUDING MONTHLY MILEAGE RECORD

EXCURSION AND CHARTERED CARS AT SAN ANTONIO

The San Antonio Traction Company operates an excursion or sight-seeing car which takes in practically all the historical and interesting points in the city. The car makes two trips per day, about four hours being required to make the trip. The route is about 35 miles long, and a charge of 50 cents per passenger is made. It is provided with signs denoting its use, and a guide with a megaphone calls the passengers' attention to interesting places or relates bits of history concerning many of the old buildings in the city which are relics of Spanish and Mexican occupation. Advertising matter regarding the car is found in hotel lobbies and announcements are kept posted in the guests' rooms of the hotels. Before starting on the trip the car stops in front of the principal hotels and the guide with the megaphone enters the lobby and announces the arrival of the car.

The company derives considerable receipts from chartered cars, there usually being ten or twelve cars chartered per week for picnic parties or for trolley rides gotten up by different societies. The charges for an open bench car with a capacity for forty-five people is $3 for the first hour, $2.50 for the second hour and $2 for each succeeding hour.

A RADICAL DESIGN OF SEMI-STEEL CAR

The new semi-steel cars of the Milwaukee Railway & Light Company, built for service on the recently constructed single-phase interurban systems west and southwest of Milwaukee, are different in almost every detail from previous types of steel cars. The most out-of-the-ordinary features of this type of car are the method of supporting the platforms, the construction of the bottom framing, as necessitated by the limited headroom, the height of the arm rest and the manner in which the lower sash are raised up against the roof inside the side plate. The car was designed by E. W. Olds, superintendent of rolling stock of the operating company, and under the general direction of John I. Beggs, president and general manager of the company. An order for ten cars is now being completed by the St. Louis Car Company. Several of the cars have been delivered and are now in service.



SEMI-STEEL CAR IN SERVICE ON AN INTERURBAN DIVISION

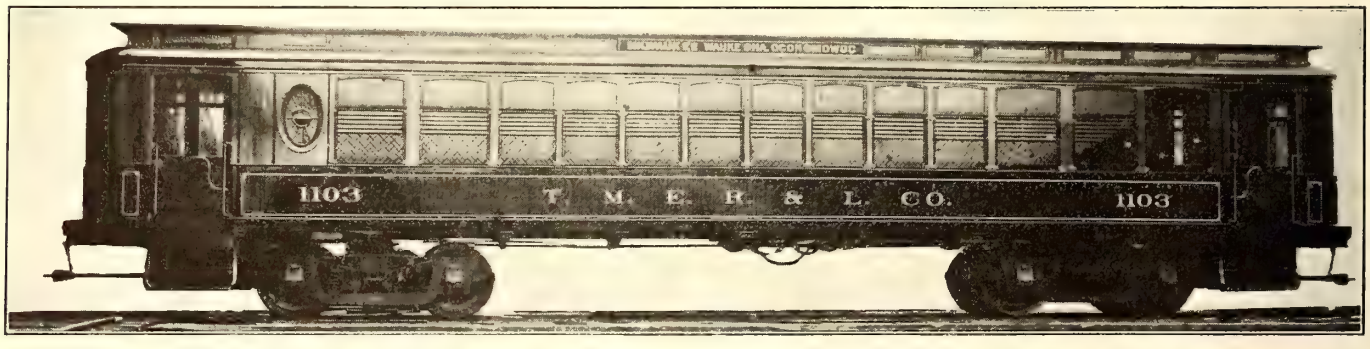
BOTTOM FRAMING

Bridge and subway construction in Milwaukee limits the headroom to 13½ ft. The car was accordingly built with a height from rail to top of roof of 11 ft. 11¾ ins. In order to avoid a squatty appearance to the interior, the floor was placed as low as possible, and as built the flange of the wheels may come within 1¾ ins. of the bottom of the floor. With 36-in. wheels the height of the floor with the car body light is 41¾ ins. above the rail or about 8 ins. lower than is customary with wood or steel under-framing. The trussing effect of the car body is practically all obtained by steel side plates extending from the floor to the arm rest.

The only longitudinal member under the car floor is a 10-in. 25-lb. channel, which extends under the center of the car continuously from bumper to bumper. At the end sills and bolsters this channel is offset so as to avoid cutting any of the members. The channel passes between the top and bottom members of the bolsters. Between the bolster and the bumper there is riveted to its under side a 4-in. x 5-in. T-iron. The needle beams, which are 6-in. channels, are reinforced with ¾-in. truss-rods. The end sills are of similar channels and are trussed in a similar manner. They are further reinforced by gusset plates riveted to them on the upper side and to the corner posts. The gusset plate at each corner of the car is intended not only to support the end sill, but also to form a rigid base for a truss post placed over an I-beam knee supporting the platform.

These knees are the main support of the platform. Together with the central channel and floor plate they form a truss, all members of which are either in tension or compression. The bending strength of beams, as in the usual construction, is not depended on for support. The knees are of 4-in. 8-lb. I-beams. They are secured to the channels forming the side sills, pass under and behind the top step and are riveted through a strut to a 6-in. cross-channel under the forward door post and also to the platform floor.

The side sills of the car consist of two angle-bars, one measuring 3½ ins. x 5 ins. x ⅜ in. placed outside, and an inner one 3 ins. x 4½ ins. x 5/16 in. Extending between



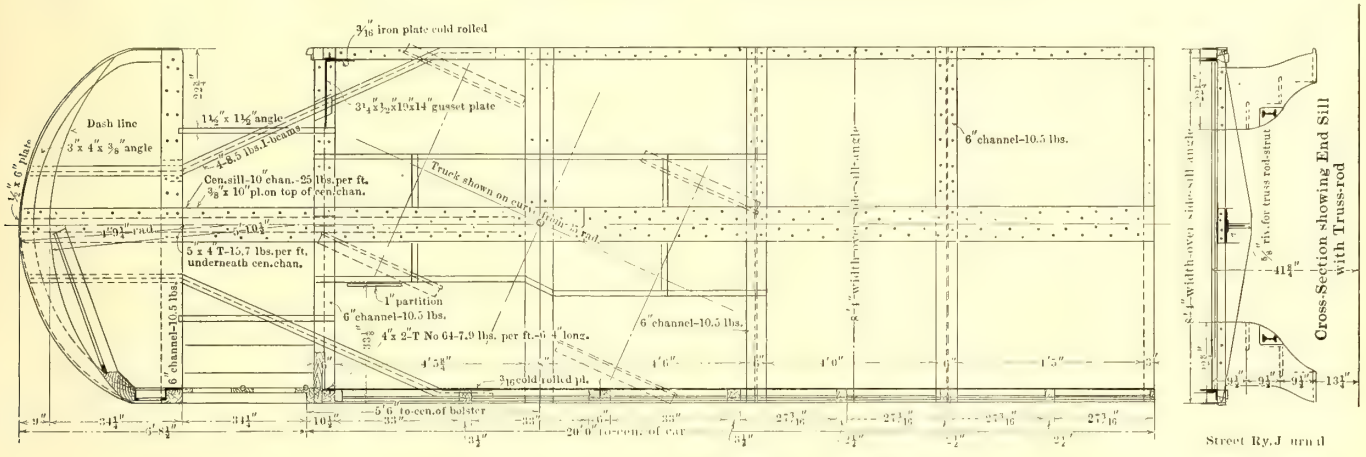
SEMI-STEEL CAR BUILT FOR THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY

the two angles is the ⅛-in. steel plate which forms the under flooring. This flooring, which covers the entire under-framing, extends from bumper to bumper and is riveted to all the longitudinal and cross-members of the bottom framing. The seperate plates of which it is made up are joined over the needle beams and cross-sills.

SIDE FRAMING

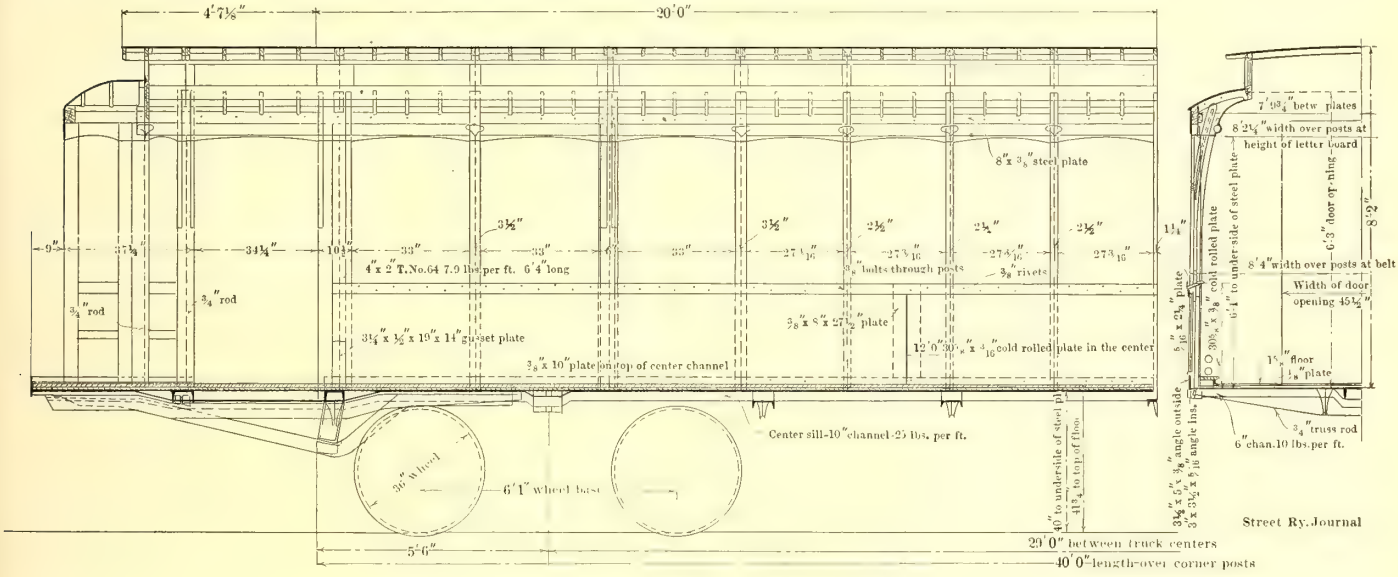
The side plate previously referred to as forming the longitudinal truss of the car body is 3/16 in. thick and 30⅝ ins. high and forms the inside finish of the car below the windows. The smaller of the side-sill angles is riveted to it and the posts are also riveted and bolted to it. The corner posts and those immediately behind the bolster are the only ones in compression. These are of 4-in. x 2-in. T-irons sandwiched between wood fillers. All of the other of the posts are of wood, but tensional stresses are cared for by ½-in. rods running through and behind them. The lower ends of these rods are secured by a nut underneath the side-sill construction and their upper ends are secured to a plate forming the top member of the side framing by bolts passing through broad feet on the ends of the rods. The plate referred to is 8 ins. x ⅜ in. and is bolted between two wood plates. The letter board is of wood and is secured in the usual manner to the posts and to the outside top plate. The four steel posts on each side of the car are riveted to the plate girder at the bottom, and at their upper end to the 8 ins. x ⅜-in. plate. The steel roof carlines are bolted to this latter plate.

The low arm-rest and the unusual construction of the top plate necessitated, in order to get sufficient raise of the sash, that the top of the lower sash when raised be brought inside the plate. The wood posts containing the sash pockets were accordingly built so that their tops extend across from the side plate to the upper-deck sill. They also extend to the under side of the lower-deck roof and the steel carlines are sandwiched in their tops.



BOTTOM PLAN OF 40-FT. SEMI-STEEL MOTOR CAR

The spaces between the posts below the arm-rest are filled in with wood and this furring is covered with vertical-matched siding in the usual manner The roof construction is similar to that for cars with wood framing. It is of the



BODY FRAMING OF 40-FT. SEMI-STEEL MOTOR CAR

monitor type with the monitor extending well forward. This style was preferred to the usual steam-coach type because the end of the monitor gives an excellent location for the destination sign.

The steel floor of the car is covered with a double floor 1⅝ ins. thick.

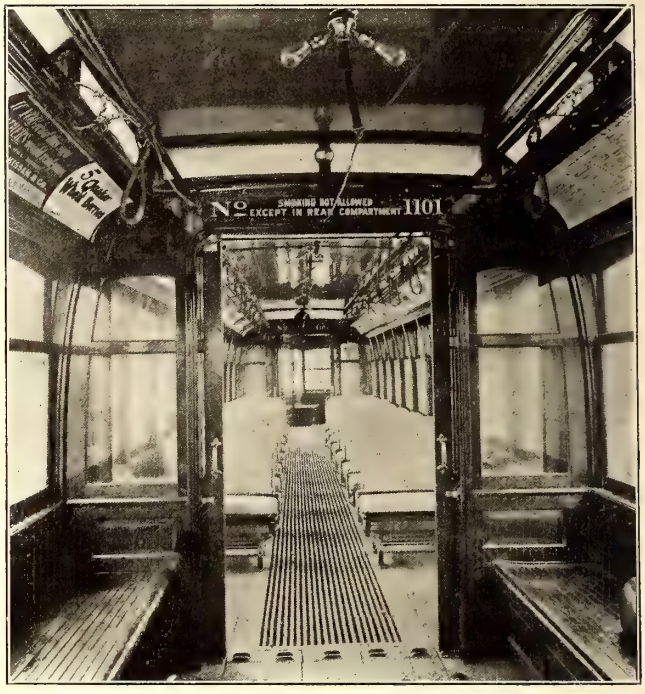
The interior is divided into an observation compartment at each end and a center passenger compartment. The hot-water heater, toilet room and a high-tension switch cabinet are in one end of the car, and in the opposite end is a small cabinet for the air brake and light switches and fuses and

fire tools. Seats are provided for sixty-four people. The car is equipped with the General Electric a. c.-d. c. system of control. The dimensions of the control apparatus were considered in spacing the cross-members of the bottom framing. The compensator is hung between the needle beams. It is supported by a strap fastened to the longitudinal channel in the center and to the main side sills.

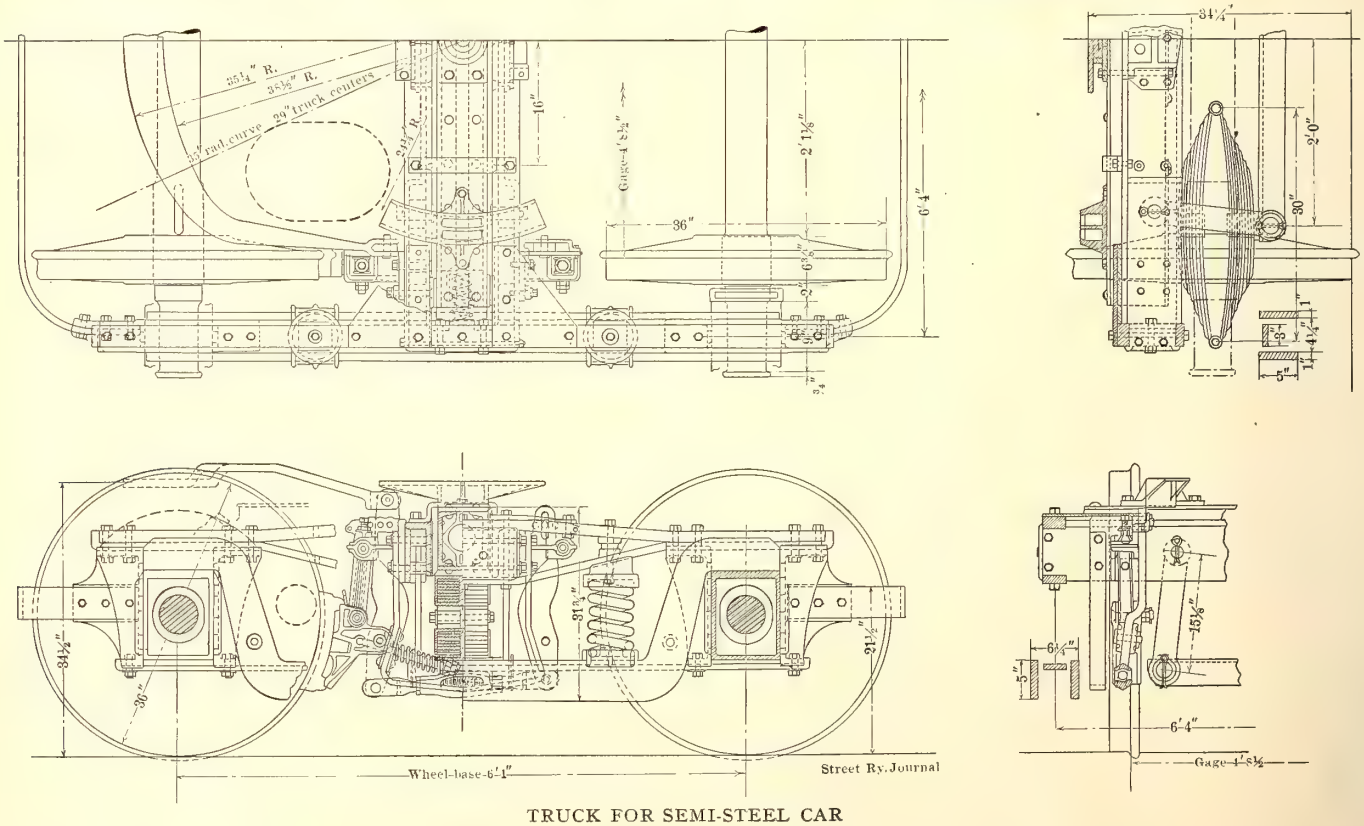


HIGH-TENSION SWITCH CABINET

The car is equipped with National Electric air brake apparatus which includes a combination a. c. and d. c. compressor motor, so that the equipment can be used with equal facility on single-phase railways, or on such lines where part of the operation is by direct current. A detailed description of this system is published elsewhere in this issue, but it may be interesting to note here that the principal novelties are the use of a four-pole commutator type motor with two inter-poles, and the automatic relay for changing from one kind of power to the other. In general, most of the other parts are of standard character.



INTERIOR OF SEMI-STEEL CAR, SEEN FROM SMOKING COMPARTMENT



TRUCK FOR SEMI-STEEL CAR

The truck is a modification of the T. M. E. R. & L.

standard M. C. B. truck and was designed by Mr. Olds. It is distinctive in that each shoe has an individual release. Attached to the shoe head is a release rod which passes through a U-shaped support or hanger immediately behind the head. A coil spring between this support and an adjustable nut on the end of the rod, holds the shoe back when the brakes are not applied. The rod passes through a sleeve bolted to the U-shaped support of such a length as to form a guide and prevent the shoe from tipping sidewise. The shoe head is hung by the St. Louis Car Company open link hanger, described in the STREET RAILWAY JOURNAL July 13, 1907, and which was originally designed by Mr. Olds.

Instead of being attached to rods running to an arch bar carried on the truck, the live levers of the truck are pinned directly to the arch bar, which is made in the shape of a bail. This construction eliminates one set of pins in the brake rigging and the arch bar is gotten close up to the king pin so that its movement is lessened. The bail, moreover, is supported from the car body.

The transom construction is extra heavy. The transoms are built up of ¾-in. x 7-in. x 3½-in. channel bars reinforced by ¾-in. x 7-in. steel plates. At the center these plates are hot-riveted up against the web of the channel. They are then bent outward and extend to the side frame parallel with the channel and 2 ins. from it. The head of the bolster hanger is held between the plate and the channel by a pin extending through both plate and channel.

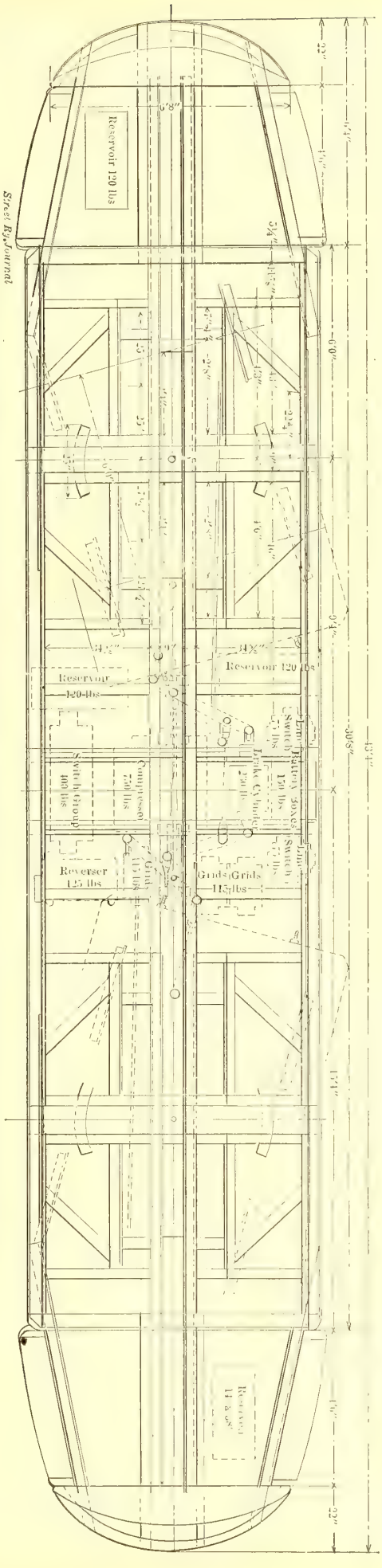
Gussets extending from the top arch bars to the transoms give rigidity to the center construction, but gussets are not employed at the corners between the top arch bars and end bars, the idea being to allow a little flexibility of the truck frame. Under heavy strains, Mr. Olds is of the opinion that a truck built absolutely rigid will break at some point, when with a flexible truck only a slight deformation will occur.

The truck has 5-in. x 9-in. journals. The wheels are of the Standard Steel Company's rolled steel pattern. They are 36 ins. in diameter, have 2¾-in. tread, ¾-in. x 1⅛-in. flange and a 2⅝-in. tire. They are mounted on 5½-in. axles, which were the largest that could be used with the motor. The wheel base is 6 ft. 1 in.

MULTIPLE UNIT SURFACE CARS IN BALTIMORE

The United Railways & Electric Company, of Baltimore, ordered some time ago for its Sparrow Point & Bay Shore line eighty Brill semi-convertible cars. Forty of these are now in service and the remainder are being wired and equipped at the company's Carroll Park shops. The cars, which measure 43 ft. 4 ins. over all, are not only the largest operated on the Baltimore lines, but are the first to be equipped for multiple-unit control. In possessing the latter feature they mark a distinct advance in electric car equipment, for while the cars are used for suburban high-speed service, they are similar in construction to those of like size now in use in some of the larger cities. The principal dimensions of this car will be found in the accompanying plan, which also shows how the problem was worked out of distributing a lot of extra apparatus in the limited space under a car with 34-in. diameter wheels. The body is 30 ft. 8 ins. over all and has special platform rails with folding gates. The doors are double and are operated by a ratchet and rack mechanism instead of the less reliable chain movement. An interesting feature in the equipment of the car is the use of wire glass ventilator sash to reduce breakage.

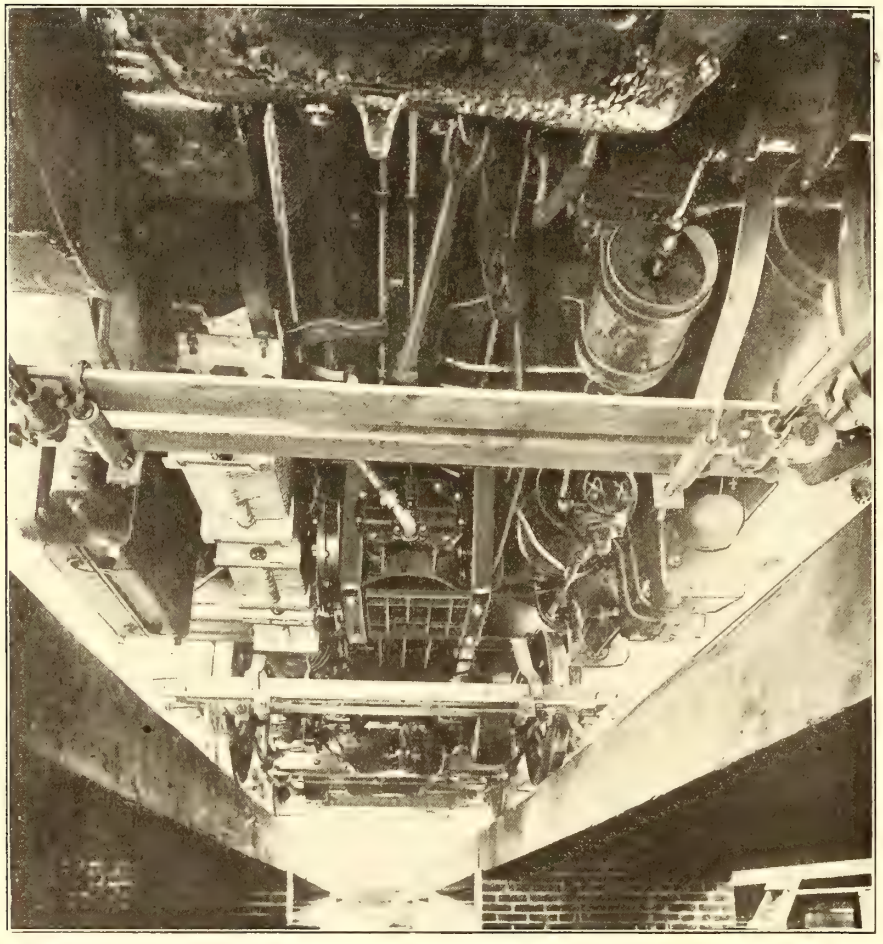
The interior of the car is furnished with fourteen trans-



PLAN OF BALTIMORE CAR, SHOWING THE LOCATION OF MULTIPLE-UNIT AND AIR-BRAKE APPARATUS ON THE UNDER SIDE

verse seats and four longitudinal seats. All are of rattan and have grab handles, although there are also straps installed. The corner seats each seat four passengers comfortably and leave enough free area to allow the rapid movement of passengers in and out of the car. The windows have arm rests and curtain fixtures from the Curtain Supply Company.

The electrical equipment consists of four 101-D Westinghouse 55-hp motors mounted on No. 27 E-1 trucks and controlled by a Westinghouse unit switch group. In addition to the usual contactors, reverser, line switches, air reservoir and battery boxes mounted under the car, there is an extra air tank as a reserve for operating the contactors should the regular air supply fail. The brakes are of the Westinghouse type with D-2 combination straight and automatic valve, straight air being used when the cars are operated singly. The cars also have Van Dorn draw bars and hose attachment so that they can be operated in trains immediately. All cars are also furnished with Peacock hand brakes, Earll trolley retrievers and United States combination arc and incandescent headlights.



UNDER SIDE OF SURFACE CAR WITH MULTIPLE-UNIT EQUIPMENT

The total weight of the equipment suspended from the car body is 3105 lbs. distributed to balance on each side of the center sill as nearly as practicable. Of this weight, 1195 lbs. is taken up by the air-brake equipment, so that the multiple-unit outfit under the cars weighs 1910 lbs. The under-car apparatus of a straight four-motor equipment would weigh 1100 lbs., so that about 2005 lbs. is added by using multiple-unit control and air brakes. As the cars weigh 50,700 lbs. fully equipped, it will be seen that the extra weight of the improved brake and control system constitutes only 3.9 per cent of the total weight. All circuits are carried in metal conduit except the motor wiring run from the switch group to the motors. This consists of asbestos-covered flame-proof wire placed in canvas hose, varnished with flame-proof paint.

All of the mounting of the apparatus and wiring was done by the company's men under the direction of H. H. Adams, superintendent of shops. Sixteen men were assigned per unit. The best record was the completion by thirty-two men of eleven cars in six days, which is certainly fast work, considering the fact that the men were dealing with a novel and unusually complicated equipment. The total cost per car, including unloading of cars, labor, piping, miscellaneous material, finishing up, etc., was $148.45.

THE LEFFLER ELECTRO-MAGNETIC RAILWAY SYSTEM

Circulars have recently been issued of the Leffler electric railway system for car propulsion. According to the circulars, electromagnets are placed between the tracks 2½ ft. center to center, and of alternate polarity. The car carries another magnet whose poles span the distance between the track magnets. This car magnet is excited by a storage battery and is provided with a pole changer, which alternates the current in the car magnet every time the car travels 2½ ft. The mutual effect of the car and track magnets is then to give a progressive magnetic pull to the car and produce motion. The air gap is said to be 1 in. and the storage battery required is reported to be "small." On long-distance railways it is proposed to use a sectional third rail instead of storage batteries.

No doubt a small model made up on this principle would run around an experimental track, but the major portion of the power required to propel the car must come from the storage battery, and as the application is an uneconomical one, the battery would have to be very large. Other possible complications not explained in the circulars are the hysteresis and eddy losses in the car magnets, and the troubles incident to maintaining an air gap of this size in the streets, especially with the presence of so much magnetism. It is possible, however, that the inventor has some way to avoid these defects, as he says, "This description is only general, because it is very difficult to go into details without a lengthy description, such as we would not have room for in this booklet on all the technical details."

The Sandusky-Fremont branch of the Lake Shore Electric is now in good shape and cars are running regularly. The work of ballasting the roadbed is going forward satisfactorily. This branch will enable through Cleveland-Toledo cars to pass through Sandusky, which has heretofore been impossible without losing quite a little time in doubling on the route.

STREET RAILWAY LEGISLATION IN MASSACHUSETTS

The work of the Massachusetts General Court of 1907 was not especially important, so far as the interests of street railway companies and investors were concerned. The number of matters referred to the committee on street railways was smaller than usual and their general effect not so far-reaching, with the result that legislation was proportionately minor in effect.

The most important street railway legislation of the year was that referred to the committee on metropolitan affairs and affecting the interests of the Boston Elevated Railway in the matter of providing the metropolitan district with improved rapid transit facilities. In fact, this subject occupied a large part of the time of the legislature. The problem presented by the rapid growth of the city and its suburbs is an ever-present one, in spite of the strides which have been made toward solving it in the last decade. Among the propositions presented this year were the petition of Mayor Fitzgerald for a Beacon Street subway from Park Street to the Back Bay Fens; of George B. Upham for a similar subway; of Mayor Fitzgerald for a crosstown subway from the present Park Street station to the South Terminal Station; and of George Holden Tinkham and others for a subway between the North Union Station and East Cambridge, to be constructed in place of the elevated railway, for which a location was given by the legislature last year. These bills were given almost innumerable hearings before the committee on metropolitan affairs, and from the first three there was evolved what is known as the "Riverbank Subway Bill," designed to follow the general line of the bank of the Charles River from the present Park Street subway station to a point in the Back Bay, near the junction of Commonwealth Avenue and Beacon Street. This subway is to be built and owned by the city of Boston, and the Boston Elevated Railway Company is to be given the exclusive use of it for a term of twenty-five years, with a rental of 4½ per cent of the net cost of the work of construction. The construction of the subway is made subject to the acceptance of the act by the Elevated Railway Company, which has not yet been filed, but nearly twenty days yet remain in which this action may be taken.

For several years, the trend of street railway legislation, as well as that affecting other public service corporations in Massachusetts, has been to enact general legislation whenever possible, rather than grant special privileges, and this policy has been consistently carried out by this year's General Court, with one exception, when it revived a special charter for the Boston, Quincy & Fall River Bicycle Railway Company. The committee on street railways stood by the policy and reported a bill allowing the aged inventor, Moody Boynton, to incorporate his company under the interurban act of last year. This bill was sent to the House, rejected, and Mr. Boynton's special bill put in its place. The special bill reached the Senate, and again became a general bill. Then there followed the appointment of a conference committee, which reported in favor of the general bill. This report the House refused to accept. A second committee was appointed which reported recommending that Mr. Boynton be given the bill he desired. This report was adopted, the bill went to the Governor and was signed by him.

Another measure which would have vitally affected every street railway company in the Commonwealth had it become law, was that heard before the committee on taxation, providing for the taxation of bonds of street railway companies. It came before the legislature as a part of the report of last summer's special recess committee on taxation, and, strange to say, attracted very little attention in that report, the companies not becoming thoroughly alive to its importance until it appeared in the Senate calendar with a favorable report of the committee. They had it recommitted to the committee in order that they might be heard, and after pointing out the great hardship it would work on the country roads, succeeded in getting from the committee a recommendation that it be referred to the next General Court, which suggestion was adopted.

The bill providing for one day's rest in seven would also have caused considerable trouble among street railway companies had it found its way onto the statute books in its original form. This bill came from a recess committee appointed to consider the laws relating to the observance of the Lord's Day, and provided that no employer should "require or permit" an employee to work more than six days in any week. Massachusetts street railway companies expressed no opposition to the idea of the bill, but they realized that any such iron-clad law would work havoc with the Sunday traffic, and so at their suggestion the words "or permit" were stricken out, and employees in Massachusetts are permitted to work seven days in succession if they desire, but they cannot be required to do so.

Perhaps the most bitter fight of the session came on the bill providing for the joint use of tracks by two or more street railway companies, giving the board of Railroad Commissioners authority to fix the compensation for which one company might be required to transport the cars of another. The bill remained in committee for several weeks, finally going into the Senate with an adverse report of the committee on street railways. Senator Shaw, president of the Boston & Worcester Street Railway Commpany, however, after repeated roll calls succeeded in getting the bill through the upper branch. It was overwhelmingly defeated in the House, however, upon its first appearance, and no attempt was made to ask for reconsideration..

A bill which caused a great deal of comment was that authorizing the Fitchburg Railroad Company to purchase the Conway Electric Company. This matter was introduced early in the session, and those who oppose control of street railway lines by steam railroads immediately announced that it was only an entering wedge for the absorption of trolley lines by steam railroads. When the bill was heard in committee, however, it developed that the Conway Street Railway Company was operating its road at a loss each year, and that only the public spirit of the citizens of the isolated country town had for some years kept running this, the one means of transportation connection with the outside world. The company owned a very valuable waterpower, however, which the Boston & Maine was desirous of acquiring, and which the Conway Company was equally anxious to sell, realizing that with its limited field of endeavor it could not be developed to its full value. The bill finally reached the Governor and was signed by him.

A bill requiring a street railway company, in case of accident, to file with the Railroad Commission all names taken of witnesses to such an accident caused considerable debate, but was killed in the Senate. The argument was made that such legislation would tend to make the Railroad Commission a detective agency for accident attorneys.

The bill requiring every street railway car to be equipped with fenders suitable for saving life also failed of passage, it being deemed best to leave this matter in the hands of

the Railroad Commissioners, who have full powers to deal with it and are now making an extensive study of the matter.

The "missing link" bill was hard fought at all stages, but became a law. It provided that in case a street railway company has authority to do the business of a common carrier in two towns, but is unable to secure the necessary authority in a third and intervening town, either by the refusal or neglect of the selectmen to give permission, it can secure such authority from the Railroad Commissioners. Opponents of this bill urged that it would take away the last vestige of local control of street railway companies, but the legislature did not think that any one community should have the power to prevent a street railway company from engaging in the business of a common carrier, perhaps for a distance of 40 miles or more, as in the case of the Boston & Worcester, and the bill was made a law.

Other matters of legislation which were given leave to withdraw were: to give local boards additional powers in the granting of locations to electric railroads; that the Railroad Commissioners upon complaint may order changes in the service and accommodations of street railways; that common carriers operating less than 75 miles of track provide protection for patrons by insurance or otherwise; that motormen and conductors of street railways be licensed by the Railroad Commission; that employees of railroads and street railways be given receipts for money collected; that the Railroad Commissioners investigate the furnishing of sanitary accommodations by street railways; and that pupils of normal schools be transported at half-fare, the same as pupils of other schools.

THE FUEL-TESTING PLANT OF THE UNITED STATES GEOLOGICAL SURVEY NEAR NORFOLK, VIRGINIA

The fuel testing work of the United States Geological Survey should be followed with close interest by all engineers, not only for its importance to all power consumers, but because it is undertaken to point out new paths for the development of the natural resources of the country by locating, classifying and testing all kinds of available fuel. In Europe, where the fuel resources are now fully known, there has been no need for so powerful an organization as that which is now rapidly making facts about the resources of this country equally available. Accurately compiled results of the more recent work of this branch will soon be published, and the following particulars of the plant in Virginia will doubtless be of interest.

The machinery under test is placed in the Power and Alcohol Building at the Jamestown Exposition. The following apparatus has been added to the steam engineering division: a 250-hp B. & W. boiler, with superheater, provided with a Roney stoker; a Jones underfeed stoker with fan, added to one of the old Heine boilers; two direct-current De Laval turbine sets, rated 300-hp at 9000-900 r. p. m., also three Green Fuel Economizer Company's induced draft fans.

The method of work planned for this section is to be slightly changed, so that instead of testing a great number of coals, more tests will be made of the same coal, different sizes and different methods of stoking or feeding, etc., being employed with the object of determining the most economical performance under different rates of combustion and the best ratios of grate and heating surfaces.

The B. & W. boiler will be placed beside the two Heine boilers which have been brought from St. Louis, all three having been provided with induced draft apparatus in order to get a wide range of capacity. The Heine boiler provided with the Jones stoker has the usual arrangement for forced draft. The B. & W. boiler was inserted partly to enable tests to be made of the same fuel with different types of boilers. It serves to represent the types employing a perpendicular flow of the gases through the tubes, the parallel flow types being represented by the Heine boilers. The Heine boilers have been so rebaffled or partitioned as practically to double their length by compelling all the heated gases to pass along the entire length of the tubes twice. An additional alternating-current turbo-generator set may be installed as indicated to supply power for external and exhibition purposes. The steam engineering division, which has now practically succeeded in isolating the performance of the boiler from that of the combined performance of the boiler and furnace, will carry on further tests with the object of still further determining the performance and efficiency of the furnace alone.

Some changes have also been made in the producer-gas section. For instance, producer No. 7 has been provided with a water seal at the base to permit the ashes to be removed without admitting air, and several holes have been bored at different heights to be used for extracting samples of the gas. A special steam pipe has been provided to insure a steady water pressure, since the pressure of the supply mains fluctuates considerably.

The gas engine is belted to a 200-kw Bullock generator, which serves to drive the motors for the apparatus in the building, the machine shop, the briquette plant, the elevators and the conveyor. Any additional load required is obtained by a water-box resistance.

The plans of the gas section include the following determinations: The proper length for a test run, the effect of the size of the coal, the best depth of fuel bed, the effects of rapid load variations, the maximum returns from different fuels, and the response of a producer plant to sudden demands for power.

A new work of great importance is being undertaken in the alcohol and gasoline engine section. The equipment includes two 15-hp, 250 r. p. m. Otto gas engines; two 15-hp Nash Company's engine; one 2-hp International Harvester Company's engine, and two John Deere engines rated at 14 hp and 18 hp respectively.

Experiments will be made covering the whole range of this field, but for the present the work will be confined to examinations of different carburetters with the object of showing the lines along which a more efficient method of vaporization may be obtained. The other more prominent work is the examination of the kinds of fuels available, with special reference to gasoline versus alcohol, and an investigation of the use of kerosene as fuel for this class of engine.

The study of the destructive distillation of the coal and its combustion in gas producers, coke ovens and furnaces, especially from the standpoint of physical chemistry, will be undertaken by several divisions.

The briquetting division, which occupies the large room at the end of the building, is putting down one additional German briquetting machine, while the previous apparatus of English and American manufacture that was used at St. Louis is installed in the same room. The work of this division will be chiefly the manufacture of briquettes from various run-of-mine coals of the Eastern fields, which will be tested on war vessels.

MEETING OF THE STANDARDIZATION COMMITTEE

As announced in the last issue of this paper, a meeting was held in Cleveland, on July 26-27, of the Committee on Standards of the American Street and Interurban Railway Engineering Association At that time a list of the attendants was given, but in view of the general interest on the subject a fuller account of the meeting is published below.

The three subjects discussed were:

1. Standard axles, journals, journal bearings and journal boxes.
2. Standard brake-shoes, brake-shoe heads and keys.
3. Standard sections of treads and flanges of wheels.

A summary of the remarks upon the topics under consideration appears under the three respective heads.

AXLES

W. H. Evans, of Buffalo, chairman of the committee, called the meeting to order Friday morning and announced that the subject of axles would first be considered. He then called attention to the four axles recommended by the Central Electric Railway Association, and illustrated on page 974 of the STREET RAILWAY JOURNAL for June 1, 1907, and suggested that it would facilitate matters to discuss these axles seriatim. Axle "A," or that with a 4¾-in. x 7-in. journal, and 4½-in. motor fit, and designed to carry 1500 lbs., was the first to be considered.

Mr. Priest thought that this axle would suit motors up to 40 hp, that motors from 40 hp to 60 hp could use the 5 to 5½-in. axle; those from 75 to 100 hp, 5½ ins. to 5¾ ins.; 150 hp, 5¾ ins. to 6 ins., and 200 hp, 6½ ins. For the larger motors he insisted 50 ins. between wheel hubs was necessary. He then called attention to the shape of the key ways, and suggested that a key way cut with an end mill might be more desirable than that shown. He also said it was the practice of his company to make the key way about 3 mills less in width than the thickness of the key to insure a tight fit. Mr. Taylor explained that the shape of the key way had been adopted after a long experience with different patterns, and that it had reduced very materially the trouble of axle breaking. No difficulty had been experienced in pressing on the gear. It had been the hope of the committee which was responsible for this design that when solid gears were adopted, possibly a key might not be required at all. For that reason all keys were designed to be of the same length and size. The chairman said that it was the intention to make the "A" axle accommodate everything up to a 50 hp maximum. With the wheel fit of 5 7/16 ins., the axle would take care of the maximum strain at the point where the most trouble is usually had, that is where the axle enters the wheel.

Mr. Adams, of Baltimore, asked Mr. Taylor why the length of wheel fit 7½ ins. had been adopted on the "D" axle, with a diameter 7 15/16 ins. He thought it was considered desirable to have the length of hub equal the diameter of the bore. Mr. Taylor replied the principal reason was the desire not to increase the length of the axle, and it was hoped that the coefficient of friction with the diameter selected would be sufficient to hold the wheel in place. He thought that it would be interesting to find out the shortest length of hub that could be used on any diameter of axle without the wheel becoming loose. Mr. Lewis, of the Standard Steel Works, replied that there would be no difficulty in using the size of wheel seat suggested, or 7½ ins. When asked if it was possible to reduce the length of the wheel fit to 6½ ins. for a 7 15/16 in. diameter bore, he said that it would for steel wheels. Mr. Lewis added that his company never used a key in their wheels on axles and had never had trouble with loose wheels. In some cases, where a pressure of 80 tons had been used to press the rolled steel wheel on the axle, 300 tons had been required to press it off.

Mr. Storer, of the Westinghouse Company, agreed with Mr. Priest that in the larger size motors it would be necessary to have at least 50 ins. between wheel hubs. He believed that a 6½-in. axle was large enough for a 200-hp motor, which was about the largest which would be used. Mr. Evans defended the desire of the committee to provide axles of ample size, and said that the entire tendency of modern practice was in this direction. He referred to the time, not long ago, when a 4-in. straight axle was considered large enough for street railway service.

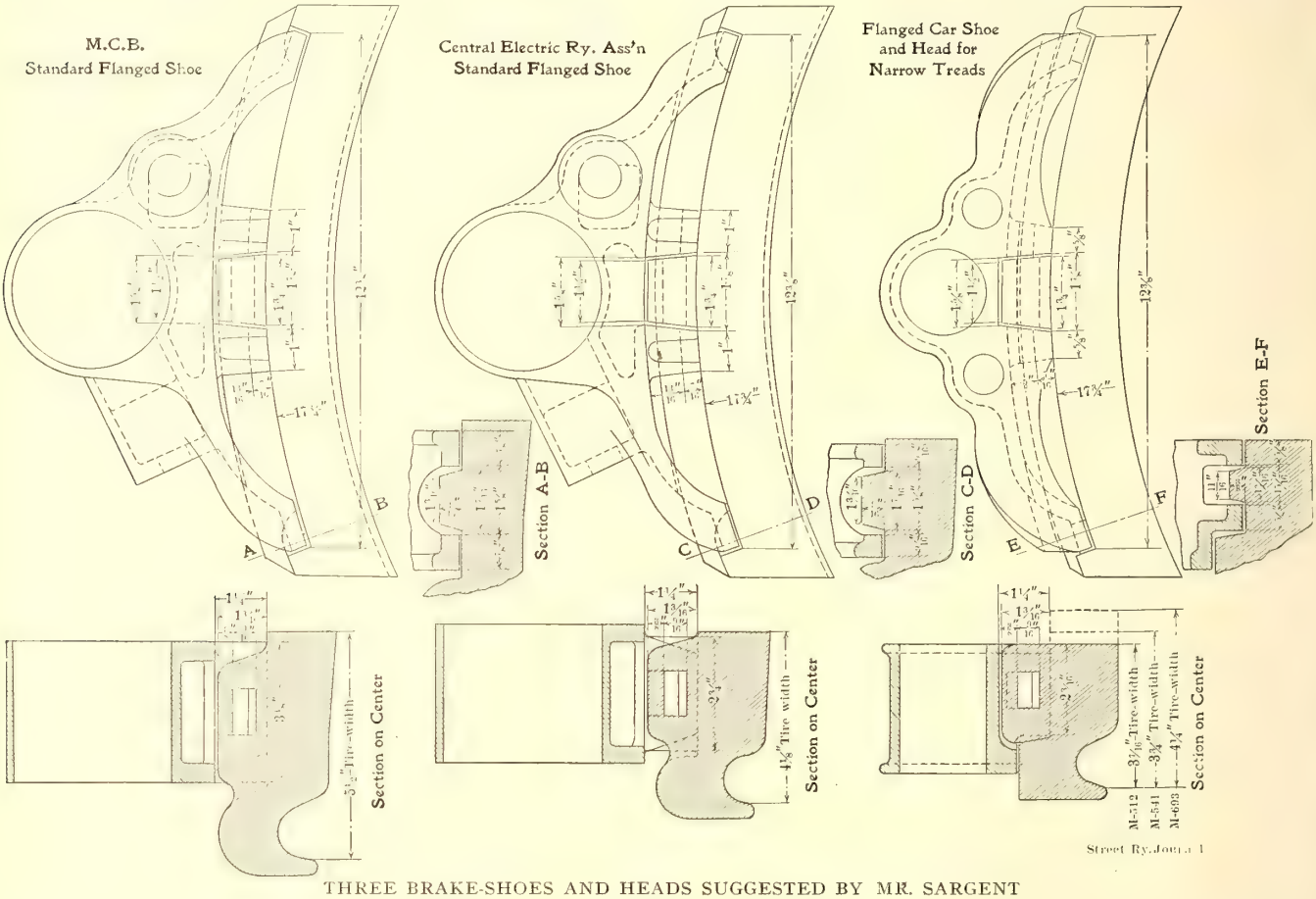
At the suggestion of the chairman, Messrs. Priest and Stover went over the question of limiting dimensions. At the conclusion of their conference Mr. Priest stated that in the absence of data from the office it was impossible to make any positive recommendation. He thought, however, in a general way, that five axles would meet the requirements of the electrical manufacturers, viz.: 25-hp to 40-hp motor, 4½-in. lining, 5½-in. gear fit, and 48 ins. between hubs; 45-hp to 65-hp motor, 5-in. lining, 6-in. gear fit, and 48 ins. between hubs; 70 hp to 100 hp, 5½-in. lining, 6½-in. gear fit, 48 ins. between hubs; 105-hp to 150-hp motor, 6-in. lining, 7-in. gear fit, 50 ins. between hubs; 155-hp to 225-hp, 6½-in. lining, 7½-in. gear fit, 50 ins. between hubs. In each case the gear fit is 1 in. larger in diameter than the lining fit, and the length of the key could be ¼ in. shorter than the length of the gear fit. As the diameter in each case of the gear seat is 1 in. larger than the lining fitting, he suggested that the committee could cut the key way the full depth at the end if it desired.. This practice, he thought, would avoid any weakening the axle because of the increased diameter at that point. A discussion on the proper sizes of axles then followed. Mr. Taylor explained that the wheel fits of the Central Railway Association were made slightly larger than with the M. C. B. axles, as electric railway axles are motor axles, while the M. C. B. axles were designed merely to carry the load, while Mr. Storer pointed out an increase in the diameter of the axle increased the length of wheel base on account of the space required for the motors.

In conclusion, the chairman announced that the committe could allow 50 ins. for the larger sized motors by slightly increasing the total length of the axles. He said that the committee would prepare a series of drawings showing the dimensions which seem desirable, and would forward prints of these drawings to the electrical manufacturers. Mr. Priest, in the meantime, agreed to take up the question of dimensions with his company, and to confer with Mr. Storer on the subject.

JOURNAL BOXES

The discussion on journal boxes centered principally on the space required on the axle, the shape of the top of the box and the space between the guides. On this latter point it developed that the principal objections to increasing the space between the guides were the question of utilizing old equipment and the adjustment of the equalizer bars. Mr. Taylor, however, pointed out that old equipment could be utilized by the adoption of slipper shoes, and that in the case of equalizer beams the slipper shoes could be left low enough to clear the equalizer beams if that construction were used. He also said that in many makes of trucks it

would be very easy to put on new pedestal jaws in case slipper pieces were not desired. The chairman suggested that it might be possible to standardize on 5⅛ ins., as the width between pedestal guides for all boxes. Mr. Adams, of the Brill Company, said that the recommendation was in favor of an M. C. B. type of journal, and called attention to the check plate type of journal for city service, which has given good satisfaction. It limits the side play of the wheels in regard to the journal boxes, which is a consideration where clearances are very close in city work. H. H. Adams asked if the check plate would not require an extra long axle. Mr. Adams thought it would require a slight increase in length. Mr. Weston, of the Symington Company, offered a diagram showing the clearances required to prevent the wear of the box against the wheel hub to aid the committee in its design of axles. The suggestions were received and were referred to the chairman.



THREE BRAKE-SHOES AND HEADS SUGGESTED BY MR. SARGENT

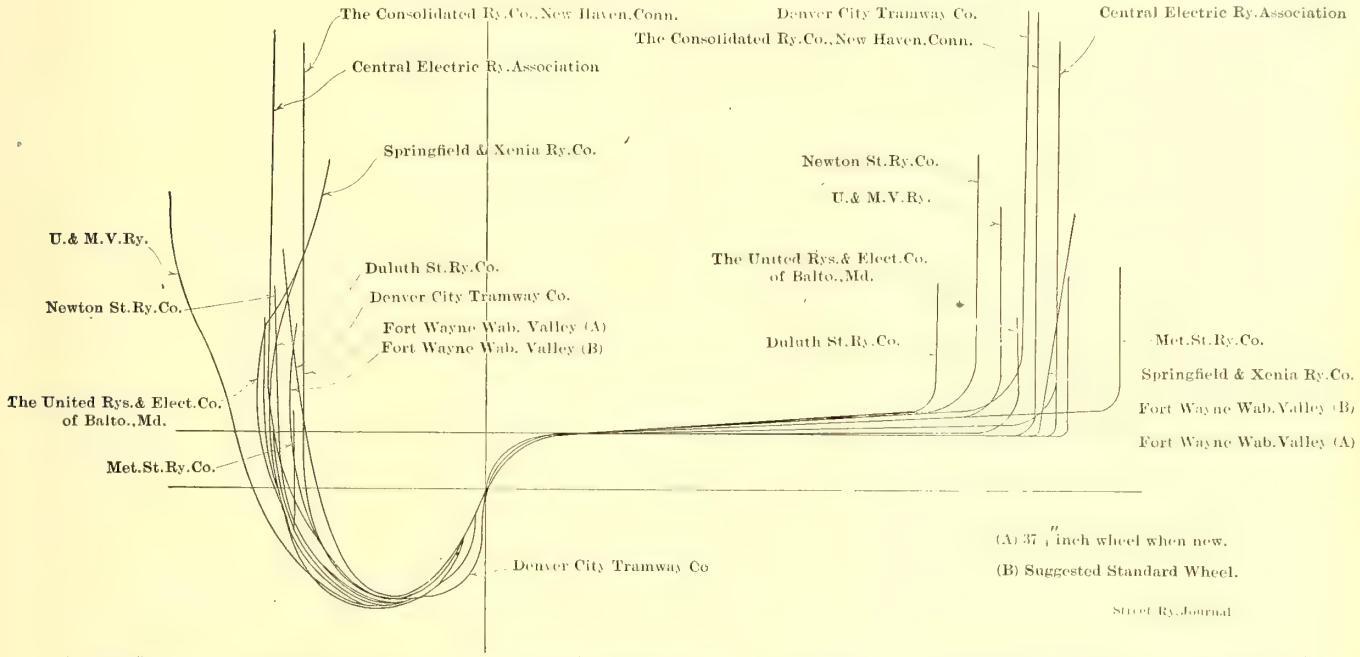
BRAKE-SHOES

The subject of brake-shoes was first considered Friday afternoon, and the discussion was continued on Saturday. Mr. Evans explained that it was the purpose of the Central Electric Railway Association to adopt a shoe which could be interchangeable to some extent with the master car-builders shoe. The shoe recommended by that association can be applied to an M. C. B. head, and vice versa. The M. C. B. shoe can also be used with the Central Electric head if desired, although it would be wider than the tread of the wheel, which had been taken as 3 ins. The Central Electric Railway Association recommended a shoe without a flange where it could be used, but furnished plans for a flange shoe to be used on trucks where it was necessary or was considered desirable.

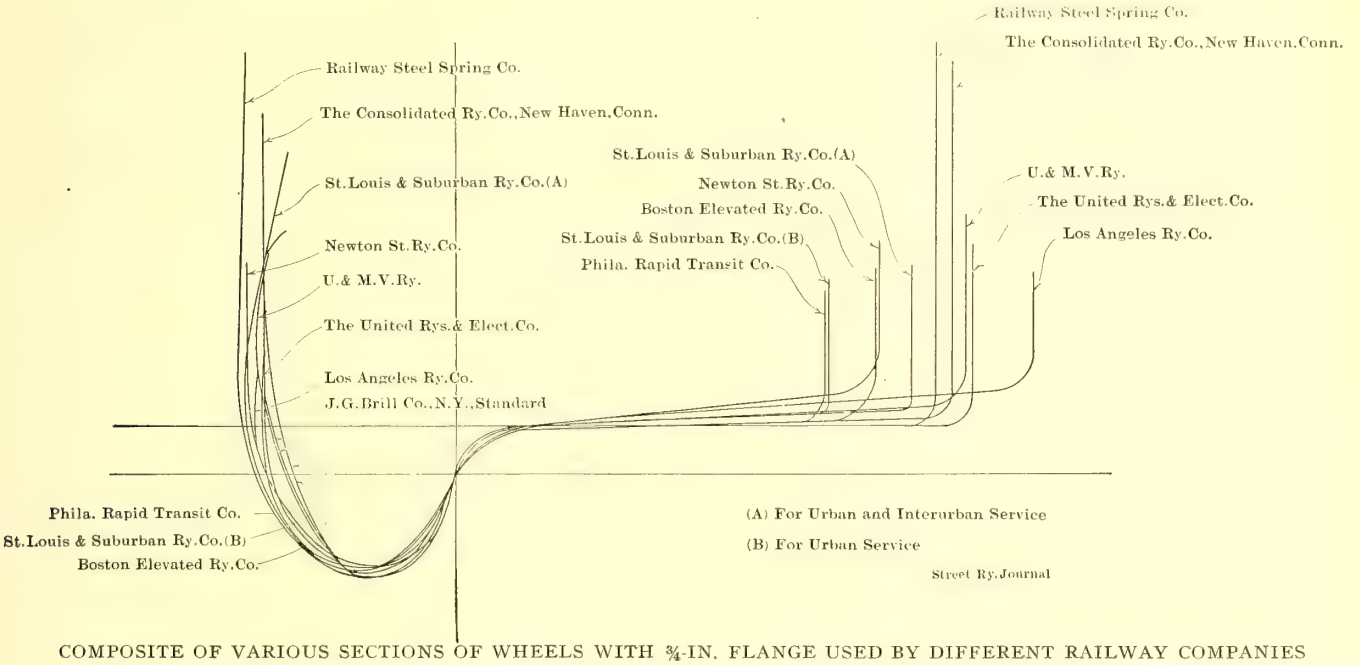
Mr. Sargent, of the American Brake Shoe Foundry Company, on being called upon, said that the 3-in. brake-shoe suggested was very desirable where it could be used. He thought, however, that many companies were employing narrow tread wheels, on which such a shoe could not be employed. At one of the Eastern plants of his company there were about 500 live patterns of street railway brake-shoes which were in constant use in filling orders. Of these, 70 per cent were for shoes on wheels with 2¼-in. tread or less; 20 per cent for shoes on wheels with 2¼-in. to 2¾-in. tread, and 5 per cent for shoes with treads more than 2¾ ins. He therefore suggested three types of shoes to cover the range of wheel treads from the M. C. B. standard to the narrow tread of the street railway lines of the East, with the idea of changing from one to the other as the equipment changes. He presented drawings (shown herewith) of the three patterns he had in mind. For the narrow tread wheels he had narrowed the width of the brake head and the end guides. The narrowest head shown will take in all of the wheels not covered by the Central Association standard and has been used for several years past in the East. Mr. Sargent added that the narrow shoe was not interchangeable with either the M. C. B. or the 3-in. shoe. A discussion followed as to the possibility of using the Central Electric Railway head with a narrow tread shoe. Mr. Evans stated that in one of the large traction roads of the country the Central Electric shoe had been used for a number of years, although the width of wheel tread on some of the cars was only 2⅛ ins. Mr. Larned, of Pittsburg, believed that many of the companies in the large cities would not adopt the 3-in. tread wheel for a long time. Mr. Thompson, of the American Track & Foundry Company, gave a history of the development of the Central Electric Railway head. The Indianapolis Traction & Termi-

nal Company originally had eleven patterns of brake-shoes, including the off-center Brill, the combined Peckham and the slipper Dupont. These have been reduced to one by the Central Railway standard. Mr. Scullen, of the Cleveland Southwestern Railway, said that some years ago he had gotten out a brake-shoe to be adaptable to different trucks and had applied it to the Brill 27, 22 and 21, and Peckham 11 and 14 B, and with wheels from 2-in. to 2¾-in. tread, of great assistance to the Master Car Builders' Association in selecting a standard wheel for the steam roads, and asked Mr. Griffin to discuss the subject of wheels for electric roads.

Mr. Griffin said that, in his opinion, the flange section selected by the Central Electric Railway Association was a very good one, although, personally, he thought that the flange might be thickened about ⅛ in. above the line where



COMPOSITE OF VARIOUS SECTIONS OF WHEELS WITH 7/8-IN. FLANGE USED BY DIFFERENT RAILWAY COMPANIES



COMPOSITE OF VARIOUS SECTIONS OF WHEELS WITH ¾-IN. FLANGE USED BY DIFFERENT RAILWAY COMPANIES

and it had been very satisfactory. Final decision on the subject was deferred for further consideration by the committee.

WHEEL SECTIONS

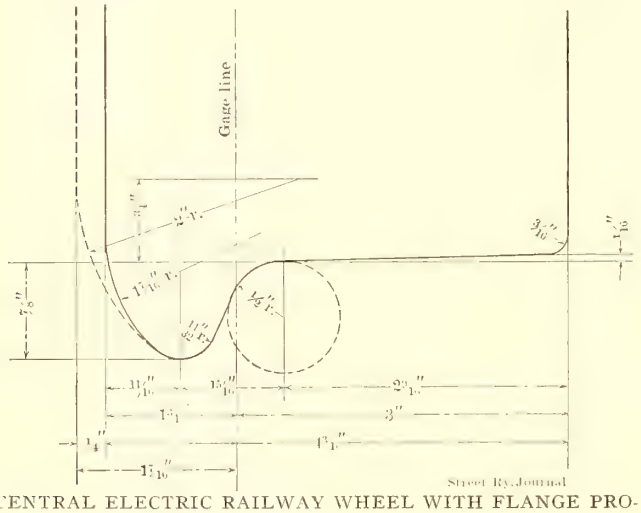
The principal discussion on wheel sections was held Saturday, when P. H. Griffin, of the New York Car Wheel Works, and J. B. Rhoades, of the National Car Wheel Company, members of the wheel manufacturers' committee, were present. Chairman Evans, in introducing Mr. Griffin, said that the wheel manufacturers' committee had been

the flange would come in contact with the rail, except in special work. Mr. Griffin showed a section, published on page 228 of such a wheel. He considered the question of length of hub as the most serious matter to-day in electric railway practice. The function of the wheel is very different in electric than in steam practice, as in the former there is a constant torque, which tends to loosen the wheel. Another important point is the shape of the switchpoint, which is often so blunt that it strikes a severe blow to the wheel flange and causes chipping. Thickening the flange

has been tried, but this does not prevent the jar to the car and does not effect any material relief to the wheel. In regard to the proper thickness of hub, Mr. Griffin believed that a 6½-in. wheel fit would answer the present needs on the larger size of axles, provided a spoke wheel was used. In regard to the coning of a wheel, the Master Car Builders' Association has recently increased the cone, the principal reason being to do away with the excessive wear on flanges. The usual practice of electric roads is to have a cone of about 1/16 in. As the electric wheels are traction wheels instead of carrying wheels, it is desirable to have as much contact between the rail and the wheel all the time as possible, so that the argument in favor of a considerable cone, as employed by the steam roads, does not apply. He considered the question of coning more or less theoretical, as after a wheel has been in service three or four months the cone is gone. Mr. Rhoades also referred to the importance of having a long hub, and the small amount of room often allowed for the wheel seat. His company has furnished wheels with 4-in. axles and only 3⅞-in. wheel seat. These wheels had to be put on from 50 to 55 tons pressure, whereas 40 tons is all that should be used.

During the discussion on wheels, Chairman Evans distributed blue prints showing composite sections of wheels with ¾-in. and ⅞-in. flanges, used by different street railway companies. These drawings had been prepared from blue prints sent to the committee by different member companies in the association and are reproduced on page 227.

Mr. Angerer, when asked to speak for the manufacturers of special work, said he believed the future wheel would be



CENTRAL ELECTRIC RAILWAY WHEEL WITH FLANGE PROPOSED BY MR. GRIFFIN

(Original section shown by solid line; proposed change shown by dotted line.)

one with a wider tread and deeper flange than at present. He thought the ⅞-in. flange a desirable one as being the minimum flange suitable for interurban railways and the maximum permissible by the conditions as they exist in city streets. He did not think that the chipping of wheels was caused by the switch points, but by the flange bearing at intersections where a heavy load is carried on the flange. To do away with the flange bearing, a wider tread even than 3 ins. was desirable, and he thought that in the future a 3½-in. tread might be recommended. Mr. Clark, of Buffalo, and recently of Cleveland, argued in favor of a shallow flange. In Cleveland a ⅝-in. flange with 2¾-in. tread is employed, and if a ¾-in. flange should be used the cars would have to run on the flange most of the time. He also advocated the thickening of the wheel flange so as to save the wear on the outside rails at curves. Mr. Entwisle thought there would be difficulty in increasing the thickness of the wheel flange, as so much special work has been laid for the thin flange. He also considered a 3½-in. tread more desirable than a 3-in. tread, as it would protect the special work and would also eliminate the flange bearing, which he considered the chief cause of broken and chipped flanges. H. H. Adams suggested that a prolific cause for chipping was too thin a flange, and said the flange should be strengthened by a backing of gray iron. Mr. Simmons did not think it necessary to recommend a 3½-in. tread. It might be an ideal condition, but almost impossible of fulfilment at the present time. Mr. Triest stated that the Pennsylvania Railroad employed a wheel flange 1 in. in height for both steel and chilled wheels, instead of the 1⅛ in. of the Master Car Builders. The Harriman lines were doing the same thing with steel wheels, but he was unacquainted with their practice with chilled wheels. Mr. Griffin pointed out that an electric wheel wears the back of a flange as well as the front, whereas in steam railroad work the wear on the back is practically nil. This tended to sharp flanges in electric railway work and made it desirable to protect the back of the wheel.

The committee, in conclusion, decided to prepare plans of standards based on the testimony given and forward such plans to those most interested. The next meeting of the committee will be held in New York during the second week in September, at which final suggestions will be heard and final recommendations will be drawn up for the report to be presented at Atlantic City.

NOTES FROM MEXICO

Governor Miguel Cardenas, of the State of Coahuila, has granted Rodolfo Garza and Guillermo de Velasco a concession to construct an electric railway in Saltillo. Saltillo had a mule car system until about four years ago when the operation of the lines was discontinued.

The Federal Government has granted the Electric Tramways Company of Mexico, Ltd., a concession to extend its system in Mexico City 2 miles. The extension must be finished within one year from the date of the concession.

It is reported that the Salvatierra & Western Railroad, which is to be built from Salvatierra, in the State of Guanajuato, to Puruandiro, in the State of Michoacan, may be operated by electricity. Andres Bermejillo, of Mexico City, is the promoter of the proposed road. He is one of the owners of the railway system in Guadalajara, which is now being equipped with electricity, and is also interested in the electric light and power plant at Guadalajara. The Guadalajara plants and systems are operated under the name of Compania de Tranvias, Luz Y. Fuerza. C. A. Malau, head of the construction department of the Compania de Tranvias. Luz Y. Fuerza has been appointed chief engineer of Salvatierra & Western. The latter road will be 80 miles long.

The survey for the Torren & San Pedro Interurban Electric Railway will soon be finished and the contract let for the construction of the line. It will be 26 miles long running between Torreon and San Pedro and will traverse the richest portion of the Nazas River valley. The city of Torreon is rapidly becoming the center of a number of electric lines. In addition to the one which is to be built to San Pedro, a line is to run from Torren to Matamoros. An electric railway is already in operation between Torren and Lerdo, a distance of 7 miles.

THE HANDLING OF TRAINMEN BY THE SAN ANTONIO TRACTION COMPANY

As soon as a trainman has been employed by the San Antonio Traction Company he is given a number and an envelope of heavy manila paper is made out for him. In this envelope is afterwards put all his application and other blanks and all written reports turned in against him, newspaper clippings or any other information concerning him. The envelopes are filed according to number and an index book is kept to get any man's number. After the trainman is accepted he is put on a car with a competent motorman or conductor and kept on this run until he is pronounced competent. He then gets one day of service on each of the other lines of the system.



CLUBHOUSE FOR THE TRAINMEN OF THE SAN ANTONIO TRACTION COMPANY

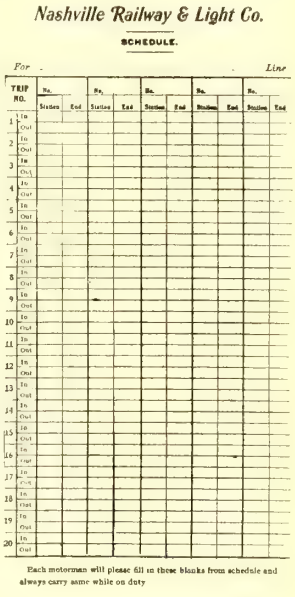
Three inspectors ride the cars and make reports direct to the superintendent of transportation. These inspectors keep cars on their schedules, maintain discipline among the men and keep a lookout in general for anything out of order. They report car troubles on special blanks, which are afterward passed over to the car house foreman, who notes on them what disposition was made of the cars. Similar blanks are provided for daily reports of motormen. The inspectors' reports concerning the trainmen are made on special blanks which are afterward kept in the trainman's record envelope in the superintendent's office.

Fort Sam Houston, at which several regiments of United States troops are kept, is located at San Antonio, and the railway company receives many applications for positions from discharged soldiers. These soldiers are preferred to other applicants, largely because they expect discipline for misdoings and take it properly. When they are disciplined they never let it appear that they consider the superintendent has a special grudge against them and get sullen, as is too often the case with trainmen.

As a means of entertainment for the trainmen, a club house has been built adjacent to the shop. The club rooms are provided with billiard and pool tables and a supply of current literature on file. The lawn surrounding the club house is kept unusually well, partly with the idea of impressing the idea of neatness upon the men.

TRAIN SCHEDULE BLANKS FOR THE NASHVILLE RAILWAY & LIGHT COMPANY'S TRAINMEN

To make trainmen of the Nashville Railway & Light Company familiar with their schedule, they are compelled to copy it on small cards which they carry with them while on duty. The original schedules are posted on large sheets in the office of the superintendent of transportation and the trainmen are required to fill in their own cards from these. It would be an easy matter to have the trainmen's cards printed complete, but if this were done it is probable that in many instances the trainmen would never study the card except at times when its use was required.



Nashville Railway & Light Co.

SCHEDULE.

For _____ Line

TRIP NO.	No.		No.		No.		No.		No.	
	Station	End	Station	End	Station	End	Station	End	Station	End
1	In									
	Out									
2	In									
	Out									
3	In									
	Out									
4	In									
	Out									
5	In									
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14	In									
	Out									
15	In									
	Out									
16	In									
	Out									
17	In									
	Out									
18	In									
	Out									
19	In									
	Out									
20	In									
	Out									

Each motorman will please fill in these blanks from schedule and always carry same while on duty

NASHVILLE TRAINMEN SCHEDULE CARD FOR

FORM T-24-4-07 10M.

SAN ANTONIO TRACTION CO.

MOTORMAN'S DAILY REPORT.

Run Car No _____ out of Repair as follows.

_____

_____

_____

_____

_____

_____

Line _____

Time in _____

Date _____

Run into shed on Car No _____

Signed. _____ Motorman.

DISPOSITION

_____

_____

_____

_____ Foreman.

MOTORMAN'S DAILY REPORT

Form T-28-5-06-5m

SAN ANTONIO TRACTION CO.

INSPECTORS REPORT
TO SUPT. OF TRANSPORTATION

Line _____ *Car No.* ___

Motorman _____

Conductor _____

Time _____ *M*

Date _____ *190*

_____

_____

_____

_____

_____

_____

Signed _____ *Inspector*

INSPECTOR'S REPORT TO THE SUPERINTENDENT OF TRANSPORTATION

San Antonio Traction Co.

Road Inspector's Daily Report.

Run Car No. _____ out of Repair as follows.

_____

_____

_____

_____

_____

_____

Line _____

Motorman _____

Time Inspected _____ M.

Date _____ 190 _____

Signed _____ *Inspector*

DISPOSITION.

_____

_____

_____

Signed _____ *Shed Foreman.*

ROAD INSPECTOR'S DAILY REPORT

FORM T 38 10-5-

No _____

NAME _____

Employed _____

Resigned _____

Discharged _____

REMARKS

_____

_____

COVER OF EMPLOYEE'S RECORD ENVELOPE

A. C.-D. C. STRAIGHT AIR BRAKE APPARATUS

For service on single-phase electric railways and those operating on both single-phase and direct-current circuits, the National Brake & Electric Company has developed a class of air brake apparatus along lines similar to its direct-current air brakes. The motor and closed type compressor are separate, except that the motor bearing at the pinion end of the motor base forms a cover for the upper part of the gear, but when assembled form a compact and rigid compressor unit. Either may be replaced without interfering with the successful operation of the other. The compressor and motor are separated by a ½ in. air space, which carries off the heat radiated by the compressor.

The crank chamber and gear case are cast in one piece, The crankshaft has a third bearing in the center which strengthens it at its weakest point, eliminates all tendency to fracture at the center, makes the operation of the compressor quicker and produces less vibration than two-bearing compressors. The crankshaft and gear are removed by lifting them straight out of the crank chamber. This enables the compressor to be dismantled and reassembled in less time than where the gear must be removed from the shaft. The compressor is of the two-cylinder, single action type, with trunk pistons fitted with Dunbar type piston ring. The connecting rod head is connected to the body of the rod by a hinge and a hinged eye-bolt with lock-nuts and a split pin.

The valve head is constructed with the discharge valve towards the center and the suction valve towards the outside of the head. The discharge pipe runs straight out from the valve head to the main reservoir, thus dispensing with attaching elbows, etc. The suction has two openings, one on each side of the valve head; either or both can be used. The suction openings have straining screens to exclude foreign matter from the cylinders.

The gear and pinion are of the herring-bone pattern. Both gear and pinion are made in halves and riveted together. They are carried on their respective shafts by a taper fit and are clamped with lock-nuts to facilitate their removal when required. The lower half of the motor magnet frame is a steel casting, which also carries the bearings and forms a cover for the upper half of the gear, thus insuring permanent alignment of all parts, and the accurate replacement of the armature when it must be removed.

The diameters of the shaft and bearing at the pinion end have been considerably increased to stiffen the shaft at its weakest point. An oil deflector is provided just inside of the pinion end of the shaft to prevent the oil from the gear and pinion creeping into the armature bearing and damaging the insulation of the motor. An overflow device into the crank chamber is also added to the armature bearing at the pinion end to maintain the oil-level constant even though some oil may work past the deflector.

The motor is of the four-pole commutator type with two consequent poles, and is designed for operation on 500 to 600-volt direct-current circuits, and on 280 to 340 volts alternating current 25-cycle single-phase circuits. The motor has two distinct field windings, one for alternating current and one for direct current. Laminated sheet-steel pole pieces are used. The pole faces have a compensating winding, consisting of four coils which are short circuited upon themselves.

The armature is removed by taking off the motor cover, then removing the bearing cap and cap screws holding the magnet frame to the motor base and lifting the magnet frame and armature away from the base. The field coils are removed by first removing the armature and then taking out the four cap screws that hold the pole piece on to the magnet frame. The pole piece can then be pushed in toward the center line of the shaft far enough so that the field coil can be removed. This can be done without disconnecting the compensating winding, as the latter is flexible and can be bent as the pole is pushed inward or back into place.

The brush gear proper is fastened to a cast-iron yoke made in two halves, secured in a groove running entirely around a projection of the armature bearing at the commutator end of the motor. Two sets of brush holders of two brushes are used. The inspection of the armature, commutator and brushes is rendered easy by the inspection doors at the sides of the motor casing.

The compressor is started by throwing it directly on the full voltage, either alternating current or direct current.



RELAY FOR A. C.-D. C. COMPRESSOR

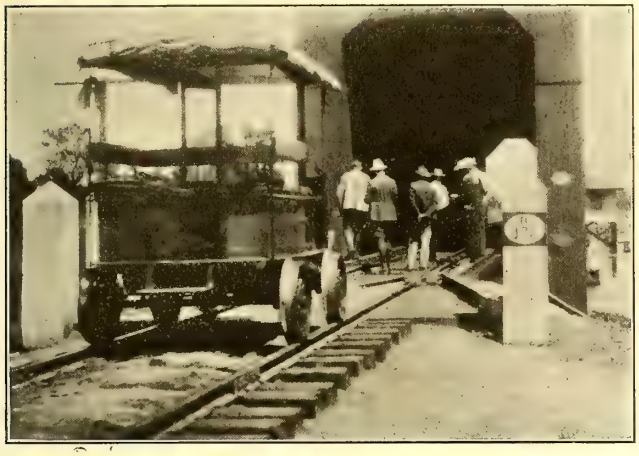
A relay is provided for automatically making the connections for running the motor either on alternating or direct-current circuits. When the direct-current circuit is closed, the necessary connections for direct-current operation are made by the solenoids of the relay attracting plungers to which the contact pieces are secured. When operating on the alternating-current circuit these solenoids are not in circuit, and the contact carrier drops by its own weight and makes the necessary connections for operating on alternating current. The relay is entirely enclosed. A diagram of connections is supplied with each compressor and relay, and the leads are all tagged so that no wrong connections need be made.

The compressor is suspended in a cradle under the car body. This allows the pump to be exposed to the cooling effect of the air at all times. None of the parts of the suspension cradle obstructs access to the compressor. The relay is mounted under the car body with the compressor. The capacity of the a. c. d. c. type of compressor is 25 cu. ft. of free air per minute. The standard National type "N" oil pneumatic governor is furnished in connection with a. c. d. c. air brake equipments, and will operate equally as well on either direct or alternating current circuits. Thirteen of these equipments with compressors, as described, were recently furnished the Milwaukee Electric Railway & Light Company for service on its new interurban lines.

It is reported that the syndicate of American and Canadian capitalists which has been operating in Brazil for some time, mainly in connection with traction and lighting properties, has secured control of a number of steam roads and is planning extensions and improvement that will result in an expenditure of from $50,000,000 to $100,000,000. Among the members of the syndicate are: Sir Wm. Van Horn, Frederick S. Pearson and Lauman Bull, of Edward Sweet & Company, of New York.

GASOLINE MOTOR CARS FOR INSPECTION SERVICE

The general interest felt in gasoline motor cars for railroad service has called attention to the application of this power to inspection cars. Fairbanks, Morse & Company, of Chicago, have done a great deal of work in this direction, first with a small velocipede car and later with a larger car for section gangs, signal service, track inspection, trolley repair work, etc., in place of the ordinary hand car. The



GASOLINE INSPECTION CAR ON THE SANTA FE RAILROAD

engine used in this company's cars is of the high compression type, four-cycle and water jacketed. The accompanying engraving shows an inspection car built by the company for the Santa Fe Railroad. This car has made 286 miles in a day and has run 2000 miles without repairs.

In some cases these cars are being used for passenger service, as at Houston, Tex., on a suburban extension to the Houston electric railway system. This road is owned by Brook Smith, a prominent banker at Houston, and a gasoline motor car of the kind illustrated, and designed to be operated at any speed up to 35 or 40 m. p. h. is employed.

Another point where a Fairbanks-Morse gasoline motor car is being used for passenger service is between Hoxie and Walnut Ridge, Ark., a distance of about 2 miles. This car has transported 600 passengers in one day. Another car is owned by the Mineral Wells & Lake Wood Park Street Railway Company, of Mineral Wells, Tex., which has lately ordered two others of the same type.

CIRCUIT BREAKERS FOR ELECTRIC CARS

A new line of circuit breakers to be used on electric railway cars, having cylinder controller equipments up to 300-hp capacity, known as the MR, has recently been placed on the market by the General Electric Company. These devices automatically break the main control circuit in case of excessive overloads on short circuits and can also be used as a hand-operated main circuit switch. The circuit breaker operates on the well-known magnetic blow-out principle, the arc being extinguished in an extension arc chute located at the top of the casing so that the circuit breaker can be placed in any convenient position in the car vestibule without objectionable arcing or flashing.

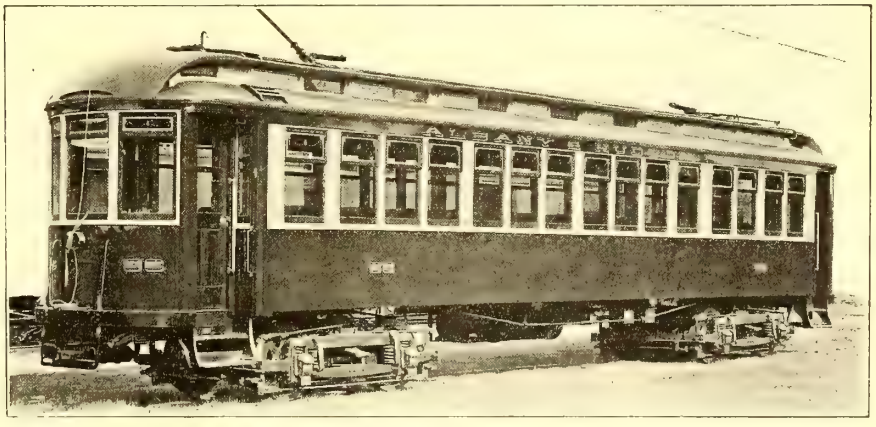
INTERESTING CARS FOR ALBANY & HUDSON RAILWAY

The Wason Manufacturing Company, of Springfield, Mass., has recently turned out a number of combination passenger and smoking cars for the Albany & Hudson Railway, which contain some interesting features. The side posts are of various widths so as to permit wide pilasters



INTERIOR OF ALBANY & HUDSON CAR

to be put where the posts are widest. The passenger compartment is made up of windows in triplet with a single window at each end of the compartment, while the windows of the smoking compartment are arranged in pairs. The entrance ways are arranged with the doors set back. This avoids the necessity for using a trap door. The ventilating system is the same as that used on the cars for the Boston Elevated, built by the J. G. Brill Company, and recently described in these columns. The seats in the passenger compartment are upholstered in plush, and those in the smoking compartment in leather. The



EXTERIOR OF ALBANY & HUDSON CAR

windows raise in the usual manner, the top sashes being stationary. The inside finish is in mahogany. There are trolley poles at either end, but the line, except where it passes through the several towns between Albany and Hudson, is operated by the third rail. Some dimensions are: Length over end posts, 43 ft.; over vestibules, 52 ft.; length of smoking compartment, 11 ft.; width over sills, 8 ft. 2 ins.; height from track to under side of sills, 3 ft. 2 ins.; from under side of sills over trolley board, 9 ft. 2⅜ ins.; size of side sills, 5½ ins. x 8½ ins.; end sills, 6 ins. x 10 ins.

FINANCIAL INTELLIGENCE

Wall Street, Aug. 7, 1907.

The Money Market

The active demand for money both here and in Europe has been reflected in a decided hardening of rates for practically all classes of accommodation. Bankers and other large lenders of money are not disposed to offer funds for fixed periods with any degree of freedom, and in consequence the asking charges for time money are now at the highest of the year. It is true that the demand for money from railroads and other corporations, and from stock exchange houses, has been comparatively small, but there has been an increasing demand for accommodations from commercial sources. Brokers making a specialty of mercantile paper report an active demand for money on the part of merchants, and 6 per cent is now quoted as the minimum for prime paper. The demand is also urgent at all of the principal interior points. It was generally believed that the demand for money at the West would be delayed this year owing to the backwardness of the grain crops, but the advance in the rate of New York exchange to 30 cents premium indicates that preparations are already making to finance the movement of the various crops. As yet no shipments of money for that purpose have been made, but indications are that the New York banks may soon be called upon to make the usual provisions to meet the crop-moving requirements. Canada has been drawing gold rather freely from this center, and Europe has also been in the local market for gold. In all $1,000,000 of the precious metal has been sent abroad during the past two weeks, of which $500.000 went to Paris as a regular exchange transaction, while the $500,000 shipped this week to Holland was arranged for when rates of exchange were materially higher than they are at the present time. At the present level of foreign exchange further gold exports to Europe are entirely out of the question. There exists, however, an urgent demand for gold at all of the leading European centers, and this is emphasized by the fact that last week the Bank of England secured only $2,000,000 of the $5,000,000 laid down in the London market from the Cape, while Continental institutions were successful in securing the bulk of the receipts of gold from the same source this week.

Money on call loaned at rates ranging from 3½ to 3 per cent. Rates for time loans, however, reached the highest of the year, six months money commanding the full legal rate of 6 per cent, plus commission, bringing the total charge to the borrower up to 6¼ and 6½ per cent. while in some instances still higher rates were demanded. Rates for other maturities ruled at 5 per cent for sixty days, 5½ and 5¾ per cent for ninety days, 5¾ per cent for four months and 6 per cent for five months. Under ordinary conditions foreign capital would have been attracted by the prevailing high rates, and while some foreign money has been loaned here against exchange transactions the aggregate amount has been small compared with former years, owing to the fact that foreign bankers are not disposed to make advances with the same degree of liberality as in former years. At the close of the week indications pointed to a continued firm market. This week the banks have gained from the Sub-Treasury about $1,500,000, which compares with a loss of nearly $2,400,000 in the corresponding period last week. An instalment on account of the Union Pacific bonds becomes due this week, and other similar payments become due in the near future.

The bank statement published on last Saturday was favorable. Loans increased $3,787,000. Cash decreased $903,100, which was considerably below expectation. The reserve required was $822,375 more than in the preceding week owing to an increase of $3,529,500 in deposits. The surplus reserve therefore was reduced by $1,785,475 to $7,473,200. This compares with a surplus in the corresponding week of 1906 of $14,122,675, $12,163,525 in 1905, $56,308,850 in 1904, $21,587,075 in 1903. $9,031,250 in 1902, $22,165,350 in 1901, and $29,144,875 in 1900.

The Stock Market

Wall Street continues in a pessimistic frame of mind, and in consequences prices for stocks generally have suffered further material declines during the past week. There have been quite a number of favorable developments, such as the publication of the report of the United States Steel Corporation for the quarter ended June 30 last, showing net earnings nearly $4,000,000 in excess of any recorded for a similar period in the history of that enterprise; the announcement that the labor troubles of the Steel Corporation have been practically settled, the publication of numerous gratifying statements of railway earnings, and the raising of the Southern Pacific dividend from a 5 to a 6 per cent basis. These developments, however, have been totally ignored, or else they have failed utterly to have their rightful influence upon values. One reason for this condition of affairs is found in the fact that speculation is at present entirely in the hands of professional operators, who evidently believe that the profits to be made just now are on the short rather than on the long side of the account. The public still refrains from taking anything like an active part in the market, as witnessed in the comparatively small transactions on the floor of the Stock Exchange, and from present appearances there is no reason to expect that these very essential elements to any prolonged or sustained upward movement will come in until the uncertainties now hovering over the financial situation have been effectually removed. Monetary conditions have played a considerable part in offsetting all there was good in the situation, as while there has at all times been an ample supply of call funds at easy rates, time money has ruled decidedly firmer, with fears entertained that the coming fall may be productive of more or less stringency in all branches of the loan market. While all this is largely problematical and may never transpire, it has, nevertheless, served as a deterrent to the purchase of both stocks and bonds, not only on the part of investors but among speculators as well. However, there have been several more tangible reasons to account for the drooping tendency of values. The report of the United States Steel Corporation was accompanied by a statement that there had been quite a considerable falling off in orders during July, and this was accepted as a forerunner of similar conditions in all kindred industries, if not in all lines of business. The unfavorable construction placed upon the crop report, the disturbed foreign financial market, are partly reflected in a drop in British Consols to the lowest price touched for a long time, and finally the enormous fine of more than $29,000,000 imposed upon the Standard Oil Company by the Federal Court for violation of the rebate clause of the Elkins law, and the action of the Alabama State Legislature in revoking the license of the Southern Railway Company to do business in that State supplied the bearish element with a plentitude of ammunition, and they were careful not to waste any of it.

In the slump in prices which resulted from the unsettling factors above referred to, not to mention the advance and no doubt unfounded rumor concerning the forthcoming dividend on Erie second preferred stock, those stocks which were prominent in the advance of a few weeks ago were the chief sufferers. The impression that the action of Judge Landis in the Standard Oil case would be followed by other prosecutions of alleged violators of the rebate law was by no means calculated to inspire confidence, hence the shares of railway companies in general sustained losses equally as great as those of the industrial concerns. It is worthy of note, however, that Standard Oil stock held firmer than most others.

The local traction shares withstood the bearish pressure better than any other group of stocks, and failed to exhibit any pronounced weakness or liquidation worthy of note.

Philadelphia

There was a larger volume of business transacted in the local traction shares during the past week, but prices continued to move with considerable irregularity. Philadelphia Rapid Transit was again the center of interest, the total transactions in the stock aggregating nearly 15 000 shares. In the early dealings there was rather heavy selling as a result of the decision of the directors to call an assessment on the stock of $7.50 per share, and in consequence the price declined ⅝ to 19⅝. Later, how-

ever, support was rendered, and the stock rose to 21⅛. At the close, however, there was another reaction to 19. In other parts of the list trading was comparatively small. American Railways declined ½ to 48, and Philadelphia Traction lost ¾ to 93¾. Union Traction, after an early rise to 57½, subsequently lost all the improvement. Other transactions included Philadelphia Company at 40 and 40½, and United Companies of New Jersey at 247.

Chicago

There have been no important developments in the traction situation during the past week, but it is understood several conferences will be held in the near future, after which the amended plan for the reorganization of the Chicago Union Traction Company will be made public. It is believed that the modified plan will satisfy a large majority of the various interests. Trading in the local traction shares was practically at a standstill during the week. Chicago City Railway stock sold at 160, which is somewhat higher than the last previous transaction. South Side Elevated brought 81 and 80, and Metropolitan Elevated preferred sold at 64.

Other Traction Securities

Trading in the Baltimore tractions was confined almost entirely to United Railway issues, and while the dealings in them were not large, prices displayed decided strength. The free stock was in excellent demand throughout the week, and on purchases of about 1200 shares the price advanced nearly a point to 13½. The 4 per cent bonds brought 87½ and 87¼, and the incomes sold at 53½. The refunding 5s were under slight pressure early in the week, but later on there was a full recovery to 80. Macon Railway & Light 5s sold at 92½. The feature of the Boston market was the advance of nearly a point in Boston & Worcester common from 22¾ to 23⅝. Massachusetts Electric common sold at 14, but the preferred dropped from 56 to 54, and recovered to 55. Boston Elevated sold at 139 and West End common sold at 87½ and 88.

While trading on the Cleveland Stock Exchange the past month did not amount to more than half as much as July a year ago, tractions were not trailers after all. Cleveland Electric stood second in the list, 1210 shares having changed hands, with prices ranging from 46½ to 53. In traction bonds, Washington, Baltimore & Annapolis securities lead, though they showed a 2-point loss for the month. Cleveland Electric stock showed a decline of a few points from the price reached a week ago, and has been selling about 50 for the past few days. Forest City stock has held close to the old prices and closed at 97 bid and 98¼ asked. It is still in the unlisted column.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	July 31	Aug. 7
American Railways	48½	48
Boston Elevated	136	134
Brooklyn Rapid Transit	56⅛	50¾
Chicago City	155	—
Chicago Union Traction (common) certificates	3	—
Chicago Union Traction (preferred) certificates	15	—
Cleveland Electric	46½	49¾
Consolidated Traction of New Jersey	71	70
Detroit United	65	—
Interborough-Metropolitan	15⅜	13
Interborough-Metropolitan (preferred)	43⅝	38¼
International Traction (common)	—	45
International Traction (preferred), 4s	—	a67
Manhattan Railway	130	130
Massachusetts Elec. Cos. (common)	14	14
Massachusetts Elec. Cos. (preferred)	55	54½
Metropolitan Elevated, Chicago (common)	a24	22
Metropolitan Elevated, Chicago (preferred)	a64	63
Metropolitan Street	a91	a91
North American	68½	66
North Jersey Street Railway	40	40
Philadelphia Company (common)	40	40
Philadelphia Rapid Transit	19¾	19
Philadelphia Traction	94	93
Public Service Corporation certificates	66	65
Public Service Corporation 5 per cent notes	90	92
South Side Elevated (Chicago)	80	80
Third Avenue	104	90
Twin City, Minneapolis (common)	91	88
Union Traction (Philadelphia)	57¼	57

a Asked.

Metals

According to the "Iron Age" the July output of coke and anthracite pig iron was somewhat disappointing. The production was 2,259,687 tons, compared with 2,234,675 in June. While the pig iron markets in the East are irregular and weak, they show a moderate amount of activity. The Southern and Western markets are very dull. Eastern steel makers report a somewhat better volume of business in billets. An improved demand from car builders is reported.

Copper metal continues quiet. Consumers are not disposed to enter the market at this time, and in some quarters a further reduction of the leading grades is looked for. Lake is quoted at 22 and 23, and electrolytic at about 22 cents.

KENTUCKY COMPANIES CONSOLIDATE

The Lexington & Versailles and the Frankfort & Versailles traction lines have been merged under the name of the Central Kentucky Traction Company, the articles of consolidation for which have been filed. The capital stock of the new company is now $425,000. Louis des Cognets, J. R. Morton, J. W. Rhodes, Theo. Harris and C. N. Manning signed the articles for the Lexington & Versailles, while Louis des Cognets, J. R. Morton, M. J. Meagher and J. C. Noel signed for the Frankfort & Versailles.

The directors of the consolidated company consist of the following gentlemen: Louis des Cognets, C. N. Manning and J. W. Rhodes, of Lexington; Theo. Harris, of Versailles; M. J. Meagher and J. C. Noel, of Frankfort; Howard E. Young, J. B. McAfee and J. Levering Jones, of Philadelphia; C. E. Emmons, of Ft. Wayne, Ind., and Judge J. R. Morton, of Lexington. Louis des Cognets was elected president; J. Levering Jones, vice-president; T. D. Murray, secretary; Henry Rainey, assistant secretary; H. J. Delaney, treasurer; J. W. Stoll, assistant treasurer. The company is authorized to issue $4,000,000 bonds and it is said that $3,500,000 will be spent in building lines from here to Nicholsville, Versailles, Winchester, Shelbyville, Owenton, Paris, Cynthiana, Lancaster, Harrodsburg and a number of other towns in the central part of the State.

THE KANSAS CITY BOND ISSUE

The Kansas City Railway & Light Company has announced the terms of the $5,500,000 notes. The notes are in two series: Series A, $4,125,000; series B, $1,375,000, bearing interest at 6 per cent, redeemable at the option of the company at par and accrued interest upon eight weeks' notice on any interest day after Sept. 1, 1908. The notes mature Sept. 1, 1912, and each of the series A $1,000 notes is convertible at the option of the holder after Sept. 1, 1908, into 6½ shares of common stock and 7 shares of preferred stock of the company.

The notes are secured by the pledge of at least $5,500,000 par value notes of the Metropolitan Street Railway Company of Kansas City, $1,000,000 par notes of Kansas City Electric Light, $2,695,000 par of the common stock of the Kansas City Railway & Light, subject as to said preferred stock to the lien of the indebtedness now secured by the deposits of such preferred stock as collateral, which indebtedness matures Dec. 15, 1907, and also the various securities of subsidiary companies.

Series "A" notes are offered at 95 per cent of their par value and accrued interest to the stockholders. Every stockholder can subscribe to an amount equal to 22 per cent or less of the par value of his holdings.

Kuhn, Loeb & Company and Blair & Company are to form a syndicate to guarantee the sale of notes of series A and to buy all the notes not taken by the stockholders.

The proceeds of the notes are to meet the maturing obligations of the company and to provide for improving and extending the property in which it is interested.

THE TRANSIT INQUIRY IN NEW YORK

William M. Ivins, as special counsel for the Public Service Commission, began Thursday, Aug. 1, the investigation of transit conditions in New York. Mr. Ivins had with him at the counsel table Herbert D. Mason, A. E. Blackmar, general counsel for the Public Service Commission, and A. H. Walker, the Commission's assistant counsel. In addition to its legal staff, the Commission has also retained Marvin Scudder, as financial expert. Paul D. Cravath and De Lancey Nicoll represented the Interborough-Metropolitan Company as counsel. The other officers of the company present in addition to Mr. Shonts, the president, who was the first witness, were H. H. Vreeland, president, and Oren Root, vice-president of the New York City Railway Company, President Bryan of the Interborough, General Manager Hedley of that company and others.

At the outset of the hearing Mr. Ivins made a preliminary statement as to the methods and purposes of the investigation. He then asked the Interborough-Metropolitan representatives to produce an index of all the charters and franchises of all the companies included in the merger, and for all the correspondence that has passed between the company and the old Board of Railroad Commissioners for the last seven years for the purpose of determining what regulative orders have been issued and in what manner they have been obeyed.

Mr. Shonts was first called on for an outline of his railroad experience and reviewed briefly his work since 1881, when he began his career. This statement closed with the announcement that when he accepted his present position he was chairman of the Isthmian Canal Commission. After this Mr. Shonts, in reply to questions, said that while the systems under his control, the subway, elevated and surface lines, differ in operation they can be advantageously operated as a whole. Mr. Shonts said that there was at present ordered and awaiting delivery 200 cars for the elevated lines, 50 cars for the subway, 155 cars for the surface lines, and 50 cars for the New York & Queens County Railway. These will go on in addition to the present equipment, except in the case of the subway, where the road had been overtaxing its present car capacity, and hence will be obliged to retire some cars to the shops for repairs. The new elevated cars, he said, were of the present type, while those for the subway were of steel construction, so arranged that side doors could be put into them if desired. The new surface cars are of the pay-as-you-enter type, and Mr. Shonts said distinctly, an experiment. Then Mr. Shonts said, the limit in capacity of some of the lines was reached long since, and that in order to better service it was his purpose to apply to the city authorities for help in keeping the tracks free from vehicle traffic, which was constantly growing and ever becoming more of a hindrance to the operation of cars. Mr. Shonts said that in the last four years this congestion has increased so rapidly that the average speed had been cut down from 8 miles to 7 miles an hour.

Taking up the situation in the subway after Mr. Shonts testified that the company had in subway service 791 cars, of which 300 are steel and the rest are wooden. The wooden bodies cost about $5,700 exclusive of the wiring. The steel cars cost, bodies and trucks, some $15,000. In reply to a question as to whether he considered the wooden cars safe, Mr. Shonts said: "A good deal depends upon a point of view. As compared with cars in other subways they are very safe, and when the subway was opened they were the best cars known. The steel car was an experiment. There is, of course, a greater danger in the wooden cars than in the steel cars, but the accident record of the subway speaks for itself."

Mr. Ivins and Mr. Shonts then took up the matter of types of subway cars with specific reference to the feasibility of using the Illinois Central type, which has side doors for its entire length and which has been described in these columns. Mr. Shont's main objection to this car was that it would increase the danger to passengers at stations where the platforms curve, that it would tend to a worse confusion of the entering and leaving crowds than there is at present, and that inasmuch as the present 8-car express trains overlap the platforms at each end, the Illinois Central type of car would not be of much avail at either end of a train in point of saving time.

He told of some of the troubles that his experts had in studying the congestion in the subway, and said that if relief could be obtained as sought by the company and approved by the late Rapid Transit Commission for the jam at Ninety-Sixth Street, it would at least enable the subway to run its expresses on a 2-minute headway and average 25 miles an hour including stops, which the company is not doing at present. Mr. Ivins called attention to the fact that the agreement between the city and the Interborough provides that the expresses shall average 30 miles an hour including stops. Mr. Shonts said that an average speed of 30 miles would mean 56 miles between stations, which was not considered safe, and hence could not be deemed within the terms of the contract.

When the hearing was resumed on Friday, the first questions asked related to the value of certain underlying lines of the Metropolitan Street Railway Company. Mr. Shonts agreed to prepare for the Commission schedules setting forth the physical cost values of the various properties, the cost of intangible rights in the streets, such as easements and the like, and the value of its franchises.

In reply to a question by Mr. Ivins as to how many miles of track the Interborough-Metropolitan has that are not electrified, Mr. Shonts said about eighty, but that contracts were let for the electrification of some fifteen of these. It would cost in the neighborhood of $900,000 for the street work alone, the witness added, and then Mr. Ivins asked for the aggregate figures covering both construction and equipment so that the Commission might be able to compare these expenses with some of the previous ones going to make up the costs referred to above. When Mr. Ivins asked the witness whether there was in contemplation the electrification of still other lines Mr. Shonts said that if the company had received the permit in time it would have electrified the Twenty-Eighth and Twenty-Ninth Street lines, whereupon Mr. Ivins asked Mr. Shonts for the circumstances connected with this delay in order that it could be looked into. Mr. Hedley and Mr. Bryan were witnesses after Mr. Shonts, but their appearance was in connection with details of little concern here.

Mr. Ivins made various requests for additional data on Friday, among them one for a detailed schedule of the trains run on the Ninth Avenue line at 135th Street, 116th Street, Fifty-Third Street, Christopher Street, and the Battery. Another request was for a statement showing the number of cars run on the surface and the elevated lines just prior to the opening of the subway and thereafter; also similar figures showing the conditions before and after the last merger of the traction lines.

Commissioners Bassett, McCarroll and Eustis have been appointed a committee to investigate the Coney Island & Brooklyn Railroad Company.

When the hearing was resumed on Tuesday, Mr. Hedley, general manager of the Interborough Company, was called as witness. All the questions put to him by Mr. Ivins concerned the details of operation of the subway and elevated lines, and the inquiry was continued along similar lines on Wednesday. The object sought by Mr. Ivins was an insight into the methods of train operation, with the object of learning if possible whether additional trains could be secured with the present facilities. Special attention was given to the number of trains run on the Sixth and Ninth Avenue elevated lines. An examination of schedules of these lines showed that the maximum density of travel on the Ninth Avenue line in the morning rush hours between 7 and 8 o'clock was fifty-one trains an hour. The average headway for all trains between 6 and 7 o'clock appeared to be 3½ minutes, and between 7 and 9 o'clock 1½ minutes. Mr. Hedley then told how efforts are made to increase the service to meet special requirement, and showed by examples from operation that it is impossible promptly to meet the vagaries of traffic. Mr. Hedley said that the service on some of the lines had been increased 40 per cent to meet the demands of public during the non-rush hours, and that now a schedule was being worked out for the Ninth Avenue elevated line providing for a 17 per cent increase there which would go into effect just as soon as equipment now ordered was received. Mr. Hedley said he deplored the action of the present Police Commissioner, who had caused to be withdrawn from service on the elevated lines special policemen in blue uniforms paid for by the company, as the gray-coated special officers are not respected by the hoodlums who so frequently are a cause of considerable annoyance to the company. At the close of the session on Wednesday it was announced that Mr. Hedley would be called again when the hearing was resumed Thursday afternoon.

EARNINGS OF THE KANSAS CITY RAILWAY & LIGHT COMPANY FOR YEAR ENDED MAY 31, 1907

The full comparative income account of the Kansas City Railway & Light Company for the year ended May 31, 1907, is as follows:

	1907	1906
Gross receipts	$5,715,339	$5,153,168
Operating expenses	2,909,136	2,596,539
Net earnings	$2,806,203	$2,556,629
Other income	9,440	9,671
Total income	$2,815,643	$2,566,300
Charges, etc.	*2,095,684	1,644,524
Surplus over charges	$719,959	$921,776
Bond retirement	55,000	55,000
Balance	$664,959	$866,776
Dividends	476,105	476,105
Surplus for year	$188,854	$390,671
Previous surplus	657,351	266,680
P & L surplus, May 31	$846,205	$657,351

*Includes $329,814 transferred to surplus in reserve.

A few years' comparison of the most important statistics follows:

Street railway companies:

	1907	1906
Gross earnings	$4,821,902	$4,454,286
Rev., passengers	94,996,998	88,296,480
Trans., passengers	41,074,800	37,810,545
Gross earnings per car mile	21.36c	21.61c
Net earnings per car mile	11.24c	11.25c
Miles of road	124,998	113,838
Miles of track	239,038	222,715

Electric light companies:

Gross earnings	$893,436	$902,744

Connected load, equivalent to 16-candlepower:

Incandescent lamps	$546,790	$380,832

The general balance sheet of the Kansas City Railway & Light Company, as of May 31, 1907, compares as follows:

ASSETS.

	1907	1906
Stocks, gold, notes, etc.	$28,456,884	$28,456,884
Met. St. Ry. Co. adv.	4,234,134	2,910,429
Cent. El. Ry. Co. adv.	.....	.....
K. C. El. Lgt. Co. adv.	1,012,376	636,079
Accounts received	62,699	71,025
Cash	18,977	142,110
Treasury stock, common	2,978,200	2,864,420
Treasury stock, preferred	2,864,420	2,978,200
Treasury bonds	1,875,000	1,875,000
Total	$41,502,690	$39,934,147

LIABILITIES.

Preferred stock	$12,500,000	$12,500,000
Common stock	12,500,000	12,500,000
First lien bonds	9,200,000	9,200,000
Coll. 3-year notes	3,000,000	3,000,000
Bill and accounts payable	3,007,645	1,957,769
Dividend	119,026	119,026
Surplus in reserve	329,814	.....
Surplus	846,814	657,352
Total	$41,502,690	$39,934,147

In his annual report to stockholders, President Corrigan says in part as follows:

During the past fiscal year the gross earnings of your company have shown a satisfactory increase over those of the preceding year, amounting to 10.91 per cent. The percentage of increase in the operating expenses amounts to 12.04 per cent, due principally to the increase in wages and increase in cost of paving and track maintenance.

During the fiscal year ending May 31, 1903, the management of the Metropolitan Street Railway Company adopted a new policy in reference to handling personal injuries and damages, and since that time have contested up to the Court of Last Resort all cases where the company, in the opinion of its legal department, was not liable. The result of this policy has been that, while the total number of passengers carried both for revenue and on transfers, has increased from 90,823,557 to 136,071,798, or over 50 per cent, the total expense in connection with the account has, during the same period, increased from $253,946.51 to $276,892.19, or only 9 per cent, and the percentage in money paid out in damages to gross earnings has decreased from 7.97 to 5.74.

During the past year the street railway company paid out in premiums on fire insurance policies $26,684.00, which is $10,449.00 less than paid out for the same account during the preceding year. This economy has been effected by the installation of sprinkler systems in the most important car houses. Contracts have been awarded and the work of equipping two more houses is now in progress.

At the present time the Metropolitan Street Railway Company is operating 222.28 miles of single track, and the Kansas City & Westport Belt Railway Company, 16.76 miles of single track, making a total operated by the two companies of 239.04 miles of single track.

In the fall of 1906 your company secured the stock of the Kansas City & Westport Belt Railway Company, which operated a single track steam railroad from the old town of Westport, now located in the southern part of Kansas City, Mo., to Dodson, a small town about 8 miles south of Kansas City, where it made connections with the tracks of the Missouri Pacific Railway and the St. Louis & San Francisco Railroad. This road affords the only entrance into the southern part of Kansas City, Mo., for the delivery of freight, and in view of the fact that the growth of the city is principally towards the South, we believe that these freight facilities will be of great value. Since its purchase this road has been stone-ballasted, and the entire track relined and resurfaced. A substantial overhead line has been erected and the operation with steam locomotives abandoned and electricity substituted. A fireproof sub-station equipped with a 750 K. W. rotary converter has been completed and put in operation, and furnishes the necessary current for handling both the freight and passenger business. The company purchased a 50-ton 500-hp electric locomotive, capable of hauling twelve loaded freight cars. It is expected that during the coming year the operating expenses will be very materially reduced, and that this company will contribute a substantial amount toward the general income.

ELECTRICAL OPERATION FOR ST. PAUL RAILROAD IN NORTHWEST

It is announced from Spokane, Wash., that the Chicago, Milwaukee & St. Paul Railway Company is planning to install a series of hydro-electric power plants on the St. Joe River, between North Fork and St. Joe, in Northern Idaho, east of Spokane, and to utilize the electrical power developed for operating the railway across the Bitter Root Divide and also for operating several saw-mills and other plants. The work will cover 35 miles of the St. Joe River and it is stated that 180,000 hp can be developed. Three years will be necessary to complete the work which will cost nine million dollars. If the trial is successful, it is possible that electricity will be used on the entire line between Missoula, Mont., and Puget Sound, a distance of nearly 600 miles.

It is stated that three dams are to be constructed at once and others will be built later. One dam, 86 ft. high, will be built at Little Falls, three miles above St. Joe, to develop 5000 hp. Another dam will be constructed at Cottonwood Island, 10 miles up the river. Good dam sites are to be found at frequent intervals and it is thought no difficulty will be found in making the power developments.

The power will also be used extensively in developing the resources of the tributary country, especially in the operation of saw-mills, as the St. Paul interests control large timber lands in Idaho. A large paper-pulp mill is also to be erected.

The development of the power possibilities are in charge of C. B. Price, a hydraulic engineer, and they are said to have received the sanction of A. J. Earling, president of the railway company.

THE CLEVELAND SITUATION

The officers of the Forest City Railway Company caused a curative ordinance to be introduced in the City Council at a special meeting called Thursday evening. This ordinance, fathered by Councilman R. J. Koch, will operate to re-enact all the grants formerly made to the Forest City Railway Company and in addition makes a number of amendments to the old ordinances that are intended to guide the company in its attempts to gain the joint use of the Cleveland Electric's tracks in certain places. The assertion was made in a letter to the Council and personally by the officers of the company that Mayor Johnson is no longer interested in the company and that there is now nothing to make the grants to the company by the corporation itself illegal.

While the letter does not admit all the transactions in which the mayor is said to have been interested in the way of aiding this company, it virtually says that the old company was right in its contentions in suits brought from time to time and that the courts were justified in the decisions they arrived at. The new ordinance provides that all the rights and privileges given the company by former ordinances shall continue. It further states that these ordinances are not repealed but re-enacted, to give strength to the new position the company now assumes. Amendments to these ordinances are to the effect that the company shall have joint use of the tracks of the Cleveland Electric in what is called free territory and that in other territory the company shall gain joint use of tracks by appropriation and the case shall be tried in a competent court. The franchises are to expire on Sept. 9, 1923, except in cases where the right of joint use of tracks is given and they shall expire on the date that the Cleveland Electric's grant expires. The ordinance was read a second time at a meeting of the Council Friday evening.

All last week was taken up in the preparation of this ordinance, but the Central Avenue franchise is still in question, even if the curative ordinance holds good on the others, as it has been held to be invalid. In order to make it good, the curative ordinance would require the consents of the abutting property owners, which can not be gotten, it is thought. Fulton Road is also in doubt, as a suit is pending that may render the grant there illegal and void. While the company states that it will proceed to build a road on Central Avenue and Quincy Street at once, if the curative ordinance is passed, there is grave doubt about the matter.

Councilman Orgill has raised the question of the power of the Council to re-enact ordinances that were originally illegal because of the financial interest of the Mayor. City Solicitor Baker claims that the Council has full power to re-enact them. However, it would seem that if they are illegal, they have never really existed and it would be difficult to re-enact an ordinance that had never existed.

Secretary Albers, of the Forest City, has been questioned as to his reason for stating that the guarantees of the Mayor were made without the solicitation or knowledge of the company, when the Mayor had testified before a notary some time ago that he had made certain guarantees that could hardly have been made without the knowledge of the company. Mr. Albers did not answer the questions, but referred to his letter to the Council and to the attorneys for the company.

By a vote of nineteen to eleven the City Council passed the Koch ordinance at a special meeting Saturday. A number of Councilmen opposed to the ordinance attacked it vigorously on the floor and declared that it was useless to take such action, since the ordinance would be worthless. In addition it was admitted that one or two of the Mayor's guarantees are still out, notwithstanding the fact that the letter of the Forest City Railway Company stated in explicit terms that they had all been taken up or liquidated. The company will probably attempt to act in accord with this ordinance, but it is said that the Cleveland Electric is preparing a suit that will attack the validity of the whole procedure and that injunctions will be brought against the Forest City Railway Company to prevent its doing anything further in the way of construction. Attorneys for the Cleveland Electric, it seems, believe that the action of the Council has done nothing toward giving validity either to the company or its grants.

Papers showing the revocation of Forest City consents for 1200 feet of frontage on Fulton Road were filed with the City Clerk Saturday morning. This, it is claimed, leaves the Forest City 512 feet short of a majority and invalidates the blanket franchise that was passed later in the day, since the grants included this thoroughfare, for which consents are necessary. Cleveland Electric agents had been at work along that street for some time and seem to have been quite successful in their quest.

THE SOUTHERN PACIFIC'S ELECTRIC PLANS

In regard to the Southern Pacific Company's plans for operating its suburban system in Alameda and Oakland by electricity, Vice-President Julius Kruttschnitt recently stated: We are soon to build up on the Oakland estuary on a block of land we bought for the purpose, one of the finest, most modern and up-to-date electric power plants in the United States. It will occupy the whole block, which is about 400 feet square. It will be quite a showy building, and high, because we shall have big coal bunkers there and mechanical stoking machinery for supplying the furnaces with fuel. The plans for this electric power house have been finished, and Electrical Engineer Babcock has started East to submit them to Mr. Harriman. They are the result of Mr. Babcock's study and adaptation of a number of notable plants in different parts of the country, and they embody all the latest ideas. When the service will be established I can not now state definitely.

KEY ROUTE EXTENSIONS

The San Francisco, Oakland & San Jose Railway Company, operating the Key Route ferry and electric-train system, is planning several important extensions to its property in Oakland and Berkeley on the east side of San Francisco Bay. These extensions will embrace a new line beginning at a point at Adeline and Sacramento Streets and running up Sacramento Street to Hawkins Street, where the line crosses to the Santa Fe right of way and parallels its tracks for a short distance, leaving them to skirt the base of the foothill slopes at that point along the 400-ft. boulevard passing by the proposed new capitol site in Berkeley. There will also be a spur from Sacramento Street running into the lands of the Piedmont Improvement Company.

One of the most important extensions proposed is the new line into Piedmont. It will start at the corner of Fortieth Street and Telegraph Avenue and run northeast across the intervening country and tap the lower section of the central Piedmont tracts, and then cross the upper portion of the East Piedmont Heights section, crossing the proposed city park at that point. The line will then run to Thirteenth Avenue just north of the Fourth Avenue Terrace tract. The entire right of way for this Piedmont extension has been purchased.

The extension of the company's tracks up Claremont Avenue to the new Claremont Hotel has practically been completed and service will probably be inaugurated as soon as the hotel is completed. When these extensions are made it is probable that the Key Route officials will introduce a 10-minute ferry service in place of the present 20-minute service. This will necessitate the addition of more boats.

The extensions which have been planned by the Oakland Traction Company, which is under the same control as the Key Route, are also of a very comprehensive nature. One of the important lines which they will at once build is on the Grand Avenue car-line. This extension will cross the head of the lake and run up Lakeshore Avenue into the lower portion of the Piedmont district. There will also be an extension of the Fourth Avenue line and an extension up Alicia Avenue to Allendale from the Hayward line. Four extensions are also planned for the Berkeley district, as previously mentioned in these columns. The two companies have placed large orders for new cars of a heavier and more modern type, with all modern conveniences, and will take up all the light rails on their lines and replace them with rails of a heavier type, making marked improvements in the service and equipment of the two companies. The officials say that the cost of the improvements under way and in contemplation will involve the expenditure of at least $3,500,000.

Interests closely identified with the San Francisco, Oakland & San Jose Railway have bought the entire double block in Oakland known as the old Pope and Talbot tract, between Twelfth, Fourteenth, Union and Poplar Streets. The purchase of the site has given rise to much speculation as to the use to which it will be put. The best information at this time obtainable indicates that a large station and yards will be established on the property as a center for the West Oakland department of the Key Route business.

PAID-IN-CAPITAL CLAUSE MADE PART OF RECENT CONNECTICUT INCORPORATION REQUIREMENT

A provision that not less than 25 per cent of the capital stock shall be paid for in cash, which has been incorporated into the franchises of two street railway companies just chartered by the Legislature, establishes a new Connecticut policy toward public utility corporations. The Windsor Locks & Western and the Meriden, Middleton & Guilford charters contain this requirement, and they have been signed by the Governor. From the outset of the present session Governor Woodruff has consistently urged legislation providing that the capitalization of street railway companies shall rest on a cash basis.

THROUGH DETROIT-CHICAGO SERVICE PROMISED AS RESULT OF SALE OF CHICAGO ELECTRIC TRACTION

Through electric railway service between Chicago and Indianapolis is promised by Detroit capitalists who purchased the Chicago Electric Traction Company at a receiver's sale before Master in Chancery James S. Hopkins, of the United States Court. The road, which has 32 miles of track connecting Chicago with Harvey, Ill., will be used to bring passengers into the city from a network of lines in Illinois and Indiana. Efforts will be made to run cars from the present terminal of the road, Sixty-Third Street and South Park Avenue, downtown over the South Side Elevated Company's tracks. The price paid was $330,000, of which $250,000 was paid in court. The sale was the result of foreclosure proceedings brought by Moran, Mayer & Meyer on a mortgage of $1,200,000 held by the Manhattan Trust Company, of New York. The road failed in 1900, and since that time Charles Henrotin has operated it as receiver. The line was built in 1896.

KANSAS CITY AS AN INTERURBAN CENTER

It is announced by J. J. Heim, promoter of the Kansas City, St. Joseph & Excelsior Springs Electric Railway, that within the next few years it will be possible to travel by electric car from Kansas City to Coffeyville, 175 miles distant. Kansas City will soon be a suburban electric railway center, says Mr. Heim. Lines to Olathe and Leavenworth, Kan., are now in operation and lines are projected to Atchison, St. Joseph and other North Missouri towns, with branches to Excelsior Springs and Liberty. Other lines are planned up the Kaw Valley. One of these is projected to Paola, Kan. Mr. Heim says only 60 miles of track are needed to connect Kansas City with the extensive electric interurban systems in Southern Kansas and Southwest Missouri. This will give Kansas City direct connection by electric car with the gas and oil fields of Southern Kansas and Oklahoma. There is a population of 2,000,000 within a radius of 170 miles of Kansas City. Where there is no local electric light plants electricity could be furnished for light and power. Mr. Heim says plans are being discussed for a general union station at Kansas City like the one in Indianapolis, to be used by all traction lines.

PENINSULAR RAILROAD TO CONNECT SAN JOSE AND SAN FRANCISCO

Work on the railway being constructed by the Peninsular Railway Company of San Jose is progressing favorably. This railway will connect San Jose, Cupertine, Mayfield, Palo Alto, Redwood City and San Mateo and will later be extended north to San Francisco. The grading for the railway has been finished from Mayfield to its intersection with the old narrow-gage road at Vasona near Los Gatos. It is expected that the ballasting will be done at once and that rail laying will be commenced within a few weeks.

Trains will be run between San Francisco and Los Gatos in one hour and fifteen minutes when the Bay Shore cutoff of the Southern Pacific is opened and the Peninsular road completed. It is understood that work will proceed as promptly as possible on the electric road, which is already built ten miles west of San Jose, with a junction with the Peninsular road. It will use the same right of way as far as Mayfield and then go across the Stanford University along the foothills to Redwood City and San Mateo, the right of way having been purchased. The street grading and cement are being put down in the town of Los Altos on the line, and surveys are being completed for the town of Elevada.

Congress Springs, which has been purchased by the railroad, will be improved to some degree this year, but not till next season will plans be made for its ultimate development as one of the great California resorts. It is the intention of the railroad to give Congress Springs one hour and half service from the city. A branch line is being built which will make an important junction near the Sorosis farm. The company has recently applied for franchises in Mayfield and for Santa Clara County.

In regard to the railway entering San Francisco there is some talk that it will use the Valencia Street railroad line of the Southern Pacific when it is abandoned for regular service by that company on the completion of the Bay Shore cut-off.

CONNECTICUT TROLLEY BILLS PASSED OVER GOVERNOR'S VETO

The House received five veto messages from Governor Woodruff, of Connecticut, July 31, all of amendments to trolley charters, and passed all of them over the veto except that of the Meriden, Southington & Compounce Tramway Company, which was indefinitely postponed. The other vetoes were of amendments to the charter of the Norwalk, Bridgeport & Bethel Traction Company, the Connecticut Railway & Lighting Company, the Thomaston & Watertown Electric Railway Company and the Middletown & Middlefield Traction Company. A new resolution incorporating the Orange Street Railway Company, with provisions objectionable to the Governor removed, was passed in concurrence. The public utilities matter was tabled. The Consolidated, Connecticut Railway & Lighting, Thomaston & Watertown & Norwalk, Bridgeport & Bethel trolley bills were passed over the vetoes in the Senate.

STREET RAILWAY PATENTS

UNITED STATES PATENTS ISSUED JULY 23, 1907

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

860,673. Braking Device; Van Buren Lamb, New Haven, Conn. App. filed Oct. 28, 1905. Consists of a plurality of brake-shoes having interfitting faces welded together by a self-fusing compound.

860,681. Contact Pole Retriever; Joseph F. Mackin, Columbus, Ohio. App. filed April 6, 1906. Includes a pneumatic cylinder and means actuated by an abrupt movement of the pole for putting such pneumatic cylinder into operation.

860,726. Surface Contact Electric Railway; William M. Brown, Johnstown, Pa. App. filed July 29, 1904. Means for preventing the continuation of arcs in contact boxes after the passage of a car. Consists in means whereby any arc which tends to continue in the boxes is short circuited as the car leaves the same and thereby extinguished.

860,734. Railway Crossing; Walter V. Cushing, Chicago, Ill. App. filed Dec. 24, 1906. Short sections of the rails at intersecting points are pivoted and adapted to be turned by mechanical means to provide continuous rails on either track.

860,777. Car Grip; Frederick B. Wentworth, Boston, Mass. App. filed Sept. 21, 1905. Provides handles arranged upon individual supports which depend from a single hanger and are so arranged thereon that one handle and support may be used independently of another.

860,800. Automatic Slack adjuster for Brakes; Richard F. Hamilton, New York, N. Y. App. filed Jan. 26, 1907. A slack for use in connection with air brakes.

860,892. Car Truck Bolster; Jahn McE. Ames, Dongan Hills, N. Y. App. filed May 1, 1907. The bolster is deepest at its middle and has horizontal end portions, the side plates being extended vertically below the bottom member along the adjacent upwardly extending and horizontal end portions of the same.

860,935. Signal; William H. Nelson, Kingsville, Mo. App. filed April 27, 1907. Details of a pneumatically operated semaphore signal.

860,923. Rail-Joint; George V. Lawrence, Carnegie, Pa. App. filed April 30, 1907. The heads of the abutting rails are provided with longitudinal holes for the reception of a

pin, and splice bars integral with one rail adapted to overlie the base flange of the other rail. Spike recesses in the rail and splice bars adapted to register. Dispenses with the use of nuts and bolts.

860,945. Apparatus for Railway Signaling; Henry W. Spang, New York, N. Y. App. filed Sept. 22, 1902. Means for controlling the action of an electromagnet by the moving of the rolling equipment of the railway. Provides means whereby the current from sectionally energized track rails may be caused to flow in different directions through a polarized relay in the locomotive, thereby giving different signals.

860,955. Construction of Car Trucks; Ransom C. Wright, Philadelphia, Pa. App. filed Oct. 18, 1904. A truck frame having metallic sides and flanged transom beams, and a straight flanged beam with upwardly projecting flanges secured to the flanged transom beams and sides.

860,976. System of Control; George H. Hill, Schenectady, N. Y. App. filed Nov. 14, 1905. Apparatus for controlling the operation of motors through a distant point, and relates more particularly to systems wherein a plurality of motors or groups of motors are controlled from a single station.

861,015. Block Signal System; Elmer F. Bliss Schenectady, N. Y. App. filed March 7, 1906. Has sectional track rails energized by an alternating voltage and connected by inductive bonds. Has protective devices adapted to reduce the current in case of abnormal flow.

861,018. Switching Mechanism for Electric Railways; Ed. W. Clark, Coalton, Ohio. App. filed March 26, 1907. Means whereby a motorman may control a switch from a distance so that the car may be made to take a siding or vice versa. Has a special trolley co-operating with a suspended contact plate in the overhead system.

861,064. Strain Insulator; Theodore Varney, Pittsburg, and Christian Aalborg, Wilkinsburg, Pa. App. filed June 4, 1906. Has a metallic cylindrical core on which is placed an insulating tube which in turn supports an eye-ring or bolt.

861,065. Nut-Lock; Thomas P. Vuncannon, Van Vleck, Tex. App. filed April 3, 1907. Relates to nut-locks especially designed for rail-joints for preventing the nuts of fish-plate bolts from jarring loose, and consists of a sheet metal plate disposed under the rails and bent upwardly and inwardly and having holes therein for the reception of the cuts of the fish-plates.

861,071. Strain Insulator; Christian Aalborg, Wilkinsburg, Pa. App. filed May 2, 1906. Consists of an insulating body with tapered holes containing supports which are threaded to engage the nuts of a U-shaped bolt or staple.

861,086. Railway Tie; Judson Carr, Longbeach, Cal. App. filed Feb. 14, 1907. Two relatively spaced ties to provide broader bearing space for the rails and means for fastening the ties together and the rails to the ties.

861,094. Strain Insulator; Harry P. Davis, Pittsburg, Pa. App. filed June 4 ,1906. Comprises a metal tube with a rod projecting therein and having an enlargement located substantially at the middle of the tube, and insulating tubes interposed between the end walls of the metal tube and the ends of such enlargement.

861,143. Means for Securing Wheels to Shafts or Axles; Thomas S. Scott, Pittsburg, Pa. App. filed Dec. 4, 1905. The shaft has a circumferential recess into which a segmental ring is inserted after the wheel has been placed on the axle and a circumferential collar adapted to be secured to the wheel.

861,145. Passenger Car Construction; Albert H. Sisson, St. Louis, Mo. App. filed Oct. 11, 1906. A car having a metal floor, framing posts and base places, each having an outwardly inclined portion to provide a tapering pocket for the filling.

861,149. Strain Insulator for Electric Lines; Theodore Varney, Pittsburg, Pa. App. filed June 4, 1906. Has a ribbed insulating body with metallic rings molded therein and which support thereon bolts projecting from the ends of the insulating body.

861,204. Railway Tie; Samuel M. Coleman, Johnstown, Pa. App. filed March 2, 1907. A composition tie provided with a metallic top.

861,233. Automatic Trolley Pole; Hugh W. Fellows, Cahuenga, and Ira A. Cammett, Hollywood, Cal. App. filed July 16, 1906. The pole is impelled upward by a spring connection which is automatically tripped or released in case of a too abrupt movement of the pole occurring when the pole leaves the trolley conductor.

PERSONAL MENTION

MR. JOHN B. PULLIAN, of Fruitport, Mich., has been made general manager of the Winnebago Traction Company, of Oshkosh, Wis., to succeed Mr. Edward B. Kirk. The company was recently placed in the hands of a receiver.

MR. R. B. HAMILTON has been elected secretary of the Chicago City Railway Company, vice Mr. J. B. Hogarth. Mr. Hamilton will continue his present duties as purchasing agent. Mr. A. G. Mitten has been elected auditor, vice Mr. Hogarth.

MR. WALTER MOREHOUSE has resigned from the Cincinnati Northern Traction Company to accept the position made vacant by Mr. A. S. Swank as assistant superintendent of construction of the electric railway to be built from Buffalo, N. Y., to Erie, Pa.

PROF. CHARLES HENRY BENJAMIN, dean of the School of Engineering at Purdue University, has been appointed to succeed Prof. William F. M. Goss, who resigned to accept a similar appointment at the University of Illinois. Prof. Benjamin comes to Purdue from the chair of mechanical engineering at the Case School of Applied Science at Cleveland.

MR. HARRY A. MOORE, for the past five years claim agent of the Public Service Corporation's street railway department, and Mr. Charles H. Flatt, a claim adjuster, have resigned. Mr. Moore is succeeded by Mr. Harry Down, assistant claim agent, while Mr. Flatt is replaced by Mr. Edwin L. Cushing. Mr. Down came to the Public Service Corporation from the Rhode Island Company in February, 1907. He had previously been with the Cincinnati Traction Company and Pittsburg Construction Company.

MR. ALFRED B. NELSON, of Trenton, N. J., has accepted the position of chief engineer of the Columbus Railway, Light & Power Company, of Columbus, Miss. For the past two years Mr. Nelson has been engineer of construction for the Conestoga Traction Company, of Lancaster, Pa., previous to which time he built the Trenton, Newhope & Lambertville Street Railway the Camden & Trenton Railway, and several roads which now form a portion of the Public Service Corporation of New Jersey, besides having had considerable experience in gas, light and water works construction. It is the intention of the Columbus Railway, Light & Power Company, to build several extensions to the railway system and enlarge and remodel the electric light and gas plants.

MR. JOHN C. HENDERSON, assistant to the president of the Louisville & Southern Indiana Traction Company, the Louisville & Northern Railway & Lighting Company and of the companies owning and operating the various utilities of New Albany, is dead, after an illness that had confined him to the house for nearly a year. He was 63 years old and is survived by three daughters. Mr. Henderson came to New Albany about three years ago, having been appointed to the position of chief engineer in the construction of the approaches to the Big Four bridge at Jeffersonville, which were built for the use of the interurban trains in crossing from Indiana into Louisville. Two years ago he was appointed by Mr. Samuel Insull assistant to the president and had complete charge of the interests above mentioned in and about New Albany.

MR. J. F. COLLINS, formerly superintendent of the Toledo Railways & Light Company's lines, has been promoted to manager of railways, with entire charge of the transportation end of the business. Mr. Collins thus is rewarded with a position that will give wider scope of authority and judgment in the operation of the lines. Mr. Collins will announce the appointment of a superintendent later. Mr. C. R. McKay, superintendent of light and power, has been made manager of light and power, and in addition to the gas and electric departments, he will have charge of the power and heating plants as well. These promotions will relieve General Manager L. E. Beilstein of much of the detail in the management of the properties. Mr. Collins began his career in Indianapolis as a horse car driver, when Mr. Tom L. Johnson was interested in that city. He was in the employ of the roads there when they were changed to electric power and later on was made night superintendent. For ten years he has been superintendent of the Toledo lines and for the past year or more has also had charge of the Maumee Valley and the Toledo Beach lines.

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Of this issue of the Street Railway Journal 8500 *copies are printed. Total circulation for* 1907 *to date* 271,050 *copies, an average of* 8213 *copies per week.*

Continuous Light in Power Plants

In times of emergency in the power plant there is no more awkward predicament than the blotting out of the station lights through the blowing of a fuse or failure of a main generating unit upon which the illumination of the installation depends. Lanterns are the usual recourse in such cases, but in the time while these are being lighted and in the relative darkness which obtains until an important generating unit can be put in service on the station bus-bars, a good deal can happen that might often be forestalled if the plant had some auxiliary means of lighting. The plans for several new power stations equipped exclusively with a. c. apparatus illustrate how the chances of total darkness in such a station can be very largely reduced by a little care in planning the station lighting circuits.

At one of these plants the scheme consists of bringing all the station lighting circuits to a controlling distributing panel supplied with 110-volt alternating current from station transformers and with exciter current as a recourse in case the alternating circuits fail. The important parts of the station are lighted by two sets of lamps; both of these lamp circuits or groups are brought to the panel and fed from opposite sides of a three-wire bus within it. In the panel box are knife switch blades, which enable the exciter circuit to be thrown upon the lamp lines in case the a. c. supply fails. The important duplicated sections are the switchboard, the high-tension switch floor, turbines, basement where the auxiliaries are massed, engine room arcs, and the boiler room stop valves. An ordinary direct-current railway plant cannot, of course, enjoy such a reserve, but it may pay to install a separate small direct-connected unit or local central station service in case offices or shops are close by. The cost of a few lamps on the city supply is a small matter compared with the additional insurance it affords.

Abuses to Which Electric Railways are Subjected and Their Cure

There seems to be a general disposition on the part of electric railway companies to submit to imposition and abuse of a nature that other semi-public corporations would not tolerate. If a wagon driver through his own carelessness lets the hub of his wagon break through a few of the panels of a newly-painted car and mar the surface of the remaining panels on that side of the car, usually no attempt is made to punish him for his carelessness or to threaten him in regard to future offenses. Cars are also subject to a great deal of abuse by passengers from violation of the anti-spitting ordinance to actual destruction of seats and fittings, but unless there is an infraction of a health law or injury to another passenger no one is punished. Frequently a steam road company regards it as its privilege to hold up the electric cars at crossings just as long as it feels disposed, and on the street their progress is delayed by truck drivers in spite of the incessant sounding of the gong by the impatient motorman. The right to "joint" use of the track by teamsters seems to have been so well established that wagon makers frequently take it upon themselves to make the wheels of their wagons the same gage as the track. The cross-road shelters of interurban lines are not infrequently

whittled up, torn down or defaced with pencil marks and verses. In general it seems electric railways get more abuse and stand for more abuse than do other corporations of a similar character.

In some cases this injury is committed because the offender knows that he cannot be detected, but in others, as in highway delays, the offender is known but realizes that he is practically immune from punishment. Is this because the public believes the railway company will accept petty imposition without resentment?

Many railway companies no doubt feel that because they are dependent on the public, both for their receipts and their franchises, it is the best policy to submit to and make the least of what should in reality be regarded as indignities, but this is often permitted to go too far. There is in fact very little reason for electric railway to continue to submit to abuse and if they stood up vigorously for their rights they would no doubt find public sentiment growing in their favor.

One small interurban and city road in the Middle West is doing this. It has gotten a city ordinance passed which prevents steam roads holding the city cars more than a certain interval of time. Frequent arrest of train crews has taught the steam road that in that city at least the electric railways' rights must be respected. A similar policy is being carried out with regard to other abuses. On one occasion the train crews on the interurban line made five arrests in one day. These were largely for such offenses as spitting on the floor and using profane language in the cars. The cross-road stations and the company's property in general are likewise being protected. It is safe to say that a continuation of this policy will soon educate the public to a point where it will have the proper respect for the company's rights and properties.

The company, and the patrons as well, will be gainers in many ways. Cleaner cars, cleaner stations and faster schedules will certainly be appreciated by the patrons, and lessened maintenance expenses will be an additional inducement to the company to continue its policy of self-protection.

Rolling Stock Depreciation

The more depreciation is studied by operating officials on electric railways the more certain it becomes that money set apart to renew wornout or obsolete equipment must be expended, not in a lump sum as a fixed percentage of the investment, but in separate disbursements applicable to a considerable number of varied replacements. In any given year the total depreciation fund will, of course, be a definite percentage of the capital represented by the equipment, but there is little reason to suppose that this percentage will remain constant on any given system from year to year. These points apply to all parts of the equipment, but may possibly be realized with special force when considered in connection with the question of rolling stock depreciation.

It is a difficult matter to determine when a car has reached a point where it should no longer be operated in electric railway service, looking at the question from the single standpoint of physical deterioration. Only to a limited extent is the electric railway able to shunt veteran pieces of rolling stock upon branch lines or relatively unimportant routes. In the main, a car must compete with the latest and best products of the factory, as long as it continues in street railway service. It is probable that more cars have been retired from service because other types capable of handling a larger traffic—often 30 to 50 per cent more passengers seated—have been developed than because of mere weakness. The rapid changes of the past few years in rolling stock standards on electric railways have dislocated many admirable theories of depreciation, based upon the disintegration of each car as a unit. Managers have found it is often wiser to put the depreciation allowance into the purchase of more modern cars rather than keep the economy of other parts of the system low by the use of obsolete rolling stock. This has complicated the subject. Omitting this aspect from immediate consideration, however, and assuming no change in type, the following two practical queries present themselves: "When does a car reach a point where the repairs upon it are so great that it is cheaper to buy a new one?" and "How can one obtain a reasonable basis for rolling stock depreciation estimates?"

The answer to the first question must of necessity be somewhat elastic. If separate records are kept of the cost of repairs to the different parts it is comparatively easy to determine when it would be cheaper to scrap or sell to a second-hand purchaser a part of the equipment, or the car itself, rather than continue the up-keep, with deterioration growing worse each year. But if lump records are kept of the repairs and renewals of motors, trucks, air brakes, body and controlling equipment, giving the parts of the car no identity on the repair sheets, difficulties increase and it will often seem wiser to retain the car in service for a longer period of time. As each piece wears out finally, it will be replaced by another, so that after ten years the motors may have had several new armatures and field coils, the brake-shoes may have been changed scores of times, the wheels scrapped and replaced perhaps three or four times, the control contacts renewed several times, and the body reinforced by additional pieces in place of broken members. In such a case, the composite car will not be replaced or superseded for many years, unless improvements in the art demand a radical change in type. On a large system there is less liability of a well tried type of cars going out of service completely, even in the face of sweeping changes to secure competitive traffic on certain routes. In plain words, the old cars are good for a vast amount of wear still, and unless they are actually distasteful to the public, it would be unwise to scrap them, or even to dispose of them before they are worn out unless at attractive second-hand prices.

Maintenance figures and life records of individual car parts from the shops are the most reliable indices of depreciation. The cost of repairs is well kept on many electric roads at the present time, but the life expected in different services is far too uncertain. Broader study of the characteristics of different divisions and routes is needed with respect to wear and tear. Averages applying to single parts, such as brake-shoes of known composition, are most helpful, but when the averages of the heterogeneous equip-

ment which make up the complete car are lumped carelessly together for the purpose of securing a constant to apply unchanged year after year on a growing system, the results cannot but be of hazardous accuracy, and the cost of securing the original data is largely thrown away. Depreciation is an ever-present problem; but its action shifts with changes in known conditions. It is a most hopeful sign of the times that the whole subject, vast in its ramifications from decaying franchise valuations to rail-bond crystallization is being analyzed under such varied conditions of operation as are embraced among the electric railways which are properly classed as progressively managed.

Overhead Construction on the New York, New Haven & Hartford

The recent installation of the electric service on the New York, New Haven & Hartford Railroad adequately completes the reorganization of the terminal work in New York. It has been a long pull, this breaking down of the walls of conservatism and ridding the metropolis of smoking engines, but the time is now come and a review of some of the methods that have led to the result is in order. The system used in this latest work is notable, not only as involving the use of single-phase locomotives, but as departing at last from the third-rail construction which has been in this country the accepted means of current supply when large units are used. Granted the use of high voltage, which is the condition of success in heavy railway work, the third rail becomes progressively less desirable as the voltage increases. At 11,000 volts, the pressure used for distribution on the New York, New Haven & Hartford, overhead construction is a necessity, and the engineers in charge very evidently made up their minds to take no chances in installing it. For high-speed work with an overhead trolley the catenary construction is also necessary. The section of road concerned contains a varying number of tracks and could not well be broken by pole lines, and the result was the exceedingly solid, although costly, bridge construction now familiar to the eyes of travelers to the Eastward.

The description of the system and the reasons for its adoption offered by Mr. McHenry, which we publish this week, will repay careful study. There were many new problems to be solved, and none of them seems to have been forgotten. The double catenary with its triangular trolley wire support is the most characteristic feature of the actual line construction. It certainly should give effective lateral support, and yet one cannot help speculating as to how far this extreme measure was necessary, considering the use of the pantograph sliding trolley. Failure of one catenary cable would leave the line in bad shape for operation so that there is little gain, save in lateral stability. In a sense the line under consideration was a trying one for high voltage distribution, since at some points the conductors are necessarily rather low. For this reason it has been necessary to take unusual precautions in the matter of safety, and certainly no line has been more thoroughly provided with automatic protection and means for cutting out sections upon which trouble occurs. More attention seems to have been paid to factors of safety than is usual in line work, the insulators in particular being subjected to tests that are really adequately severe.

One interesting feature of the installation is the use of three-phase generators and the operation of all of the trains from one leg of the circuit. This is accomplished by connecting all of the trolley wires in multiple for one conductor, using the track as the second, and carrying an auxiliary wire the length of the line for miscellaneous power purposes, as the third conductor of the three-phase system. It will be shown in a later issue that this unbalancing of the phases does not involve any very great loss in generator capacity, even if the power taken from the third conductor is not large, while under the circumstances the output reaches a large percentage of the generator capacity on three-phase operation.

No electric traction system has ever been put in under more strenuous conditions than this, since the terminal requirements of direct-current operation demanded not only motors of very remarkable properties, but a complete duplicate collection and control system. It was wise policy to take no chances with the overhead equipment, making it mechanically as sound and perfect as possible regardless of cost. The event may prove some of the extreme precautions to have been needless, but the error, if any, is on the side of safety, as it should always be in new and important installations. The whole system, in a case like this, would stand risk of unthinking condemnation if there were failure in some really unimportant feature of construction. The railroad is to be congratulated upon having done thoroughly well the task undertaken and upon giving the first great demonstration of high-voltage railroading upon this side of the Atlantic.

A review of the New Haven electrification as discussed in this issue would not be complete without a reference to the succinct and clear cut article by Mr. McHenry, describing the reasons for the adoption of the 25-cycle 11,000-volt system, and the results which the company expects will follow from its use. At the time when a selection had to be made, the purchase of a few d. c. locomotives to haul the company's trains from Woodlawn to Forty-Second Street would undoubtedly have been the simplest way out of the problem. This would have cared for temporary needs and afforded opportunity for a further development of the single-phase system. Fortunately it was not the plan adopted and the wisdom of the company in making provision for future expansion is being amply demonstrated by the successful operation of the system to-day.

The analysis of the comparative merits of 25 and 15-cycle distribution, and of the advantages of electricity over steam are worthy of careful consideration. Upon the latter point Mr. McHenry sums up the major benefits under three headings, viz: (1) Economical operation of smaller passenger train units; (2) higher speed of freight trains; (3) increase of station capacity. Direct economy over interest and other fixed charges due to electrification may also be expected under favorable conditions, so that while a general change from steam to electricity will involve some sacrifice of invested capital, Mr. McHenry believes that "the transition already in progress will be rapidly extended and applied at all points where congested terminals, high frequency of train service and low cost of power create favorable conditions."

HEAVY ELECTRIC TRACTION ON THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD

BY E. H. McHENRY, VICE-PRESIDENT

The act of Legislature of May 7, 1903, of the State of New York, providing for the future regulation of the terinals and approaches thereto of the New York & Harlem Railroad in the city of New York, authorized the New York Central & Hudson River Railroad Company and the New York, New Haven & Hartford Railroad Company, lessees of the New York & Harlem Railroad Company "to run their trains by electricity, or by compressed air, or by any motive power other than steam, which does not involve combustion in the motors themselves" through the tunnel and over the tracks more specifically described. The act required that the change of motive power be made on or before July 1, 1908, and provided a penalty of $500 per day on and after that date for failure to comply with its terms. As there was no available form of motive power other than electricity which met the conditions of the act, it accordingly became necessary for the New York Central and New Haven companies to provide the equipment for electricity operating all trains between the Grand Central Station at Forty-Second Street and the prescribed sub-limits within the limits of the city of New York.

The terminal tracks of the New York & Harlem Railroad, between the Grand Central Station and the junction point at Woodlawn, a distance of 12 miles, are jointly leased and operated by both the Central and New Haven companies. The zone of electric operation on the lines of the latter was further extended 21 miles, to Stamford, to include the greater number of its suburban trains.

This feature of joint operation more than all others restricted and narrowed the latitude of choice in the selection of a system of electric traction by the New Haven Company. The Central Company was first in the field, and having previously adopted a system based on the use of continuous-current motors taking current from a third rail, it was obvious that no method inconsistent with such conditions was open to the New Haven Company, and it was thus practically confined to a choice between the continuous current, low-voltage system as adopted by the Central Company and the more recently perfected high-tension single-phase system. The first has been in general use for a number of years, and, as installed by the Central Company, includes the generation of alternating currents at 11,000 volts and 25 cycles, high-tension transmission to sub-stations located approximately 5 miles apart, at which points it is reduced and transformed by static and rotary transformers to low-tension continuous current at 666 volts. This current is supplied to the engine contact shoes through a secondary system of distributing feeders and an inverted third rail of improved type. Continuity and regularity of operation are further insured by a large and most noteworthy installation of storage batteries in each sub-station.

The single-phase system is the latest and most advanced step in the evolution of electric traction, and it was not until 1904 that the first commercial installation on the Indianapolis & Cincinnati Traction Company was operated. With this system electric power may be generated, transmitted and supplied directly to the electric locomotive, substantially at the initial frequency and voltage, without intermediate reductions or transformations of any kind. In effect it duplicates the simplicity of the local street railway operating with continuous currents supplied directly to the motors from the trolley line. It avoids all necessity for the ordinary equipment of static and rotary transformers, storage batteries, low-tension switchboards, and low-tension distributing and contact conductors, while affording the flexibility and economy of high-tension a. c. transmission over long distances.

The single-phase motor, as its name implies, operates with single-phase currents, and its characteristics are essentially identical with those of the more familiar continuous current series motors. Single-phase motors are adapted for operating with either alternating or continuous currents, and this valuable feature makes it possible to design engines which may be operated at will by high-tension alternating currents from an overhead conductor, or low-tension continuous currents from a third rail.

The New Haven Company was one of the earliest pioneers in the field of heavy electric traction, and has operated six of its shorter branch lines by electricity in commercial service for a number of years past, beginning as early as 1895. Three of these lines, aggregating 33 miles in length, were equipped for overhead contact, and the remaining lines, aggregating 39½ miles in length, for a third-rail contact. All lines were operated with 500-volt continuous current motors, supplied from main stations and sub-stations of the familiar type. The third rail was rather primitive in form and without protective devices of any sort. So many fatalities and injuries followed the use of this method of supplying current to the motors that the railroad company was compelled to abandon all third-rail operation in Connecticut and revert to steam service, by a decree of the Superior Court dated June 13, 1906, and it now has no third rail in service, excepting a junction overlap with the New York Central Railroad at Woodlawn. Improved methods of protecting the third rail were available, which would have considerably mitigated the more dangerous features of the earlier installations, but the unfortunate and unsatisfactory experience of the New Haven Railroad Company with this type of construction influenced its decision in favor of the single-phase system, which was finally adopted after a careful and complete investigation of the relative merits and disadvantages of the two methods of construction.

Had the study of the question been limited to the equipment of the terminal section in New York City, considerations of uniformity and expediency would doubtless have influenced the decision in favor of continuous current motors, taking current from a third rail. The New Haven Company, however, recognized the great importance of its decision in its far-reaching effect upon future extensions of electric service to other parts of its system, and the final decision was based upon a study of the subject as a whole rather than upon the solution of the terminal problem only.

The distinguishing characteristic of electric traction as contrasted with that by steam-driven locomotives is in the condition that the motive power is utilized at variable and varying distances from the point of generation, and the selection of a system of transmission best adapted to such conditions, which combines in greatest measure qualities of efficiency, flexibility, simplicity, and lowest first cost, is of paramount importance. A glance at the map of the New Haven Company's system will show that it comprises a network of lines and indicates that its transmission problems must be worked out for areas rather than for linear distances, thus reversing ordinary conditions.

As the area served increases as the square of the radius of

transmission from the generating center, and as there may be many circuits in the network which will serve as paths to common points of use, it is evident that ordinary methods of calculation will be geatly modified. Under such conditions the economic radius corresponding to any initial potential will be considerably extended, and the commercial and practical value of high potential transmission will be much increased.

While both methods under consideration included high-tension transmission by alternating current, it was believed that the combination method requiring transforming devices and continuous current motors was less well adapted to the conditions than its simpler single-phase competitor for many reasons. The electrical efficiency of the combination system between power house bus-bars and engine shoes is 75 per cent only, as compared with 95 per cent for the single-phase system, the flexibility of the former is impaired by the limited radius of the secondary low-tension distribution, requiring sub-stations at frequent intervals, and still further by the limitations imposed by the use of a third or conductor rail. The position and height of this rail in its proper relation to the track rail must be rigidly maintained, and the practical margin of permissible variation is measured in fractions of an inch. Moreover, its continuity is broken at switches and crossings by frequent transferrence of the conductor rail to the opposite side of the track or to an overhead position. In contrast, the single-phase system requires no sub-stations or secondary circuits; the continuity of the overhead conductor is complete, and its position and height may vary within vertical and horizontal limits of 8 ft. and 4 ft., respectively, without losing contact with the collecting shoes on the pantograph frames.

It is yet too early to furnish definite and positive comparisons of cost of the two methods under consideration, but the calculations and experience of the New Haven Railroad Company's engineers indicate that the total cost of a single-phase installation will be much less than that of the continuous current system, and that the higher electrical efficiency, lower fixed charges, maintenance and operating expenses of the single-phase system all tend to reduce the relative cost of current delivered to the engine shoes in about the same proportion.

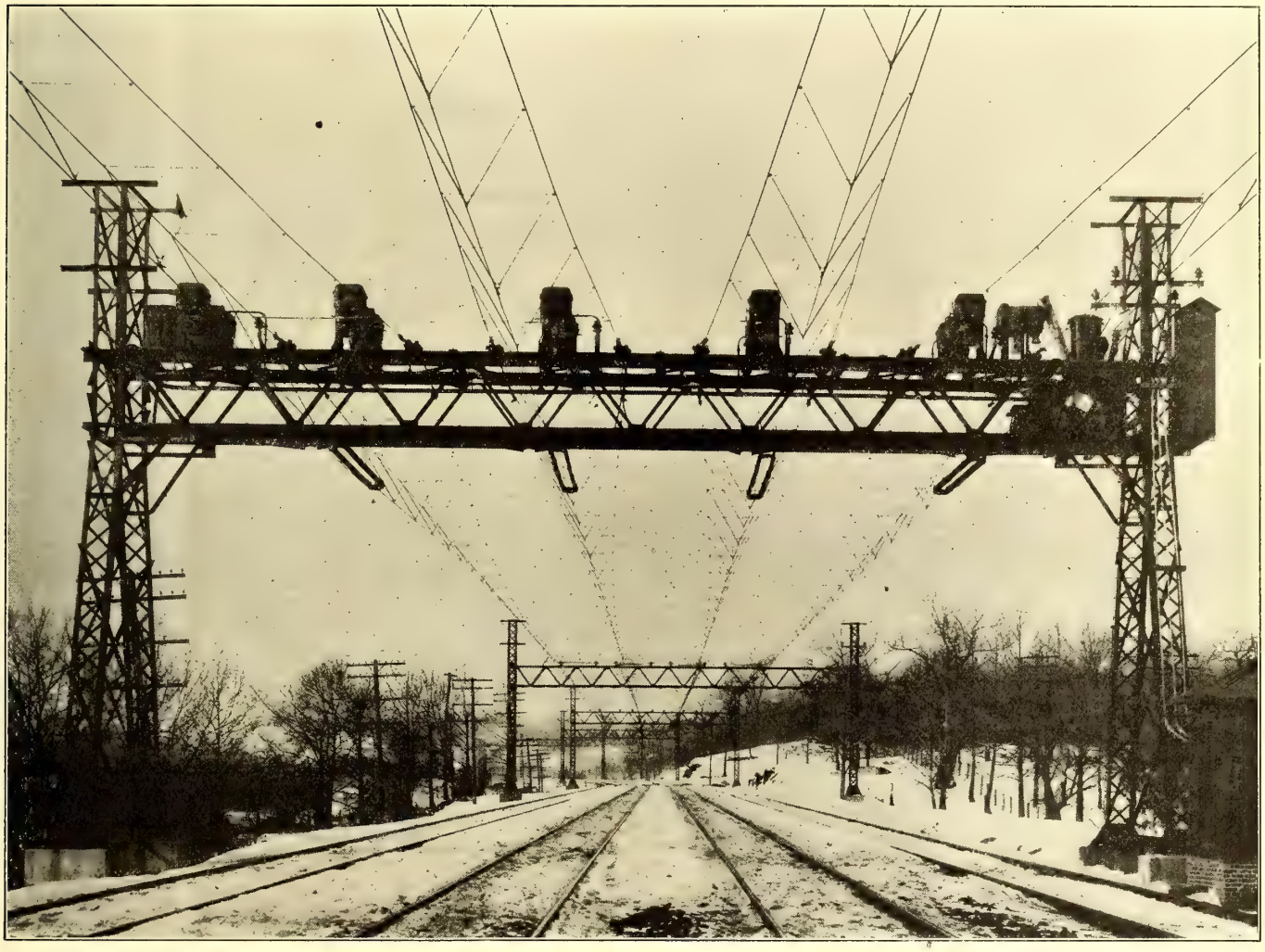


FIG. 1.—ONE OF THE INTERMEDIATE BRIDGES ON THE NEW HAVEN ROAD, SHOWING SEMAPHORE SIGNALS

The determination of the most economical and desirable frequency and voltage of the transmission system involved the consideration of many factors entering into the problem. The choice of frequency was practically fixed by the manufacturing companies within limits of 15 cycles and 25 cycles, and the comparative merits of these two rates only were considered.

The lower frequency afforded a material reduction in weight, size, and cost of motors, a reduction in conductor losses and induction disturbances, together with an increase in the power factor of the motors. Per contra, its adoption would have materially impaired the commercial value of the system, as a whole, in restricting or preventing its ex-

tension for many other uses incidental to railway operation. The standard power and railway frequency in general use is 25 cycles, and as the New Haven Company already owned a number of power houses generating current at this frequency for standard trolley operation, and, in addition, had equipped many of its shops with 25-cycle motors, the adoption of 15 cycles would have required the abandonment of a large amount of standard apparatus, or the interposition of costly and inefficient means of translation. The lighting of stations and other buildings was quite an important factor, as 25 cycles is the lowest frequency at which the carbon filament lamps in general use can be satisfactorily operated. It was also considered desirable to provide for operation in parallel with the 25-cycle generators already adopted by the New York Central Company. The practical effect of a change from 25- to 15-cycle apparatus was thus substantially equivalent to a "break of gage," and under existing conditions it was decided that the practical commercial value of the higher frequency outweighed the more theoretical merits of the lower one.

Various alternatives were considered before fixing the generating and transmission e. m. f. of the system. It was at first proposed to increase the economical radius of transmission to the utmost by generating current at the highest initial voltage for which generators could be safely designed (about 22,000 volts), and to provide sub-stations at suitable intervals, equipped with static transformers for supplying current at 3000 to 6000 volts to secondary contact circuits. As the two motors on each electric locomotive truck are permanently connected in series, current must be supplied at 560 volts through the transformer forming a part of the locomotive's equipment.

It became evident, however, that a great gain in simplicity would result if the intermediate sub-stations and line transformers could be cut out altogether, and further study demonstrated the possibility of effecting this by reducing the initial e. m. f. to 11,000 volts and raising the ratio of the locomotive transformer to correspond. This was carried into effect with a resulting reduction in capital and operating cost, coupled with an increase of electrical efficiency, which proved most gratifying. Incidentally, the difficulties in designing satisfactory collecting devices were greatly diminished.

The difficult and responsible task of determining and analyzing operating conditions and requirements was assigned to Calvert Townley, consulting engineer, and William S. Murray, electrical engineer, of the New Haven Company, to whom, together with their able assistants, credit is due for the design, supervision and successful execution of the many and difficult details of this novel installation.

THE COMMERCIAL ASPECT

A few comments upon the commercial aspects of electric traction may not prove uninteresting, as the natural prejudice of the stockholder in favor of the continued maintenance of dividends must be respected, and the technical expert too frequently neglects this aspect in his scientific ardor for the building of monuments of engineering skill and achievement.

Numerous analyses and comparisons of the comparative costs of electric and steam operation have been published from time to time, which tend to prove that a considerable saving in fuel, engine repairs and other operating expenses may be expected. Under favorable conditions this saving may be large enough to pay interest and other fixed charges upon the additional construction investment and still leave a satisfactory margin to apply on dividends. Under general conditions, however, it is altogether improbable that the saving resulting from the simple substitution of electric for steam power will be sufficient to justify the additional investment and financial risk.

In changing the method of motive power on existing railways, the conditions are by no means so simple as in the construction of new lines, as in the former case a great amount of capital already invested must be sacrificed, and the problems of adaptation to existing conditions are peculiarly severe. In particular, the transition stage in bridging over the gap between steam and electric operation is both expensive and difficult, as the change affects train lighting and heating, telegraph and telephone service, signaling, and track maintenance, for which both temporary and permanent provision must be made. The simultaneous maintenance of facilities and working forces for both steam and electric service within the same limits will be rarely profitable, for the reason that a large proportion of expense incident to both kinds of service is retained, without realizing the full economy of either.

To secure the fullest economy it is necessary at least to extend the new service over the whole length of the existing engine stage or district, and to include both passenger and freight trains, and in this connection it is interesting to note that in the case of the New Haven Company the passenger train mileage forms so large a proportion of the whole that no additional generating and transmission capacity will be needed when electric traction is extended to freight service.

The application of electric traction to heavy railway service will probably be governed by other and more important considerations than its mere relative cost as a motive power under similar conditions, as illustrated in the development of the ordinary trolley service. In this development the commercial value of higher speeds and of increased car capacity is so large that the relative cost of electric versus animal tractive power becomes almost negligible by comparison. Analogous results may be hoped for in the corresponding development of electric traction in heavy railway service, as the new conditions will afford opportunities for at least two radical modifications of existing conditions, quite apart from minor economies.

In steam service the weight and speed of trains are limited by the horse-power capacity of the locomotive, which generates its own power, and there are but few locomotives which can generate sufficient steam to utilize their full cylinder tractive power at speeds in excess of 12 miles an hour. Consequently, any increase of speed beyond certain limits can only be attained by sacrificing train tonnage in a corresponding degree. The division of the train-mile cost by the lesser number of tons increases the ton-mile proportionately.

The high cost of fast freight service is principally due to this effect of a diminishing divisor, while it would seem that electric traction should permit high speeds without sacrificing commercial tonnage, as, with a relatively unlimited source of power at command, the maximum draw bar pull permitted by the motor design may be maintained at all speeds.

The commercial value of high speed in freight and passenger service is so great that the prospect of escaping the present penalties accompanying reduced train capacity becomes doubly interesting.

Hardly less important is the opportunity afforded at the opposite end of the scale, for the economical operation of trains of minimum capacity. The train capacity cannot be

reduced without loss below the point where the earnings equal the train-mile cost, and if this cost cannot be reduced proportionately with reduced capacity, the inferior limit of capacity may be uneconomically large. In steam service the irreducible elements entering into the train-mile cost are so large that it is rarely profitable to operate trains earning less than 40 to 50 cents per mile. In contrast, electric service permits an extreme reduction of the train length to single car units, costing to operate but 10 to 15 cents per car-mile. Hence, the frequency of service may be increased and the rates reduced, which in turn will react upon the volume of traffic, with the final result of increasing both gross and net earnings.

It may, therefore, be claimed for electric traction that it will extend the limits of profitable operation of high-speed heavy trains, and also of light trains of low capacity.

Other but relatively minor advantages are possible in the effect upon earnings, due to the elimination of smoke, gases, dust, cinders and heat, the better ventilation of cars, the extension of electric train lighting and heating, and of the effect upon expenses due to the concentration of power production in large and economical power houses, a reduction of engine repairs, an increase of effective engine and train mileage, a more or less complete elimination of engine houses, turn-tables, fuel stations, water tanks, cinder pits, and other operating facilities, the consolidation of power requirements for traction, pumping, operating shops, elevators, and general uses, and the use of current for lighting switch lamps, stations and other buildings.

Finally, the availability and value of real estate and structures at large terminals will be greatly augmented by the possibility of using two or more superimposed track levels, as strikingly exemplified in the plans for new terminals in New York City for the New York Central and the Pennsylvania companies.

A general change from steam to electricity will render unproductive a very large amount of invested capital, and create the necessity for the expenditure of additional amounts still greater, but there is no reason to doubt that the transition already in progress will be rapidly extended and applied to all points where congested terminals, high frequency of train service and low cost of power create favorable conditions.

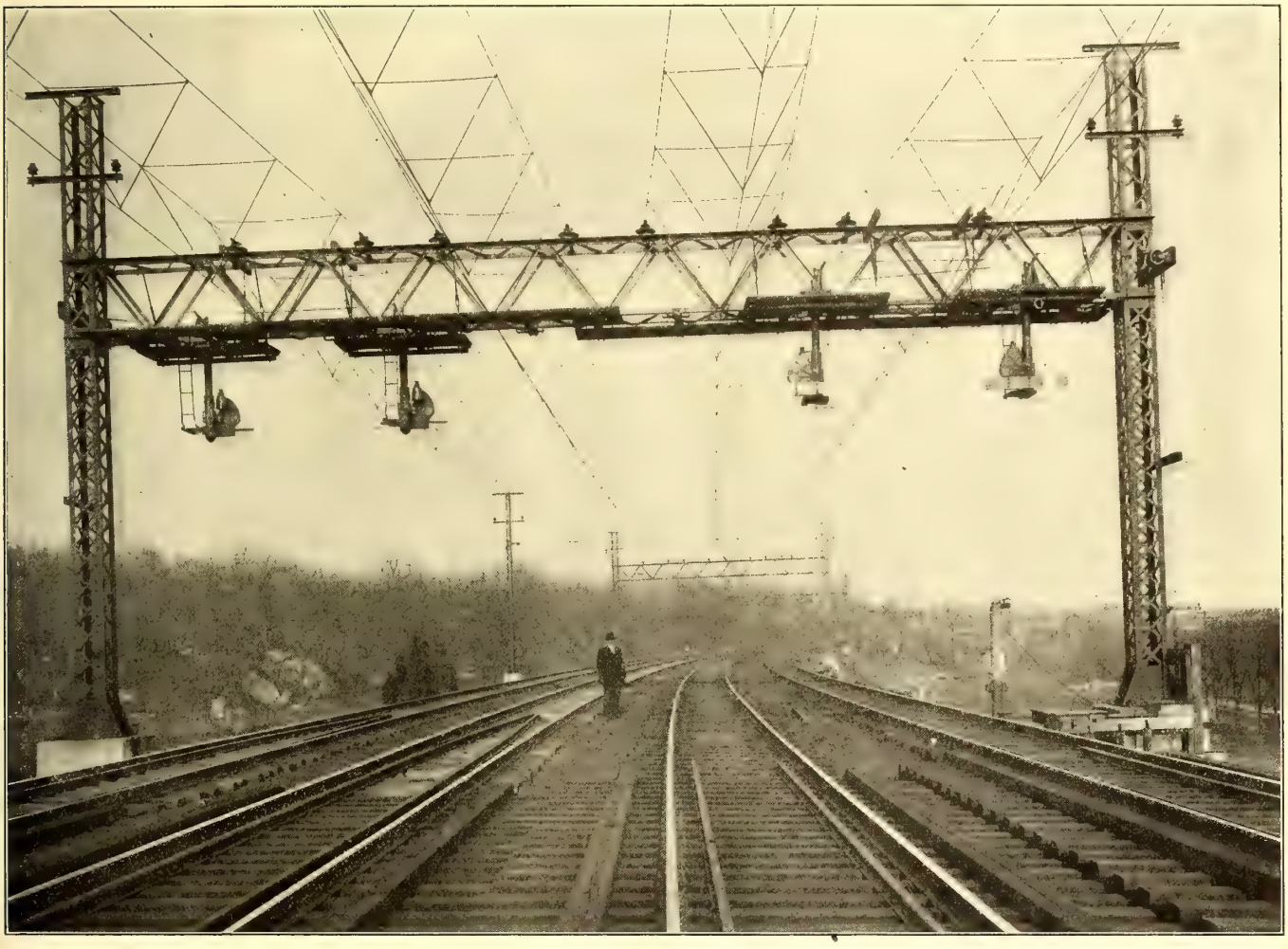


FIG. 2.—ANCHOR BRIDGE NEAR PELHAM STATION, NEW HAVEN RAILROAD

THE OVERHEAD CONSTRUCTION OF THE NEW HAVEN RAILROAD

The previous article by Mr. McHenry gives the reasons which lead the New Haven Railroad to adopt the single-phase system on its line from Woodlawn to Stamford. It is now proposed to publish a series of articles on the equipment as installed. The first of these articles will treat of the overhead construction.

The electric trains of the New York, New Haven & Hartford Railroad leave the direct-current zone of the New York Central at Woodlawn, N. Y., which is 12.03 miles from the Grand Central Station, and pass onto the alternating-current line of the New York, New Haven & Hartford Railroad, which at present extends as far as Stamford, Conn.

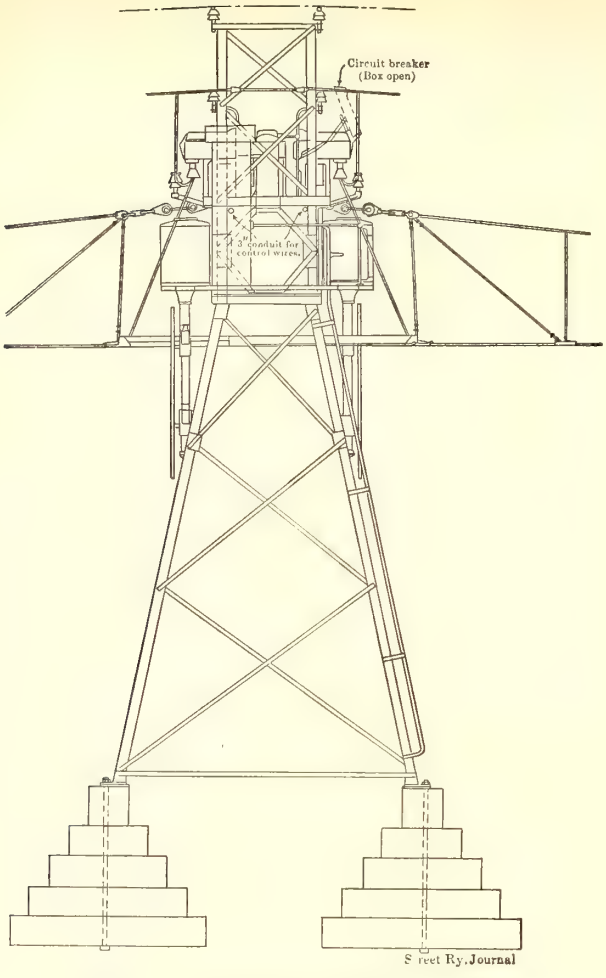


FIG. 3.—END VIEW OF ANCHOR BRIDGE

Stamford is 33.48 miles from the Grand Central Station, and hence 21.45 miles beyond Woodlawn. Upon this section, between Stamford and Woodlawn, as has been stated, 11,000 volts are employed. The catenary construction, as well as the supporting bridges, have been illustrated and briefly described in the STREET RAILWAY JOURNAL on page 558 of April 7, 1906, and 595 of April 14, 1906, when front elevations of the overhead bridges were shown, and on page 546 of March 30, 1907, when an account was given of the method of erecting the bridges. The information given then will not be repeated, but details will be published which were not available at that time.

OUTLINE OF OVERHEAD SYSTEM

The supporting bridges are of varying lengths, so as to accommodate four, five, six, or as many as twelve tracks, as the local conditions require, and are of two types, anchor bridges which are used only at intervals of about 2 miles, and intermediate bridges. The latter have side posts of square cross-section, and are of comparatively light construction. On the other hand, the anchor bridges have A-shaped posts and are made heavier to withstand the strain of the cables.

The anchor bridges are provided with automatic circuit breakers, by means of which the different sections may be isolated, and, also, the several parallel tracks may be electrically separated from one another in case of accident to any one track. The anchor bridges also carry lightning arresters, shunt transformers for operating the circuit breakers, together with foot walks, hand railings, lamp circuits and the wires and conduit for the auxiliary control circuits.

The working conductors have sufficient capacity for the current, but two auxiliary feeders are carried the entire length of the line from Stamford to Woodlawn. These feeders are connected with the main conductors at each anchor bridge through circuit breakers and provide means for feeding around any one section in case it is cut out of service on account of some accident in that particular section.

Provision is also made on all of the bridges for carrying two separate feeder wires called "power feeders," which are connected to the third phase of the generating system and are used for operating three-phase apparatus at certain intervals along the road. Provision is also made on the bridges for carrying two three-phase circuits, one circuit being supported on the top of each post at the ends of the bridges.

In laying out the bridges for the section from Woodlawn to Stamford, it was found that the sharpest curvature was 3 degs. As this curvature will permit of stringing the trolley wire in straight lines between points of support 150 ft. apart without deviating from the center of the track more

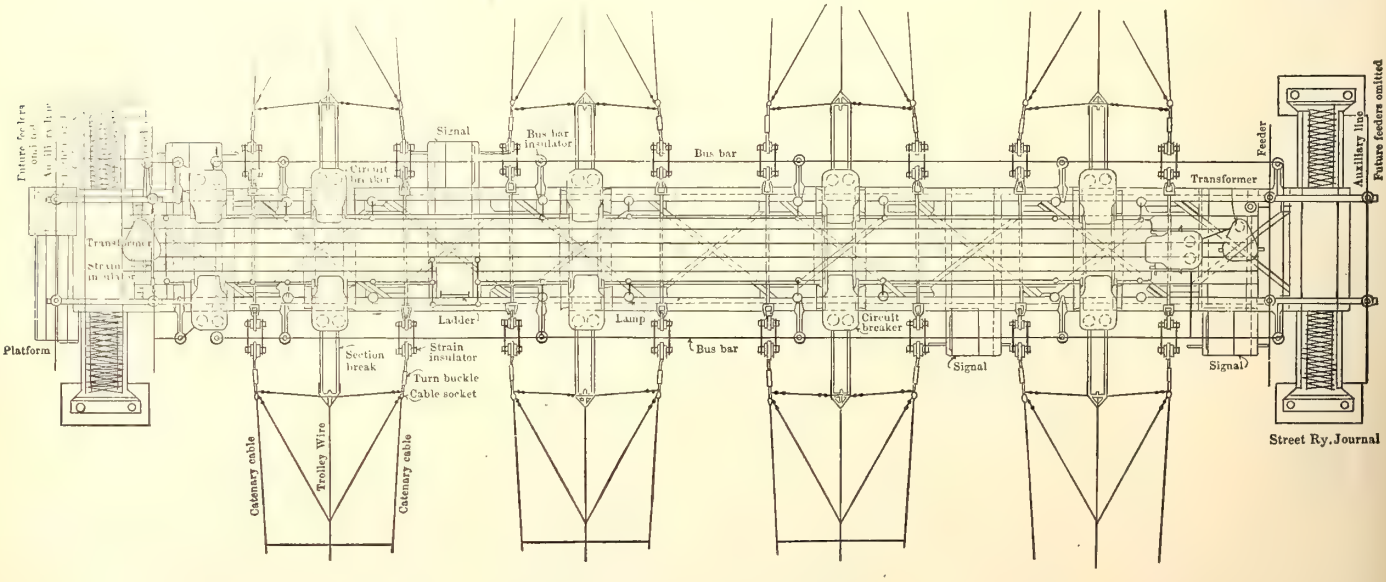
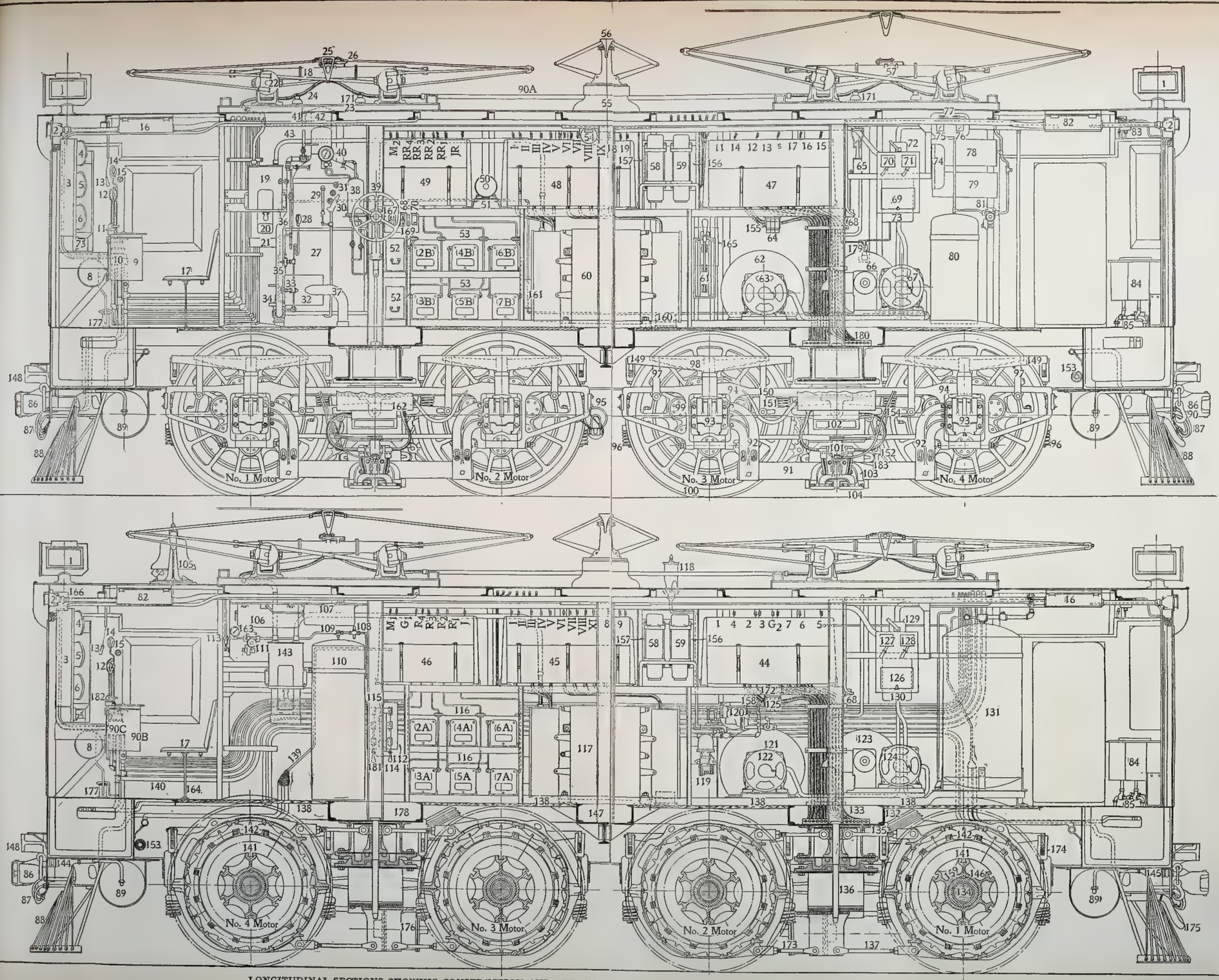


FIG. 4.—PLAN OF ANCHOR BRIDGE



LONGITUDINAL SECTIONS SHOWING CONSTRUCTION AND ARRANGEMENT OF EQUIPMENT OF NEW HAVEN ELECTRIC LOCOMOTIVE

KEY TO LIST OF PARTS

1. Headlight.
2. Train Line Receptacles, Type 444 D-E and F.
3. Instrument Board.
4. Speed Indicator Meter.
5. D. C. Ammeter Motors.
6. A. C. Ammeter Motors.
7. Temperature Indicator Meter.
8. Equalizing Reservoir Air Brake.
9. No. 1 Master Controller.
10. No. 1 Automatic Motorman's Brake Valve.
11. No. 1 Independent Brake Valve.
12. Duplex Gage Main Res. and Train Line.
13. Whistle Handle.
14. Straight Air-Brake Gage.
15. Three-Way Snap Switch in Light Circuit.
16. No. 1 Junction Box, Type 427.
17. Motorman's Seat.
18. No. 1 A. C. Pantograph Trolley.
19. No. 2 Oil Circuit-Breaker.
20. Overload Trip.
21. Oil Tank on Circuit-Breaker.
22. Insulators for Pantograph Trolley.
23. Support for A. C. Trolley.
24. High-Tension Cable from A. C. Trolleys.
25. A. C. Trolley Shoe.
26. A. C. Trolley Lock Cylinder.
27. Steam-Heating Boiler.
28. Gage—Air Pressure on Burner.
29. Water Gage.
30. Drain Cup.
31. Try Cocks.
32. Fire Door.
33. Burner.
34. Gold Car Co. Regulating Valve.
35. Strason Regulating Valve.
36. Steam Line from Boiler.
37. Air Inlet to Fire-Box.
38. Water Feed Regulator.
39. Hand Brake Wheel.
40. Steam Gage.
41. Safety Valve.
42. Stack for Boiler.
43. H. T. Conduit from Oil Switch to Transformer.
44. Switch Group No. 1, Type 259.
45. Switch Group No. 2, Type 251E.
46. Switch Group No. 3, Type 257A.
47. Switch Group No. 4, Type 259.
48. Switch Group No. 5, Type 251E.
49. Switch Group No. 6, Type 257B.
50. Motor Generator Set for Battery Charging.
51. Base for Motor Generator Set.
52. Storage Battery.
53. No. 2 Set of Resistance Grids.
54. A. C. Integrating Wattmeter.
55. Base for D. C. Trolley.
56. D. C. Trolley.
57. No. a A. C. Pantograph Trolley.
58. Preventive Coil, 100 Volts, 250 Amps.
59. Preventive Coil, 50 Volts, 500 Amps.
60. No. 2 Transformer.
61. Main D. C. Switch.
62. No. 2 Blower Motor Fan Casing.
63. No. 2 Blower Motor.
64. Permanent D. C. Field Shunting Grid No. 2.
65. Hand Air Pump for Unlocking A. C. Trolley.
66. No. 2 Air Compressor.
67. No. 2 Air Compressor Motor.
68. Magnet Valves, Type 386-D.
69. No. 2 Fuse Box.
70. Canopy Switch for No. 2 Blower Motor.
71. Canopy Switch for No. 2 Compressor Motor.
72. No. 2 Motor Control Cut-out.
73. No. 2 A. C. D. C. Change-Over Switch.
74. Relay Box.
75. Snap Switch for Cab Lights.
76. Snap Switch for Headlights.
77. S. P., D. T. Switch Light Circuit.
78. Control Reservoir.
79. Cover for Resistance Grid.
80. Oil Tank.
81. Slide Valve Reducing Valve.
82. No. 2 Junction Box, Type 427.
83. Signal Valve.
84. Sand Box.
85. Electro-Pneumatic Sander.
86. Coupler.
87. Hose Couplings.
88. Pilot.
89. Main Air Reservoir.
90. Hook for Safety Chains.
90-A. Cable Connecting A. C. Trolleys.
90-B. No. 2 Master Controller.
90-C. No. 2 Automatic Brake Valve.
91. Third-Rail Shoe Beams.
92. Third-Rail Shoe Bracket.
93. Journal Box.
94. Truck Frames.
95. Magneto for Speed Indicator.
96. Motor Suspension Springs.
97. Spring Hanger.
98. Elliptical Springs.
99. Wheel Pocket Cover.
100. Main Driving Wheel.
101. Third-Rail Shoe Cylinder.
102. Third-Rail Shoe Fuse Box.
103. Main Casting for Third-Rail Shoe.
104. Third-Rail Shoe.
105. Bell
106. A. C., D. C. Change-Over Switch Heater Circuit.
107. Fuse Box, Heater Circuit.
108. Governor Valve for Emergency Control Reservoir.
109. Three-Way Cock Emergency Control Reservoir.
110. Emergency Control Reservoir.
111. Slide Valve, Reducing Valve.
112. Balancing Transformer (Back of S. T. and D. T. Switches).
113. Combined Strainer and Drain Cup.
114. D. T. Switch No. 1 Heater Circuit.
115. S. T. Switch Heater Circuit.
116. No. 1 Set Resistance Grids.
117. No. 1 Transformer.
118. Whistle.
119. Governor—Air Brake.
120. Distributing Valve.
121. No. 1 Blower Motor Fan Casing.
122. No. 1 Blower Motor.
123. No. 1 Air Compressor.
124. No. 1 Air Compressor Motor.
125. Permanent D. C. Field Shunting Grid No. 1.
126. No. 1 Fuse Box.
127. Canopy Switch for No. 1 Blower Motor.
128 Canopy Switch for No. 1 Compressor Motor.
129. No. 1 Motor-Control Cut-out.
130. No. 1 A. C., D. C. Change-Over Switch.
131. Water Tank.
132. Air Connection to Motors.
133. Motor Leads for No. 1 and No. 2 Motors.
134. Axle of Main Driving Wheels.
135. Upper Torque Rod.
136. Center Pin.
137. Lower Torque Rod (long).
138. Trap Doors Over Motors.
139. Heater Circuit Leads.
140. Air-Brake Piping.
141. Motor Armature.
142. Motor Field Frame.
143. No. 1 Oil Circuit-Breaker.
144. Bus Line Socket Heater Circuit, No. 2 End.
145. Bus Line Socket Heater Circuit, No. 1 End.
146. Quill.
147. Tool Box.
148. Bumper Block.
149. Motor Suspension Cradle.
150. Spring Hanger.
151. Equalizer Spring.
152. Brake-Shoe.
153. Steam-Heating Line.
154. Equalizer Bar.
155. Series Transformer for A. C. Ammeter No. 3 and No. 4 Motors.
156. Preventive Coil, 100 Volts, 250 Amps. (back of No. 58).
157. Field Shunting Resistance (back of No. 58).
158. Series Transformer for A. C. Ammeter, No. 1 and No. 2 Motors.
159. Armature Spider.
160. Air Inlet to Transformer.
161. Air Inlet to Resistance Grids.
162. Third-Rail Shoe Leads.
163. Gage—Control Line Pressure.
164. Support for Motorman's Seat.
165. D. C. Wattmeter.
166. Blind Lights.
167. D. P., D. T. Switch for Battery.
168. D. P., D. T. Switch for Battery
169. S. P., S. T. Switch for Motor-Generator Set.
170. Snap Switch for Motor Generator Set.
171. Insulators Supporting A. C. Trolley Cable.
172. Shunt for D. C. Ammeter Motors, No. 1 and No. 2.
173. Lower Torque Rod (short).
174. Motor Suspension Hanger.
175. Steam-Hose Coupling.
176. Brake Cylinder.
177. Foot Push-Button Switches.
178. Air Conduit.
179. Shunt for D. C. Ammeter Motors, No. 3 and No. 4.
180. Motor Leads for No. 3 and No. 4 Motors.
181. D. T. Switch, No. 2 Heater Circuit.
182. Independent Brake Valve No. 2.
183. Third-Rail Shoe Unlock Cylinder.

than 8½ ins. on each side, it was decided to place all bridges a fixed distance of 300 ft. apart, and on curves to provide guy poles to which pull-over wires are attached and secured to the catenary spans (see Fig. 1). By this means a minimum amount of overhead wiring was obtained, and the deviation from the center of the track was maintained within safe limits for use in connection with the sliding pantograph trolleys on the locomotives, the bow of which is 4 ft. long.

INTERMEDIATE BRIDGES

The general appearance of the standard four-track intermediate bridge is shown in Fig. 1. This illustration shows also signals mounted on the bridge, the semaphore blades being located below the truss so as to afford an unobstructed view. As will be noted, the bridge consists of two supporting side posts and a horizontal truss. Each supporting post is approximately 38 ft. long by 1 ft. 10 ins. square. Each is composed of four 4 in. x 4 in. x 7/16 in. angles secured together by 2¼-in. x ⅜-in. lacing bars.

Each post rests upon a concrete foundation, each containing about 9 cubic yards of concrete. Anchor bolts extend entirely through the concrete foundation and hold the base of the post to the foundation by means of heavy nuts. The cross-truss is attached by means of bolts to the vertical posts, allowing a distance of 23 ft. 4 ins. from the lower side of the truss to the top of the rails. The truss is 4 ft. 6 ins. deep from back to back of the upper and lower chord angles, which latter are placed 1 ft. 10 ins. from back to back. The lacing bars of the upper chord are depressed below the upper surface of the chord angles so that the latter are left free from rivets or other obstructions, thereby affording a ready means for attaching the insulators at any point. The lacing bars of the upper chord consist of flat strap, while the diagonals in the sides and bottom of the truss consist of angles. The upper chord angles are 3½ ins. x 6 ins. x ⅜ in., and the lower are 4 ins. x 3½ ins. x 5/16 in.

The extensions of the side posts above the trusses are utilized for supporting the feeder wires which are carried upon angle-iron cross-arms bolted to the posts. The lower cross-arm carries two insulators, upon the inner one of which is carried the auxiliary feeder. The upper cross-arm is located 5 ft. above the lower one and carries two wires of the three-phase circuit. The third wire of the three-phase circuit is carried upon a vertical angle-iron support.

In the calculation of these bridges very heavy weather conditions were assumed and provision was made for clamping the catenary cables on the intermediate bridges so that they are obliged to partially withstand the longitudinal pull of the latter. It was assumed that the entire system of the bridges and cables might become coated with sleet, and that this coating might be ½ in. in thickness around all surfaces. It was assumed also that the wind pressure on the bridges and the catenary spans might at the same time be as high as 25 lbs. per sq. ft. It was further assumed that the effective area of all round cables would be two-thirds of their projected areas.



FIG. 6.—MAIN LINE INSULATOR WITH SUPPORTING YOKE

Each catenary cable is clamped to its supporting insulator on every intermediate bridge, and it was assumed that if one pair of cables should be broken, the remaining cables would exert a balancing influence on the bridge. The truss, however, was made strong enough to prevent its buckling under the strain produced by the breakage of any pair of cables.



FIG. 5.—VIEW OF PLATFORM ON ANCHOR BRIDGE, SHOWING CIRCUIT BREAKERS ON EITHER SIDE

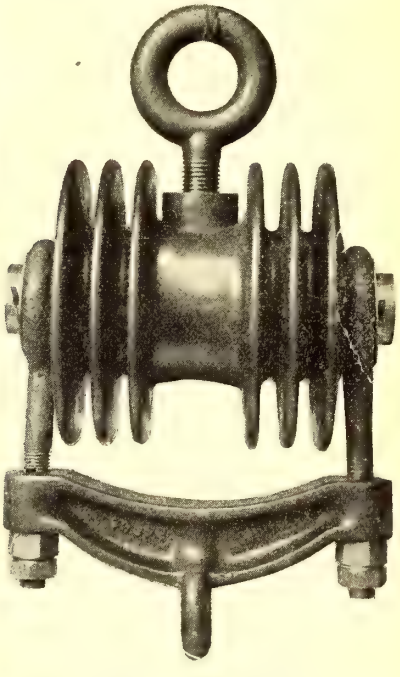


FIG. 7.—STRAIN INSULATOR FOR DEADENING CABLES

ANCHOR BRIDGES

Anchor bridges of especial heavy construction are placed every 2 miles, and against these bridges the catenary cables are anchored. Fig. 2 gives a view of a standard four-track anchor bridge with the auxiliary apparatus mounted upon it. The four-track anchor bridge consists of two A-shaped

posts, each having a spread at the base of 15 ft., and a width at right angles to the track of about 2 ft. The main members of these posts consist of 6-in. x 4-in. x 5/8-in. angles. These posts are also extended above the truss in the manner shown in the illustration for the purpose of carrying the feeder wires. The truss is bolted to the side posts, allowing

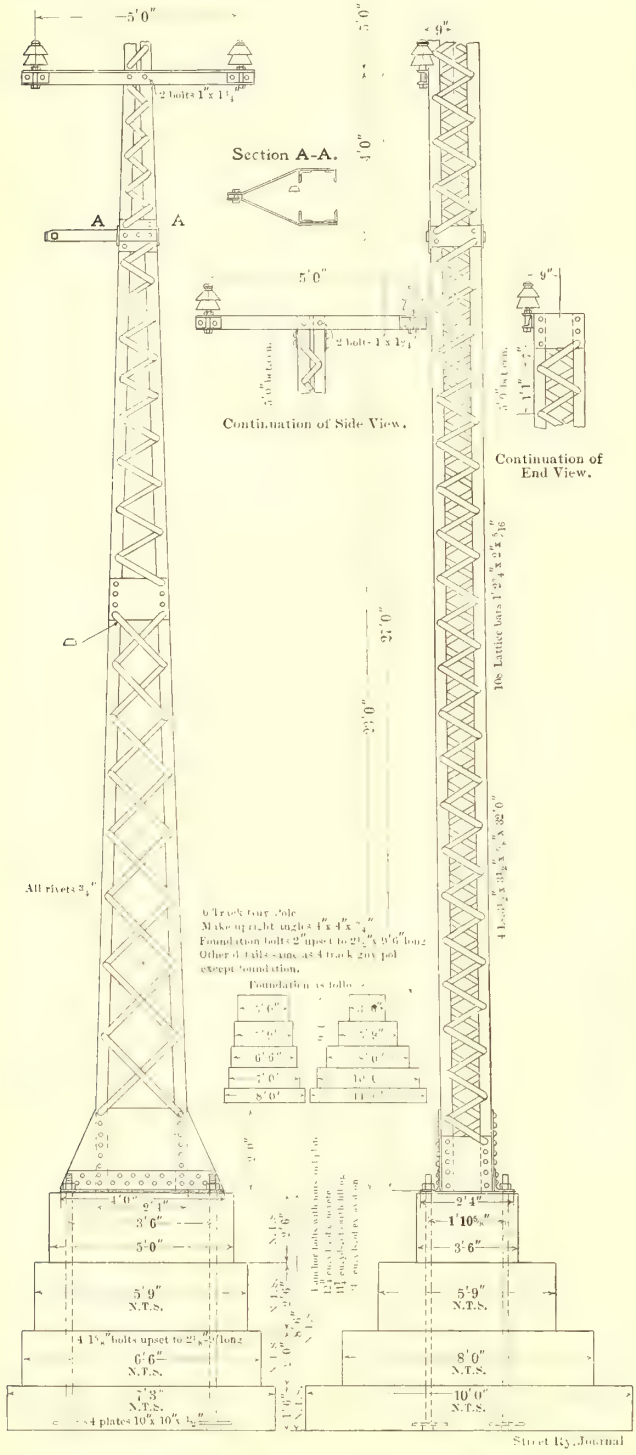


FIG. 8.—DETAILS OF RIGID GUY POLE

a clearance above the rails to the lower side of the truss of 24 ft. 3 ins. The truss is 4 ft. 6 ins. deep by 5 ft. wide between the backs of the chord angles. The upper chords consist of 8 in. x 8 in. x 9/16 in. angles, and the lower chords consist of 4 in. x 3½ in. x 9/16 in. angles.

Fig. 3 represents the side view of the anchor bridge, and Fig. 4 a plan view of the same bridge from which additional details of the construction may be noted. A ladder is provided on one of the posts leading to a small platform at the end of the truss. This platform is provided with a hand rail and carries upon it a box containing an 11,000-volt, low-equivalent lightning arrester. A portal is furnished in the end of the truss, by means of which the attendant may step onto the platform supported upon the lower chord of the truss. From this platform access is provided to the short ladders leading to the signal lanterns, and a second short ladder extending up to another 2-A platform supported upon the upper chord of the truss. This platform, a view along which is given in Fig. 5, is surrounded by a

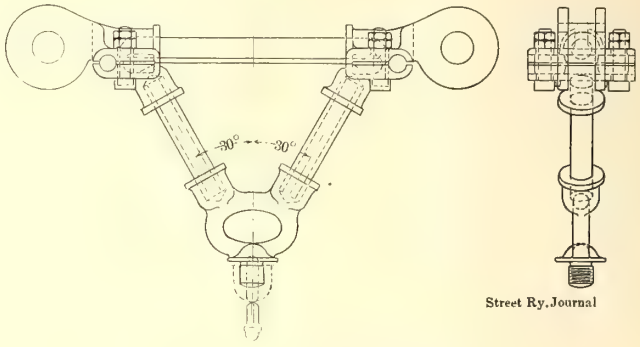


FIG. 10.—PULL-OFF HANGER

hand rail, which is also attached to the iron-supporting frames of the circuit breakers in such a manner that the attendant can in no way come in contact with live parts of



FIG. 11.—INSULATING SEPARATOR

the circuits. At each end of the truss a 5-kw 11,000-volt shunt transformer is provided, one of them being connected directly into a bus-bar which runs around the outside of



FIG. 12.—TROLLEY HANGER

the circuit breakers and which is supported upon porcelain insulators and bus-bar brackets, secured to the upper chords of the truss. The other transformer is connected directly into one of the "power" feeders. As the "power" feeder is connected to the third phase of the generating system, means are available for operating the switches in case of accident to the trolley section. The four-track anchor bridge is secured to concrete foundation by means of long anchor bolts and nuts. Each post rests upon blocks of concrete, each block containing about twelve cubic yards of concrete.

CATENARY CABLES

Each of the two catenary cables which support the copper trolley conductor consists of an extra high-strength steel cable, 9/16 in. in diameter, consisting of seven strands. This steel has an ultimate strength of about 200,000 lbs. per square inch, and each strand is heavily galvanized. The completed cable has a total strength of 33,800 lbs. These cables are strung between the bridges with a sag at mean temperature of 6 ft. in a standard span of 300 ft. Owing to obstructions at certain places along the right of way, the spacing of the bridges is occasionally varied from the standard distance of 300 ft. In order to allow for this the cable is run out in long lengths and is pulled up to a uniform tension until the sag in the span of 300 ft. is 6 ft. The sag in the other spans is allowed to adjust itself, since the tension is the same. After being pulled up to the proper tension the catenary cables are anchored to the anchor bridges and are clamped to the insulators of the intermediate bridges.

MAIN-LINE INSULATORS

The insulators which support the catenary cables of the intermediate bridges consist of heavy porcelain insulators of the skirt type, which are 15 ins. in diameter and about 7 ins. high. These insulators are cemented upon short lengths of double, extra strong pipe, which in turn is held by means of U-bolts to a cast-iron yoke, bolted to the upper chords of the truss. The catenary cable rests in a groove in the top of the porcelain and is held by means of a malleable-iron clamp fitted with U-bolts and placed one on each side of the insulator. The head of the insulator is conical in shape and is surrounded by means of a split malleable-iron clamp and a lead packing. Fig. 6 represents the main line insulator complete with its supporting yoke.

One feature of the construction to be noted is the arrangement of the clamp and the collar, which is such that in case of the breakage of the messenger cable on one side of the insulator, the pull of the cable on the other side will cause the clamp to swing downwards, thereby lowering the point of application of the pull of the cable. Thus the porcelain is put in compression, and there is no tendency to shear off the top of the porcelain, as is usually the case with porcelain line insulators. Each porcelain is subjected in the shop to a test of 55,000 volts when assembled.

ANCHOR BRIDGE STRAIN INSULATORS

Fig. 7 represents the general appearance of the strain insulators which are used for dead-ending the catenary cables at the anchor bridges. These insulators, which are of special construction, are designed to withstand a shop test of 50,000 volts and a working load of 20,000 lbs. Each consists of a length of 2 in. extra heavy iron pipe, surrounded at its middle point by an iron collar. Outside of this collar a long insulating tube, composed of especially hard and reliable insulating material, is pressed. This tube is surrounded by a second collar into which a bolt is screwed and to which turnbuckle of the catenary cable is attached. The entire surface of the insulating tube and the inner and outside collars are then effectively sealed against moisture by means of a high-grade insulating compound applied by means of hydraulic pressure. The insulator thus made up is supported by means of an iron yoke from cast-iron hooks bolted to the upper chords of the anchor-bridge truss.

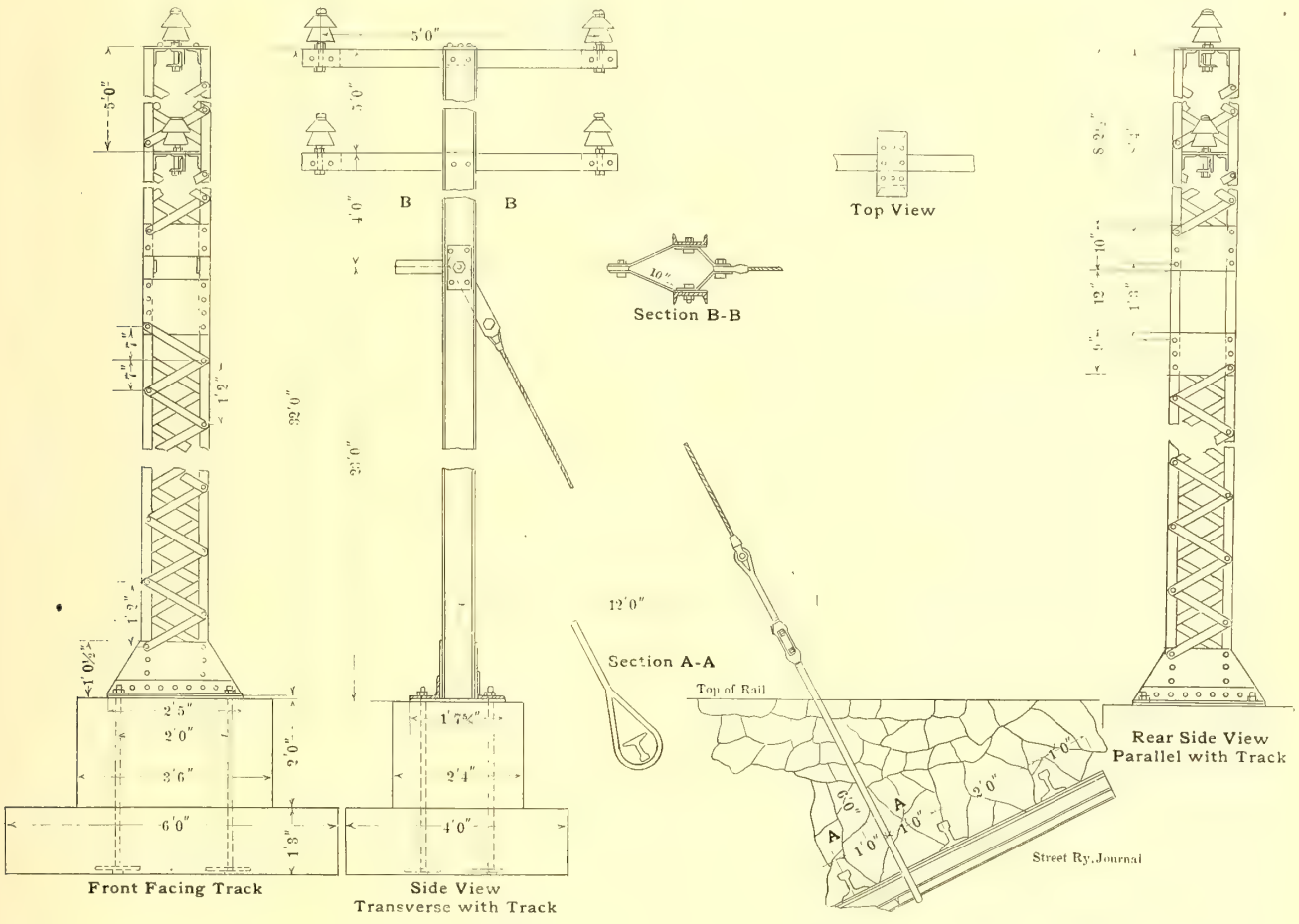


FIG. 9.—DETAILS OF ANCHORED GUY POLE

One of these insulators is provided in each catenary cable at each anchor bridge, thereby electrically dividing the road up into separate sections between the anchor bridge.

GUY POLES

Midway between the supporting bridges and curves a guy pole is located on the outside of the curve. These guy poles are of two types, namely, rigid and anchored, the former being used wherever there is room on the right of way for the anchorage, while the latter is used in places where the width of the right of way is restricted. Fig. 8 represents the rigid pole, and Fig. 9 indicates the type of anchored guy pole. A pole of the latter type is seen in place in Fig. 1.

Heavy strain insulators are attached to the guy poles at the proper height, and pull-over wires are attached to this strain insulator and to the catenary cable and trolley wires of the several tracks.

GUY-POLE STRAIN INSULATOR

This insulator is somewhat similar in appearance to the well known "giant strain," except that it is designed to withstand a test of 50,000 volts, and a mechanical pull of 15,000 lbs. It is made up of steel castings and solid mica insulating cones and is sealed with a high-grade insulating compound. These strain insulators are attached by means of one loop in the guy poles, and the pull-over wires are attached to the other loop.

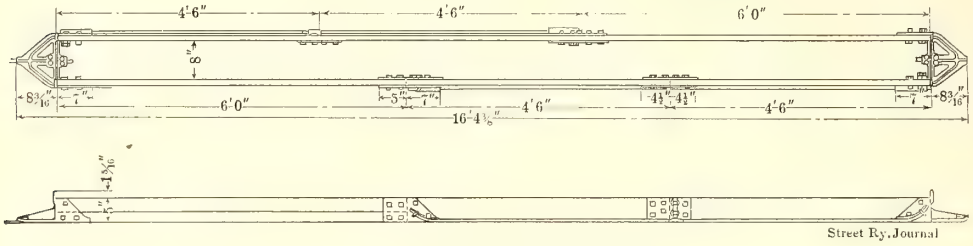
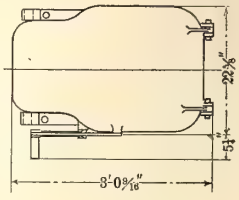
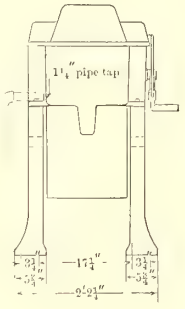


FIG. 13.—SECTION INSULATOR





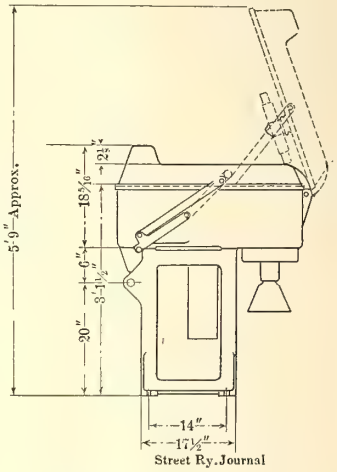


FIG. 14.—OIL CIRCUIT BREAKER FOR BRIDGES

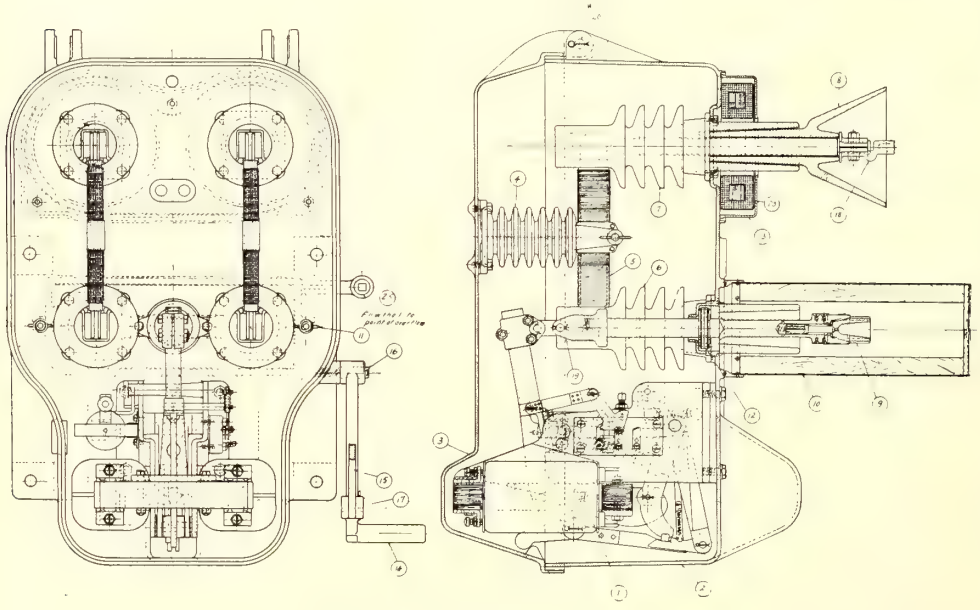


FIG. 15.—DETAILS OF OIL CIRCUIT BREAKER

PULL-OVER HANGER

At the points where the pull-over wires are attached to the catenary span (Fig. 1), a triangular hanger of heavy construction is provided. The character of this hanger, which is indicated by Fig. 10, consists of malleable-iron clamps, which are attached to the two catenary cables, and into which short lengths of heavy pipe are threaded. At the lower end of the triangle is provided a malleable-iron casting, which is threaded into a heavy bronze clamping ear which is attached to the trolley wire. Loops are provided as shown for attaching the pull-over wires in such a manner as to hold the trolley wire directly under the catenary cables.

INSULATING SEPARATORS

In order to enable any one track to be electrically disconnected from any other parallel track when the circuit breakers on the anchor bridges are open, insulating separators are provided in the pull-over wires between the tracks (see Fig. 1.) The appearance of these is shown by Fig. 11. They consist of 5-ft. rods of selected hickory, thoroughly impregnated and fitted at the ends with malleable-iron heads secured to the conical-shaped heads of the rods by means of bolts. Each insulator has an ultimate strength of about 16,000 pounds. At no point in the entire construction is wood relied upon for insulation to ground, and it will be noted that these wooden separators normally have no difference of potential upon them. They are merely provided in case of accident, when it is necessary to isolate one section of track from another. They are, however, subjected to a test of 30,000 volts.

TROLLEY HANGERS

The trolley wire is supported from the catenary cables at

10-ft. intervals by means of triangular trolley hangers of varying lengths. These hangers are so adjusted in length that the trolley wire is maintained in a horizontal position (Figs. 1 and 2), it being 6 ins. below the catenary cables at the middle point of the span. The appearance of a hanger is shown in Fig. 12. It consists of a pair of small drop-forged steel jaws, which engage with the grooves of the trolley wire and are clamped by means of a malleable iron Y, which is screwed down upon the threaded portions of the jaws. The sides of the triangle are then screwed into the Y and are bolted to the messenger cable above. As all of the threads are right handed, it is impossible for the hanger to come loose.

TROLLEY SECTION BREAK INSULATORS

At each anchor bridge it is necessary to provide an insulator in each trolley wire, and this is accomplished by means of the piece of apparatus shown in Fig. 13. Each consists of two bronze end castings, to which the ends of the trolley wire are bolted. Two parallel sections of impregnated hardwood are fastened to these castings, and to these wooden strips are fastened renewable pieces of trolley wire in such a manner that the ends of these renewable pieces overlap one another in distance along the track, although the two wires are electrically distinct. By this means it is possible for the sliding contact on the locomotive to pass from one section to the next without opening the circuit, thus avoiding all flashing. It will be noted, however, that an effective insulation is provided so that when the circuit breaker on the anchor bridge is open, the two sections will be disconnected. The manner in which this section insulator is installed is clearly shown in the end view of the anchor bridge, Fig. 3. Insulators in place under an anchor bridge are shown in Fig. 2.

LOW-BRIDGE CONSTRUCTION

This construction consists of a corrugated porcelain spool, mounted on a length of gas pipe, which in turn is supported at each end from a skirt type porcelain insulator of the same design as that used on the intermediate bridges. An insulating support of this character is mounted on each side of the overhead bridge and is located so that it will receive the washing effect of rainwater and be kept clear of soot accumulation.

The messenger cables, where they pass under the bridges, are heavily insulated and are secured to the porcelain spools just described. The trolley wire is suspended from the messenger cables by means of hangers, constructed of impregnated hardwood, so that the trolley wire is isolated from the catenary cables.

A waterproof shield above the cables prevents the accumulation of dirt and water upon them.

TROLLEY WIRE

The trolley wire consists of standard No. 0000 B. & S. gage grooved copper.

AUTOMATIC CIRCUIT BREAKERS

Fig. 14 represents in outline the type of circuit breaker which has been developed for this installation, while Fig. 15 gives the details of the device, and Figs. 2 and 5 show the breakers in place on anchor bridges.

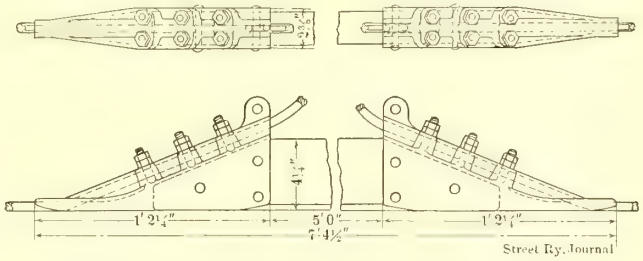


FIG. 17.—SECTION INSULATOR FOR TURNOUTS

The breaker consists of a cast-iron framework adapted to be bolted to channel irons resting upon the upper chords of the anchor bridges. This framework carries an iron box provided with a hinged cover. This cover is arranged to fit tightly in place so as to exclude all rain and snow and be entirely weather-proof. The moving parts of the circuit breaker are contained within this box and are made especially rugged and reliable in their operation. The terminals of the switch are brought out through specially constructed insulators mounted in an overhung portion of the box at the rear (Fig. 15). Upon the tops of insulators are carried knife-switch jaws, and there are corresponding jaws mounted on the upper ends of the circuit breaker contacts. Two switch blades are carried on insulating pillars fastened to the hinged cover of the box in such a manner that when the cover of the box is closed one terminal of the switch is connected to the bus-bar on the anchor bridge and the other is connected to the trolley wire. Arrangements are provided so that if the cover is opened the circuit breaker will be automatically tripped so as to prevent any possibility of the attendant taking hold of live parts.

The circuit breaker is capable of handling 11,000 volts on heavy, short circuit. A tripping coil is provided, together with closing magnets, both of which are operated from a circuit supplied from the small shunt transformers on the

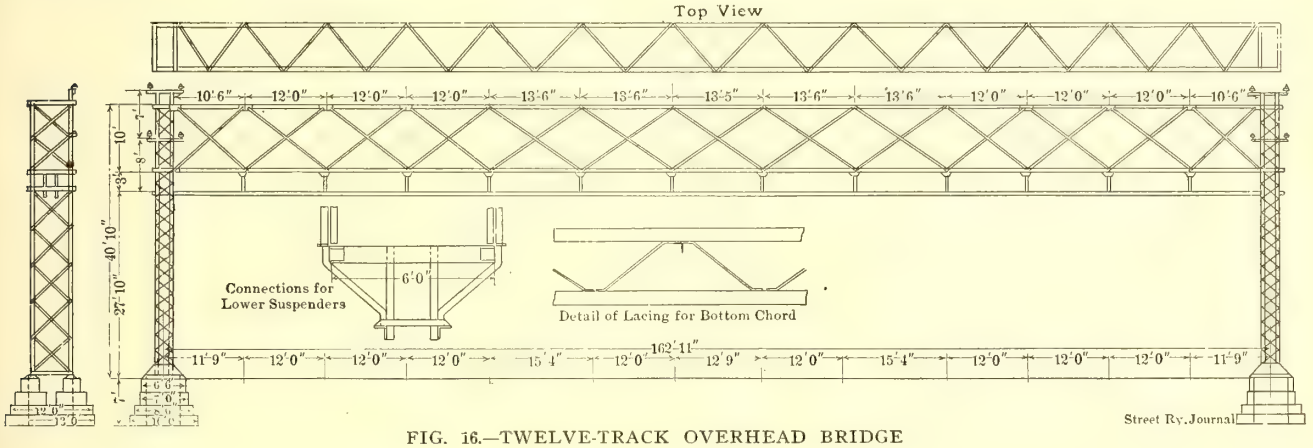


FIG. 16.—TWELVE-TRACK OVERHEAD BRIDGE

anchor bridge. The switch is also arranged to open automatically on overload.

The control wires for the closing magnets and the tripping coils are carried in iron conduit and lead-covered cable to the adjoining signal tower, where a switchboard panel is provided. This panel is fitted with switches so that any circuit breaker may be tripped by hand, or closed by the attendant in the signal tower. There is also a switch by means of which the attendant may connect either of the shunt transformers on the anchor bridge to the control circuit.

AUXILIARY FEEDERS

The auxiliary feeders, which are supported on the inner insulators of the lower bracket arm on the bridges, are looped in to the bus-bars on each alternate anchor bridge. These connections are made through automatic circuit breakers, so that in case of the grounding of the bus-bar structure to any anchor bridge, one of the auxiliary feeders will pass around the grounded bridge to the next section beyond. On each anchor bridge one auxiliary feeder is broken by a strain insulator, and connections are made through circuit breakers to the bus-bar. The other auxiliary feeder is carried directly through, and a single tap connection is made from the feeder through the circuit breaker to the bus-bar. Upon the next bridge these conditions are reversed, so that each auxiliary feeder is divided into 4-mile sections. This arrangement provides a maximum flexibility of control.

YARD CONSTRUCTION

At a number of points along the road, where there are numerous side-tracks, it is necessary to provide extra long bridge supports. Fig. 16 represents one of these long bridges, which is designed to cover twelve tracks. The catenary cable insulators are attached to the lower member of the truss.

TRACK BONDING

Both rails of all tracks are bonded by means of No. 0000 compressed terminal flexible bonds placed around the fish-plates.

TURN-OUTS AND CROSS-OVERS

Whenever one track diverges from another a section insulator shown in Fig. 17 is inserted in the trolley wire. Insulators like Fig. 11 are inserted in the catenary cables supporting the diverging wire between parallel tracks. The diverging trolley wire is connected to the main wire by means of a frog of standard design, and in order to prevent the contact shoes on the locomotive from catching, deflector wires are placed in the angle between the trolley wires. These deflectors are carried by yokes scured to the trolley wire and to a yoke at the rods fastened to the catenary hangers. These deflectors are raised at each end so that the collector shoe cannot catch on them. The arrangement is shown in Fig. 18, the details being given in Fig. 19. There being a certain amount of flexibility in the overhead trolley system, when the bow is pressed upward against the contact wire, this wire is raised above the level of the other contact



FIG. 18.—DEFLECTOR WIRES IN PLACE BETWEEN THE MAIN TROLLEY AND CROSS-OVER TROLLEY

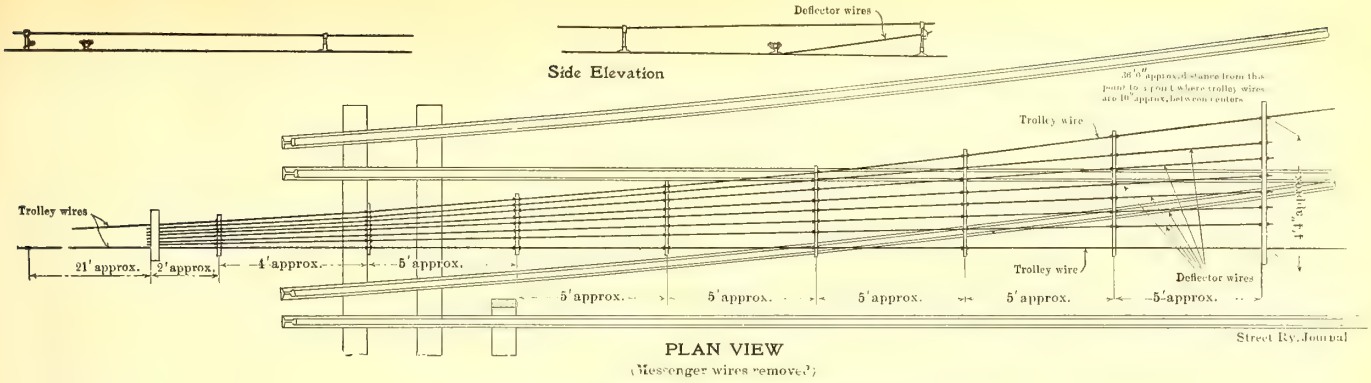


FIG. 19.—OVERHEAD CONSTRUCTION AT TURNOUTS

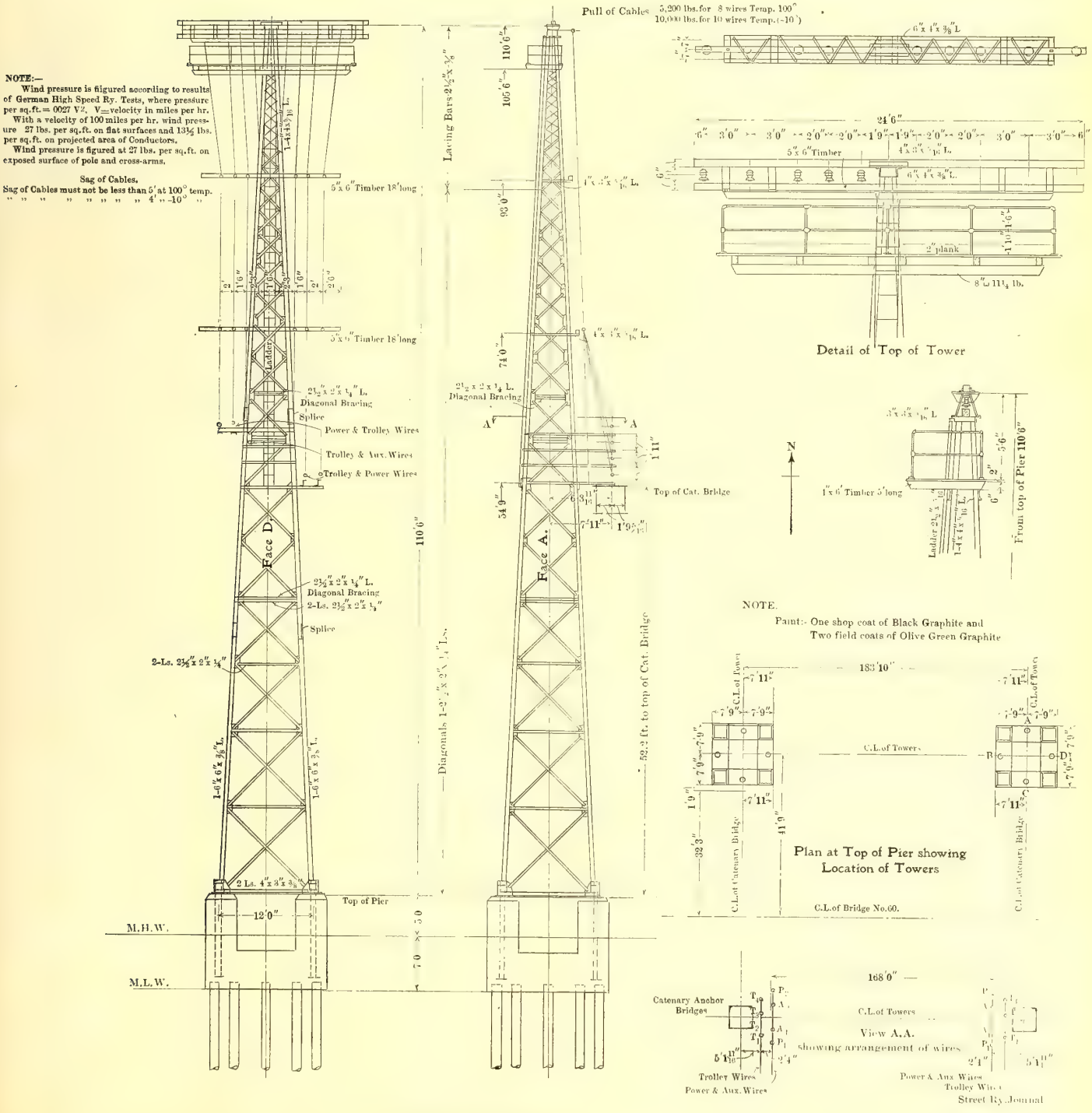


FIG. 20.—HIGH-TOWER WORK AT COS COB BRIDGE

wires in the immediate neighborhood. Thus, certain portions of the short length of trolley wire used to interconnect the two main trolley wires at cross-overs would tend to remain in a plane below that of the active trolley wire as the locomotive passed this point. The deflector wires are designed to tend to cause the cross-over trolleys and the main trolley to be raised partly in unison by decreasing the upward movement of the main trolley and increasing the upward movement of the cross-over trolley. The contact bow of the trolley mechanism on the locomotive is given a certain amount of upward curvature towards the center, so that the bow has no tendency to catch in either the cross-over trolley wires or the intermediate deflector wires.

DRAW-BRIDGE CONSTRUCTION

An interesting piece of special work is indicated in Fig. 20, which shows side and end views and constructive details of extra high steel towers used at the Cos Cob drawbridge. These towers enable the transmission and trolley wire circuits to be elevated about 115 ft. above the high-water level when crossing the stream at the point mentioned.

LOCOMOTIVES

Two longitudinal sections, with key of parts, of the locomotive used are published on the inset between pages 246 and 247. Further details of these machines will appear in an early issue of this paper, together with an account of the power station at Cos Cob, from which the power for the alternating-current section of the line is obtained.

CONTRACTORS

The contractors for the electric locomotives, catenary construction and turbo-generators used in the power sta- into were the Westinghouse Electric & Manufacturing Company, and for the rest of the power house equipment and power station itself, Westinghouse, Church, Kerr & Company.

NOTES ON THE SYDNEY, NEW SOUTH WALES, GOVERNMENT TRAMWAYS

The street tramways of the State of New South Wales are owned by the Government and operated by a Chief Commissioner for Railways and Tramways, with an Assistant Commissioner for Railways and an Assistant Commissioner for Tramways appointed every seven years to manage both railways and tramways. The tramways are not subject to municipal control or rates.

The tramways were opened in 1879 and were worked by steam motors. In 1886 and 1894 short cable lines were installed. In 1890 the first electric line was equipped, and within the last five years the whole system in Sydney and suburbs has been converted to overhead electric traction. The single track mileage is: Electric, 137; steam, 18. Steam systems are also worked in Newcastle (19 miles) and Broken Hill (6 miles). A number of electric extensions, both on the city and country lines, are about to be put in hand.

All lines are divided into fare sections averaging 2 miles in length, the fare for which is 1 penny. Children under twelve years are carried three sections (say 6 miles) for 1 penny, and on the first inward car each morning, workmen are carried two sections (say 4 miles) for 1 penny. Transfers are not granted. Conductors are provided with a case holding ten different books of tickets, each book holding 250 numbered tickets. A ticket is issued to each passenger on payment of fare, and conductors enter commencing number of tickets on a trip sheet each trip. Officers are employed to check the numbers of passengers' tickets with the conductors' sheets.

The rails used are 83 lbs. girder, and 60 and 80 lbs. "T." The maximum grade is 1 in 8½, the minimum curve 40 ft., and the gage 4 ft. 8½ ins. A considerable portion of the busiest track is "Thermit" welded.

The power plant comprises seven direct-connected G. E. generators, total 7900 kw, driven by seven Allis engines, and one Parsons turbo-generator of 1750 kw. The management has also ordered two 5000-kw Parsons turbo-generators. There are forty-eight Babcock & Wilcock 350-hp boilers with chain-grate stokers. The cost of power production per kw-hour is 0.638d., including interest. Besides the power house there are seven car houses, seven sub-stations and four battery houses, repair shops and a large permanent way depot.

The rolling stock comprises 685 motor cars, fifty-one trailers, forty-two service cars, sixty-eight steam motor cars and seventy-six trailers. The present total is 922, but sixty cars have been ordered to take care of increased business on the present lines and also for several extensions under way. The seating accommodation varies from twenty-six to seventy passengers. The fifty and seventy-seat cars have cross-seats and side doors. A large number of motor cars are run in pairs, and in some cases draw a seventy-seat trailer. Brill and McGuire trucks are used with General Electric and Westinghouse motors. All cars are fitted with power brakes and automatic fenders. The running of the cars is checked by Bundy time recorders, stationed along the routes, and all lines are controlled by a staff and ticket system.

The employees number 4133 and work 8 hours a day for six days a week. The running staff is provided with uniforms free, and the motormen are provided with seats. The daily rates of pay are: Conductors, 6s. 6d. to 7s. 6d.; motormen, 7s. 6d. to 8s. 6d. Conductors are promoted to motormen.

For the year ended June 30, 1906, the number of passengers carried was 145,262,799; the revenue, £851,483; the working expenses, £665,083; the car-miles, 17,734,008, and the consumption of power, 32,315,754 kw-hours.

The general management of the tramways is under T. R. Johnson, Chief Commissioner for Railways and Tramways; D. Kirkcaldie, Assistant Commissioner for Railways, and H. Richardson, Assistant Commissioner for Tramways. The traffic superintendent is John Kneeshaw; electrical engineer, Orlando W. Brain, and permanent way engineer, George R. Cowdery.

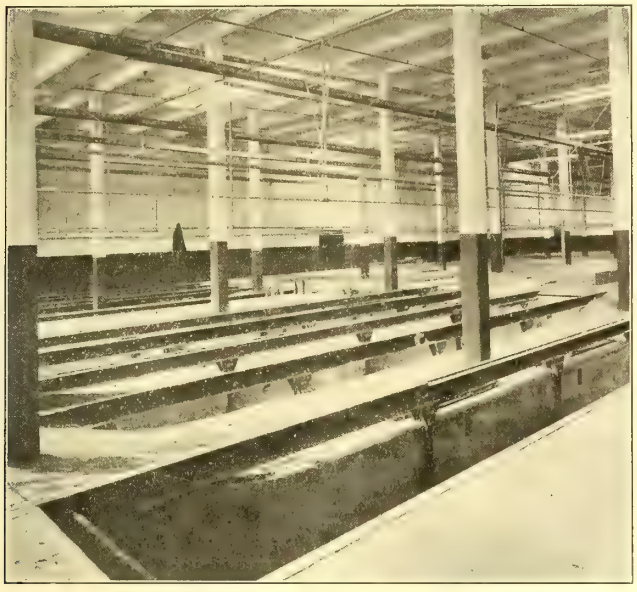
R. J. Fleming, manager of the Toronto Railway Company, recently issued an order which will obviate the future delay of cars on his system by parades and processions, which, it is stated, will be appreciated by the traveling public who have trains to catch or important engagements to fulfil. The order is as follows: "Motormen and conductors are notified that they must at all times bear in mind that the cars have the right of way over all other traffic, and that no traffic, whether vehicular or pedestrian, has any right to stop or impede the proper operations of the cars. * * * The employees are instructed, in the event of any obstruction being offered by anyone in connection with any parade or procession, to secure the names of such persons and witnesses, and make a full report to the office."

THE EDMONDSON AVENUE CAR HOUSE OF THE UNITED RAILWAY & ELECTRIC COMPANY OF BALTIMORE

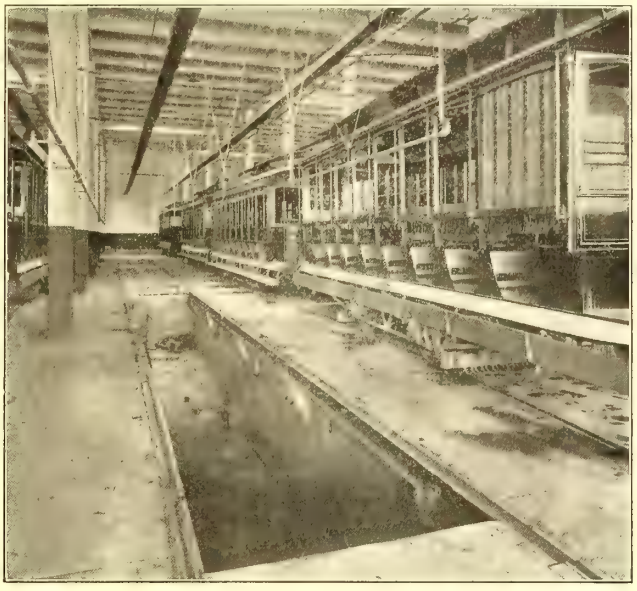
The STREET RAILWAY JOURNAL of Feb. 2, 1907, contained plans and a preliminary description of the Edmondson Avenue car house, but as the building is now in service the accompanying outside and inside views may also be found of interest.

The exterior illustration shows the military appearance of the new car house very well. The construction is of round-bar reinforced concrete with wire-glass sash and slag roofing. The floor is also of concrete, but as shown in one of the pit views slag blocks are laid adjacent to the rails to prevent cracking.

As mentioned in the earlier article, the pits in the car house are furnished with either flush or depressed aisles, the latter being preferable for work alongside the trucks, compressor, etc., while the flush aisles are more convenient for armature changing. Both types of pits are clearly shown in the accompanying illustrations.



SOME OF THE DEPRESSED AISLES IN THE EDMONDSON AVENUE CAR HOUSE



TYPE OF FLUSH-AISLE CONSTRUCTION IN THE EDMONDSON AVENUE CAR HOUSE



VIEW OF THE EDMONDSON AVENUE CAR HOUSE OF THE UNITED RAILWAYS & ELECTRIC COMPANY, BALTIMORE, ILLUSTRATING THE MILITARY EXTERIOR

THE PITTSBURG & BUTLER STREET RAILWAY CO.—II.

BY M. N. BLAKEMORE

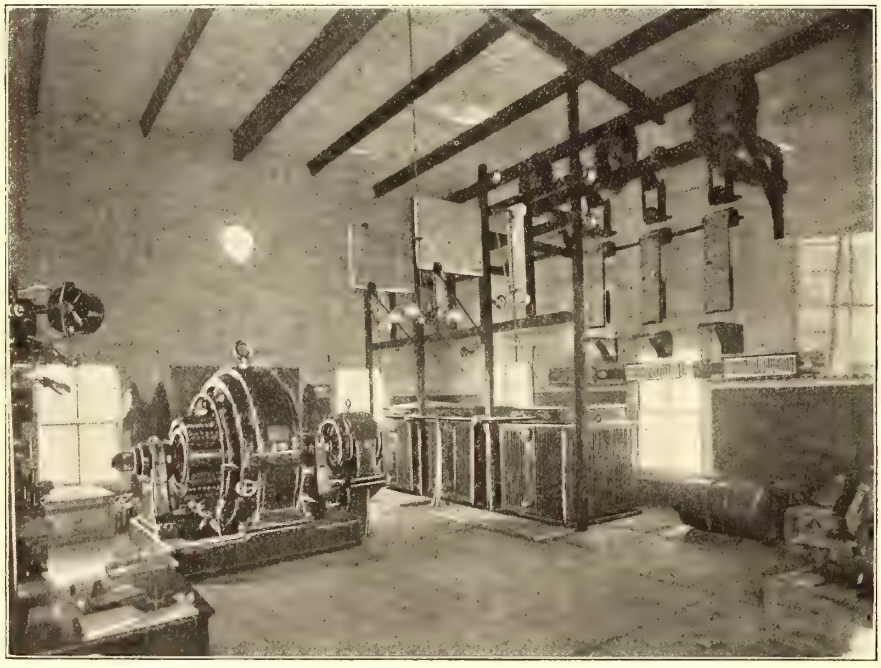
Last week an account was published of the power station of the Pittsburg & Butler Street Railway, lately built and equipped with the single-phase system. A description of the remainder of the equipment follows:

SUB-STATIONS

At the present time two static transformer stations have been installed approximately 12 miles apart; one at Mars, which is practically the middle of the system, is shown in the illustration, while the other is at Bryant, near the Pittsburg terminus of the road. In the former station there is mounted one 500-kw oil-insulated, self-cooling transformer, having a ratio of 22,000/6600 volts, but at present operated with a secondary voltage of 3300 volts. In the Bryant station there are two such transformers connected in parallel.

The high-tension sides of these transformers are controlled by means of fused circuit breakers separated by marble barriers. Low-equivalent lightning arresters and choke coils effectually protect the high-tension lines from lightning discharges. The low-tension sides of the transformers are controlled by means of oil circuit breakers, the same being mounted upon small blue Vermont marble panels supplied with suitable gas-pipe framework.

The two sub-station buildings are practically identical in construction, with the exception that the one at Bryant, in addition to forming a protection for the static apparatus, also includes a small waiting room. The same style of architecture has been followed in the construction of these sub-stations as is used in the other buildings of the company. The high-tension leads are carried into the sub-stations in the same manner as provided for in the power house.

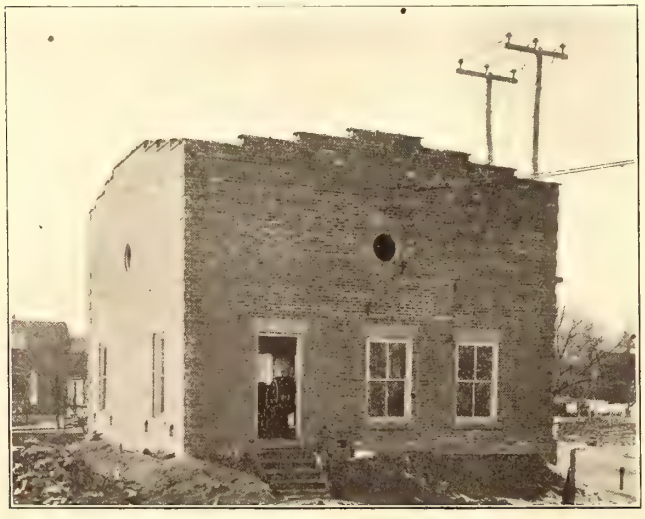


INTERIOR OF BUTLER ROTARY CONVERTER SUB-STATION

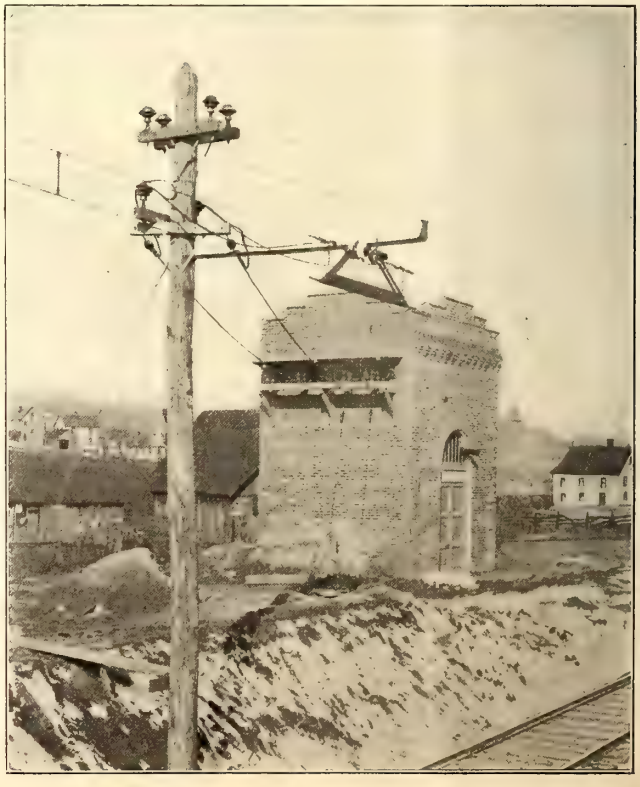
To supply current for the local trolley system in Butler, a rotary converter sub-station has been installed at that place. This station, as shown in the illustrations, includes, in addition to similar high-tension switching and protective apparatus, three 200-kw, 22,000/334-volt transformers. The station also includes one 500-kw, 550-volt direct-current Westinghouse rotary converter, together with a three-panel blue Vermont marble switchboard, which has mounted upon it a full complement of instruments and switches for the control of both the alternating and direct-current sides of the rotary converter, and for two outgoing direct-current feeder circuits. A Wurts tank lightning arrester has been installed to protect the direct-current feeder circuits.

TRANSMISSION AND TROLLEY LINES

The high-tension circuits are carried from the power house to the transmission lines on Locke insulators mounted on

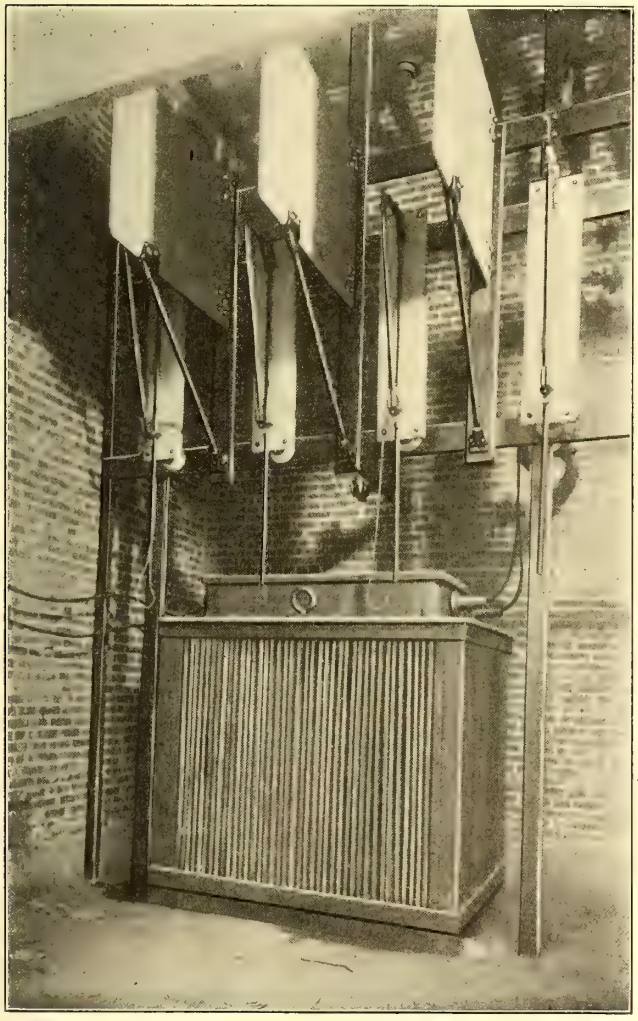


EXTERIOR OF BUTLER ROTARY CONVERTER SUB-STATION



EXTERIOR OF MARS STATIC SUB-STATION

wooden cross-arms securely fastened to two wooden poles, as shown in an engraving in Part I. From a point opposite the power house the transmission lines extend in both directions, the 22,000-volt single-phase line running in one direction and feeding the two static sub-stations at Mars and Bryant, while a three-phase, 22,000-volt feeder extends to Butler for supplying current to the rotary converter at that point. The transmission lines consist of No. 4 hard-drawn bare copper wire, secured to Locke insulators fastened to the tops of the same poles supporting the catenary trolley wires. Wherever the high-tension wires cross telegraph lines or public highways, large wire nettings have



INTERIOR VIEW OF MARS STATIC SUB-STATION

been suspended below them to prevent accidents due to the breakage of the high-tension wires.

The trolley construction is of the single catenary skirt type and has been designed for a pressure of 6600 volts. The trolley is No. 000 grooved wire, and is suspended from a 7/16-in. seven-strand galvanized steel messenger cable by means of galvanized-iron trolley hangers, spaced approximately 10 ft. apart. These hangers consist of short lengths of pipe threaded at one end and flattened and punched at the other. The threaded end engages in a socket which fits over the threaded portion of two drop-forged steel lugs, which engage in the groove of the trolley wire. The punched end of the hanger is secured to the messenger cable by means of a strap-iron clamp bolted to it.

On straight tracks the poles are spaced 120 ft. apart, but on curves this spacing has been reduced in proportion to the degree of curvature. The trolley wire is suspended from standard T-iron bracket arm at an average height of about 19 ft. above the top of the rail. One end of the bracket arm is secured to a 35-ft. chestnut pole by means of iron straps bolted to the bracket and fastened by lag screws to the poles.



SINGLE CATENARY CONSTRUCTION ON TANGENT

The other end of the bracket is supported by means of a round iron tension rod passing through the pole and secured to the bracket by a malleable iron lug. The messen-

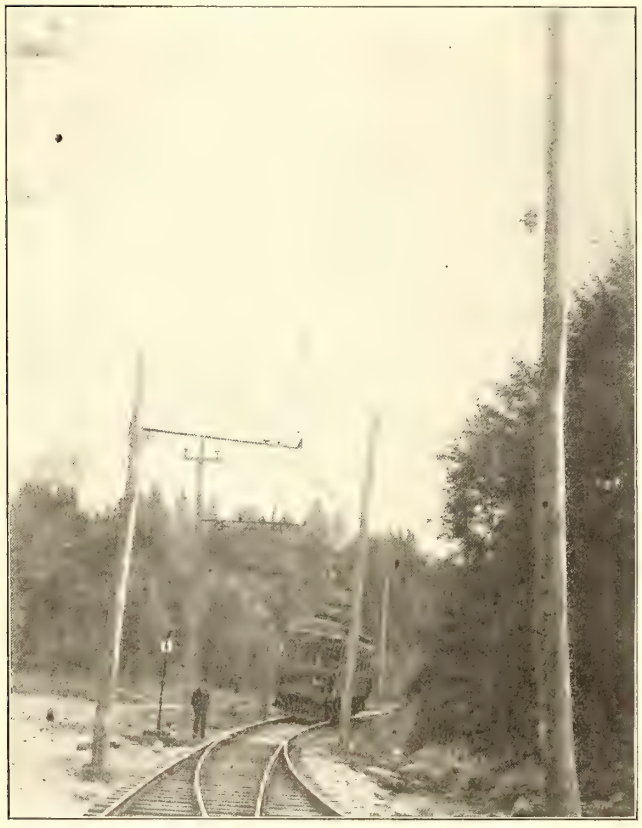


SINGLE CATENARY CONSTRUCTION ON CURVE

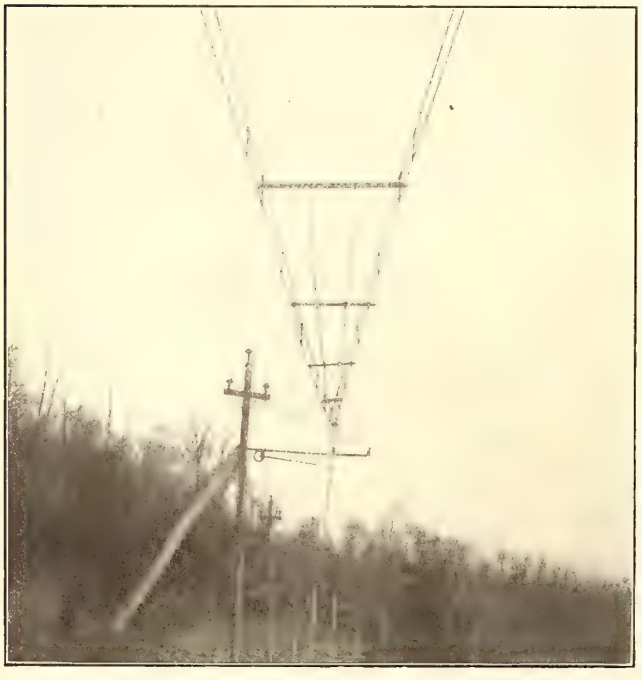
ger cable is supported from these brackets on porcelain main-line insulators which are cemented upon malleable iron supports arranged to clamp upon the T-iron bracket arms. The insulators are placed on the bracket arms in such a manner as to give a gradual staggering of the wire

from a point 8½ ins. on one side of the center of the track to a point 8½ ins. on the other side at intervals of 1000 ft. or so. This is done to distribute the wear on the sliding contact trolley shoes.

At all points of support on curves, and also at frequent intervals on straight track, a steady strain is used to keep the trolley wire exactly under the messenger cable to prevent swaying owing to the passing of cars. To insure the passing of the sliding contact shoe over turnout switches, a special form of deflector, illustrated on this page, has been provided. This deflector consists of pieces of trolley wire held in place by clamps, the ends of the wires being elevated. The construction is such that the sliding contact trolley shoe is properly diverted from one trolley wire to the other without engaging between the two at the junction of the two wires. At one or two spurs along the road this deflector scheme has been somewhat modified—this is shown in the illustrations—but at regular turnouts the above described method has been followed out.



MODIFIED DEFLECTOR SCHEME AT SPUR



DEFLECTOR SCHEME AT TURNOUT

Section-break insulators are used at several points, and that installed at the Butler end of the single-phase line, where it joins the direct-current feeder of the local traction line is shown in an accompanying illustration. A similar insulator is installed at the Pittsburg terminus of the road. When crossing bridges the trolley wire is suspended by means of bracket arms and insulators secured to steel arches erected upon the bridge structures. The high-tension transmission wires are carried on cross-arms, secured to these same arches. At other points along the line, the high-tension wires are carried on the wooden poles as previously explained. In addition to the high-tension wires, the trolley poles also support the wires for the telephone system used in connection with the dispatching of trains. No trouble has been experienced due to static interference from the single-phase line.

ROADBED AND TRACK

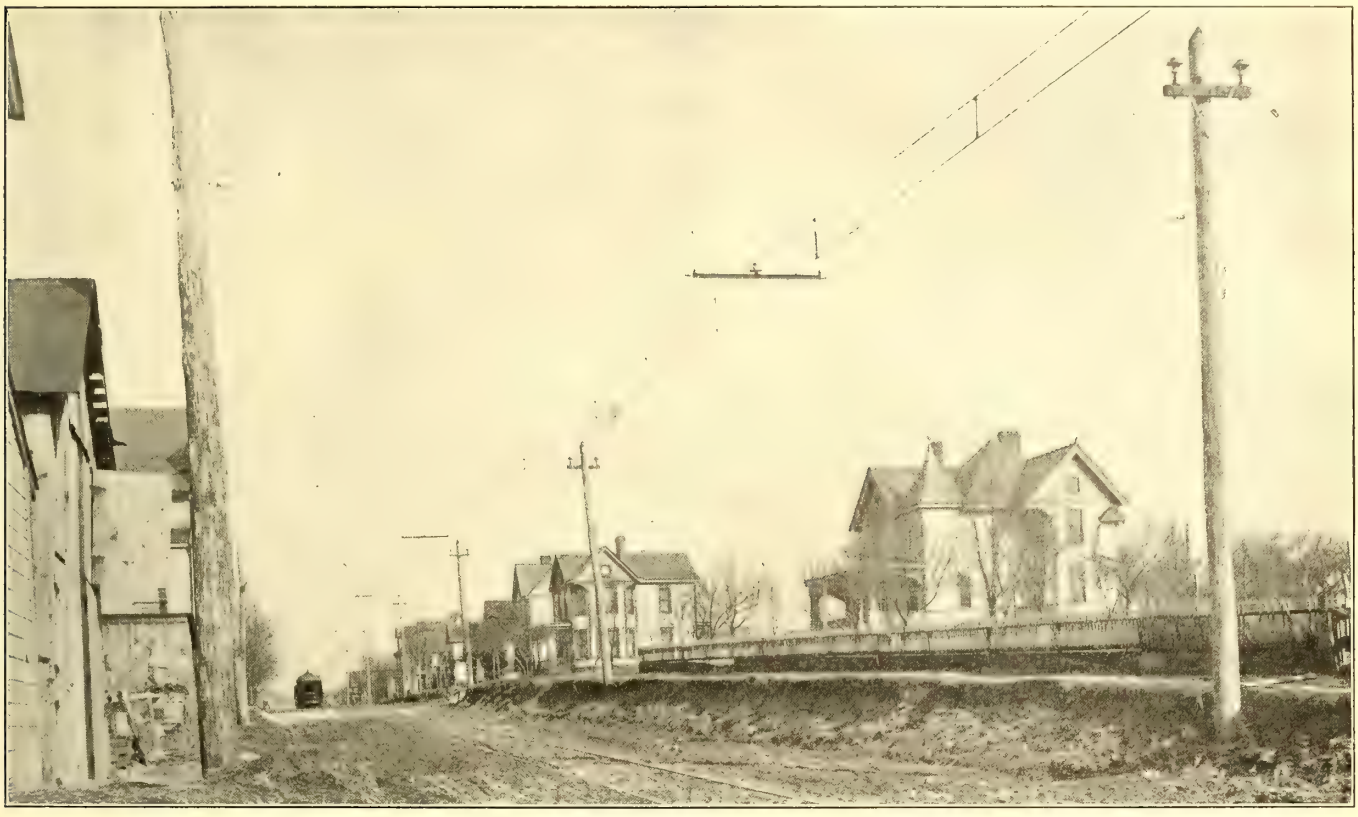
In order to adapt its tracks to those of the Pittsburg Railways Company, over which the entrance into Pittsburg is obtained, a gage of 5 ft. 2½ ins. is employed. A. S. C. E. rails weighing 75 lbs. per yard are laid on 7-in. x 8-in. x 8-ft. chestnut ties on 2-ft. centers. The road is single track, except within the city limits, and is stone ballasted throughout to an average depth of 12 ins. Wherever possible the road has been depressed below public highways, but where it crosses the highways on a level, warning posts are erected. Guard rails are used on all curves which exceed 9 degrees, the guard rails being raised about 1 in. above the running rails by means of blocks inserted under the rails.



SECTION BREAK AT BUTLER

As stated, the road is exceedingly hilly and contains numerous curves, the grade varying from 3 per cent to 6 per cent, although there is one grade at Etna amounting to 9½ per cent. A considerable portion of the road is over

private right of way. In the interurban portion of the road the stops average 2 miles apart, at which locations attractive frame waiting rooms supplied with seats have been erected. One of these is shown on page 260.



SINGLE CATENARY CONSTRUCTION AT MARS



VIADUCT CROSSING THORN CREEK

On the entire road there are three steel and concrete bridges, in addition numerous culverts of substantial character. The viaduct over the Baltimore & Ohio Railroad tracks at Bryant is 297 ft. long and is reached from the

north by a 5½ per cent grade. In addition to this there is an 8-degree curve at this point. Another bridge crossing the Thorn Creek at Renfrew is 800 ft. long and stands 85 ft. above the water line. The bridge at Butler, spanning the tracks of the Baltimore & Ohio Railroad at that point, is also of interest as containing one girder 115 ft. long, having a depth of 9 ft. The tracks at this point ascend a grade of 6 per cent, containing a 2-degree curve. The economical abutment construction is noticeable in all of the viaducts as well as the good mechanical appearance of the steel work.



TWO-CAR TRAIN

ROLLING-STOCK EQUIPMENT

At present the company is operating ten passenger cars, and orders have already been placed for eight additional equipments. The cars were manufactured by the Niles Car & Manufacturing Company, and weigh, complete with electrical equipment, 43 tons. The trucks were supplied by the Standard Motor Truck Company and weigh, each approximately, 17,200 lbs. They are provided with 36-in. rolled steel wheels and 6-in. forged steel axles.



TYPICAL WAITING STATION USED ALONG ROUTE

The cars measure 51 ft. 3 ins. long, 8 ft. 1½ ins. wide, and 8 ft. 9½ ins. in the center of the aisles, and have 27-ft. 6-in. truck centers, the wheel base of individual trucks being 6 ft. 8 ins. Particular attention has been paid to make the underframing exceptionally strong to hold the heavy electrical equipment, the under sills being made of 4½-in. x 7¾-in. yellow pine, while the center sills are made up of 6-in. I-beams, with yellow pine fillers. The cars are equipped with Peacock hand brakes and with standard Westinghouse type "SME" air brakes.

Five cars have been provided with a baggage compartment, and all with smoking compartments. The interior of the cars is finished in mahogany, and the ceilings are painted a light green and gold. All of the cars are provided with a lavatory. In addition to side lights, there are three center clusters supplied with holophane globes which are mounted from the ceilings of the cars. The cars are heated by Peter Smith hot-water heaters. In the combination cars the heating apparatus is located in the baggage compartment, while in the straight passenger cars it is located in the motorman's cab.

The electrical equipment of each car consists of four 100-hp Westinghouse single-phase motors. The gear ratio adopted is 19:64. The Westinghouse unit switch system of multiple control, adapted for operation on both alternating and direct currents, is used. The cars are arranged for double-end operation. The motors are operated two in

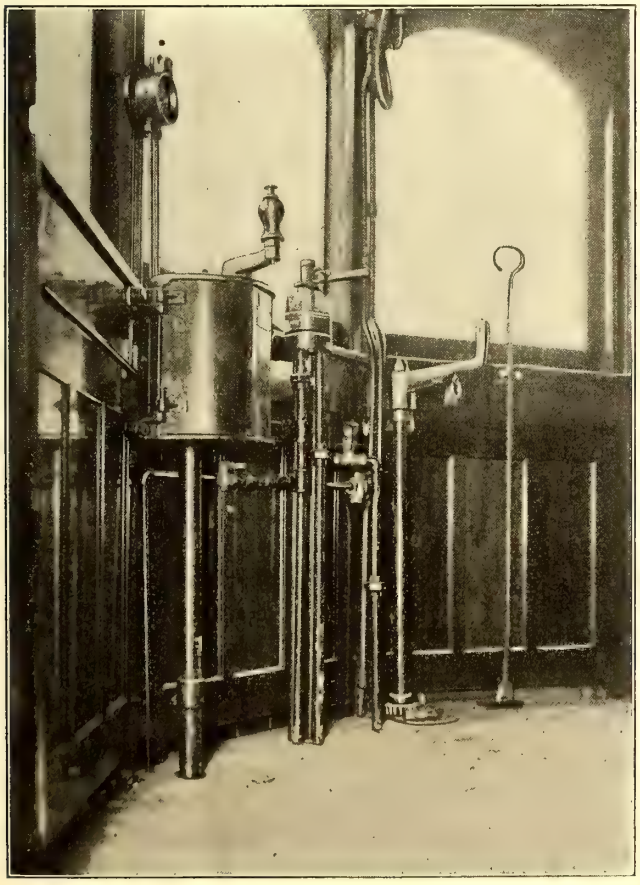


STANDARD CAR—PANTOGRAPH TROLLEY RAISED

series with two pairs in parallel on a. c. and all four in series on d. c. There is only one running point on d. c.

Each car carries two No. 8 U. S. wheel trolleys for use when operating on direct current, and one pantograph trolley for the collection of the single-phase current. Only one pantograph trolley has been provided, as this type of trolley readily lends itself for operation in either direction. The control of the wheel trolleys is taken care of by means of retrievers mounted on the ends of the platforms, as is the usual practice, whereas the pantograph trolley is controlled entirely by air supplied from the air brake system. The control of this trolley is provided for by means of a suitable valve mounted in the motorman's cab.

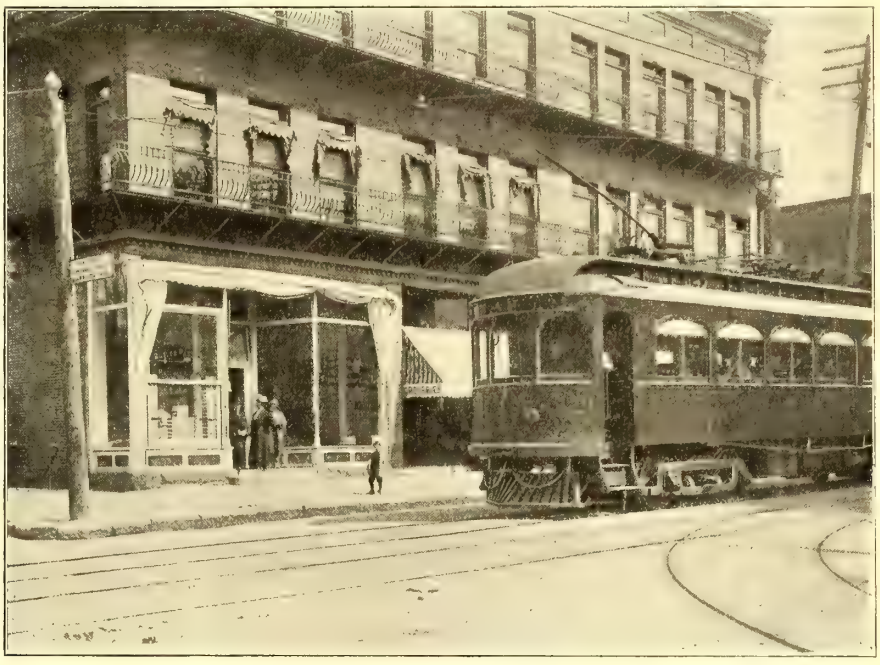
In passing from the direct-current section of the line to the alternating current portion it is only necessary to lower the direct-current trolley and raise the pantograph trolley, and in changing from alternating current to direct current, the reverse operation is to be performed. The only other operation necessary is the throwing of a small changeover switch controlling the air-pump motor. This can readily be performed without stopping the car,



INTERIOR MOTORMAN'S CAB

or even checking its speed. If it is desired to operate the cars in trains, as is contemplated, this can be accomplished by connecting the cars through the train line receptacles by means of seven-point train line jumpers.

Inasmuch as the operating coils for the unit switches



BUTLER TERMINUS AND COMPANY'S WAITING ROOM

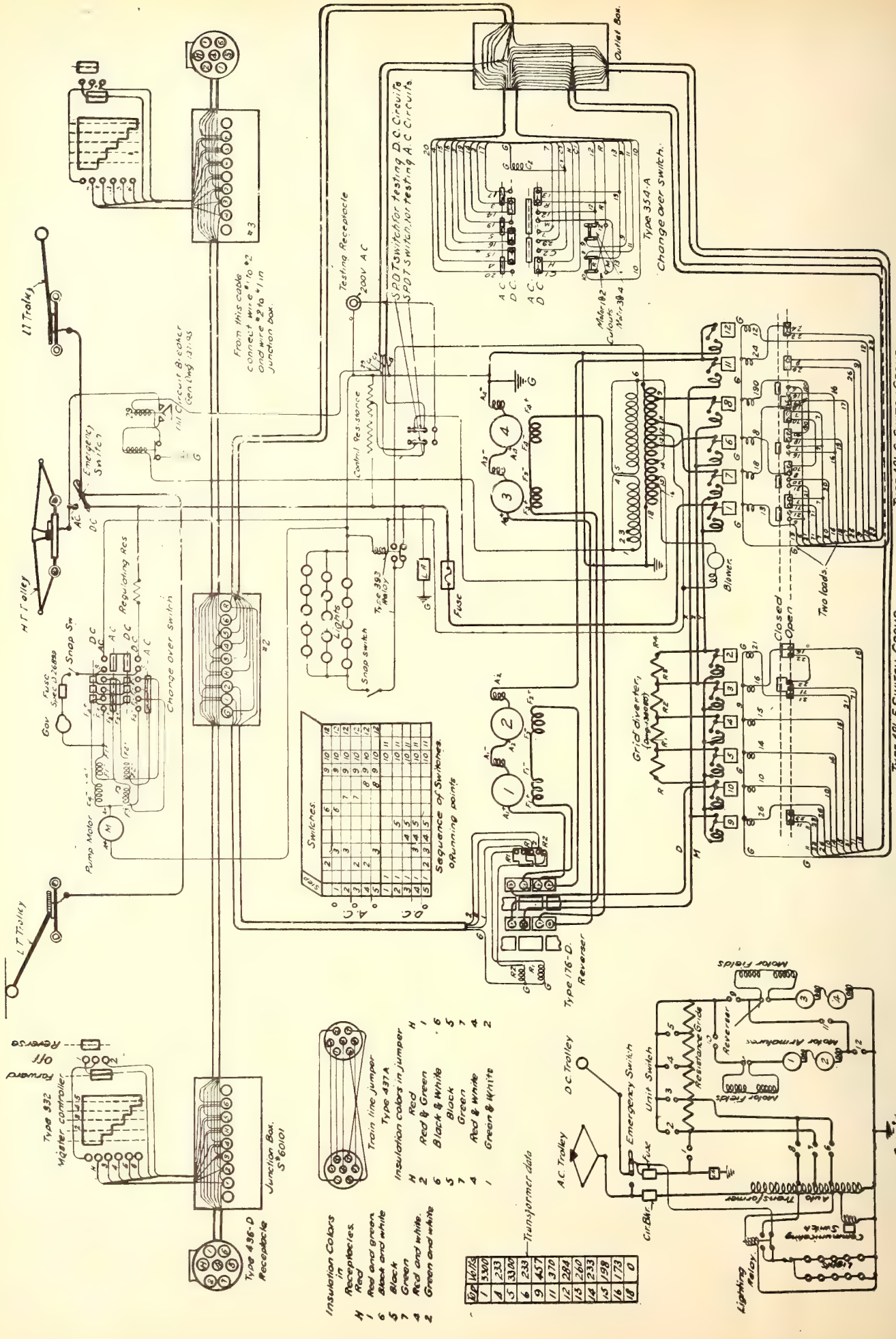
receive their current from the main line, means must be provided for testing the motors and operating circuits when the car is not in operation. This is accomplished by the installation of two single-pole, double-throw switches and a testing receptacle, by means of which the motors and control circuits are disconnected from the line and an outside source of power supplied to the car for operating the switches and testing out the circuits.

Especial care has been exercised in the mounting of the apparatus so to distribute it as to equalize the weight on the car body. All car wiring is carefully concealed in loricated conduit, and a sufficient number of junction boxes



INTERIOR OF COMBINATION BAGGAGE AND PASSENGER COACH

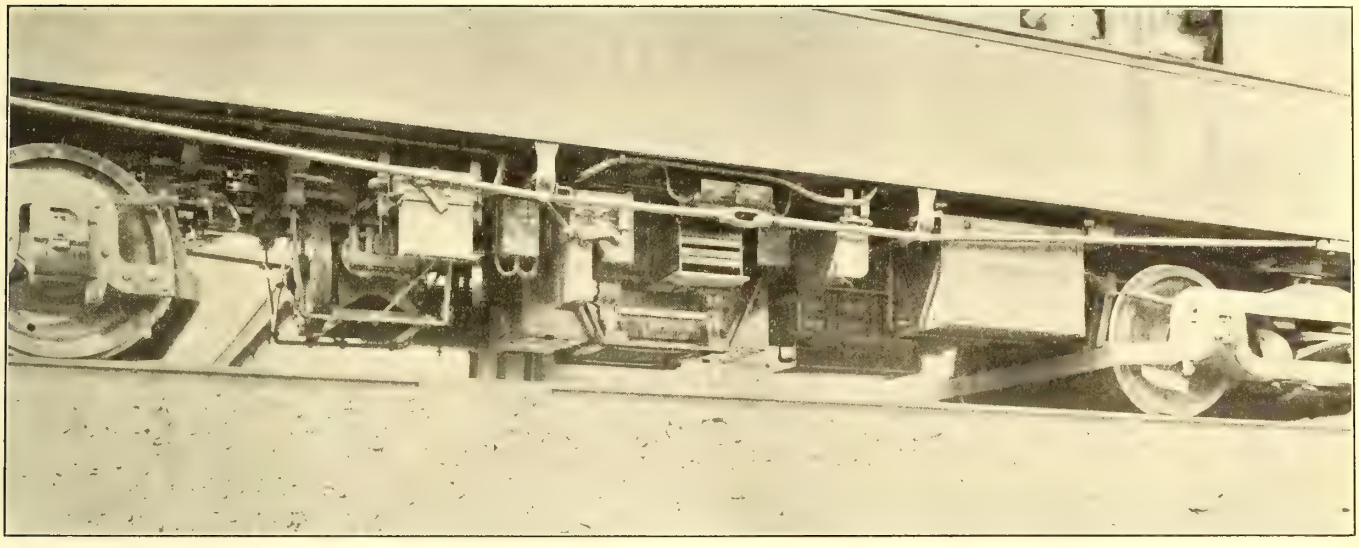
has been provided at suitable points, which materially cuts down the wiring and facilitates ready access to the connections.


Type 481-F Switch Group
Type 481-G Switch Group
Type 354-A Change over Switch
Type 176-D Reverser
Type 436-D Receptacle
Type 332 Master Controller
Junction Box. S.60101
Train line jumper Type 431-A
Transformer data
Insulation Colors in Receptacles.
Insulation colors in jumper
Sequence of Switches
Diagram of Car Connections

CAR HOUSE AND REPAIR SHOP

A large brick car house and repair shop is located at Mars, near the center of the system. The building measures approximately 181 ft. x 80 ft. and contains four tracks in the car house section, each provided with a pit, and two such tracks in the repair shop.

At the side of this car house, and adjacent to the tracks, there has been built a small brick addition to accommodate the dispatcher's office, and also afford a waiting room for the train crews. The large amount of trackage necessary for such a location has been admirably laid out so that the cars can readily be switched from one track to another with the minimum amount of handling.



VIEW OF UNDER SIDE OF CAR, SHOWING CONTROL APPARATUS



CAR HOUSE AT MARS

OPERATING FEATURES

The general offices of the company are located at Butler, where there is a large waiting room on the ground floor of their office bulding. This is shown in one of the engravings. At the present time an office is also maintained in Pittsburg, but it is the ultimate intention to direct the entire operation of the road from Butler.

The dispatching of the trains is done by means of the positive order system similar to that employed on steam railroads. The movement of all trains is in direct charge of the chief dispatcher, who is located at Mars. When a car is ready to start on its run, the conductor gets in touch with the dispatcher's office by telephone, receiving his orders in the same manner. These orders are then written in triplicate on forms provided for that purpose, and after that they are repeated to the dispatcher to insure their correctness. He gives one copy of the order to the motorman, retaining the other copy; the third copy is retained in the telephone booth for future record.

At each siding a small telephone booth has been provided and at these points the train crews receive further orders before moving to the next meeting point.

At the present time the company is conducting only a passenger service, but it is proposed in the near future to equip

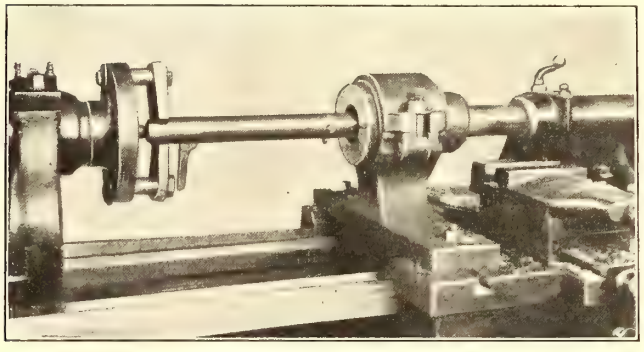
several baggage cars to handle small freight. In addition to the local cars the company intends inaugurating an express service, which will make single trips in about an hour. The regular local cars require about an hour and a half for the same run.

George Heard is the president of the company, and Charles Gibson, Jr., is vice-president, while H. W. Pape—to whose courtesy the greater portion of the information necessary for this article is due—is general manager. C. L. Wilcoxon is general superintendent, and has entire charge of the track and line. L. H. Kidder is general superintendent of motive power and has general supervision over the operating machinery and equipments of the company. The chief train dispatcher is W. M. Kessler, who has C. O. Fry and A. S. Fullerton as assistants.

SOME SHOP KINKS AT LOUISVILLE

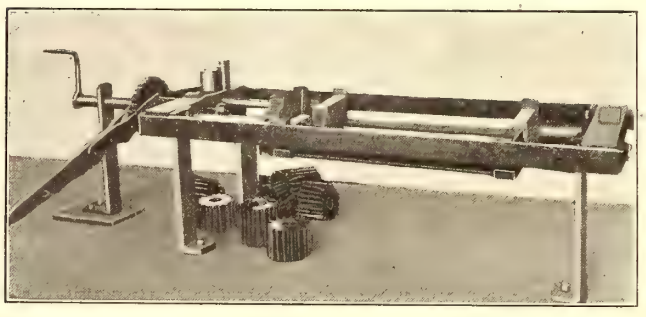
BORING BEARINGS

Usually when babbited bearings are bored in a lathe they are chucked on the lathe spindle. In the shops of the Louisville Railway Company, however, the bearing is clamped in a head attached to the carriage, and the tool is



MACHINE FOR BORING BEARINGS

held in a boring bar extending through the bearing. The head in which the bearing is clamped is shimmed up 1/32 in. to bore the bearing this distance off center to allow for wear. Bushings are provided so several sizes of bearings may be bored in one head. This method of boring the bearings has the advantage that the shells may be quickly put in the lathe and no delicate adjustments are required to get them centered.



DEVICE FOR TAKING OFF AND PUSHING ON PINIONS

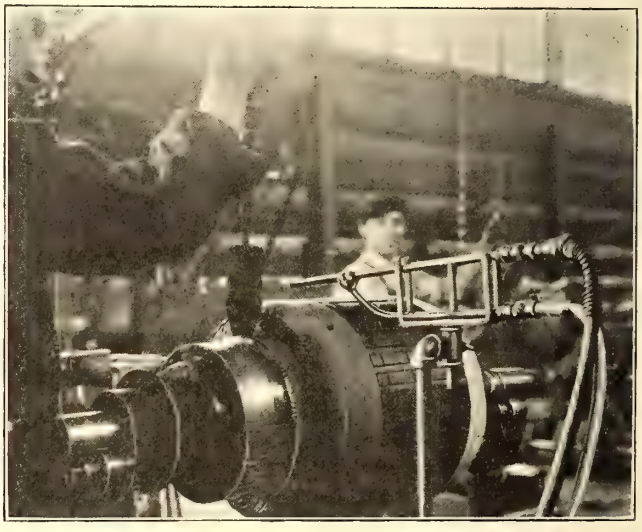
SOLDERING COMMUTATORS

About one-half hour per armature has been saved in soldering commutators by using a gas flame to heat the soldering iron. The gas lamp employed consists simply of two brass tubes brought together at one end. The other ends have attached to them rubber hose for air, obtained from the compressed air piping system and for illuminating gas. The lamp is held in an adjustable iron pipe frame. In soldering commutators the lamp is placed in such a position that the flames strike the heavy soldering iron so that it is unnecessary to change irons during the work.

PULLING AND PUTTING ON PINIONS

Pinions are put on and pushed off by means of a single device, which consists of an iron frame provided with a heavy screw operated by a ratchet lever.

When a pinion is to be pushed off the armature is so laid in the cradles that the heavy yoke shown extends over the shaft just behind the pinion. This yoke is supported by heavy bolts from the end bar of the frame which carries the screw. The smaller of the two cylinders shown resting on the end bar, which cylinder has a smaller diameter than the pinion bore is then placed between the end of the shaft and



SOLDERING AN ARMATURE WITH A GAS LAMP

the screw. On tightening the screw the pinion is held by the yoke behind it, while the armature and shaft are pushed toward the rear of the frame.

When pinions are to be pushed on, the cylinder shown at the rear of the frame is placed behind the armature shaft to limit its movement, and the hollow cylinder shown resting on the front end frame is placed between the pinion and the screw so the force of the screw is applied to the pinion only.

The device has been found of so much use in the shop that two of them have been built.

The employees of the Toledo Railways & Light Company held their annual field day and outing at the Casino a few days ago. The company furnished free transportation for the men, their families and friends. Arrangements were made so that all the men could attend at some time in the day. The theater was bought outright during the afternoon and evening performances for the men and their friends. Baseball games, a tug-of-war, running races and a number of other amusement features were arranged and proved a success. Entertainment was also provided for the women and children who did not care to witness the athletic features. Prizes were donated by the company for the winners in all the contests. Officers and managers were present to aid in making the afternoon and evening a delightful one for all.

THE BALTIMORE COAL CAR

The United Railways & Electric Company, of Baltimore, has just completed at its Carroll Park shops a 15-ton side-dump coal car, designed by H. H. Adams, superintendent of shops. This car was built primarily for carrying coal to the company's power station at Bay Shore Park after loading from the fuel hoppers at the Pratt Street station, but at other times it will serve for carrying cinders for fills, etc. As shown in the accompanying drawing, the car is 36 ft. 9 ins. over all and 8 ft. 5⅜ ins. wide. The body itself is 29 ft. long. The floor of the car is inclined to form a steep inverted V to permit quick unloading of the material. The flooring and sides are built of North Carolina pine, but the flooring is reinforced by angle iron, as shown in the plan and section. The sill plates are carried around the ends to form what are practically end braces for the crown pieces. The car is transversely braced by 2-in. hydraulic piping around 1-in. tie-rods and longitudinally braced by inside truss-rods. Both sides of the car are divided into ten sections stiffened by vertical T-irons and each furnished with a 20-in. x 32-½-in. plate steel shutter ¼ in. thick. The shutters at the bottoms of these sections are lifted by chains connected to a shaft running along the side of the car. These shafts are turned from a handle at each end so that the shutters are opened in groups of five; hence two men are required to unload a full side at one time. No obstruction is offered to the rapid egress of the coal except where the truss-rods cross at the end shutters.

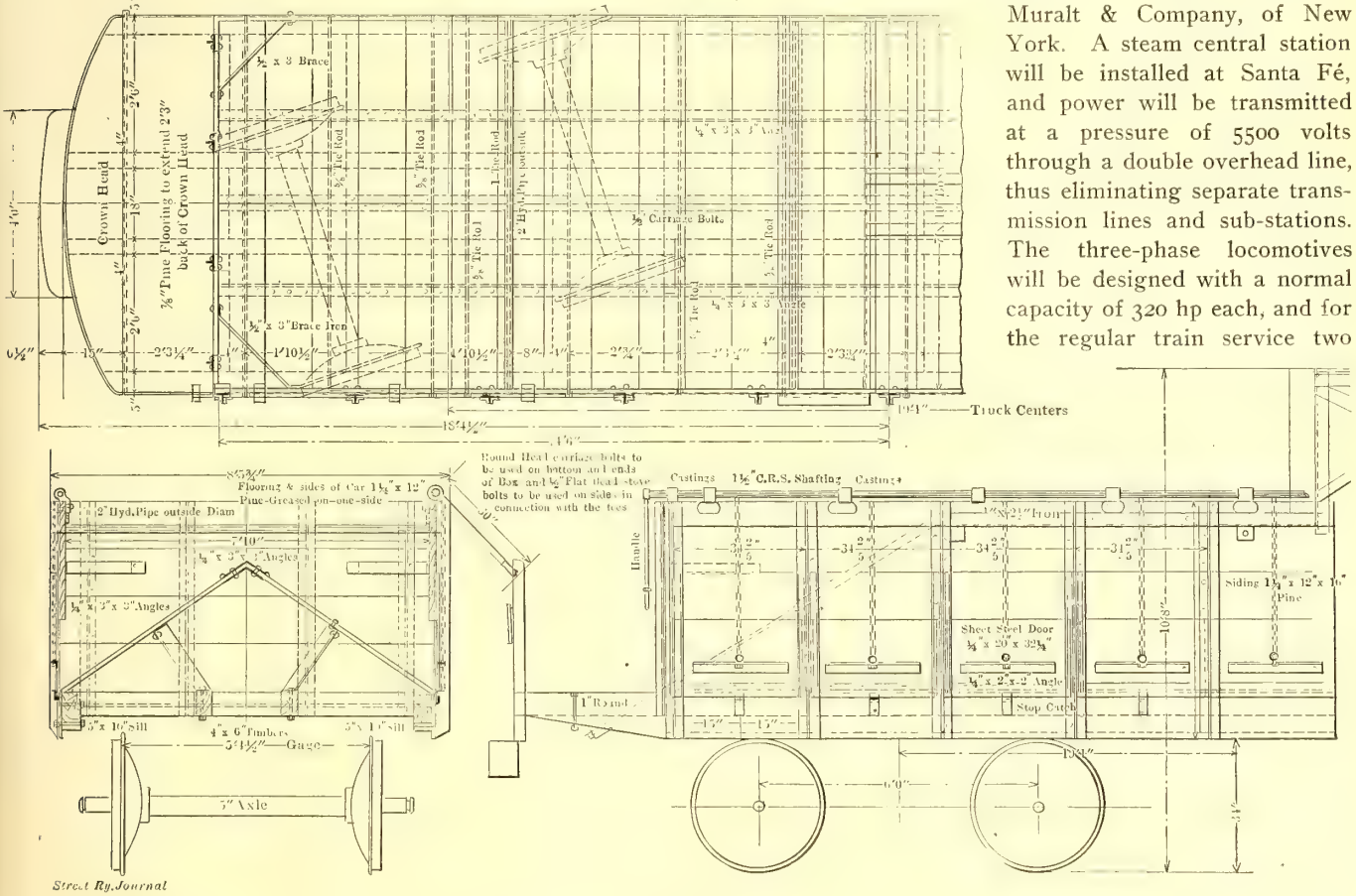


GENERAL APPEARANCE OF CAR WITH SOME OF THE SHUTTERS UP

The car is mounted on two Brill 27 E-1 trucks and carries a complete operating equipment consisting of four 40-hp Westinghouse 101 B motors, K-28 controllers, Westinghouse straight air brakes, Peacock hand brakes, Christopher sand boxes, Van Dorn draw-bars, Baltimore car fenders and U. S. incandescent headlights. All of this equipment is entirely new. The car is furnished with a single trolley stand, the base of which rests on a platform supported on angle braces carried over the sides. The total cost of the car is placed at $4,500.

ELECTRIFICATION OF SPANISH TRUNK LINE RAILROAD

The three-phase system is to be introduced on a trial stretch of the main line from Linares to Almeria, in Spain, about 145 miles, according to Muralt & Company, of New York. A steam central station will be installed at Santa Fé, and power will be transmitted at a pressure of 5500 volts through a double overhead line, thus eliminating separate transmission lines and sub-stations. The three-phase locomotives will be designed with a normal capacity of 320 hp each, and for the regular train service two will be coupled together. The lighter trains will be hauled by a single unit. The trains weigh from 150 to 300 tons and are run at 16 m. p. h. Advantage is to be taken of the feature whereby energy is returned to the line by the trains going down grade.



PART PLAN AND ELEVATION OF COAL CAR

CORRESPONDENCE

LOSS OF RECORDS AT SNOHOMISH, WASH.

Snohomish, Wash., Aug. 6, 1907.

Editors Street Railway Journal:

On Aug. 1, the office of the Snohomish Valley Railway Company, in Snohomish, Wash., was destroyed by fire. The company lost all of its records, books, correspondence, maps, estimates and data, which will require a great deal of extra time and labor to replace, and much of which it will be impossible to renew. Among the losses were the Street Railway Journals for 1906 and 1907 to date, also the Red Book of Street Railway Investments which was just received and had not been opened, all of which we valued very highly.

To expedite the replacement of our records and the re-establishment of our working data, the Snohomish Valley Railway Company requests all dealers with whom we have had correspondence, and from whom we had received specifications of equipment, or had received special catalogues and prices, to duplicate those specifications, prices and lists without special request, and at their earliest convenience.

The loss of our records, correspondence, specifications and data at this time was very unfortunate, as the company was expecting to commence construction between the first and fifth of August. The date of commencement will now be delayed until the records can be reproduced, which will be at the earliest possible moment. The co-operation of those with whom we have had correspondence, and with whom we were negotiating for equipment and supplies, will be greatly appreciated.

The Snohomish Valley Railway Company,
By Charles A. Barron, Gen. Supt.

[This letter is published so that manufacturers and others who have had correspondence with the Snohomish Valley Railway Company will learn the needs of the company, and will supply duplicate catalogues, quotations, etc.—Eds.]

WAGES IN PROVIDENCE

Providence, R. I., Aug. 13, 1907.

Editors Street Railway Journal:

In the review of the municipal ownership reports of the National Civic Federation, published in the Street Railway Journal of July 27, a table is published on page 138, showing the average wages per hour of conductors and motormen in twenty-one of the largest cities in the United States. This table states that the minimum wage in Providence is 18.2 cents, and the maximum rate 22.7 cents per hour. Below is given the rate of wages as paid by the Rhode Island Company (effective April 28, 1907):

	Cents Per Hour.
First year	20
After first year	21
After second year	22
After third year	23
After fourth year	24
After fifth year	25

I am calling the above to your attention, believing that you would like to correct same.

A. E. Potter,
General Manager.

GALVANIZING LINE MATERIAL

Schenectady, N. Y., July 30, 1907.

Editors Street Railway Journal:

The writer has noted with interest the editorial article in your issue of July 13, relative to the galvanizing of line material. He wishes to take exception, however, to that portion of your article which reads: "The hot dipping process tends to leave shreds of metal on the threads, which must either be cleaned off by a die or tapped before assembly, with the resulting stripping of some of the galvanizing coating." There is no difficulty in obtaining galvanized bolts with even a small diameter where the proper allowance was made for the zinc coating when machining. Just what allowance to make in threading bolts which are to be galvanized has been the subject of considerable study.

In a recent letter to the writer on this subject, William L. Wilcox, of the Wilcox, Crittenden Company, of Middletown, Conn., well known galvanizers, says: "In reference to the galvanizing of heavy material, we shall have to differ from the author in his statement that the hot process leaves shreds of metal on the threads, etc. Possibly some hot galvanizers may have this trouble, but we can furnish the threads thoroughly and cleanly galvanized by the hot process without being obliged to re-cut the threads after galvanizing, and guarantee that the same will stand sulphate of copper test."

This letter is written on the basis of mutual enlightenment rather than criticism, and I trust that the facts which I have given you above will be of interest.

A Subscriber.

[We are pleased to learn that certain manufacturers have no difficulties of the kind mentioned in the editorial. We said that the hot dipping process "*tends* to leave shreds of metal on the threads," not that it always does so. To indicate that some have found the process troublesome in this respect, we quote the following opinions, among several, which appear in the 1907 Question Box of the National Electric Light Association.—Eds.]

Most engineers demand that articles when galvanized meet what they call "four-immersion test," and to accomplish this the hot galvanizing or dipping process must be used. This method does not leave the coating as clean and smooth as the electrolytic process, but the coating is heavier, therefore, no doubt, is the best for such articles as anchor rods, cross-arm braces, washers, etc. The electrolytic process * * * is best on bolts, lag screws, etc., for the reason that the coating is left clean and smooth, while with the other process spelter is left on the thread, which will be broken off when the nut is screwed on the bolt, and destroys the galvanizing feature of the threaded part of the bolt.

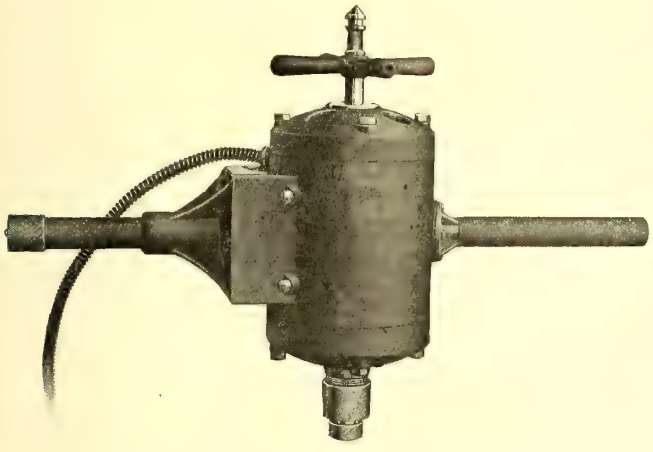
J. S. Reesman,
North Shore Electric Company, Highland Park, Ill.

Regarding galvanizing of such articles as contain threads, like nuts, bolts, and turnbuckles, where a snug fit is required, my experience has been that the electrolytic process is better, as in the employment of the hot process for this kind of work it is necessary to run over the bolt with a die, or in the case of the nut to retap. This would remove the galvanizing done by the hot process. * * * In the case of coach or wood screws the hot process is better, as it gives us a heavy coating. The hot process would likewise apply better to washers, cross-arm braces, and anchor or ground rods, because the zinc is thicker.

H. Frederic Frasse, Purchasing Agent
Edison Electric Illuminating Company, Brooklyn, N. Y.

AN ELECTRIC DRILL FOR HEAVY WORK

An electric drill especially designed for heavy drilling and reaming has been placed on the market by the Van Dorn Electric & Manufacturing Company, of Cleveland. In this drill the motors are of the enclosed type, ventilated by means of holes in the top and bottom heads and in the



ELECTRIC DRILL FOR HEAVY WORK

sides of the machine, air being drawn in through the ventilating holes and forced out through the vent holes in the side. The drills are made in four different sizes, Nos. 0, 1, 2 and 3, and are wound for 110 and 220 volts, direct current. The No. 0 machine is equipped with a Jacobs chuck, taking in sizes from 0 to 5/16 drill. The Nos. 1, 2 and 3 machines are equipped with standard Morse taper sockets, according to these numbers, taking in the drills that fit these sockets. The upper and lower thrust are ball bearings. All other bearings are of phosphor bronze. The gearing and all other gearing parts are made of machine steel case-hardened. A movement of a quarter turn of a knurled ring starts or stops the machine, so it is at all times under instant control of the operator. Each machine is equipped with an armored cable grounded to the machine.

EXCESSIVE SPRINKLING IN DETROIT

The question of track sprinkling in Detroit has assumed a serious aspect. Despite the fact that the Detroit United Railway Company has nine sprinkling cars in constant use on its lines, each with a capacity of 42,084 gals. of water a day, making some 378,756 gals. as the total for all the cars, the city administration still insist that the company sprinkle its tracks more frequently. This the company considers unfair, as it says unmistakable evidence is at hand of injury already done to the track because the streets are kept wet almost constantly, the watering being in the nature of a constant rainfall. The water, it has been discovered, runs down the side of the rail under the pavement and ruins the concrete wherever it is cracked. Mr. Kerwin, the superintendent of tracks of the company, says he believes that water underneath the concrete causes it to crack in cold weather. He estimates that the continual sprinkling of tracks costs the company about $100,000 a year, as it ruins more than 2 miles of double track each year, the foundation never being dry during the summer. There are several places in Detroit where, according to Mr. Kerwin, the rails are churning up and down in a pool of water all the time, in this way bringing the clay from underneath the concrete to the surface of the pavement. In consequence the rail and concrete sink into the mud. The mileage covered by the sprinklers is 52.85 miles of single track, and 52.54 miles of double track.

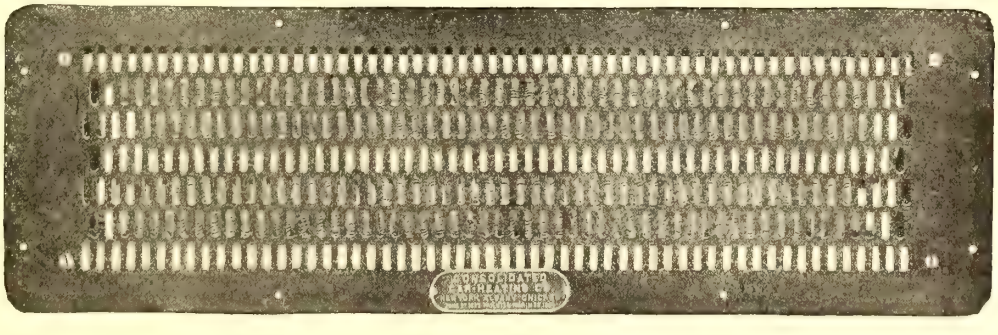
A NEW ELECTRIC HEATER

A new electric heater of the panel type has recently been developed by the Consolidated Car Heating Company, of New York. In this heater the company's standard coil construction is used, and the heater is fitted with a steel back, with a circulating air space between the back and asbestos lining, preventing the loss of heat back of the seats. The heater ends are made with openings for metal conduit and are fitted with double clamps for holding the conduit. In some cases each alternate heater is fitted with long lead wires, which somewhat simplify the labor of equipping, as it is only necessary to screw the heaters in position, slip the conduit over the lead wires, which can be held by the double clamps, and then remove the backs of one-half the heaters in order to make connections to the binding posts.

The front of the heater is of heavy steel with openings sufficient for thorough ventilation, but made somewhat narrower than standard openings, to prevent the placing of umbrellas or canes in contact with the heater coils. This heater is meeting with great favor and has recently been adopted by the following large companies: Interborough Rapid Transit, Manhattan elevated division, number of equipments 200, number of heaters 4400; subway division, number of equipments 50, number of heaters 1300; New York City Railway, number of equipments 195, number of heaters 3120; Hudson Companies, number of equipments 50; number of heaters 900.

Similar heaters have recently been adopted by the following companies:

Chicago City Railway, number of equipments 300, number of heaters 6000; Brooklyn Rapid Transit, number of equipments 100, number of heaters 600; Consolidated Railway of New Haven, number of equipments 103, number of heaters 1142; International Railway of Buffalo, number of equipments 49; number of heaters 980; Boston Elevated Railway, number of equipments 29, number of heaters 174.



NEW PANEL HEATER

INTERESTING CARS FOR PEORIA

The fourteen cars shipped recently by the American Car Company to Peoria contain a number of interesting features. They are "single-enders" equipped with double doors at the rear end with the "Detroit" style of platform. The door at the front end is of the Brill accelerator type.



NEW CAR FOR PEORIA

These cars will be run in trains. Longitudinal seats are furnished—a somewhat unusual specification for large double-truck cars of this type. The chief dimensions are as follows: Length over end panels, 32 ft.; over crown pieces, 43 ft. 2½ ins.; width over sill plates, 7 ft. 4 ins.; over posts at belt, 7 ft. 10 ins.; height from track to under side of sills, 32 9/16 ins. The bottom framing is unusually substantial and includes 8-in. x ¾-in. sill plates placed on the outside of the sills, under trusses anchored at the body bolsters, short struts under the needle beam trusses and inside truss rods shouldered high upon the posts, the side sills of long leaf yellow pine are 4 ins. x 7¾ ins.; center sills, 4 ins. x 4¼ ins.; end sills, 4¾ ins. x 7¾ ins. The platform timbers are reinforced with angle-iron and are additionally strengthened, and at the same time protected by angle-iron bumpers of patented type. The sill plates are brought around the end sills and heavily bolted through corner brackets on the insides of the sills, a form of construction which gives great resisting power against cornerwise strains. The trucks are of the No. 27-G1 type having solid forged side frames. The wheel base of the trucks is 4 ft. 6 ins. Each car carries four motors of 40-hp capacity each.

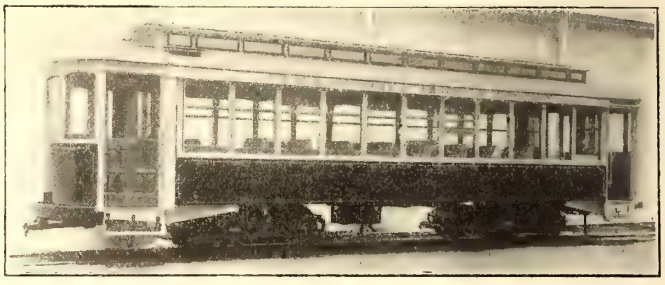
EXPRESS COMPANY EXTENDS ITS ELECTRIC BUSINESS

The United States Express Company is negotiating with the Toledo & Indiana Railway Company for the right to operate over its lines. This company is also making arrangements with all the electric railways that parallel the Lake Shore & Michigan Southern, so far as possible, in order to retain its local business. At present it is operating over the Detroit United, Detroit, Monroe & Toledo Short Line, and Toledo & Western. A temporary arrangement has also been made with the roads on which the Electric Package Company operates.

SEMI-CONVERTIBLE CARS FOR THE MICHIGAN SOO

The semi-convertible car has found a new field in the country of the Soo. A number of these cars are now on their way to the Trans-St. Mary's Traction Company, of Saulte Ste Marie, Mich., one of a number of subsidiary companies controlled by the Lake Superior corporation. Another subsidiary company, the International Transit Company, operates the railway system on the Canadian side of the Soo, and also owns and operates the ferry line between the two Soos. The cars of the Trans-St. Mary Company make close connection with the ferry steamers at the ferry dock, and the Canadian company does likewise, so travel to any point in either of the two towns is convenient.

The normal population of the Michigan Soo is in the neighborhood of 12,000, but in the summer months when navigation is heaviest and the throng of tourists and summer visitors arrives, eager to view the Canadian and American ship canals, the rapids and the water power and manu-



EXTERIOR OF SOO CAR

facturing plants, the population is greatly increased. It was chiefly to take care of this annual invasion of visitors that the new semi-convertible cars were ordered.

The trackage of the Michigan Soo system is at present 8½ miles, the most recent addition being the line of Algonquin, the busy suburb west of Sault Ste Marie, on the St. Mary's River above the rapids. The service between these points will be especially benefited by the new equipment.

The electrical system on both the American and Canadian side is d. c. overhead trolley, with power furnished by the Michigan Lake Superior Company to the Trans-St. Mary's Traction Company, and by the Lake Superior Power Company to the International Transit Company, both subsidiary to the Lake Superior corporation.

The illustration shows a typical straight-sided cemi-convertible car of the J. G. Brill Company. The chief dimensions are as follows: Length over end panels, 30 ft. 8 ins.; over crown pieces, 40 ft. 1 in.; width over sills, including sheathing, 8 ft. 4 ins.; size of side sills, 4 ins. x 7¾ ins.; end sills, 5¼ x 6⅞ ins.; sill plates, 12 ins. x ⅜ in. The



INTERIOR OF SOO CAR

equipment is standard, including Brill seats and numerous specialties, such as angle-iron bumper, radial draw bar, etc. The 27-G1 trucks with 4-ft. wheel base are used. Each car is equipped with four 40-hp motors.

FINANCIAL INTELLIGENCE

WALL STREET, Aug. 14, 1907.

The Money Market

Increased strength characterized the local money market in all its branches during the week. The demand for money for stock market purposes was materially lessened by the heavy liquidation and severe declines in values on the Stock Exchange, but the inquiry from mercantile and other sources continued brisk, and resulted in rates for practically all classes of accommodations making new high records for the year. Day to day money loaned at 6 and at 3 per cent, the average rate being about 4 per cent. Money for sixty days, which was obtainable a week ago at 5½ per cent, was in demand at 6 per cent, while other maturities up to six months commanded the full legal rate of 6 per cent and commissions, bringing the total charge to the borrower up to 6½ and 7 per cent, the latter figure prevailing for six months loans. Even at the advanced rate the supply of money for fixed periods was comparatively small, and came principally from trust companies and outside sources. The local banks were practically out of the market, there being a disposition on the part of the New York banks to prepare for the extraordinary demands soon to be made upon them. Currency shipments to the West and South for crop-moving purposes are already under way and are likely to develop larger proportions from now on. In addition preparations must be made for the $15,000,000 payment on account of the new Southern Pacific stock due this week, and for similar payments falling due in the near future. The present condition of the money market was reflected during the week by the partial failure of the City of New York to sell an issue of stocks and bonds. Out of a total of $15,000,000 4 per cent securities offered about $3,000,000 were disposed of. The bids were generally for small amounts, and there was an absence of offers from the large banking and bond houses which, under ordinary conditions, would have been willing to take the entire amount at better prices than were realized. Another feature of the present situation is the attitude of foreign bankers. Usually at this time of the year when money rates work firm, considerable amounts of foreign capital become available, but so far this season offerings from that source have been extremely light, there being a disposition on the part of foreign bankers to refrain from making advances with the same degree of liberality as in previous years. Foreign exchange, however, continues to display a drooping tendency, rates being now well below the gold export point, and the belief prevails in banking circles that the outflow of the precious metal is about over for the year. The situation at the principal European centers has not changed materially during the week. The liquidation in the securities market at London carried the price of Consols down to the lowest yet recorded, and there was heavy selling of American securities. The demand for gold continued active, the Bank of England securing about one-half of the gold arriving in London from the Cape, the balance going to Continental centers. Private discounts at London have also hardened, and there was some talk of an advance in the official bank rate in the near future.

At the close of the week the local market ruled decidedly firm. Reports from Washington are to the effect that the Secretary of the Treasury will relieve the situation by placing Government funds in the banks should such assistance become necessary.

The bank statement published on last Saturday revealed a decrease in cash of $5,312,100, or somewhat larger than was indicated by the preliminary report of the currency movements. Loans decreased $16,497,400, and as there was a decrease in deposits of $22,397,800, the reserve required was $5,599,450 less than in the preceding week. Deducting from the latter amount the loss in cash the surplus reserve was increased by $287,350. The total surplus was $7,760,550, as compared with $8,271,525 in the corresponding week of last year, $12,846,800 in 1905, $57,731,475 in 1904, $21,563,575 in 1903, $7,126,600 in 1902, $20,952,950 in 1901 and $28,125,950 in 1900.

The Stock Market

Conditions in the stock market have been going from bad to worse during the past week, and the wonder is that the further tremendous shrinkage in values was not attended by failures, if not actually by panic. On several occasions there appeared to be danger of the uninterrupted and heavy liquidation developing such a condition, but the placing of supporting orders at the proper time undoubtedly averted such an undesirable event. However, such buying power as was in evidence on occasions was by no means sufficient to stem the tide of falling values, and prices for all classes of stocks crumbled until in very many cases they not only went below those reached in March last, but also touched the lowest points since the memorable Northern Pacific panic in 1901. For a time after the first wave of liquidation broke out about a fortnight ago the higher grade railway and industrial securities withstood the pressure remarkably well, and only yielded moderately in sympathy. Latterly, however, all the so-called gilt edged issues have displayed equal, if not greater, depression than the lower grade stocks, and such ordinarily desirable securities as Standard Oil, American Tobacco, Great Northern preferred, New York Central, Pennsylvania, St. Paul and Union Pacific have fallen to prices which in most instances net the investor an excess of the rate of interest now current in the money market. The demoralization in the market was attributed to the uneasiness over the attitude of the Federal Government toward corporations; the increasing tension in the money market; the lower prices for copper metal, and the strike of the telegraphers here and at many large cities throughout the country. The foreign political and monetary situation has again been unsettled, with the result that the price of British Consols has dropped to the lowest point on record. Other factors in the situation included reports of a moderate recession in business, particularly in the copper metal trade, while the Government crop report was looked upon rather unfavorably, except in the case of corn. It is felt that there will in all probability be considerable improvement in all our principal cereals between now and harvest, and that the railroads will in consequence have ample tonnage and experience to let up in their present prosperity, which is one of the strongest underlying factors in the situation, and one which in the end is bound to have its influence on values.

The feature of the week in the local traction group which, of course, gave way in company with all kinds of securities, was the severe shrinkage in the market price of the Interborough-Metropolitan 4½ per cent bonds, which at one time sold as low as 53, comparing with 74¼, the high figure of the previous week, and 82 the price at which they sold in January last. The shares of the Interborough-Metropolitan also fell to new low records, the preferred reaching a point at which 17 per cent would be yielded to the investor, assuming, of course, that the 5 per cent dividend is to be continued. There were no special developments in connection with the other local traction properties, if the continued record-breaking earnings of the Brooklyn Rapid Transit be excepted. Nevertheless, all these shares exhibited sympathetic weakness.

Philadelphia

Trading was heaviest in Philadelphia Rapid Transit, the price of which was forced down to 165⅛, the lowest recorded for some time, but subsequently there was a fractional recovery. In other issues the volume of business was comparatively small, but prices generally suffered to a greater or less extent. Consolidated Traction, which for some time past has ruled around 72½ and 73, dropped to 70, and United Companies of New Jersey lost 2 points to 245. Philadelphia Traction ran off from 94½ to 93, and Philadelphia Company common lost a point to 39. Union Traction declined from 57 to 56. Fairmount Park Transportation sold at 9 and American Railways at 48.

Chicago

Further progress was made during the week in clearing up the local traction situation. The amended plan of reorganization of

the Chicago Union Traction Company was announced, and it is generally believed will be accepted by a majority of those interested. The order turning over the properties on the West and North Sides to the Chicago Railways Company, which is to operate them under a lease, has been signed by Judge Grosscup. An application for an appeal from the order has been made in behalf of the first mortgage bondholders of the North Chicago Railway, and the date for the hearing has been set for Aug. 19. Trading in the local tractions, however, was very quiet. Metropolitan Elevated sold at 22 and South Side Elevated went at 80. Northwestern Elevated common brought 21½, and the preferred stock 60¾.

Other Traction Securities

There were no important developments in the traction issues at Baltimore, trading for the most being confined to small amounts, at slightly lower prices. United Railway common was about the only issue to display any degree of activity, several thousand shares of the stock selling at 12½. United Railway 4s declined from 87⅛ to 86½, and the incomes sold at 52. The funding 5s brought 79 and 79¼. Washington City & Suburban 5s changed hands at 100, and Norfolk Railway & Light 5s sold at 95. The Boston market for tractions was quiet and irregular. Massachusetts Electric common held steady at 14, but the preferred fell from 56 to 54. Boston Suburban preferred advanced from 50 to 52 on light purchases, and Boston & Worcester sold at 20½ and 20¼. Boston Elevated held at 134. West End common sold at 88, and transactions in the preferred were made at 101½ and 101.

But little trading has been done in traction on the Cleveland Stock Exchange the past week. A few small blocks of Cleveland Electric changed hands at 49½, while there was some activity in Aurora, Elgin & Chicago common at 32½. Lake Shore Electric common remains at 10, with a few small sales at that figure.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Aug. 7	Aug. 14
American Railways	48	47
Boston Elevated	134	131
Brooklyn Rapid Transit	50¾	42
Chicago City	—	160
Chicago Union Traction (common) certificates	—	—
Chicago Union Traction (preferred) certificates	—	—
Cleveland Electric	49¾	49½
Consolidated Traction of New Jersey	70	69
Detroit United	—	62
Interborough-Metropolitan	13	8⅞
Interborough-Metropolitan (preferred)	38¼	26½
International Traction (common)	45	45
International Traction (preferred), 4s	a67	a67
Manhattan Railway	130	115
Massachusetts Elec. Cos. (common)	14	12½
Massachusetts Elec. Cos. (preferred)	54½	52
Metropolitan Elevated, Chicago (common)	22	21½
Metropolitan Elevated, Chicago (preferred)	63	63
Metropolitan Street	a91	a70
North American	66	55
North Jersey Street Railway	40	40
Philadelphia Company (common)	40	38
Philadelphia Rapid Transit	19	17¼
Philadelphia Traction	93	92½
Public Service Corporation certificates	65	65
Public Service Corporation 5 per cent notes	92	92
South Side Elevated (Chicago)	80	80
Third Avenue	90	75
Twin City, Minneapolis (common)	88	86
Union Traction (Philadelphia)	57	56

a Asked.

Metals

The "Iron Age" says that foundrymen, large and small, seem to persist in the policy of keeping out of the market, and even the large smelters are buying only from week to week for prompt delivery. They are encouraged in their course by constantly lower prices in some sections. In steelmaking irons interest centers entirely on basic iron, which is weaker. There has been no further buying of steel by the leading interests since last week. While steel works and rolling mills have assurance of full work for the balance of the year, and while they are crowded now, it is undeniable that on the whole new orders are coming in at a considerably reduced rate, so that the winter may find a slackening of operations necessary.

The deadlock between copper producers and consumers continues. Very little copper is being sold, but as yet there has been no lowering of prices by the large producing interests.

B. R. T. EARNINGS FOR YEAR ENDED JUNE 30, 1907

The Brooklyn Rapid Transit Company's full income account for the year ended June 30, 1907, as reported to the Public Service Commission (subject to change) compares as follows:

	1907	1906
Gross receipts	$19,381,587	$18,473,328
Operating expenses	11,465,705	10,441,377
Net earnings	$7,915,882	$8,031,951
Other income	555,166	323,936
Total income	$8,471,048	$8,355,887
Fixed charges	6,026,386	5,612,934
Surplus	$2,444,662	$2,742,953
Special appropriations	442,064	580,343
Surplus	$2,002,598	$2,162,610

Surplus after special appropriations is equal to 4.45 per cent on the $45,000,000 capital stock.

Elsewhere in this issue brief mention is made to these figures as bearing on the hearings now in progress in New York.

REPORT OF THE RUTLAND RAILWAY, LIGHT & POWER COMPANY FOR YEAR

The Rutland Railway, Light & Power Company, of Rutland, Vt., has just issued a statement of its earnings covering the year ended June 30, 1907. As compared with the previous year it shows as follows:

	1907	1906
RAILWAY COMPANY		
Gross receipts	$105,744	$96.847
Operating expenses	55,747	55,884
Net earnings	$49,997	$40,963
GAS COMPANY		
Gross receipts	$33,034	$29,306
Operating expenses*	22,745	20,539
Net earnings	$10,289	$8,767
POWER COMPANY		
Gross receipts	$27,220	*$3,789
Operating expenses	10,070	2,261
Net earnings	$17.150	$1,528
RUTLAND CITY ELECTRIC COMPANY		
Gross receipts	$63,394	$57,320
Operating expenses	44,368	39,535
Net earnings	$19,026	$17,785
TOTAL, ALL COMPANIES		
Gross receipts	$229,392	$187,262
Operating expenses	132,930	118,220
Net earnings	$96,462	$69,042

*Three months.

The electrical equipment promised for January, 1907, has just been received and installed, and will enable the company to make use of water power entirely for the operation of the electric light plant. The properties at Rutland were described in the Street Railway Journal for Nov. 24, 1906.

THE TRANSIT INQUIRY IN NEW YORK

The inquiry into the methods of management of the Interborough Metropolitan Company was continued by the Public Service Commission, with Wm. M. Ivins as special counsel, on Thursday and Friday of last week, after which an adjournment was taken until Wednesday, Aug. 14, when the inquiry into the Brooklyn Rapid Transit Company was begun. Mr. Hedley, general manager of the Interborough Company, was the witness on Thursday, while on Friday, both Mr. Hedley and Mr. Bryan, of the Interborough Company, were called upon for details of management of the subway and elevated lines with which the Commission felt itself concerned. The question of disorder on the elevated lines was again brought up on Thursday. Mr. Hedley said the company maintains a secret service corps to suppress the rowdy, and that five or six arrests a day result from the work of these men. Still, cases continue of assaults upon passengers. Mr. Hedley reiterated the statement he made last week to the effect that he knew of no way to prevent such occurrences unless the company were allowed to put special policemen on the station platforms. During the hearing the fact was brought out that the original charter of the Manhattan Railroad Company contains a provision that during certain hours passengers who are not provided with seats shall not be compelled to pay any fare. Mr. Hedley points out that it would be quite impossible for physical reasons to live up to any such provision. Of course this was plain to the Commission beforehand, and the object sought in continuing the inquiry along these lines is impossible to conjecture. Other subjects considered on Thursday were the facilities at the 155th Street station on the Ninth Avenue elevated, and the training received by employees of the subway in the handling of emergency tools.

On Friday Mr. Hedley was again called to the stand, and questioned as to the means provided for meeting the provisions of the contract for operating the subway insofar as they concerned minor details. It seems that one of these details concerned the supplying of drinking water at stations to patrons of the subway. No public fountain is maintained at each station, but the ticket booth is equipped with a cooler, and the instructions to the agents are to comply with requests of patrons for water. In this way the general inconvenience is overcome, which would result from having a public fountain generally available where it would be at the mercy of those maliciously inclined and might be easily converted into a source of considerable annoyance to a majority of passengers. Questioned regarding the strength of the elevated railroad, Mr. Hedley said it was systematically inspected, and that there was absolutely no cause for alarm as to its physical condition. The question of protection from accident afforded passengers in the subway resulted in a brief review by Mr. Hedley of the safety appliances especially provided with this end in view. In reply to a question by Mr. Ivins as to why the overhead system was not used in the subway, Mr. Hedley said it was impracticable, because of insufficient clearance. President Bryan, of the Interborough Company, in replying to questions regarding the tunnel under construction under the East River between Forty-Second Street and Long Island City, said that it would be operated as a shuttle service, with a 3-cent fare. Figures obtained from Mr. Bryan showed that there were 137,919,632 passengers carried during the year ended June 30, 1906, and 166,363,611 passengers carried during the year ended June 30, 1907.

On Wednesday the Commission turned its attention to the Brooklyn Rapid Transit Company. President E. W. Winter was the official witness, but most of the questions about financial matters were answered by Col. T. S. Williams, vice-president, by whose testimony the foundation was laid for questions relating to the garbage contract and its developments as a factor in Brooklyn Rapid Transit finance. It appeared that H. Milton Kennedy in 1902 made his arrangements with the city on the basis of 17 cents per car mile, and with the Brooklyn Heights Railway Company on the agreement that he should furnish his own cars. But by July 30, 1903, the American Railway Traffic Company had been incorporated in New Jersey with a capital of $1,000,000, Mr. Kennedy, C. I. Taylor and J. Haviland Tompkins being named as the incorporators, and to this concern Mr. Kennedy assigned his contract. That was on Sept 2. The same day 9995 shares of the Railway Traffic Company stock were assigned to the Transit Development Company, leaving five shares to qualify directors, and eventually the Brooklyn Rapid Transit paid the Transit Development Company $500,000 cash for its $500,000 capital. Mr. Ivins put in a number of exhibits showing the corporate development of the present Brooklyn Rapid Transit Company with its seventy constituents. Among these was one showing the amount of securities of each of the important subsidiaries owned by the Brooklyn Rapid Transit, as contrasted with that which is in the hands of the public. At the hearing the results of the operations of the company for the year ended June 30, 1907, became known. The company showed gross earnings of $19,381,587 and net earnings of $7,915,704. The total income was $8,471,048, and fixed charges, including interest, rentals, and guaranteed dividends $6,026,886, making the net income of $2,444,661 and the surplus $2,002,598, after $442,063 special appropriations had been deducted. The fixed charges included interest on bonds of $2,772,771, and on certificates of indebtedness of $1,305,160.

The Public Service Commission has adopted a set of rules, formulated by its counsel, covering the form of application to be made by any railroad company for an extension of its line within the jurisdiction of the Commission. The Commission has instructed its counsel to formulate sets of rules covering also the application by companies for issues of securities of any kind.

PROGRESS ON THE CHICAGO, LAKE SHORE & SOUTH BEND ROAD

Satisfactory progress is being made in the construction of the Chicago, Lake Shore & South Bend Railway, one of the most important interurban electric railway lines now building in the United States. The road will extend from Kensington, on the outskirts of Chicago, where connection will be made with the Illinois Central Railroad for operation into Chicago, to Hammond, Gary, Dunne Park, Michigan City and South Bend, a distance of about 30 miles. With the completion of this road and the link between Warsau and Peru, Indiana, by the Winona Interurban Railway Company, Chicago will have trolley connection with the network of interurban lines in Indiana and Ohio.

A mile of track in South Bend has been completed, and the track for 16 miles west, also the pole line has been completed. The company has purchased a gravel pit adjacent to its line and is now ballasting the portion of the track constructed. From the end of the present track through to Michigan City, a distance of 18 miles, the grading will be finished within the next thirty days, when track laying will be begun on this section from both the east and west end, also the erection of poles. The track is now laid two-thirds distance through Michigan City and will be completed within a few days.

From the western limits of Michigan City, 12 miles west to Dunne Park, the grading has been completed and the laying of track and erecting of poles will be begun soon in Michigan City. The grading is progressing from Dunne Park on to Gary and all contracts have been let. Two miles of track are laid in Gary and the poles erected.

The abutments for overhead crossings west of Gary over the Wabash, Pennsylvania and Elgin, Joliet & Eastern Railways are nearing completion and the bridges will be erected as soon as the construction work on the piers is completed. The bridge across the Calumet River, 610 ft. in length, has been completed, and the grading between Gary and Indiana Harbor will be completed within two weeks, when track laying and erection of poles will immediately follow.

Private right-of-way has been purchased across the city of Hammond to the State line. The grading and filling between Kensington and through to a point at the Little Calumet River has been completed and track-laying will be begun soon.

All the foundation walls for the power house and the engine, generator and boiler foundations have been completed. The stack, which is of Custodis pattern and is to be 210 ft. high, has been completed to the height of 150 ft. All apparatus to be installed in the power house has been contracted for, and the cement blocks for constructing the walls of the power house are upon the ground.

Within thirty days the company will install a force of men at South Bend and begin the overhead single catenary construction.

PROGRESS ON THE W., B. & A.—SERVICE PROMISED FOR NOV. 1

Officials of the Washington, Baltimore & Annapolis Railway Company have announced that train service on the line between Washington and Baltimore will be inaugurated Nov. 1. Construction work on this road was begun in April of last year. The grading has been practically completed and 20 miles of double track are now laid.

The road will be 42 miles long, and is being built as a high-speed line, the maximum curvature of the main line being 1 per cent, and the maximum grade 2 per cent. The construction work is of the highest class, the bridges being of concrete, and the track across them ballasted with stone. The same kind of construction is used in the overhead crossings of public and steam roads, there being no grade crossings. In some places the electric line will pass underneath the other roads.

The total cost of construction will be in the neighborhood of $6,000,000, of which about $1,250,000 will be required for the 4½ miles of terminal lines and approaches to Baltimore. Engineering work of the most costly character was necessary for the latter, there being heavy fills and stretches of masonry incline necessary to cross railroads and secure an entrance satisfactory to the company and the city.

The car equipment will be in keeping with the excellence of the road, the intention being to operate on a 15-minute schedule, and make the distance between Washington and Baltimore in 72 minutes. Both express and local trains will be provided, and a first-class freight service will be maintained. The cars will be fitted with four 125-hp motors, and geared to 75 miles an hour. The block signal system will be used.

Entrance to Washington from Chesapeake Junction will be made over the line of the Washington Railway & Electric Company, the cars running to the Treasury Department, in the center of the city. The power house will be located at Hyattsville, and the yards and repair shops at Naval Academy Junction.

A handsome depot will be erected in the business district of Baltimore. It will be two stories high, with basement. The ground floor will be used for ticket offices and waiting rooms for passengers, and the second floor for the general offices of the company. The basement will serve for freight and express purposes.

The system of lines that will ultimately be operated by the Bishop-Sherwin syndicate comprises the Washington, Baltimore & Annapolis, 42 miles; the Annapolis, Baltimore & Washington, 21 miles, which is now being operated as a steam road between Naval Academy Junction and Annapolis, and the Washington, Berwyn & Laurel, 9 miles long, and operating between Laurel and Washington. The Annapolis, Baltimore & Washington is now being electrified. The system will serve about 1,000,000 persons when completed.

AFFAIRS IN CHICAGO

In the case of the application of the Chicago Railways Company to take over the properties of the Union Traction Company, Judge Peter S. Grosscup, of the United States Circuit Court, has announced that he would turn the properties over to the Railways Company. The purpose intended was plainly announced. It was to keep the Union Traction properties together and make it possible to operate them under the ordinance which the city has granted to the Chicago Railways Company. The form the order will take has been indicated pretty clearly. It will be a lease of the Union Traction properties to the Chicago Railways Company—not a sale or even an "operating agreement." The position of the court is that it is in as absolute possession of the different properties as if it was a private and individual owner; that its obligation is to do with them what in the best judgment will best conserve them for the benefit of the legal owners and the creditors. The position the company is in is a peculiar one. It owns no right of way worth talking about, and what few franchises it has left are dying fast. It is operating by sufferance of the city to meet a public demand. The city has offered it a franchise if it would comply with certain conditions. If it does not it must go out of existence. To meet those conditions the securities of the properties must be scaled down, the Chicago Railways Company organized, and the properties turned over to it.

Briefly, the features of the changes in the traction plan follow:

The bond issue is to have 4 per cent for the first five years and 4½ per cent after that.

Holders of West and North Chicago Railways, the underlying companies, are to get more debentures and less bonds. They will get $100 in bonds. They were offered $200 previously. The division of participation certificates is to be made 16 per cent to the West division, 7 per cent to the North division, and 2 per cent to the Chicago Passenger Railway.

North Chicago stock referred to in page 12 of the original plan as $499,800 is changed to $449,820.

West division stock originally mentioned as $1,249,200 is changed to $449,680.

Collateral mortgage 3 per cent bonds series "A" are changed from $6,617,200 to $5,867,200. Total junior collateral and reserve consolidated mortgage 4 per cent bonds are changed from $17,800,000 to $16,900,000.

Four per cent sinking fund debentures are changed from $3,995,425 to $4,801,200.

The issue of participation certificates of series "A" is changed from $12,250,000 to $13,250,000.

A suit by a stockholder of the Chicago City Railway Company to defeat the carrying out of the traction-settlement ordinances has been started by the filing in the Superior Court of a petition for mandamus to compel the company's officers to show their books. The petition was filed by E. N. Zoline as attorney for C. H. Venner, of New York. Mr. Venner is owner of 200 shares of stock in the company, according to Mr. Zoline. It is admitted by Mr. Zoline that the object of inspection is to furnish material for an attack on the traction-settlement ordinance and the recent issue of bonds by the company to carry out the ordinance provisions.

On Aug. 12 Judge Grosscup signed and entered the order turning over the North and West Side lines to the Chicago Railways Company, in accordance with the reorganization plan. Notice that an appeal would be taken from the order was given by the Merchants Loan & Trust Company, trustees for first mortgage bonds.

THE CLEVELAND SITUATION

Traction matters have been quiet in Cleveland the past week. The work of taking evidence before a notary public has been continued by the Cleveland Electric, and some very good material has been secured to be used in the trial of the cases that are now pending in court. Some of the persons from whom consents were secured by the policemen and city officials for the low fare companies testified that they were coerced into giving them, while, on the other hand, some stated that they gave them voluntarily.

Attorneys for the Cleveland Electric state that they have found five defects in the ordinance passed by Council last week, giving the Forest City Railway Company a re-enacted franchise over all the routes on which it has heretofore received grants. In brief, they are as follows:

1. That the ordinance was not submitted to the committee on ordinances before its passage, as provided by the rules of the Council.

2. That at its three readings, the ordinance was read only by title, although the intent of the law is to compel its reading in full each time.

3. That the third reading and final passage came within 16 hours of the second reading, this being held to be a clear violation of the State law requiring that each reading be on a separate day. The word day in the petition will be construed to mean 24 hours and not merely a calendar day.

4. That no consents were filed by the Forest City Railway Company in connection with the new ordinance, although their possession and filing is plainly mandatory.

A little four-page publication devoted to the interests of the employees of the Shreveport Traction & Light Company, of Shreveport, La., has just been issued. It contains besides news of the men, jottings of local interest and a few puns. Under the caption, We all know, some good advice is given the public in kindly spirit.

NEW SECRETARY OF THE CANADIAN STREET RAILWAY ASSOCIATION

At the annual meeting of the association held at Windsor, Ont., June 14 and 15, Allan H. Royce declined re-election to the secretary-treasurership, and the election of a secretary-treasurer was left to the executive committee. At a meeting of the committee held in Ottawa on July 31, Acton Burrows was unanimously elected to the position. Under the constitution of the association, its office is to be at the place where the secretary-treasurer resides. Mr. Burrows' address is 33 Melinda Street, Toronto, Ont.

A PRETENTIOUS WESTERN PROJECT

For the purpose of building an electric railway between Minneapolis, Minn., and the gulf, a company has been chartered with $50,000,000 capital stock under the name of the Minneapolis, Kansas City & Gulf Railway Company, with headquarters at Minneapolis. The proposed route is via Des Moines, Kansas City, Wichita, Guthrie, Oklahoma City, Dallas, Waco, Houston and Galveston, with branch lines connecting Topeka, Omaha, St. Joseph and Lawrence, Kan. The main line, as routed, runs direct from Minneapolis and St. Paul to Des Moines, Ia., thence to Kansas City and to Wichita via Ottawa, Kan. From Wichita south it will pass through Ponca City, Guthrie and Oklahoma City to Dallas, thence south to Galveston, where connection will be made with gulf steamship lines. The stock of the company is in the hands of the Northern Securities Company of Minneapolis, which is acting as the fiscal agent for the company. C. B. Holmes, former president of the Chicago City Railway, is chairman of the board of directors.

MORE NEW HAVEN EXTENSIONS RUMORED

The presence of Charles H. Mellen, president of the New York, New Haven & Hartford Railroad Company, in Troy, N. Y., Friday, Aug. 9, lent credence to the rumor that has been current for some time to the effect that the Consolidated, the holding company of the New Haven Railroad, is about to extend its electric railway properties. The right of way has been secured to Troy from Hoosick Falls, the present terminal of the electric railway system. Mr. Mellen, with H. W. Ely, counsel for the New Haven Railroad, visited Bennington, Vt., in company with several railroad men from New Haven. The New Haven line already runs to Bennington, and it is now said to be the purpose to extend it through Manchester and Poultney to Rutland, where it may connect with the Fairhaven system. Such a line would penetrate a section of Vermont and Eastern New York that is populous and prosperous. Work on the line to this city will, it is said, begin inside of a year.

PHILADELPHIA & EASTERN REORGANIZED

The Philadelphia & Eastern Railway Company was reorganized Aug. 8. The officers elected are: David P. Ayars, of Wilkes-Barre, president; Joseph S. Ransom, of Philadelphia, secretary and treasurer; David P. Ayars, of Wilkes-Barre; A. H. Sickler, of Philadelphia; W. J. Lescure, of Harrisburg; A. E. Pendergast, of Trenton; Henry B. Rush, of Lancaster; A. C. Patterson, of Philadelphia, directors.

The road was purchased from the trustee some time ago at public sale, for $100,000, subject to $825,000 indebtedness, by a committee representing the bondholders, who, by putting up more money for this purpose, will get in on the new issue of the bonds and stocks.

The road will hereafter be in charge of an executive committee under the name of the Philadelphia & Easton Electric Railway Company, operating 32 miles of road from Doylestown to Easton, connecting with the Philadelphia Rapid Transit at the Doylestown end, and with the Northampton Traction Company and the Easton Traction Company at Easton, giving a direct line between Philadelphia and Portland, 6 miles from the Delaware Water Gap.

After the issue of new stock and bonds has raised sufficient funds the company expects to make improvements, including the straightening of the line under the right of eminent domain and improving the service for passengers and freight, the latter having provided a profitable business for the road in the past.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED JULY 30, 1907

861,269. Cross-Tie Construction; Albert Cottom, Chillicothe, Iowa. App. filed March 29, 1907. Spaced bearing blocks connected to each other transversely and longitudinally, and means for fastening the rails thereto.

861,313. Car Construction; Allen E. Ostrander, Paterson, N. J. App. filed March 21, 1907. A longitudinal car sill consisting of a pressed metal web plate, provided at its upper edge with an integral laterally projecting flange, and L-shaped members secured to the lower edge portion of the web plate, said plate being interposed between the vertical legs or flanges of said members.

861,325. Device for Cleaning Overhead Trolley Wires; John L. Snitker and Wilmer S. Carl, Cincinnati, Ohio. App. filed Aug. 29, 1906. An elastic hook for engagement with the trolley conductor is mounted on the upper end of the trolley pole in such a way as to strip the ice from the conductor in advance of the wheel.

861,384. Metallic Cushion Tie; Stewart McCahon and Alexander McCahon, St. Joseph, Mo. App. filed Dec. 15, 1906. Metallic cones to which the rails are secured by cushion springs.

861,391. Steel Underframe for Cars; Herman C. Priebe, Blue Island, Ill. App. filed Dec. 28, 1906. Details of construction.

861,429.. Safety Stop; Henry H. Brockhuis and Andrew Buettner, Cincinnati, Ohio. App. filed April 15, 1907. An emergency brake consisting of a block or shoe adapted to be lowered upon the track rail, and upon which the car wheel runs.

861,491. Railway Spike; Ole C. Abrahamson, Minneapolis, Minn. App. filed March 4, 1907. The spikes are provided with projecting shoulders slightly below the head, and a tie-plate is provided having perforations for the reception of the spike and its shoulder, said tie-plate being adapted to be moved so that portions thereof will engage the shoulders.

861,547. Metallic Railway Tie; John G. Snyder, Altoona, Pa. App. filed Oct. 24, 1906. Comprises a casing or shell open at the bottom with the edges of the sides turned inwardly and upwardly to form springs, and means for securing the rail to the tie.

861,548. Metallic Railway Tie; John G. Snyder, Altoona, Pa. App. filed Oct. 24, 1906. Means for securing rails to a metallic tie, consisting of a series of openings extending obliquely across the crown of the tie, a clamp to engage the rail movable diagonally across the crown of the tie, a finger of the clamp to register with the openings and means for securing the clamp to the tie.

861,556. Brake-Shoe; James S. Thompson, Chicago, Ill. App. filed Dec. 12, 1906. A brake-shoe having a plurality of curved surfaces on its wearing face to render it adaptable to wheels of different diameters.

861,588. Automatic Fluid Brake; Thomas Gunderson, McIntosh, Minn. App. filed Jan. 21, 1907. Provides a mechanism which will automatically supply fluid to the ordinary fluid brake cylinder whenever there is a reduction of pressure in the main pipe, due to the breaking of connection between any two cars.

861,590. Automatic Railway Switch; Horace H. Hayes, Gardiner, Maine. App. filed Feb. 21, 1907. Details of a switch adapted to be unlocked, thrown and locked again by a passing train.

861,064. Railway Brake; John B. O'Donnell, Kansas City, Mo. App. filed May 10, 1907. The object of this invention is to make the movements of the parts in applying the brakes to the wheels as slight as possible, thereby diminishing the travel of the pistons in the air cylinders and economizing the compressed air.

861,617. Third Rail Ice-Cutting and Cleaning Machine for Electric Railways; George A. Spice, Chicago, Ill. App. filed April 6, 1906. A cutter wheel provided with teeth disposed spirally thereon is rotated by sprocket and chain connection with the car axle.

861,644. Metallic Railway Tie; Robert Fagan, Loami, Ill. App. filed May 8, 1907. A tie having enlarged hollow end portions, a rail engaging tongue secured upon each end portion,

and a spring rail fastener straddling and secured to each end portion of the tie.

861,700. Street Car; Albert H. Bates, Cleveland, Ohio. App. filed Sept. 12, 1903. A longitudinal seat on one side of the car, an aisle and a series of transverse seats between the aisle and the other side of the car.

861,715. Electric Indicator for Trains; Harry G. Dyer, Gloucester, N. J. App. filed Feb. 11, 1907. A plurality of special trolleys or conductors are laid alongside the usual track rails and are adapted to establish various alarm and signal circuits within the locomotive cab.

861,717. Splicing Sleeve; Harry Frankel, New York, N. Y. App. filed March 14, 1907. The end of the trolley conductor is placed in a sleeve having a split conical end which is bound upon the conductor by a threaded bushing.

861,759. Railroad Signaling Device; Elmer G. McGath, Lancaster, Ohio. App. filed April 11, 1907. An arm is positioned in the path of the train by an electric circuit connection from the semaphore signal and is adapted to close a local alarm circuit within the locomotive cab.

861,760. Roller Side Bearing for Railway Cars; John F. O'Connor, Chicago, Ill. App. filed March 25, 1907. The upper and lower bearing surfaces are provided with a toother rack and the rollers are provided with gear teeth..

861,772. Signal Controlling Mechanism; Valentine I. Smart, Chicago, Ill. App. filed July 13, 1906. Provides means by which signals at different stations are controlled by two or more operators located at different points so that the operator at one station cannot give a safety signal except with the co-operation of the operator at the succeeding station.

861,845. Rail Brace for Railway Rails; Harry Hemphill, Sarver, Pa. App. filed May 18, 1907. Provides a combined brace for bracing the rails of a track transversely and fishplates for securing the rails together longitudinally.

861,878. Metallic Tie and Rail Fastener; Robert M. McKinney, Dravosburg, Pa. App. filed Jan. 11, 1907. Relates to means for fastening rails of hollow metallic ties.

861,878. Metallic Tie and Rail Fastener; Robert M. McKinney, Dravosburg, Pa. App. filed Feb. 1, 1907. See above patent.

861,892. Car Fender; Joseph A. Poirer, Woonsocket, R. I. App. filed April 1, 1907. Means for normally maintaining the fender in an elevated position, automatic means for maintaining the same in depressed position, and adjustable collars carried by the shaft on which the fender for regulating the normal position thereof.

861,956. Trolley Pole Attachment; Patrick F. Duross, New York, N. Y. App. filed Dec. 22, 1905. A specially constructed cup or funnel with a laterally extending spout, said cup being attached to the trolley cord so as to keep rain water from running down the cord and inconveniencing the operator.

861,958. Electric Signal; Martin A. Ewing and Joseph H. Ewing, Gallatin, Tenn. App. filed Jan. 12, 1906. A depending lever on the locomotive is engaged by a magnetically positioned train-stop arm to blow the whistle in the locomotive in case a signal is disregarded.

861,969. Railway Tie; Michael A.. Glynn, Habana, Cuba. App. filed Dec. 5, 1906. Details of construction.

862,068. Automatic Train Pipe Coupling; Jean B. Genin, St. Albans, Vt. App. filed Sept. 22, 1906. The object of this invention is to substitute metal parts for the usual rubber parts wherever ppossible.

862,068. Automatic Train Pipe Coupling; Jean B. Genin, St. Albans, Vt. App. filed Sept. 22, 1906. The object of this invention is to substitute metal parts for the usual rubber parts wherever possible.

862,068. Metallic Tie and Rail Fastener; William A. Maitland, Sharon, Pa. App. filed April 30, 1907. A tie of the I-beam construction having a rail chair slidable thereon and adapted to be bolted thereto.

862,103. Railway Tie; Thomas W. Pitts, Tampa, Fla. App. filed March 6, 1907. A reinforced concrete tie having wooden blocks set therein to which the rails are spiked.

12,677, Air Brake Apparatus; Charles E. Turner, Rochester, N. Y. App. filed June 26, 1905. The combination of an engineer's valve, a brake cylinder and its triple valve, piping connecting these parts, brake control valve mechanism independent of the engineer's valve, and piping connecting the same to the brake cylinder and to the triple valve exhaust port, said brake control valve mechanism being arranged to open the triple valve exhaust port to the atmosphere, or to close the same, and to open the brake cylinder to the atmosphere.

PERSONAL MENTION

J. W. ANDERSON has resigned as superintendent of the Worcester & Southbridge Street Railway Company. Mr. Anderson was appointed to the position from which he has just resigned April 1, being promoted from the superintendency of the Blackstone Valley Street Railway.

MR. WILLIAM E. MITCHELL, formerly with the Sao Paulo Tramway, Light & Power Company, has accepted a position as electrical engineer of the Bahia Tramway, Light & Power Company, of Bahia, Brazil, which has taken over the old Siemens & Halske electric tramway, and is completely renovating and extending this system.

MR. R. A. DYER, assistant manager of the Rochester, Syracuse & Eastern Railroad, will add to his duties those of superintendent of the Auburn & Syracuse Railroad. Mr. Dyer succeeds Mr. R. P. Stevens, of Auburn, who, as recently announced in the Street Railway Journal, assumes the presidency of the Lehigh Valley Transit Company.

MR. KEMMANN, city engineer of Berlin and engineer of the Elevated and Underground Railway Company of that city, and Mr. Paul Wittig, general manager of that company, are on a visit to this country. Their purpose is to investigate the development of subways and underground electric railways here, particularly the latest methods of construction, as their company has some important extensions under contemplation. They are planning to visit New York, Brooklyn, Boston, Philadelphia, Buffalo and Chicago.

MR. JOHN C. OSTRUP, M. Am. Soc. C. E., has been appointed to fill the chair of structural engineering at the Stevens Institute of Technology, Hoboken, N. J. Prof. Ostrup is a graduate of the Polytechnic School in Copenhagen, and later took a post graduate course at the Chicago Engineering School, and has had a large and varied experience in important work extending over seventeen years. He was for five years in charge of the office work and design of the Lake Street, the Northwestern and the Union Elevated Railroads of Chicago during their construction, and afterwards designing engineer of the Boston Elevated Railroad during its building. Upon its completion he went into private practice for four years and has since for the past two years designed many important structures and bridges for the American Bridge Company in New York.

MR. G. B. DUSINBERRE, M. E., formerly sales manager of the Cleveland office of the Westinghouse Electric & Manufacturing Company, has established himself as a consulting engineer with offices in the Electric Building, Cleveland. Mr. Dusinberre will make a specialty of plans and specifications for electric railways, lighting plants, power transmission and industrial plants, and will also act in an advisory capacity, reporting on existing or proposed electric railways and other properties and in a consulting capacity in regard to improvements to existing plants and to bettering their methods of management. Mr. Dusinberre's experience has extended to various branches of the electrical field, his work with the Westinghouse Company especially fitting him to express an authoritative opinion in regard to electric railway and light problems, which he will make a specialty.

MR. J. BECKETT RUSSELL, auditor and local secretary and treasurer of the Manila Electric Railway & Light Company, of Manila, P. I., and its allied companies, the Manila Suburban Railways Company; La Electricista; Union Truck Company, and the Compania de Tranvias de las Filipinas, is at present in New York on a visit to the head office of his company, 43 Exchange Place and Wall Street. Mr. Russell was for some time connected with the Stone & Webster syndicate on their Eastern and Far West properties but associated himself with the J. G. White Company during the construction period in Manila and has been resident there for the past three years. This electrical property is America's most distant one, and a visit to this city means a complete circuit of the globe, a fact of which Mr. Russell took advantage, coming home by way of India, Egypt and Europe. He returns in a few weeks via Canada, Japan and China.

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DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

Of this issue of the Street Railway Journal 8500 *copies are printed. Total circulation for* 1907 *to date* 279,550 *copies, an average of* 8215 *copies per week.*

The Electric Equipment of the N. Y., N. H. & H. R. R.

The article on the overhead construction of the New Haven Railroad published last week is followed in this issue by a discussion of the constructional features of the locomotive which were not available when the original plans were made public some sixteen months ago. This information and Mr. McHenry's presentation of the reasons for the adoption of electricity, are extremely interesting as evidence of the possibilities of single-phase traction for the larger railroad work of the future.

When the New York Central system was selected it was probably the wisest choice, not only because there was a firm determination to push the work rapidly to completion, but on account of physical conditions in the Park Avenue tunnel, and legal conditions on the Park Avenue viaduct. The engineers of the company, however, have always been very careful to state clearly that their decision should not be construed as opposed to a. c. operation under different conditions. Undoubtedly the situation south of Woodlawn was a serious handicap to the subsequent work of the New Haven Railroad, requiring as it did the designing of a motor able to work well on either kind of current and fitted with controlling and collecting devices for both. The result has been, as appears when the locomotive of the New Haven system is examined, an amount of complication that looks at first sight formidable and which is in fact serious enough to be a cause of some anxiety. It is most unfortunate that it should be so since the apparent success of the commutating single-phase motor will hinge for the time being, not upon the real facts, but upon the successful working of a lot of things which are no part of the system and which will probably never again appear in electrical railway equipment. On the other hand, success is doubly creditable, and the engineers in charge may well be proud of it. The officials of the New Haven Railroad, even if they incidentally took some chances of temporary discomfort, were far seeing enough to put aside the temptation of settling down into sunny standardization and made a choice that looked far enough into the future to view the probability of the general use of electricity as a motive power over great railway systems.

In this connection one of the most striking things in Mr. McHenry's paper is his recognition of the fact that freight and passenger service can be separated in motive power only as a temporary expedient, and that any complete scheme of operation must contemplate freight haulage. He lays down the postulate that electric service can be applied equally to heavy traction and to light suburban service, to freight trains and to single cars on special duty. His point of view is novel in this, that it contemplates the use both of locomotives and of motor cars, each for its appropriate work on the same system and under the same management. As a rule, engineers have taken strongly one position or the other, either denouncing the locomotive, or scoffing at the single-car system. This much can be said with certainty, that it yet remains to be proved that any multiple control scheme with trains made up of motor cars is capable of replacing locomotives for really heavy traction. Quick acceleration is certainly secured by making all wheels driving wheels, but there are some reasons for believing that the advantage is gained at a rather heavy cost in efficiency and upkeep, and there are cases in which acceleration is not important enough to warrant the price. The economies of the case are hard to get at for lack of data, but Mr. McHenry seems to have little fear on this score, and the case was certainly investigated very carefully. Most of the studies on

costs of electric traction have been briefs rather than judicial opinions, and have taken extreme positions for or against success. The one side has demanded pretty nearly that an electric locomotive should have all a steam locomotive's time honored peculiarities. They have almost insisted on its possessing a smoke stack and a steam whistle. The other has chanted the praises of the single motor car and the evolution of all transportation into an exaggerated trolley system. It is certainly refreshing to encounter a wider and fairer view.

The New Haven system has now made an excellent start and it represents an amount of painstaking preliminary experimentation that augurs well for the final results. It was a daring step to undertake an absolutely new system on so large a scale and when handicapped by circumstances, and it deserves the largest measure of success. Let it be judged by results, the results of two or three years of steady working. Small troubles it will doubtless have like every other system, but this it has which other systems have not, an efficient distribution capable of covering the whole field of its operations and of allowing for future growth.

The Motor 'Bus

It will be an interesting study to watch the work of the new gasoline vehicles to be put into service by the New York Transportation Company. The motor 'bus is an object familiar enough in England where it can be put into service under an ordinary 'bus driver's license without the costly and troublesome acquisition of a franchise demanded here. Under such favorable conditions the motor 'bus has done fairly well, and there is some encouragement for its use under our American conditions.

The more general use of the gasoline 'bus abroad is, in a measure, evidence that it is preferred to the gasoline-electric vehicles hitherto used in New York. We understand that the company here, however, intends some further trials of this kind of 'bus. There are advantages in both systems and local conditions may affect materially the most desirable selection. The electric generator and motor form a very flexible and pretty type of speed-changing gear, but one which is heavy, costly and not so extraordinarily efficient or easy to keep up as to over-weigh these objections. It appears to be best suited perhaps to trucks and such like, slow and heavy affairs, where facile control is peculiarly useful in working through crowded and congested streets, or where high-class labor is not used for operation. Again, the greater weight of the electric combination makes it more suitable for routes where the grades are not very severe. The gasoline motor 'bus has more nearly the requirements of an ordinary motor car, and the gearing of a well designed car is quite sufficient for it, as experience seems already to have shown.

The interesting feature of motor 'bus operation is its peculiar field of usefulness. No one will seriously consider the 'bus as an active competitor of the street railway, but rather as an adjunct of it, able to be of great use in its own especial sphere. We who build twenty-story cities need not be surprised at finding that we require concurrently every kind of rapid transit device to be imagined, in order to make transportation keep pace with necessity. New York is literally growing at a rate that subway-building cannot keep pace with. One has only to use surface and elevated cars to realize that these, too, are inadequate, and so we can well afford to welcome the motor 'bus as one more helper in the good work. There seems good reason to expect that it will be of service, and any help is welcome.

If experience is a safeguard the motor 'bus cannot prove an economic competitor of the vehicle that moves on tracks. The cost of fuel, care and up-keep rises to a figure that probably forbids 5-cent fares on any extended runs. The recent crash in the quotations of motor 'bus stocks in England, where the 'bus has had its widest development, proves that. But by the use of improved vehicles of the double-deck construction a 10-cent fare may very likely prove remunerative. This difference makes the 'bus a competitor, not at all of street cars, but rather, we hope, of cabs. New York, we must with sorrow admit, has at once the most inadequate, the most insufficient and the most extortionate public carriage service in the world. Foreign travelers would with justice scoff at it for its badness did they not curse it for its outrageous charges. We welcome with open arms any sort of vehicle that can help scourge it into comparative decency. This, perhaps, a well organized motor 'bus system will be able in time to do and the sooner it comes with all the modern improvements the better for the metropolis.

The motor car certainly has a legitimate field in public service. It can never compete with the street car as the vehicle of the people, but it can do many things which the latter cannot do. Not being confined to a track it can work its way through crowded streets by judicious detours and can make, upon the whole, better time than a surface car. It can reach and serve streets that cannot well be equipped with tracks, and more than all, it can relieve people to a considerable extent of the Turpinesque ministrations of the metropolitan cabby.

There is another field in which the public motor car can do, and in fact is doing, admirable work. This is in the prosaic task of furnishing quick and convenient transportation at summer resorts. As a general rule such places, especially at the seashore, are not easily reached from the railway stations, and the season is too short to justify the construction of electric roads. Hence one usually reaches through the last stage of the journey by an ancient and rickety barge drawn by a pair of X-ray equines. The situation would be funny were it less serious, but really the result is to render unavailable a very large amount of valuable territory. The time consumed in the last 2 or 3 miles is often equal to that required for a 20-mile run by train, and the resort that by the timetable was a mere hour away has slipped afield to an hour and a half. The motor 'bus exactly meets the requirements of such situations. It can make good time and give ample capacity at moderate cost, doing for the case in hand everything that an electric car could do. When the season is over and the resorts close, the motor 'bus is not an unproductive burden, but can be brought back to the city to keep up its earning capacity. The type of 'bus just brought into use seems simpler and more workable than some of its predecessors, and in so far will probably do better in the matter of cost, and certainly a practical and reliable motor 'bus has its work to do.

The Preservation of Timber

The importance of preserving timber structures of all kinds, with the exception of those designed for temporary service only, needs no defense at this time. Every purchaser of timber on a large scale realizes the increasing cost of wood if he compares present prices with the figures of earlier contracts, and every user of timber ought to be interested in the prolongation of its life to the economical limit. At the present rate of timber consumption the question of an adequate supply will become critical in a few decades at the outside, and the National Government is very properly making a scientific study of the problem. Electric railways are, of course, small consumers of timber in comparison with the great steam trunk line systems, but even in the traction field the economies of increased life in poles, ties and trestle members are well worth securing if possible.

Two valuable bulletins recently published by the United States Department of Agriculture, Circulars 103 and 104, Forest Service, throw interesting light upon the problem of pole treatments. Although the tests and treatments enumerated were made chiefly upon telephone and telegraph poles, the results are of considerable importance to electric railways and power companies in general. Experiments show that both ties and poles of seasoned wood will, in contact with ground, far outlast those of unseasoned timber. Winter-cut wood seasons more regularly than that cut at other seasons, but does not, for many months, at least, reach as low weight as spring-cut wood seasoned equally long. The shrinkage of round timbers in air seasoning was found to be very slight, and when the poles were carefully cut, checking during air seasoning was found to be light. In case the tree is split or shaken in felling, however, serious checking may result. Very rapid seasoning, except after the wood is soaked or steamed, almost always leads to checks or splits on account of the unequal strain in the fibers, which dry at different rates. Winter and spring cutting of poles appear to be preferable from the standpoints of seasoning, custom, availability of labor, and susceptibility to decay. Under the conditions of the test made it was concluded that in order to secure the lowest freight charges, and at the same time minimize insurance and storage charges, winter-cut timber should be held from four to six month before shipment; autumn cut, seven to nine months; spring cut, three to five months, and summer cut, two to four months.

The preservative treatment of railroad ties and piling has been practiced commercially for a number of years, and about fifty treating plants are now being operated in the United States. The treatment of poles has made no such progress, and in many cases where it has been attempted the work has been carelessly done. Preservatives have been declared valueless because they have failed to prolong the life of green timber, or because they were improperly applied and perhaps faulty records kept. The best method of increasing the length of service of poles is a complete question to determine, and its solution demands definite knowledge of the advantages of seasoned over unseasoned poles in taking treatment. The increase in length of service of seasoned over green poles both when treated and untreated, the effect of submersion in water, in the case of treatment, influence of the season of cutting, facility of application and effectiveness of preservatives, as well as the best methods of application: time alone will solve some of these points. Bulletin 104 throws considerable light upon the capacity of poles—green, seasoned and soaked—to absorb preservatives, the degree of penetration secured with known woods and preservatives of a given chemical composition and physical characteristics, and the comparative cost of treatment by the brush and the open tank methods.

Experiments were made with seven preservatives, all being more or less modified distillates of coal or pine tar. Both the brush and the tank treatments were tried, careful notes of the conditions of temperature, penetration, area treated, etc., being recorded. It was found that the more thoroughly the pole is seasoned the deeper and more uniform is the penetration and the greater the absorption, both with the brush and tank treatments. The seasoned poles absorbed nearly twice as much as the green poles. No difference in absorption or penetration was noted on poles which had been soaked over those which had not, and in the brush treatment the season of cutting did not seem to affect the absorption. In the tank treatments, where only one preservative was used, the spring-cut poles absorbed the most—the cuts of winter, summer and autumn following. It was found that those preservatives which solidify at a low temperature were the least easy to apply. With the brush treatment, in most cases a better penetration was secured by applying the preservative when hot. In well seasoned wood the essential is that the preservative shall be thoroughly liquid. In partially seasoned or unseasoned wood, a higher temperature is essential, though in most cases it appears inadvisable to go above 200 degrees F., especially when the preservatives contain oils having a low boiling point. The light oils are undesirable in the open tank treatment.. With the brush treatment a depth of penetration of 1/16 to ¼ in. was secured, and with the open tank, ½ in. on the average.

As to cost, it was estimated that for brush treatment, six men in two days can treat 100 poles at the butts with two coats of preservative at a cost of $22. The cost of the preservative absorbed was not included in this figure, but it can be approximately obtained by weighing the pole before and after treatment, or checked by the total loss from the buckets. For tank treatment it was estimated that six men and one team of two horses can handle and treat 50 poles per day at a cost of $22.50. To the above 45 cents per pole should be added as the cost of the preservative absorbed. By the brush method the average cost per pole was about 40 cents, or 29 cents in the case of creosote. By the tank process the cost per pole with creosote was 67 cents, of which 22 cents was the cost of oil. Assuming that the cost of a standard 30-ft. pole at the setting hole is $8, and that untreated it will last twelve years, the added life necessary to repay the cost of treatment with creosote by the brush method will be about six months, and by the open tank method, about one year. At least three years, was figured as a conservative estimate of the gain in life by the brush method, and from six to eight years as the minimum increase by the tank method seems conservative.

ELECTRIC LOCOMOTIVES OF THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD

In the adaptation of electric traction to the New York, New Haven & Hartford Railroad, a number of features were presented by the problem which practically fixed the system which should be adopted, and to a large degree decided the design of both the locomotives and the line construction. Aside from the innumerable details which had to be considered, broadly speaking, the problem called for:

A system the first cost and maintenance of which would not be prohibitive; a system which would permit of large extensions with a high degree of efficiency at a reasonable cost; and locomotive equipments which would be capable of operating over the direct current lines of the New York Central Railroad.

The alternating current system was primarily selected on account of its facilities for transmission and transformation; and single-phase was decided upon because the characteristics of the single-phase motor makes it eminently suitable for railway work; and also on account of the simplicity of the line construction.

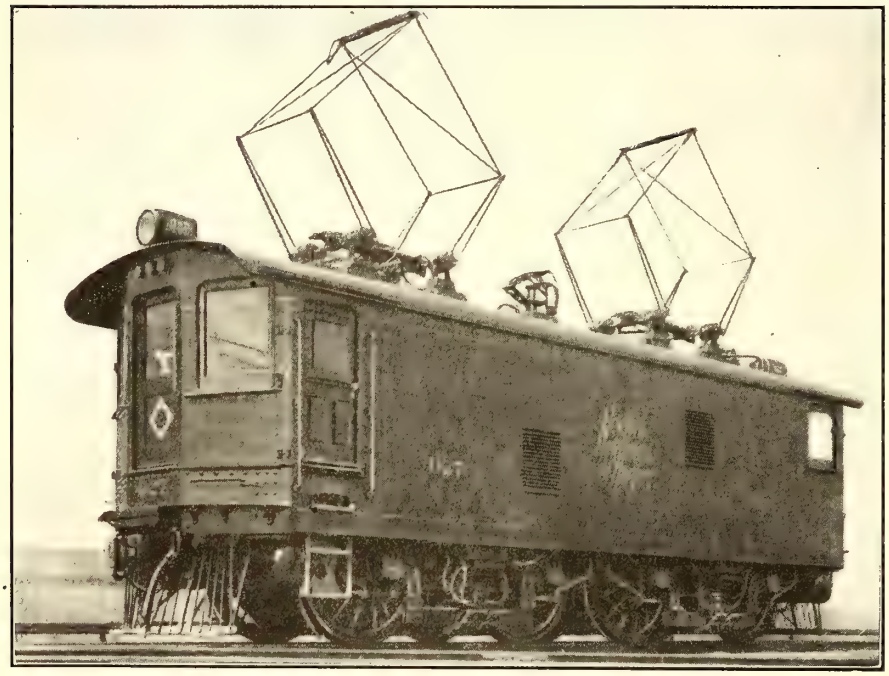


FIG. 1.—NEW HAVEN LOCOMOTIVE WITH PANTOGRAPH TROLLEY RAISED

SERVICE REQUIREMENTS

The specifications under which the locomotives were sold require that each of them shall be able to handle a 200-ton train in the most severe schedule on the present timetable, corresponding to the local express which stops about every 2.2 miles and operates on a schedule speed of over 26 m. p. h. This service requires a maximum speed of about 45 m. p. h. The locomotive is also to haul this weight of train at 65 to 70 m. p. h., and a 250-ton train at 60 m. p. h. in the long runs. Three hundred-ton, or even heavier, trains may also be handled on the long runs at reduced speeds. Heavy trains may be operated at high speeds by coupling two or more of the locomotives together and operating them on the multiple-unit system.

DESIGN

The design of the locomotives was largely dictated by certain requirements: (a) gearless motors having a flexible drive, and with all the weight carried on springs were desired and finally adopted as the most desirable form, and (b) operation on 600 volts direct current necessitated the use of four motors in order that they might be operated in the usual series-parallel relation. Having these two requirements in view, the bogie truck type was adopted after very careful consideration of the conditions imposed. It is not proposed to describe the locomotive in detail, as an extended account of it was published in the Street Railway Journal for April 14, 1906. Since that time, however, other details have become available, and are presented herewith, with comments on the method of control employed.

LOCOMOTIVE FRAME

The mechanical parts of the locomotives are built entirely of steel, measure 36 ft. 4 ins. over bumpers and weigh approximately 90 tons. The mechanical parts of the locomotive were built by the Baldwin Locomotive Company from designs developed with the co-operation of the Westinghouse Electric & Manufacturing Company, and the New York, New Haven & Hartford Railroad Company engineers.

The longitudinal members of the frame consist of deep plate girders reinforced at the top by channels, and at the bottom by heavy angles and plates. To these frames are riveted plate cross-members, one over each truck, forming the transoms for the transmission of weight to the center-pin. These transoms are further braced by gusset plates riveted to the bottom flanges of both sets of channels, which transmit the tractive power from the center-pin to the side frames. The side girders are placed outside the wheels as low down as the wheels and drawhead will permit and are braced and squared by substantial steel flooring plates which are riveted to the top flanges. The draw-bar effort is transmitted to the side frame through deep box girders joining the frames at the ends of the locomotive.

The cab is built up on a framework of Z-bars, which are riveted to the side girders. This whole design forms a very light, but extremely strong construction, able, not only to transmit large draw-bar pulls, but to resist heavy shocks in bumping.

TRUCKS

The running gear consists of two trucks, each mounted on four 62-in. driving wheels. The trucks have side frames of cast steel to which are bolted and riveted pressed-steel bolsters, which carry the center plates. A very strong construction is secured without excessive weight by the use of bolsters 30 ins. wide at the center plate and extended to nearly double that width at the ends, which are bolted to the side frames. Center bearings 18 ins. in diameter transmit the tractive effort to the frame. They are well lubricated to permit free motion on curves. The weight on the journal boxes is carried by semi-elliptic springs. Under the ends of the equalizer bars are small spiral springs to assist in restoring equilibrium. The distance between truck centers is 14 ft. 6 ins.

ELECTRIC AND MAGNETIC CIRCUITS OF THE MOTORS

As mentioned in the Street Railway Journal for April 14, 1906, the propelling motors of the locomotive are of the

conductively-compensated, single-phase, series type. For the direct purpose of improving the power factor, the magnetomotive force of the current in the armature is counterbalanced by an equal magnetomotive force in stationary coils placed in the field core structure through which the armature current is required to pass. If the so-called compensation were complete, then the armature circuit and the stationary compensating coils as a unit would form a non-inductive circuit consisting of a certain resistance and no reactance. Due, however, to the magnetic leakage between the armature and the compensating coils the combined circuits contain a small reactance component in addition to the resistance.

It is noteworthy that by far the largest portion of the reactance of the motor circuits is found in the main field coils. As a rough approximation, it may be stated that at synchronous speed the tangent of the angle of lag (of which the cosine is the power factor) is equal to the ratio of the effective field turns to armature turns, and it decreases inversely with an increase in speed. Hence, with well designed armature and compensating coils, the power factor can be rendered quite high by using a small ratio of field to armature turns and operating the machine at a speed which is high in comparison with synchronism.

The requirements for obtaining a high power factor are well met when the field is made magnetically very weak and the armature correspondingly strong, and a large number of poles is used. The improvement in the power factor by using a weak field will be appreciated when it is remembered that for a certain field current the field varies as the first power, and the field reactance as the square of the field turns. The advantage of using a large number of poles resides in the fact that the magnetomotive force for producing the field flux is distributed throughout a large number of coils of few turns (and hence having a small reactance) rather than concentrated in a few coils having a much larger total reactance.

Incidentally, when a large number of poles is used, "synchronous" speed occurs at a low rotative speed. If an increase in the number of poles did not, from mechanical considerations, entail a corresponding decrease in the rotative speed it would be possible to improve the power factor of the motor by changing the ratio of the operating speed to the synchronous speed. It is to be noted, however, that, except insofar as an increase in the number of poles may allow a smaller pole-pitch or a higher peripheral speed to be used, no improvement in power factor is obtained from a change in the ratio of the operating speed to synchronism, because no such change takes place.

The motors on the New Haven locomotive are provided with twelve poles, so that the synchronous speed for 25-cycle current corresponds to 250 r. p. m. Since the locomotive drivers are 62 ins. in diameter, 250 r. p. m. corresponds to a locomotive speed of 4060 ft. per minute, and at synchronous speed the locomotive runs at 46 m. p. h.

It is instructive to note that if the motor had fourteen poles, and the drivers were 72 ins. in diameter, synchronous speed would again correspond to 46 m. p. h. with 25-cycle current; if, however, the frequency were lowered to 15 cycles, synchronous speed would occur at 27.7 m. p. h. Moreover, if the same motor were used for 15 cycles as for 25 cycles, at synchronous speed in each case, the tangent of the angle of lag would be the same; at the same locomotive speed in each case the tangent of the lag angle would be reduced in the ratio of 25 to 15, or as 1 is to .6.

It should not be inferred from the statements made above either that there could be any very considerable improvement made in the operating characteristics of a motor by changing from 25 to 15 cycles, or that the performance at 25 cycles is unsatisfactory. The fact of the matter is that the power factor of a 25-cycle motor is so high that even a very great reduction in the tangent of the lag angle produces a relatively small effect on the operating characteristics. Assume, for example, that at a certain speed the power factor for 25 cycles is 90 per cent; the angle of lag is 26 degs. and its tangent is .483. If the same motor is operated at the same speed with 15-cycle current, the tangent of the lag angle is .289, the lag angle is 16 degs., and the cosine (the power factor) is .96. Thus, the power factor has been increased by only 6.7 per cent. In any event, whether the motor is operated at 25 cycles or 15 cycles, its power factor will be better than that of a corresponding induction motor.

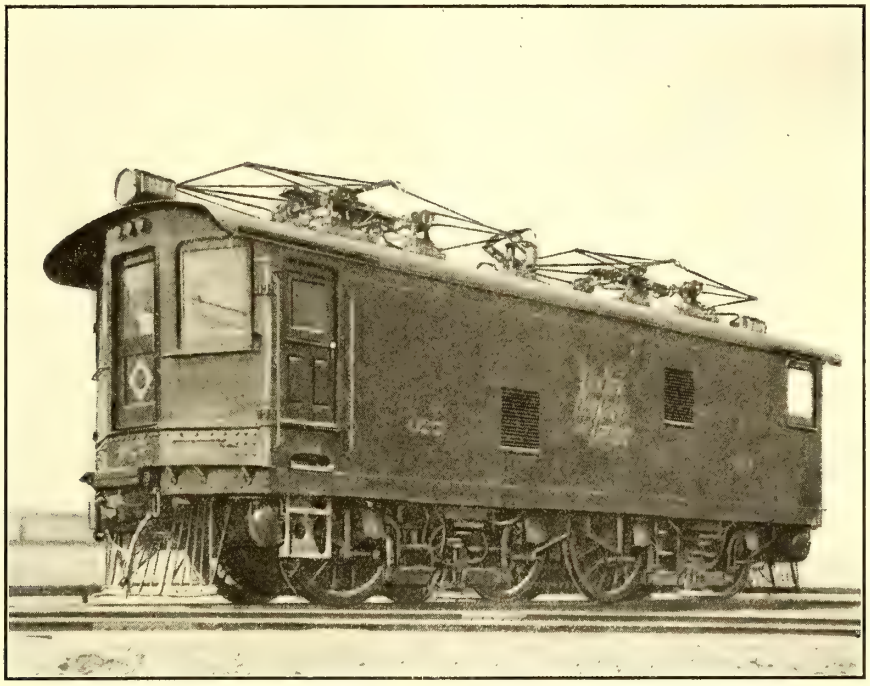


FIG. 2.—NEW HAVEN LOCOMOTIVE WITH PANTOGRAPH TROLLEY LOWERED

It will be noted from the facts discussed above that the prime object in compensating the armature magnetomotive force is to improve the power factor, and not to prevent sparking during alternating-current operation (as is frequently stated). At a certain speed and field strength the sparking depends upon the amount of current to be commutated, so that an improvement in the power factor, which results in a reduction in the current required for a certain power at a certain electromotive force does to a limited extent improve the commutation; but the minute reduction in sparking is of secondary consideration. During direct-current operation of the motors the current in the compensating coils prevents a distortion of the field by the armature magnetomotive force, and hence it removes a portion of the cause for sparking at high speeds. To the

extent that the alternating-current motor possesses the disadvantageous sparking characteristics of a direct-current motor, the compensation improves the commutation. Since the sparking in the alternating-current commutator motor is largely attributable to the transfer action of the field flux which is surrounded by the armature coil under the brush, it may be stated that in the prevention of sparking in

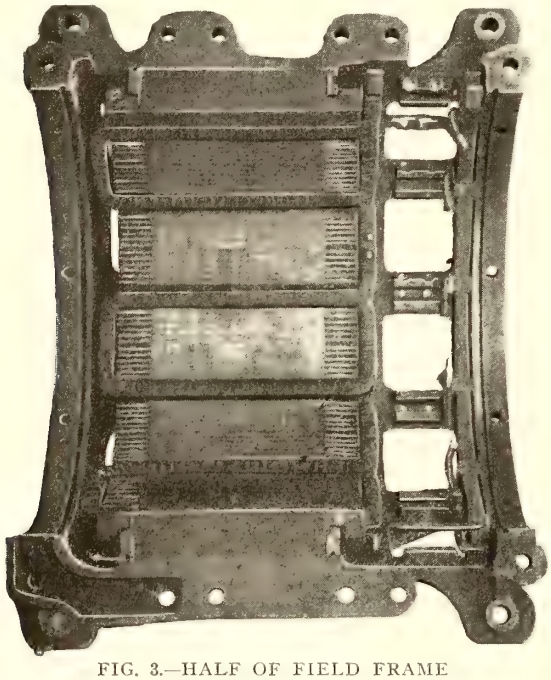


FIG. 3.—HALF OF FIELD FRAME

such motors the compensation of the armature magnetomotive force plays an unimportant part. The means for the prevention of sparking, which are confined to the armature itself, will be discussed below.

FIELD FRAME

A view of one-half of the field core structure, with both the compensating and the main field coils in place is given in Fig. 3. It will be noted that there are five complete

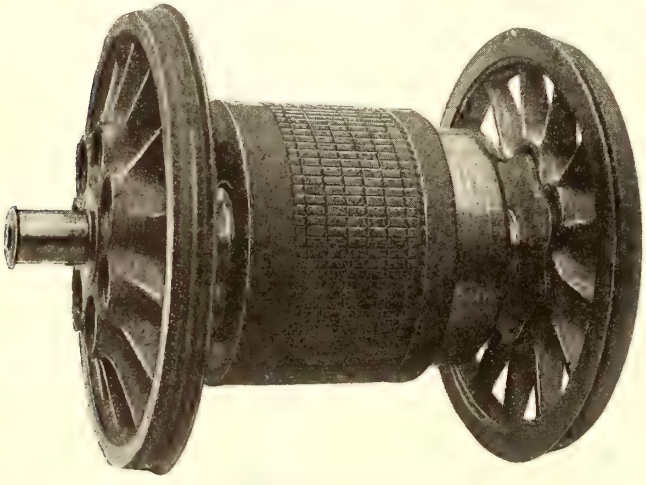


FIG. 2.—ARMATURE ON AXLE

field poles and two half-poles. Thus the field core structure is divided through the middle of two field poles, and not between certain adjacent poles as is done with the ordinary four-pole direct-current railway motor. The object in thus arranging the divisions is attributable to the existence of the compensating coils whose conductors are imbedded in the pole faces and whose end connectors pass between the adjacent poles.

It will be noted that there are twelve slots in each pole face; the conductors in six slots of each pole are joined directly to the conductors in the nearer six slots in the adjacent pole. To have divided the motor between adjacent poles would have necessitated the unsoldering and resoldering of twenty-four connectors in the compensating coil circuits. By dividing through the center of two poles, only a single connector of the compensating winding need be disturbed.

The splitting of the field core structure through the pole face has rendered desirable a slight change in the arrangement of the main field winding in order to minimize the disturbance to this winding when the two halves of the field structure are separated. Only one-half of the projecting pole cores are surrounded by main field coils, the magnetic poles at the other cores being of the "consequent" type. Thus only one connector in the main field circuit is disturbed when the field cores are separated.

Such an arrangement as the one here indicated might prove objectionable if the magnetic density over the pole area reached the saturation point of the core material. The field is magnetically very weak, however, and very little unbalancing of the poles takes place. Even when the field is

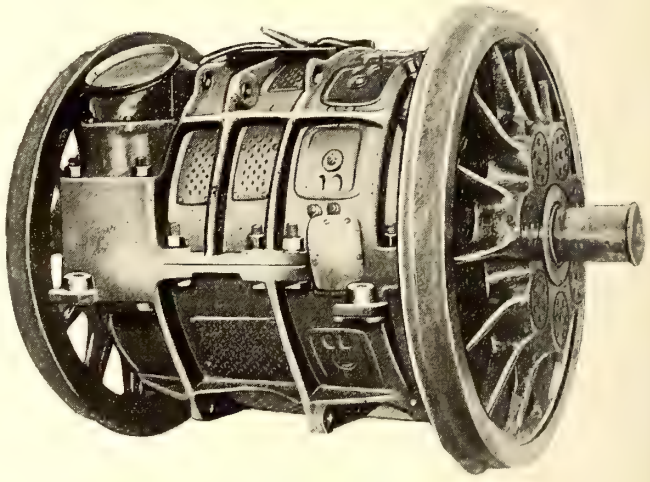


FIG. 5.—COMPLETE MOTOR, SHOWING VENTILATING APERTURES

strengthened for direct-current operation, the unbalancing is in itself of no great consequence. Moreover, the armature winding is connected at various equipotential points to "balancing rings," such as are commonly used in direct-current machinery, and no detrimental effect can be produced by a tendency to considerable unbalance in the magnetic fields.

ARMATURE

The most striking feature of the armature, which is shown in place on the locomotive axle in Fig. 4, is its appearance of compactness and stability. It differs from the ordinary direct-current armature in that the main winding is completely closed on itself, and connections to the commutator segments are made through resistance leads. The leads are tapped to the armature winding at the end of each turn, so that there is one armature turn per commutator segment. The object in inserting resistance between the armature coils and the commutator segments and in using only one turn per coil, is to overcome the sparking.

Each armature coil in its mechanical position when its commutator segments are under the brush is electromagnetically in the relation of the secondary circuit of a stationary transformer of which the primary circuit is the main

field coil; there is generated by transformer action in each secondary turn an electromotive force proportional to the product of the main field flux and the frequency. The advantages of using a single turn per armature coil, a weak magnetic field and a low frequency will be noted at once. The electromotive force generated in the single armature turn under the weak magnetic field at 25 cycles is low in value, but in an armature of the ordinary design it would produce a large value of current locally in the circuit including one armature coil, two commutator segments and the double-brush contact. The resistance of the leads, however, serves to limit the short-circuit current to an allowable safe value and to prevent detrimental sparking at the commutator.

As the preventive resistance leads are arranged so as to be non-inductive, the short-circuit current is approximately in time-phase with the transformer electromotive force in the armature coil, or in time-quadrature with the main armature current; moreover, the current in the coil undergoing commutation can be reversed most readily when the circuit of the coil is non-inductive. It will be seen, therefore, that the preventive resistance leads are well adapted to minimize the causes for sparking.

Since the main line current passes through two resistance leads in parallel, it is evident that some loss is occasioned by the presence of the leads. An excess of resistance would cause an enormous loss due to the main current, but would reduce the short-circuit current to an insignificant value; a deficiency of resistance would render the loss due to the main line current negligible, but the short-circuit current loss would be excessive.

The resistance of the leads used on the motors of the

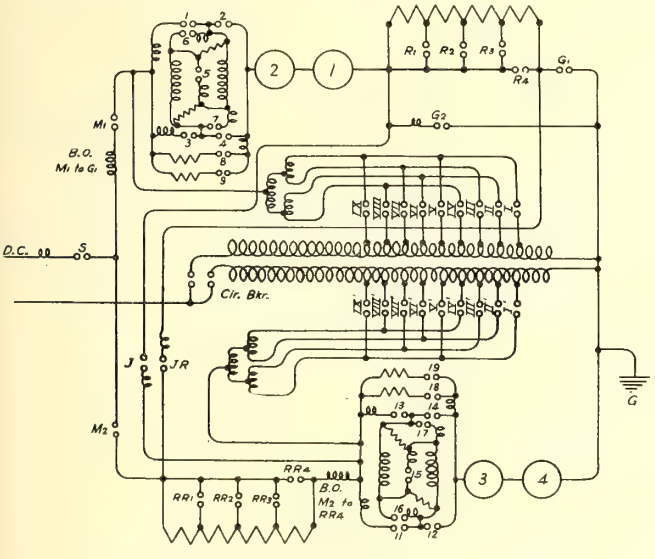


FIG. 6.—SCHEMATIC DIAGRAM OF LOCOMOTIVE CONNECTIONS

New Haven locomotives is so selected that neither the loss due to the short-circuit current nor that occasioned by the main line current is large, while the sum of the two is reduced to a satisfactory minimum.

The resistance leads are covered with insulating material similar to that used on the main armature winding and are placed in slots beneath the armature winding proper.

ARMATURE VENTILATION

Although, as stated above, the armature structure is very compact, ample provision has been made for ventilation and cooling. Experience has shown that the most effective method of cooling dynamo-electric machinery is to embed the insulated coils snugly and compactly in the mass of iron and then to keep the iron cool. Iron is an excellent thermal conductor, and it serves to extract the heat from the coils through the insulating material more readily than is possible when air is depended upon to draw the heat from the coils. Advantage is taken of the knowledge of this fact in the arrangement of the coils and core of the motor armature. Numerous ducts are provided throughout the armature core structure through which air is forced for cooling the iron to which the heat is conducted from the

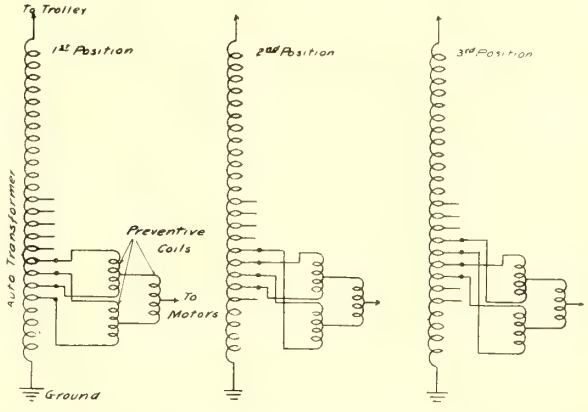


FIG. 7.—METHOD OF CHANGING CONNECTIONS OF AUTO TRANSFORMER

armature coils and the preventive leads. The air also passes through and around the commutator and serves to remove from it both the heat produced there by friction and I^2R losses and that thermally conducted to it from the resistance leads.

A view of the completed motor, indicating the means employed for cooling, is given in Fig 5. The circular opening at the top is normally connected through a canvass hose to a source of supply of air under a pressure of several ounces per square inch. In entering the motor structure the air is required to pass through a filtering screen and to the openings in the armature spider, from which place it flows outward around the commutator and through the ventilating ducts of the armature and along the air gap to the openings to the outer atmosphere, shown as perforations in sheet metal plates on the field core in Fig. 5. The forced-draft method of cooling has proved extremely effective. To guard against the remote possibility of clogging of the air ducts or some enforced stoppage, an electrical pyrometer with its thermo-elements in the motor structure and its indicating mechanism in the locomotive cab is used for showing continuously the temperature within the motor. By means of the pyrometer the motorman can ascertain when the service is too severe for the equipment or when the supply of air has been interrupted.

CONTROLLER CIRCUITS

A schematic diagram of the motor-control circuits for both direct-current and alternating-current operation is given in Fig. 6. It will be noted that the armatures of the four motors are arranged in two groups, the two armatures of each group being connected permanently in series and controlled as a unit. During direct-current acceleration the motor units are connected in series and then in parallel, while during alternating-current operation each motor unit receives power at variable voltage from a separate auto-transformer.

Although not indicated on the diagram, the various switches are so inter-locked that the circuits used exclusively for alternating current cannot become active during direct-current working, and those intended solely for use during direct-current operation are inactive when alternating current is used. It is sufficient for present purposes, therefore, to discuss the direct-current and the alternating-current circuits separately, without any relation to each other.

DIRECT-CURRENT CONTROL CIRCUITS

During direct-current operation, switches 3, 2 or 1, 4 according to direction of operation of one motor unit, and switches 12, 13 or 11, 14 according to direction of operation of the other motor unit are kept closed so that the main field circuits of each motor unit are connected at all times in series with the respective armatures. At the moment of starting, switches S, M and JR are closed, thus connecting the two complete motor units in series with each other and with eight sections of resistance. As the speed increases, switches R_1, R_2, R_3 and R_4 of one motor unit, and switches RR_1, RR_2, RR_3 and RR_4 of the other unit are closed in succession, thereby increasing the voltage impressed on each motor unit until the two units are in series across the line without resistance. Switch 8 of one unit and switch 18 of the other are then closed simultaneously, thus placing a resistance in shunt to the field windings and thereby increasing the speed by weakening the magnetic fields. The motors being of the compensated type permit of an enormous weakening of the fields at the commutators. The fields are further weakened by the simultaneous closing of switches 9 and 19, and the speed becomes accelerated to considerably more than one-half of the normal running value.

The next movement of the controller handle opens switches 8, 9, 18 and 19 (thereby increasing the strength of the fields); closes switch J; opens switch JR, and closes switches G_1 and M_2, thus subjecting each motor unit in series with four resistance sections to the full value of the supply potential. It will be noted that the transfer from full series to multiple connection is accomplished without opening any motor circuit, and without short-circuiting either motor unit. Higher speed points are obtained by closing switches R_1, R_2, R_3 and R_4, and switches RR_1, RR_2, RR_3 and RR_4 in pairs successively until the full multiple position of the controller is reached.

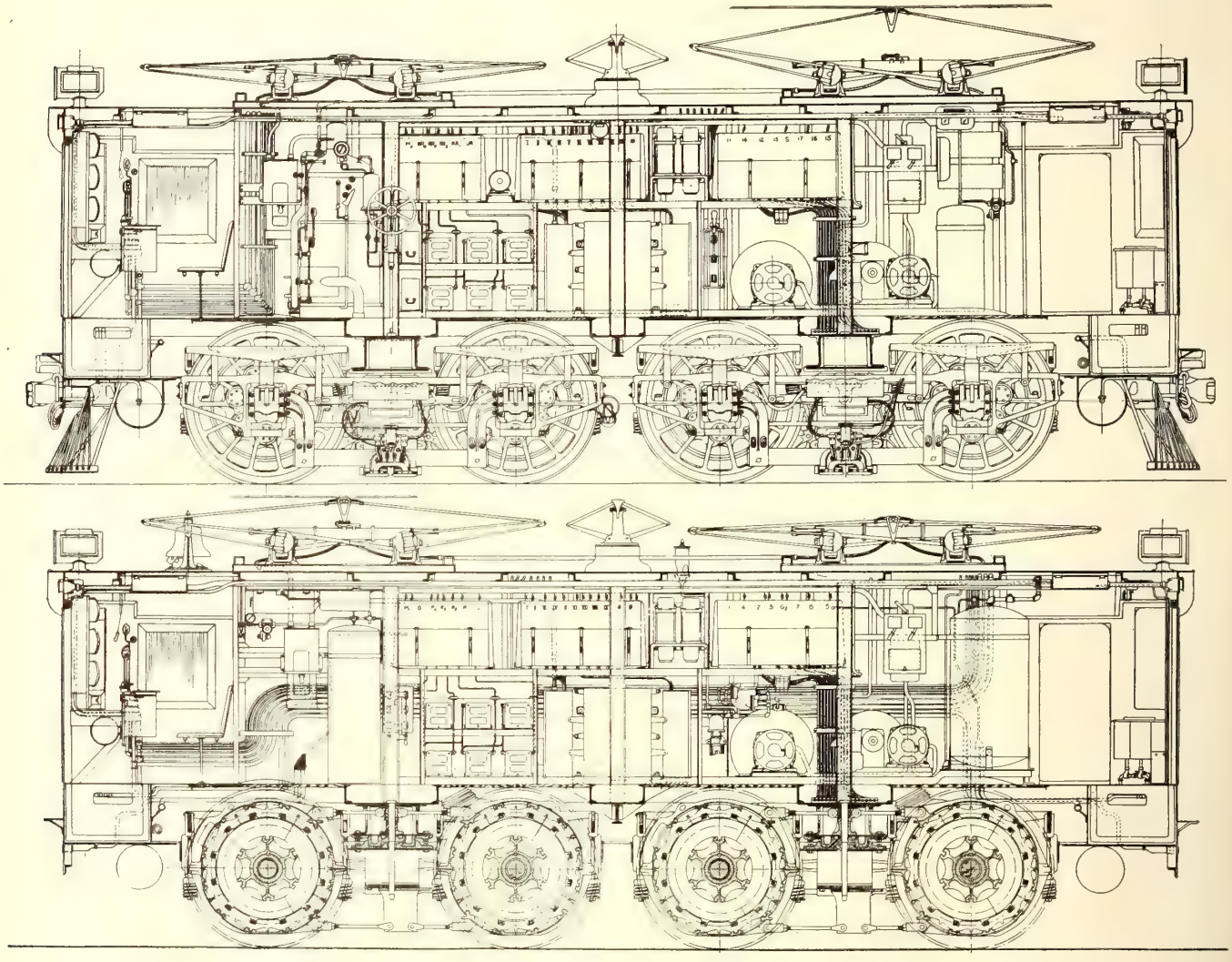


FIG. 8.—LONGITUDINAL SECTIONS OF LOCOMOTIVE THROUGH CENTER AISLE, RIGHT AND LEFT VIEWS

ALTERNATING-CURRENT CONTROL CIRCUITS

During alternating-current acceleration no resistance whatsoever is used, the speed changes being obtained by impressing variable voltages obtained from auto-transformers directly upon the terminals of the motor units. There are two electrically and mechanically distinct auto-transformers, one for each motor unit. Referring again to Fig. 6, it is to be noted that when alternating current is

used the main line high-tension circuit breaker and switches 6, 7 and 1, 4 or 3, 2 according to direction of motion of one motor unit, and switches 16, 17 and 11, 14, or 12, 13 according to direction of motion of the other motor unit are closed during operation. It will be seen, therefore, that the main field circuits of the two motors of each motor unit are placed in parallel; thus the field magnetism per armature ampere is less during alternating-current operation than during direct-current operation (neglecting the fact that at times the field circuits are shunted for extra acceleration with direct current).

There are six running points with alternating current, each corresponding to a certain voltage impressed upon the motor circuits. For changing from one voltage point to another on each auto-transformer, use is made of three small so-called "preventive coils." These preventive coils are essentially auto-transformers, having a ratio of 2 to 1. It will be observed that the motor unit receives current from the middle connection of one preventive coil whose outer terminals are joined to the middle points of the two other preventive coils; the outer terminals of the latter preventive coils are connected to certain taps on the main auto-transformer. In shifting from one running point to another, the lower tap (No. I.) would be opened and connection would be made at a tap four points higher (No. V.). The successive changes are clearly shown in Fig. 7. There are a total of six running points with alternating current; at no time is the motor circuit opened or a transformer winding short-circuited. The current fluctuations are well limited and the acceleration is extremely smooth.

ARRANGEMENT OF APPARATUS ON THE LOCOMOTIVE

The various switches indicated in Fig. 6, and all of the switches in the circuits of the propelling motors, and of the

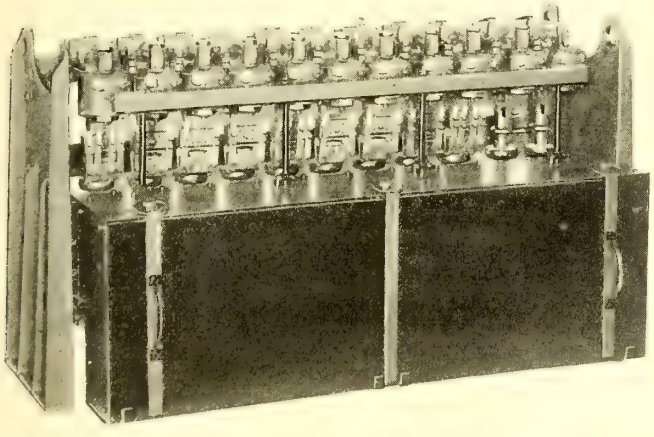


FIG. 9.—ELECTRO-PNEUMATIC SWITCH GROUP WITH INTERLOCKING CONNECTIONS

auxiliary equipment are operated by air under a pressure of 80 lbs. per sq. in., the supply of which to the switch valves is controlled by electromagnets which receive current from a 20-volt storage battery. The switches are arranged in groups that are conveniently located along each side of the center aisle of the locomotive. The groups on one side belong to one motor unit, and those on the other side to the other unit. Moreover, the main auto-transformer, the three preventive coils, and the four resistance units for each motor unit are placed on the side of the locomotive devoted to that particular unit. There are two independent sets of storage batteries, each consisting of ten cells, rated at 40-amp. hours. The batteries are charged by an induction motor-driven direct-current generator.

Fig. 8 is a reproduction of the inset published last week, except that the key numbers have been omitted for the sake of making clearer the general apparatus in the interior of the locomotive. It shows two longitudinal sections through the center aisle with the apparatus on each side. This view indicates that, with the exception of such devices as are not in duplicate, the equipment on each locomotive is so placed that an interior view is the same from one end or side of the locomotive as from the other. Thus the weight is uniformly distributed over the drivers.

UNIT SWITCH GROUPS

A unit-switch group is shown in Fig. 9. Each unit switch, of which there are eleven in the group illustrated, is of the electropneumatic type, with which our readers are

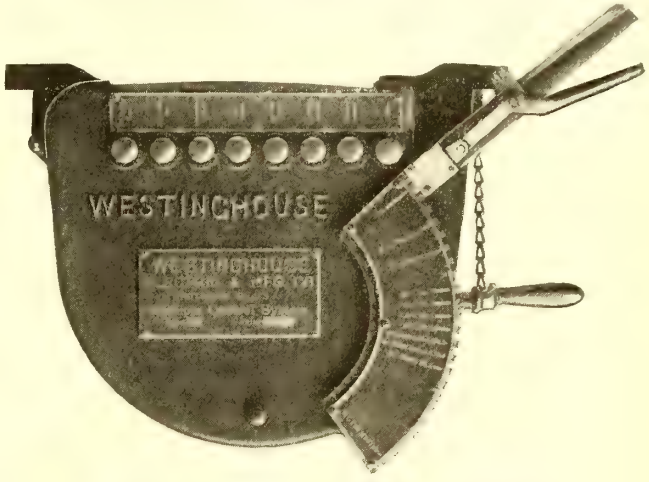


FIG. 10.—TOP VIEW OF MASTER CONTROLLER

familiar. An interesting feature is found in the means employed for "interlocking." The switches are interlocked electrically in such a manner that when one switch is closed the circuits to the electromagnets of the other switches which should not be operated are either held open or kept closed, as the case may require, by means of contacts controlled by the piston of the switch valve. These contacts are shown in Fig. 9. All of the motor circuits and switch wires are run in metal conduit along the lower portion of the locomotive, while all of the low-potential battery control circuits are arranged in metal conduit along the roof of the locomotive.

As intimated above, only the wires of the battery and electromagnet circuits pass into the controllers. These same wires are run overhead from each end of the locomotive, where they terminate in three contact plugs, taps being taken to each controller and to each unit switch along the route as desired. Thus the locomotive may be operated from either end, and two or more locomotives may be electrically interconnected through "jumpers" and controlled from a single point.

Fig. 10 gives a top view of a master controller, of which there are two on each locomotive. The controller is of the drum type, the drum shaft being revolvable by means of a handle closely resembling the throttle lever of a steam locomotive. The reverse lever, which is detachable, is mechanically interlocked with the operating lever of the controller, so that all control circuits must be dead before the reverse lever is thrown from one position to another, and the main lever cannot be moved when the reverse lever is in the neutral position. The row of knobs seen along the rear of the top of the controller are push buttons for performing certain duties not associated with the main controller lever or reverse handle, such as pulling the alternating-current trol-

leys down, pushing the direct-current trolley up, releasing the latches which hold the alternating-current trolley and the third-rail shoes down, pushing the third-rail shoes down, resetting the main line circuit breakers operating the front and rear track sanders and ringing the bell. All of the above mentioned duties are actually performed by com-

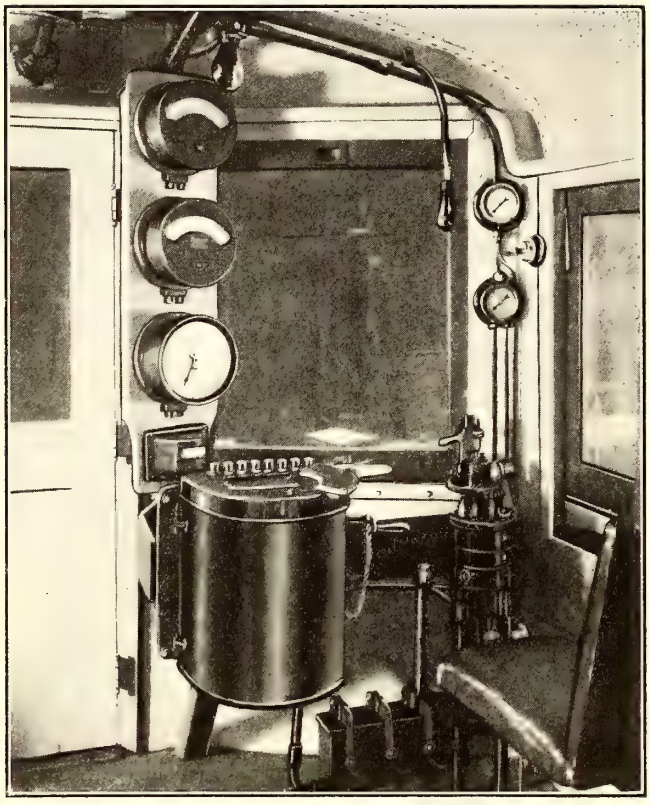


FIG. 11.—INTERIOR OF MOTORMAN'S CAB

pressed air, the eight push buttons serving merely to complete the circuit from the storage battery to the proper air-valve magnets.

A front view of the master controller in place in the motorman's corner of the locomotive is given in Fig. 11. For the convenience of the motorman, the electromagnets for operating the bell and the front and rear track sanders can be controlled by three pedals in addition to three push buttons. The motorman has an unobstructed view of air-pressure gages, a speed indicator, a direct-current ammeter, an alternating-current ammeter and an electrical pyrometer. The pyrometer, which indicates the temperature of the propelling motors, has been described. The speed indicator is an instrument which registers the voltage produced by a magneto-generator driven by one of the locomotive wheels; it is calibrated to show the locomotive speed in miles per hour. For the purpose of preventing the condensation of moisture on the under side of the steel roof of the locomotive the surface is covered with ground cork, which is then given a coat of white paint.

CURRENT COLLECTORS

Fig. 1 is an exterior view of a locomotive with the alternating-current pantograph trolleys in contact with the wire and the third-rail shoes drawn up, while Fig. 2 shows the same locomotive with the trolleys hooked down, and the third-rail shoes in the operative position. The small trolley over the center of the locomotive is connected to the circuits of the third-rail shoes and is intended for use only in case the locomotive should come to rest at some point where the third rail had been omitted and an overhead conductor had been substituted therefor. The contact bows of the large trolley, which are made of galvanized steel, are 4 ft. in length. Each bow is given an upward curvature at the center and is provided throughout its whole length with a single trough for containing the lubricating material which consists of a mixture of graphite and grease.

The design of the third-rail shoe mechanism represents a solution of a number of difficult problems. The shoes must be held by spring pressure downward against an overrunning rail, or by spring pressure upward against an under-running rail. They must be lifted so as to clear any ordinary obstruction along the track when a third rail is not used. The shoes are hinged from a framework, which, in turn, is hinged from the base plate of the device. The shoe framework may be thrown outward in a horizontal plane, or drawn upward to an angle of about 45 degs. from the horizontal by means of a toggle-joint mechanism, which is operated electropneumatically. When the framework is in the horizontal position, each shoe is held in place by means of a spring, which resists motion in either the upward or the downward direction. The valve-control circuits of the magnets for the shoe mechanism are electrically "interlocked" with those of the alternating-current trolleys, so that when the trolleys are up, the shoes are up also, and when the shoes are let down, the trolleys come down also; the trolleys can, however, be pulled down while the shoes are up. It is noteworthy in this connection that the "interlocking" is not depended upon for safety to the motor equipment and control circuits. As a matter of fact, it is a physical impossibility for direct current to reach the motors from the third rail while alternating current exists in the auto-transformers, because the "throw-over switch" either connects the motor circuit directly to the third rail and disconnects them from the high-tension circuits, or it

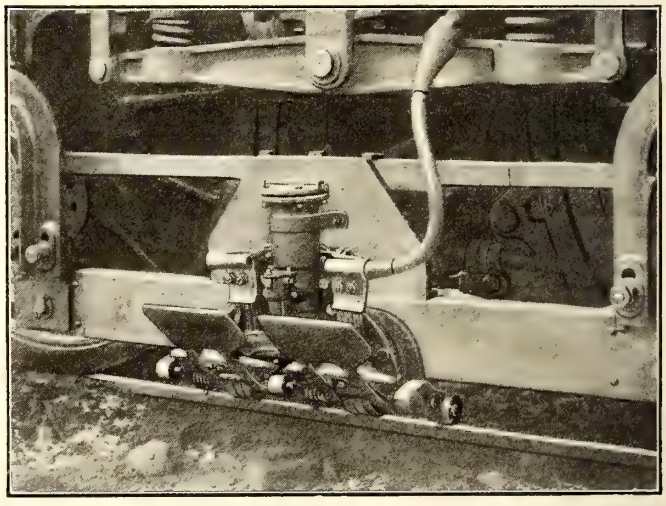


FIG. 12.—THIRD-RAIL SHOES WITH PNEUMATIC CONTROLLING CYLINDER

joins the motor circuits to the auto-transformers and thoroughly isolates them from the third-rail shoes.

PERFORMANCE OF LOCOMOTIVES

Although the locomotives have only recently been placed in actual continuous service on the New Haven Railroad, they have been subjected to a long series of tests duplicating actual service conditions. The track upon which the tests were made is equipped both with a third rail for the supply of direct current at 600 volts, and with an overhead catenary

trolley wire for alternating current at 11,000 volts. The track is 2.2 miles in length, and contains several curves and slight grades. During a recent series of tests a locomotive was required to make a scheduled speed of 26 m. p. h. with 45-second stops at each end, the maximum speed reaching

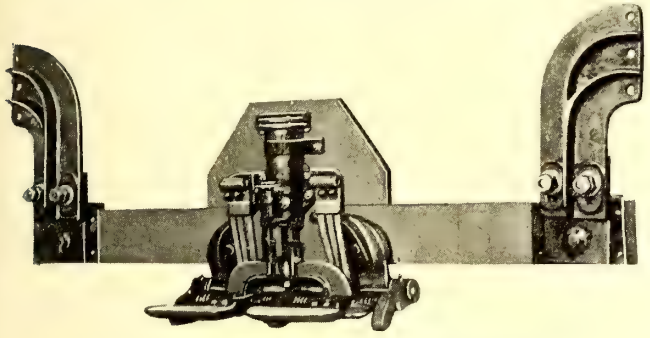


FIG. 13.—THIRD-RAIL SHOES LOWERED

45 m. p. h.; the total weight of train and locomotive being 294 tons. Watt-hour meter placed in the supply leads read at 3-hour intervals showed that during direct-current operation the consumption was 44 watt-hours per ton-mile, and that the consumption for alternating current working was 42.5 watt-hours per ton-mile. The values given represent the total energy received by the locomotive, including all losses in the control apparatus. Although the running efficiency was undoubtedly somewhat less for alternating than for direct current, the rheostatic losses during acceleration

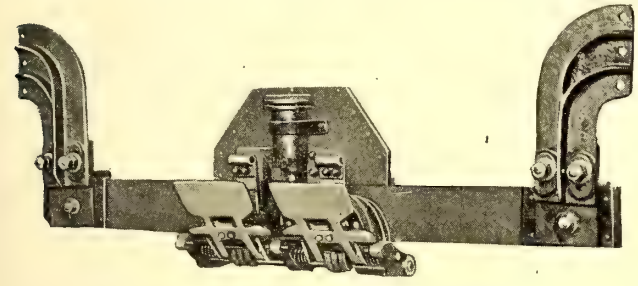


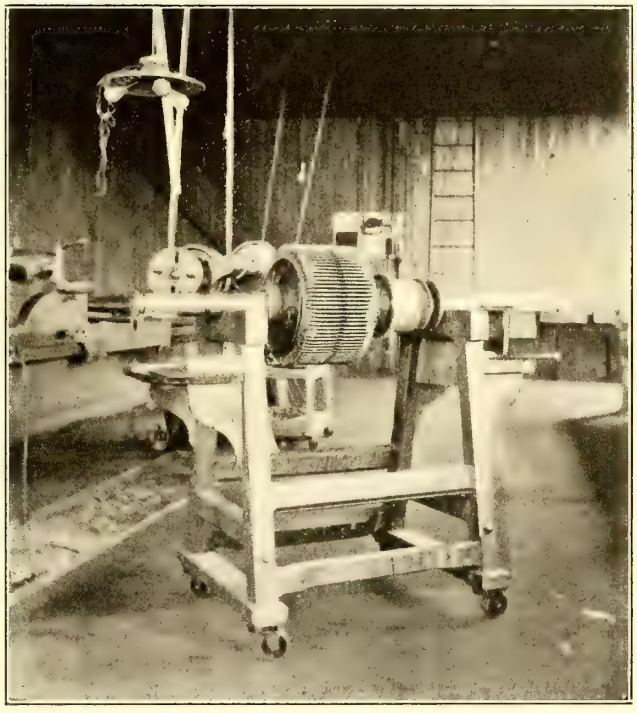
FIG. 14.—THIRD-RAIL SHOES RAISED

with direct current were much greater than the transformer losses during alternating-current acceleration, and hence the locomotive was operated more efficiently with alternating than with direct current. It is evident, however, that for longer hauls with less frequent stops, the advantage with respect to the efficiency of the locomotive as a unit would be with the direct-current working.

The Montreal Street Railway Company recently furnished seventy cars to transport some 50,000 children of Montreal free. Up to date there have been 182 cars given, and about 15,000 children have taken part in the outing. The program arranged for one week follows: Monday, 9 a. m.—Fairmount Presbyterian Sunday school, Papineau Avenue and Masson Street. Monday, 9 a. m.—St. Cunegonde Asylum, St. James and Atwater Avenue. Monday, 9 a. m.—Welcome Hall Mission, corner of Mountain and St. Antoine Streets. Tuesday, 9:50 a. m.—Berri Street Protestant school, St. Zotique and St. Denis Streets. Tuesday, 10 a. m.—Boulevard Protestant school, Beinville and St. Denis Streets. Wednesday, 9 a. m.—St. Elizabeth Church, corner of St. James Street and St. Elizabeth du Portugal Avenue. Thursday, 9 a. m.—All Saints Church, Marie Anne and St. Denis Streets.

ARMATURE CRADLE USED AT THE ST. JOHN STREET SHOPS OF THE PORTLAND RAILROAD COMPANY

A convenient armature cradle, illustrated herewith, is in use at the St. John Street shops of the Portland (Maine) Railroad Company. The cradle is used chiefly in the waiting room and serves to hold the work in place as well as to enable it to be moved easily about the room. It consists of an oak frame supported on four ball-bearing rollers, with recesses at the top of each pair of posts for the shaft of the armature and two shelves for holding tools and supplies. The center of the armature shaft is brought 36 ins. above the floor when the device is in use. An angle-iron strap bolted to the inside of the left-hand pair of posts enables the cradle to be used for GE-800, 1000, 67 and 57 armatures, and Westinghouse 68's. Different sizes of straps are used with the different armatures.



ARMATURE CRADLE USED IN PORTLAND, MAINE

The frame is 31¾ ins. long, parallel to the shaft and between posts at the top, 18 ins. wide at the top, and 26½ ins. wide at the bottom. Each shelf is 9 ins. x 16 ins. in dimensions, and is braced by a pair of brackets. Fiber and mica are kept on one shelf, and hammer, knife and wedges on the other. The principal members of the frame are 2½ ins. thick. The side posts are stiffened by ⅜ in. log bolts about 8 ins. long, and the upper longitudinal pieces are supplemented lengthwise by a ⅜ in. bolt about 27 ins. long. The lower longitudinal piece is offset 2 ins. to enable the workman to stand closer to the armature, and it would be an advantage if the top longitudinal pieces on each side were offset in the same way.

With this device the armature can be moved about the floor without the slightest difficulty, and the cradle can be taken downstairs to the machine shop on the elevator if desired. Armatures are ordinarily placed on the cradle, however, by small hoists, and the work is then moved to the corner of the winding room where the desired conditions of light and convenience obtain.

IMPROVED INTERURBAN TRAIN TESTING APPARATUS

BY SYDNEY W. ASHE

In the article published in the Street Railway Journal on Sept. 8, 1906, the writer described a train testing set which had been built under his directions. This apparatus was simple in construction and could be mounted in about an hour upon a car, whether trolley or high-speed inter-

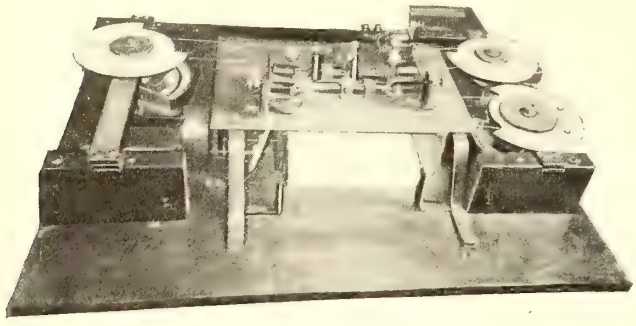


FIG. 1.—IMPROVED RECORDER

urban, and would indicate values of instantaneous speed, line current, line voltage, time in half seconds and wheel revolutions. In a later article under the title "How to Analyze Train Tests," published in the Street Railway Journal of Dec. 1, 1907, the writer described the method of analyzing the results of a series of tests with this instrument. In working up the results of these tests the writer realized that there were several ways in which this train testing set could be improved, so as to yield greater accuracy and simplify the method of making up results. Some idea of the great improvement in this apparatus may be gained when it is realized that results which were previously obtained in a period of one week were recently obtained in a period of one hour. The changes made in this instrument were brought about through the efforts of G. W. Westcott and R. H. Mitchel, of the Brooklyn Polytechnic, whose thesis covered this work.

IMPROVEMENTS IN APPARATUS

The first change in the apparatus consisted in substituting for the recording pencils stylographic pens (Fig. 1), and using for the record sheet transparent paper. The object of doing this was to facilitate the making of blue prints of entire record sheets, so that when tests were made copies of complete record sheets could be included when submitting a report. Several types of paper were tried and it was found in many cases that the grain of the paper would blue print also; finally a clear grain white transparent paper was secured which was very satisfactory. The paper had to possess sufficient toughness to prevent the hues from penetrating as the record sheet passed through the machine. Having solved the paper problem, the question of obtaining a speed time curve whose ordinate would have a maximum range of 2½ ins. was next considered. In connection with a magneto speed tachometer supplied by the Weston Instrument Company was a low-range voltmeter whose maximum scale reading was 0.3 volt. Placing in series with this instrument 4300 ohms gave a range of 1 in. of paper for a speed of 11.895 m. p. h. when the magneto was belted directly to a car axle of 4¾ in., the diameter of the car wheel being 33 ins. The sector controlling the relative movement of the instrument pointer and the pen carrier had to be enlarged to give this range. With this adjustment a very satisfactory speed time curve was produced, as is illustrated in Fig. 2.

To determine the energy consumption for an individual run with the previous apparatus, it was necessary to multiply the values of the ordinates of current and voltage, obtain values of watts, plot a curve of watt-hours, and then integrate this curve with a planimeter to obtain the watt-hour consumption. This involved considerable labor, to simplify which the following method was tried with success: A contact device in the form of a two-part commutator was mounted upon the spindle of a recording wattmeter, Fig. 3. The segments or bars of the commutator were grounded to the spindle of the meter, which then had the same potential as the case of the instrument. Several forms of brushes were tried for contact against the commutator, but their friction proved too great, affecting too much the accuracy of the meter. Finally a brush was taken from an old Thomson recording wattmeter, mounted and tried. It proved very satisfactory, changing the constant of the meter from 40.00 to 46.8. An additional relay was then mounted on the recording instrument, as shown at the left in Fig. 1. A small storage battery was placed in series with the relay, the case of the wattmeter and the

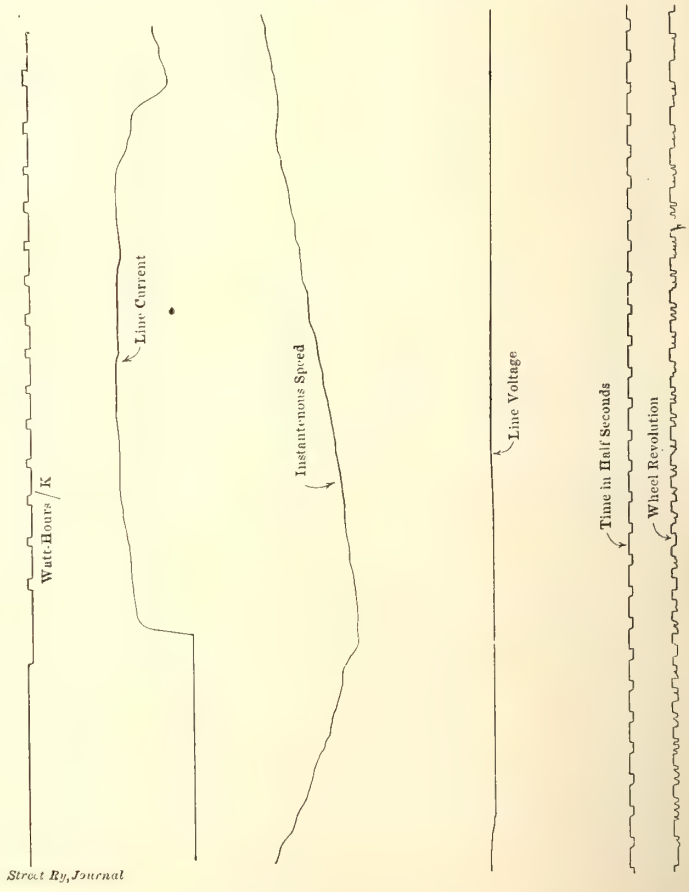


FIG. 2.—PART OF RECORD SHEET

brush playing on the commutator of the meter. With each revolution of the wattmeter armature the circuit was closed twice through the relay, which, becoming energized, moved the recording pen, producing a serrated line, as shown in the record sheet, Fig. 2. The details of the meter connections are evident from Fig. 4, where the device is shown assembled.

Considering Fig. 4, it will be noticed that the small commutator is mounted over the disc of the meter in the bottom of the case. From the curve sheet, Fig. 2, it is obvious

that the markings of energy consumption are opposite in formation from those of the wheel revolutions, being many at the start, then becoming fewer. It is recommended that,

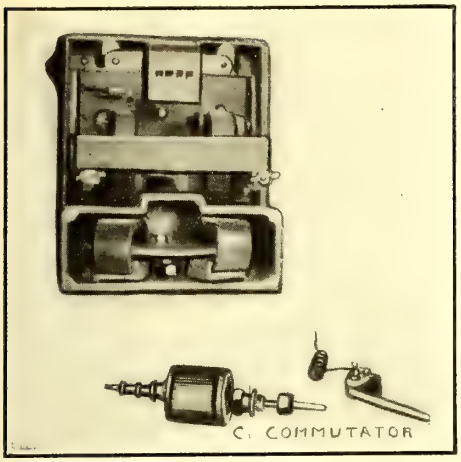


FIG. 3.—SHOWING COMMUTATOR ON CONTACT DEVICE



FIG. 6.—TYPE OF FOUR-MOTOR CAR TESTED

if this method should be tried by any of the readers, a high torque meter should be used, the Thomson recording meter being preferable, and that a four-part commutator instead of a two-part commutator be used; also that as low a range meter as will meet the conditions be employed. A 100-amp. meter is amply sufficient for trolley operation where the horse-power capacity of the motors is 140 per car. Furthermore, it is desirable that no iron should be present in the meter, as the constant changes too widely. Fortunately, with the tests made by the writer upon trolley cars, the variations in current, except where the rates of accelera-

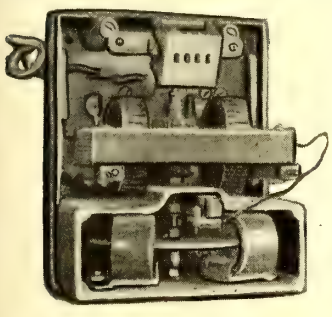


FIG. 4.—METER ASSEMBLED

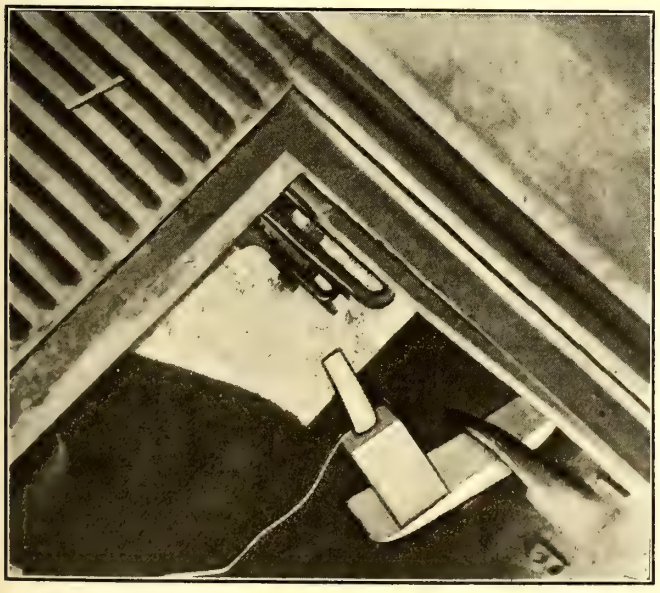


FIG. 5.—CONTACT MAKER PRESSING AGAINST MOTOR AXLE

tion were high, varied between 110 and 120 amps., through which range the meter used changed its constant inappreciably.

In taking readings of the total energy consumption, it was found desirable to use a mercury type of meter with floating disc. This type of meter is very satisfactory for railway work, as there are no jewels to puncture; but unfortunately it is not a high-torque meter, and cannot be used in connection with a contact device.

In the tests made, the Thomson recording wattmeter was mounted upon a spring-supported board to lessen the vibration. A modified form of contact maker was also used in these tests. It consisted of placing a sheet of fiber 1/16 in. in thickness and 4 ins. in length one-half way round the motor axle, and fastening it there with copper wire. A flat spring brush, as shown in Fig. 5, was then allowed to press against the axle, making contact for each revolution. The brush was mounted upon a piece of wood which could be quickly fitted into a ring on the motor frame, as shown in the figure. Leads were brought up from the contact brush and connected in series with a battery, the wheel revolutions relay and the grounded car body.

OBJECT OF TESTS

The object of the tests, performed through the courtesy of J. F. Calderwood, of the Brooklyn Rapid Transit Company, was to obtain a series of values of energy consumption for trolley cars, as operated under various conditions of initial acceleration, various schedules and various rates of braking. To obtain values which were comparative, the

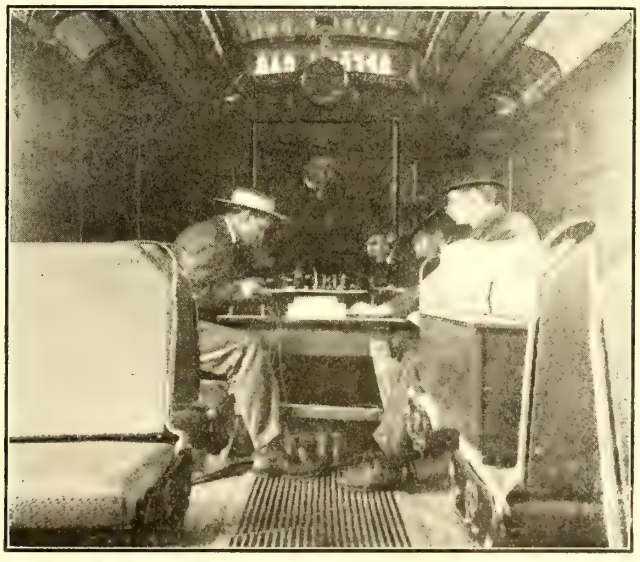


FIG. 7.—RECORDER MOUNTED DURING TEST

same motorman and the same conductor was used in every case. The rate of notching up of the controller and the distances to be run were controlled by the same man. Cars were selected of the latest type of four-motor equipment, as shown in Fig. 6. The testing apparatus was mounted in the front of the car, as shown in Fig. 7, and the records of current, voltage, wheel revolutions, revolutions of watt-meter disc, time and instantaneous speed were obtained as



FIG. 8.—THE LAST TEST; DR. ATKINSON, PRESIDENT OF POLYTECHNIC INSTITUTE, IN THE FOREGROUND

shown in the record sheet, Fig. 2. The Weston magneto tachometer used for speed values proved very convenient, particularly as it could be mounted in a very small space. The idea of employing it for this purpose was evolved by the writer last year. It proved equally successful this year. Fig. 8 is an interior view of one of the cars tested, Dr. Atkinson, of the Polytechnic, being seen in the foreground.

BOMBAY TRAMWAY REPORT

The report of the Bombay Electric Supply & Tramways Company for the year ended Dec. 31, states that the capital expenditure amounted to £1,229,349, and includes the payment of the balance of the purchase price of all the property, works, and other assets acquired under the agreement of July 3, 1905. The gross receipts amounted to £102,192; after deducting expenses chargeable to revenue, including repairs and maintenance, there remains £41,900. Interest on loans and debenture interest absorbs £28,056; the balance of £13,843 added to the amount brought forward, leaves a total available of £17,006. The dividend on the 6 per cent preference shares requires £15,642, and £1363 is carried forward.

The reinforced concrete power house which the Stone & Webster Engineering Corporation, of Boston, has been building at Georgetown for the Seattle Electric Company is completed; but, as is frequently the case, additional equipment was ordered before the completion of the building and foundations are being prepared for an 8000-kw turbine. A Weber reinforced concrete stack has also been contracted for. The car houses at North Seattle and the Georgetown shops are now practically completed. Foundations for two reinforced concrete sub-stations are now in, and it is expected they will be completed by Nov. 1.

EFFECTIVE PARK ADVERTISING IN THE TWIN CITIES

Previous articles in the Street Railway Journal have described the beautiful lake district which the Twin City Rapid Transit Company has made accessible at low fares to the people of St. Paul and Minneapolis. To foster the growth of this traffic the company created the position of general passenger agent with the appointment of A. W. Warnock. The latter immediately began a strong advertising campaign, and through posters, color folders, picture post cards, view stamps and other methods has kept the many-sided attractions of the lake district well to the fore. More recently a leaf has been taken from the book of those



SPECIMEN POSES OF AND VERSES ABOUT HIGH JINKS, THE TWIN CITY PLEASURE RIDER

advertisers who praise their wares through the medium of a fictitious personage about whom all sorts of appropriate jingles are written. The Twin City Rapid Transit Company in adapting this idea to its own wants has created a genial fun-seeking character named Hi Jinks, the Picnic Person. Mr. Jinks' specialty is to appear on car posters in a different suit of sporting clothing every week with suggestions as to where to go for a good time via Twin City car and boat lines. His picture has been printed in colors on window cards 24¼ ins. x 13¾ ins. and also in black and white in the newspapers. The accompanying illustration, including some of the verses, will give some idea of this jolly tourist, but unfortunately the colors of his variegated clothing must be omitted.

Hi Jinks appears to have proved a real hit with the company's patrons, for all classes have been sending verses about him and suggesting other pleasure trips. So he may yet become a Father Knickerbocker or Sunny Jim in pleasure traffic advertising.

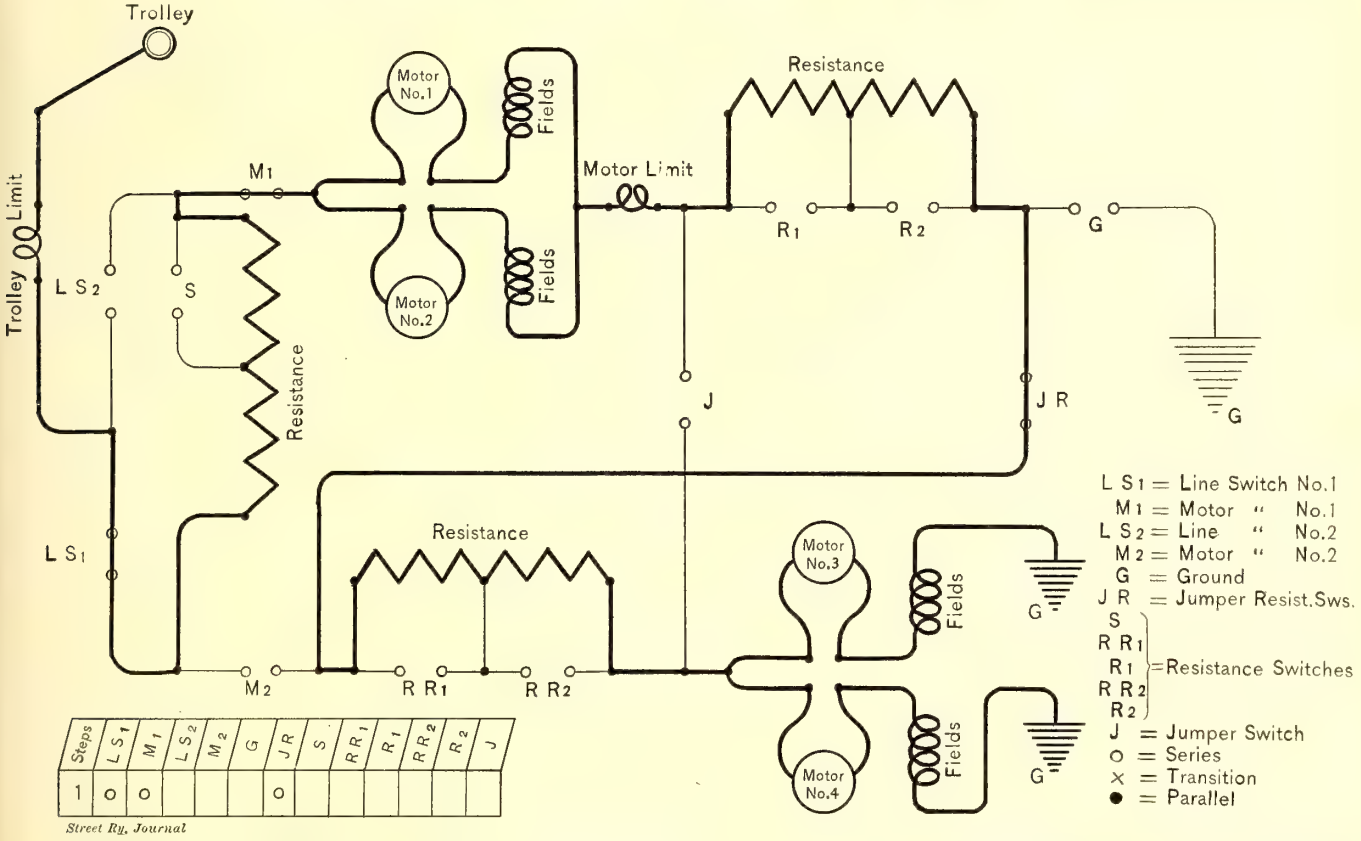
INSTRUCTION OF MOTORMEN AND SHOPMEN IN BALTIMORE

When one considers that the usual applicant for the position of motorman is innocent of the slightest technical knowledge, attempts to instruct him along the line of correcting electric troubles will fail unless the facts are presented in the simplest possible manner. The shop employee also, though acquainted in a practical way with car apparatus, will appreciate anything that makes him understand its workings with less effort. Recognizing these truths, the management of the United Railways & Electric Company, of Baltimore, when it decided to equip a large number of surface cars with Westinghouse unit switch group control, determined that all employees who were to come in contact with the more complicated equipment should be thoroughly schooled as to its leading features. The matter was taken in hand and a portion of the Carroll Park shops was set aside for a lecture room. Then a platform was erected upon which were placed a master controller, line switches, switch group, resistance, etc., together with a number of lamps for charging the batteries. Four old G. E. 800 motors were also secured to complete the equipment. H. H. Adams, superintendent of shops, then prepared a sheet showing the usual multiple connections and a sectional drawing illustrating the electro-pneumatic operation of the contactors. Both of these drawings were made on a large scale so the attendant at the lectures could readily follow the instructor.



SECTION SET ASIDE IN THE CARROLL PARK SHOPS FOR MOTOR UNIT AND AIR-BRAKE INSTRUCTION

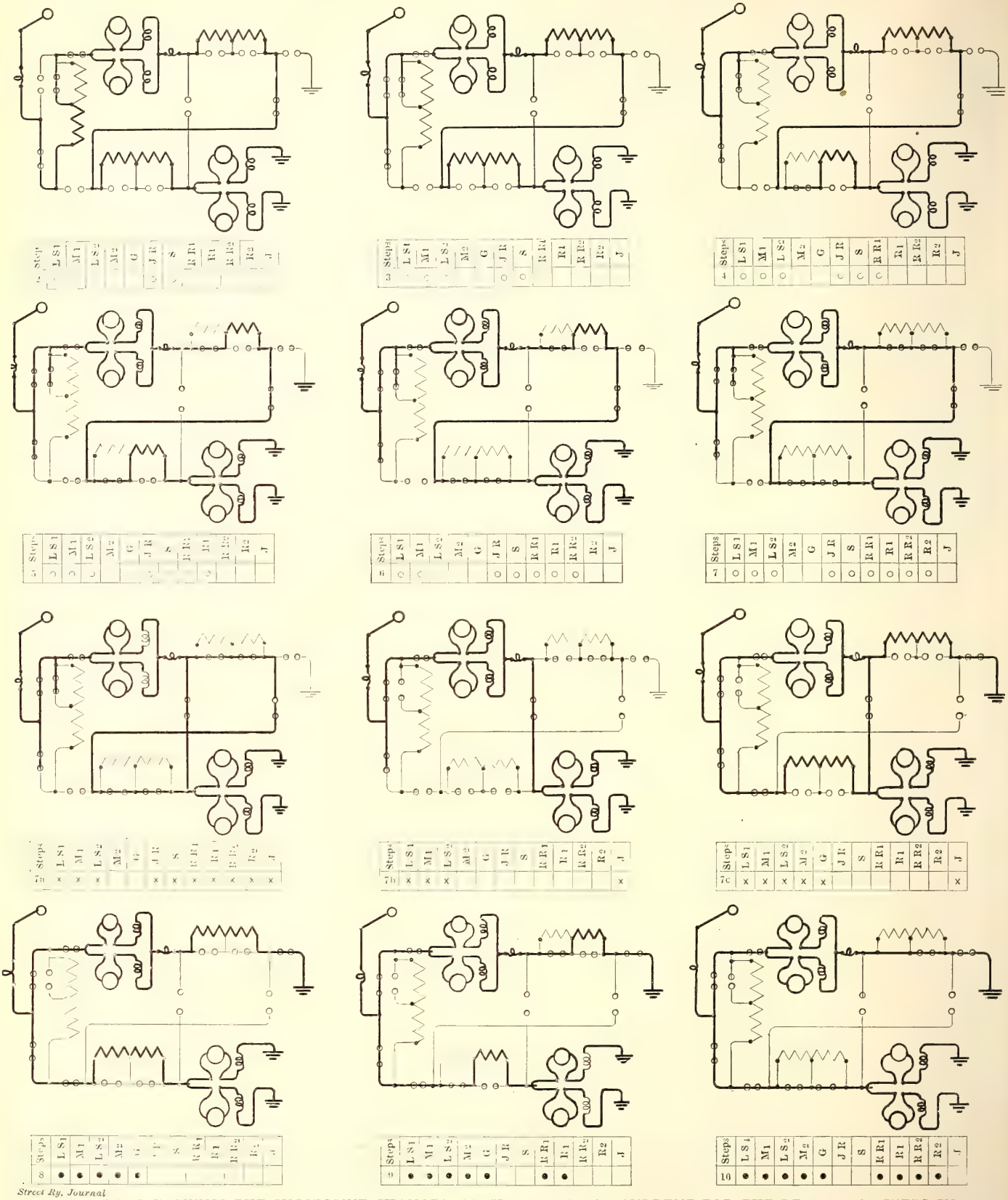
In addition to the foregoing, Mr. Adams prepared a set of blue prints showing the exact course of the current at every step in a four-motor equipment using the Westinghouse multiple unit control. This he accomplished by taking the full set of thirteen prints and drawing a red line over the "live" portion of each diagram. This scheme has greatly simplified what is usually a very complicated subject and has done much to enable the men to understand the be-



COMPLETE DIAGRAM AND KEY OF FIRST STEP IN THE OPERATION OF THE UNIT SWITCH GROUP CONTROL, THE HEAVY BLACK LINE INDICATING THE COURSE OF THE CURRENT

havior of their equipment. The prints are made on linen for the sake of permanence, because they are so frequently handled. As they have been so valuable to the motormen and shopmen in Baltimore, it is believed that the accompanying reproductions will be found worthy of attention. The red lines, of course, have been replaced by heavy black ones to indicate the course of the current. Only the first step is shown complete with all the explanatory lettering, but it will be understood that the symbols indicated in step one apply throughout the series.

Instruction is also given in the use of the air brakes employed on the cars with the electro-pneumatic unit switch group control. The air brakes are of the Westinghouse combined straight and automatic type. To demonstrate their operation under both conditions, two complete air brake equipments have been laid out on the floor adjoining



Street Ry. Journal

DIAGRAMS SHOWING THE SUCCESSIVE CHANGES IN THE COURSE OF CURRENT FOR THE REMAINING STEPS IN THE UNIT SWITCH GROUP CONTROL

the platform previously mentioned, and with this equipment the instructor shows just what takes place with either one or more cars.

While Mr. Adams does not believe in trying to make electricians out of motormen, he overlooks no opportunity to give the shopmen as much information as they can grasp easily. One feature which has been found to promote the interest of the men in their work has been to have experts from manufacturing companies lecture on the operating principles and care of different kinds of equipment. These talks usually provoke a good deal of valuable discussion, and, together with the data prepared from time to time by Mr. Adams, exercise in the long run a very favorable influence on the reduction of maintenance expenses.

THE TESTING LABORATORY OF THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY

The Milwaukee Electric Railway & Light Company maintains a special testing department, with laboratories equipped for testing practically all the material used by the company. The department is subdivided into a chemical and a physical division. The laboratories occupy two rooms in the new Public Service Building.

In the physical testing laboratory is installed a Riehle oil testing machine, a machine for testing the transverse strength of stone, timber and concrete beams, a Riehle 100,000-lb. tension and compression testing machine, and the necessary apparatus for making cement tests.

The chemical laboratory is equipped with the proper chemicals and apparatus for making chemical tests of brass, babbit metal, steel and other materials and chemical and B. T. U. tests of coal.

The oil testing machine is driven by an Electrodynamic interpole motor and is provided with a Niagara tachometer. With this machine the oils are tested for friction and temperature with different bearing metals at different pressures and different speeds. In addition to discovering inferior oils, one object of the oil tests is to find out what grades of oil are best suited for certain bearings. In testing the oils for engine bearings, for example, the conditions of the test are made to approach as nearly as possible those of actual service. The same bearing metal is used, the speed is made the same and the pressure per square inch is approximated. In addition to machine tests, oils are tested for their flash point, viscosity, acidity and specific gravity.

The beam-tester machine is operated by hand and will take beams measuring 8 ft. x 8 ins. x 8 ins. The machine for testing the tensile and compressional strength of materials is of 100,000 lbs. capacity. It is motor-driven and provided with an automatic device which keeps the beam balanced and draws a curve of stresses against strains on a chart.

Cement is tested for firmness, initial set and final set. Pat tests and tests of neat briquettes and briquettes of three parts sand to one part cement are also made. A standard sand which sifts through a twenty-mesh and stays on a thirty-mesh sieve is used. Briquettes are tested after twenty-four hours, seven days and twenty-eight days. The American Society of Civil Engineers standards of strength are used. For testing purposes a sample of cement is taken from every carload received. A uniform sample is obtained by taking portions from bags in different parts of the car.

The coal used in the power plants is tested systematically in the chemical laboratory. Once each week a sample of coal is taken from that supplied to each plant and B. T. U. and moisture tests are run. In addition, once each month a chemical test for moisture, volatile matter, fixed carbon, ash and sulphur is made.

Beside the laboratory work, the testing department conducts all outside plant trials. Boiler tests are made once each month, a different boiler being selected each time. These tests are always made with different ideas in view, sometimes for capacity and at other times for efficiency with different loadings and conditions. In connection with them an attempt is always made to improve the methods of firing.

The Milwaukee Electric Railway and Light Co.

Oil Test

Brand

Bought From

Received — Tested

Color — Spec. Grav. @60° F.

Viscosity — Flash pt.

Burning pt. — Chill pt.

% Acid — Animal — Mineral

Remarks:

(OVER)

REPORT CARD ON OIL TEST

The Milwaukee Electric Railway and Light Co.

Cement Test—Physical

Brand — Car No — Order No

Bought From

Proportions — Briquette No

Made — Tested — Age

Tens Strength — Ave. Tens. Strength

Fineness % — 100 Mesh Sieve — 200 Mesh Sieve

Pat test — hours in steam, — days in air, — days in water

Vicat Needle—Initial Set — Final Set

Spec. Grav. — Remarks

(OVER)

REPORT CARD ON CEMENT TEST

The boiler-feed system in the Commerce plant is especially arranged for making tests. The boilers may be disconnected from the regular feed line and connected to one used only for tests which is provided with a weighing tank and a separate pump. Indicator tests of the engines are made frequently, and at intervals different sections of the plant are tested through from boiler to switchboard by isolating this section of the plant from the other portion.

Contemplated additional equipment to the testing laboratories include the necessary apparatus for an electrochemical laboratory and for making high-tension tests. Records of power house tests are kept in typewriting on legal cap paper. Permanent records of other tests are kept on printed cards measuring approximately 3 ins. x 5 ins.

A motorman of the Butte Electric Railway Company raced with a cloudburst in Elk Park Canyon recently and saved sixty lives. A dispatch says: "Pursued by a wall of water 15 ft. high, McDermott put on full speed ahead down grade, and, the car clinging to the track by a miracle, reached high land just as the flood, turning up the rails and sweeping all before it, obliterated the road behind him. The flood left 6 ft. of mud in the Great Northern tunnel. The damage to property at the foot of the canyon is heavy, but no lives were lost."

GASOLINE BUSES FOR NEW YORK

The New York Transportation Company, which operates the Fifth Avenue omnibus service in New York, has just placed in service fifteen De Dion-Bouton buses of the straight gasoline type. These are similar to the one which has been running experimentally on the company's Fifth Avenue service for about a year, and their purchase might be considered significant in view of the fact that the company has had the opportunity of comparing it with a gasoline-electric bus running on the same avenue, were it not known that ten gasoline-electric buses are also on order in this country.



HEAD-ON VIEW OF NEW YORK GASOLINE 'BUS

So far this first gasoline bus has proved very satisfactory. In no case has it been taken out of service for anything but minor troubles, all of which could have been quickly remedied on the road had the necessary spare parts, such as inlet valve spring, cotter pins and platinum interrupter screw been provided. No adjustment of clutch, brakes or other wearing parts has been made, and the gears, both in the gear-box and the final driving gears, show very little sign of wear. Lubrication has given no trouble whatever and requires practically no attention on the part of the driver. The machine is reasonably quiet when running, considering its size, and gets through congested traffic with very little trouble. Four speeds are unnecessary for conditions as they prevail in New York, and a three-speed gear-box would be simpler and require changing gear less frequently.

The tires on the vehicle, although too small in section, have stood up very well, and this is attributed to the easy springs which reduce very materially the hammer blow on tires on rough surfaces. The repairs on engine and gear box are easily effected, as they are not only easy of access but can be readily and quickly removed. The gear box drops by removing three bolts. All wearing parts throughout the machine are case-hardened, glass hard, and ground to size, which is rather unusual on a commercial vehicle.

The framing of these buses is of ash, reinforced with 3/16-in. fish-plates on both sides. The cross-stays are of channel section pressed steel, and ample strength and rigidity are secured by sheet gussets riveted to longitudinal and cross-members. This rigidity, however, is all lateral, the frame being to some extent flexible vertically. The springs are extra long, of easy curvature and very well proportioned to the weight of body and passengers, so that vibration is very slight.

The front axle is forged and the journals case-hardened. There is also used a floating bronze bushing, having a number of ⅜-in. oil holes provided between the journal and the cast-iron box of the hub, thus constituting practically a double bearing. The rear axle is a steel tube, to the ends of which steel castings are shrunk and pinned, with provision for carrying the springs. The tires are 36 ins. x 3 ins. twins on the rear wheels, and 34 ins. x 3½ ins. on the front wheels.

The body is of the typical "London Road Car" type, having longitudinal seats inside with a capacity for sixteen passengers, and transverse seats on the top, seating eighteen passengers. The end windows are removable; the side windows are permanently closed, ventilation being obtained by louvers and small ventilating windows in the sides over the large windows. The winding stairway is of very light sheet steel and wood construction, protected by a high railing to prevent accident in case the bus should start sud-

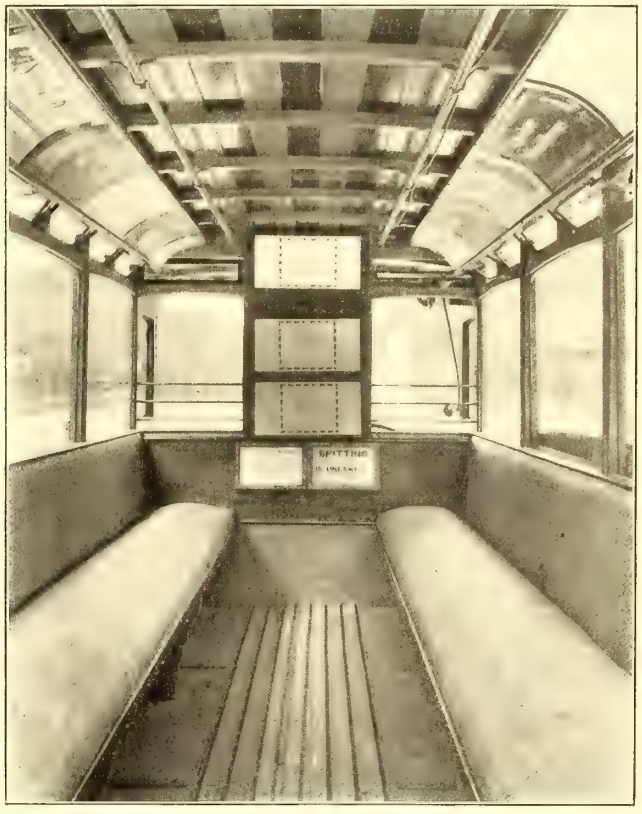


SIDE VIEW OF GASOLINE 'BUS RUNNING ALONG CENTRAL PARK

denly. The body is easily removable, having no connection whatever with any part of mechanism, brake rods, etc., and being fastened to members of the frame with eight carriage bolts.

The engine is rated at 24 hp capacity of the four-cylinder vertical type, with 105 x 130-mm. cylinders, automatic inlet valves, high-tension ignition, with high-tension distributor and single non-trembling coil, working either from the magneto or dry cells by a two-way switch. The water circulation is by a centrifugal pump driven by a flexible shaft. The carburetor is automatic and heated by shunt pipe from the circulating water. The radiator is of the honeycomb type, having a large capacity and good efficiency. The lubrication is entirely automatic, the oil being forced by a positive gear pump through the crankshaft, which has an oil passage drilled through it, the oil being fed through small holes to the main bearings, crank pins, magneto and pump spindles. After passing through the bearings the oil drops to the crank case and through a filter to the main oil reservoir which supplies the pump. The consumption of oil is very slight, as the bearings are so constructed as to prevent any oil escaping: the only loss is due to carbonization in the cylinders. The latter are protected from excessive supply of oil by baffle-plates, so that the exhaust is never smoky, nor do the cylinder walls, valves and spark plugs become coated with carbonized oil.

The gear box is of the sliding-gear type, having four gear ratios and a progressive engagement of gears. The gears are very light and of comparatively small diameter, but this is admissible owing to the large reduction of gear ratio between the driving pinions and the internal toothed driving rings on rear wheels; that is, the gears run at high speed and are subjected to comparatively small torsional stresses and toothed contact pressures. The gears are made of chrome nickel steel, and after four months' operation show no sign of wear. The differential gear and countershaft are incorporated in the gear box, thus conducing to compactness and efficiency, owing to the elimination of extra bearings. The lubrication of the gears is by a gear oil pump fitted to the bottom of the gear box, similar to the one used on the engine, this pump delivering oil to all the bearings and also to a pipe parallel to the gear-shaft and located directly above it. This pipe is provided with holes directly above each of the gears. A constant stream of oil is thus playing upon the latter at all times when the vehicle is in motion, and practically no oil is lost, as special means are provided to prevent its escape.



INTERIOR OF BODY OF THE 'BUS



GASOLINE 'BUS IN SERVICE ON FIFTH AVENUE, NEW YORK

The machine is extremely easy to control: two pedals are provided, the right one being the clutch pedal, and the left one actuating the differential hand brake and also closing the throttle. A change-speed lever and an emergency brake are at the right of the driver. Either the differential brake or hand brake will lock the rear wheels on asphalt. The clutch, which is of the single disc metal-to-metal type, is extremely smooth and easy in engagement, and the bus can be started on the top speed owing to the gradual way in which the clutch picks up the load. It runs in oil and is subject to very little wear, although automatic compensation is provided for it. When driving in traffic it is not necessary for the operator to remove either of his hands from the steering wheel, as the clutch, throttle and brake can be operated with his feet. The bus complete with water and fuel weighs 7900 lbs., increased when loaded to 13,000 lbs. The speed is 12 m. p. h. on top speed at 1000 r. p. m. This engine speed can be safely increased to 1250 r. p. m., equivalent to 15½ m. p. h.

SHUNTED TYPE OF GRAPHIC RECORDING METERS

BY PAUL MAC GAHAN AND H. W. YOUNG

The desirability of employing graphic recording ammeters and voltmeters has long been apparent to those operating d. c. railway power stations, but one of the principal reasons why they have not been more extensively used is that until recently the ammeters have been available only in the "series" type; that is, it has been necessary to pass all of the current through the instrument itself. In the very high capacities this has proved troublesome to instrument manufacturers and resort has been had to the use of a shunt placed across the instrument terminals. In either case, however, it has been necessary to carry the total current to be measured up on to the switchboard at a very considerable amount of trouble and expense; in fact, the cost of the extra busses, connecting straps and labor has frequently been higher than the cost of the meter itself, especially when the distances have been great. Again, the graphic ammeters heretofore used had many other disadvantages, among which might be mentioned short congested scales, circular or small slow-moving charts, absence of means for varying the dead-beat qualities, difficulty in interpreting readings (especially if the load is of a fluctuating nature), and inaccuracies due to friction of the pen.

It has been generally conceded that a "shunted" type of d. c. ammeter would overcome the greatest objection to the older forms, and efforts were made to develop and perfect a meter of this type. These efforts have resulted in a design which is not only operative from its own shunt, but can also be operated from the ordinary shunts used with indicating ammeters. In addition, the design employs the "band" or roll form of chart, thus giving rectangular coordinates.

Both ammeters and voltmeters are of the "relay type," employing a suitable measuring element in conjunction with a pair of control electromagnets actuating the recording pen. Each meter comprises three distinct elements: First, the measuring element; second, the pen actuating control magnets; third, the driving clock. The construction of an ammeter is diagrammatically shown in Fig. 1, in which the various elements of the meter are designated as follows:

A–B = Astatically arranged permanent magnets.
E–F = Movable coils mounted on supporting structure pivoted at G.
G = Pivoted support of E–F.
H = Upper adjustable relay contact.
I = Lower adjustable relay contact.
J = Movable relay contact attached to movable element E–F.
K = Control electro-magnet (left hand).
K′ = Iron core of K.
L = Control electro-magnet (right hand).
L′ = Iron core of L.
M = Arm supporting iron cores pivoted at N and connecting O by pin bearing P.
N = Pivoted bearing for M.
O = Pen arm connected to M by pin bearing P and provided with guide slot at upper end which bears on stationary guide pin R.
P = Pin bearing connecting M and O.
R = Stationary guide pin for O.
S = Recording pen arranged to pass across a suitable moving record paper T.
U = Helical spring connecting movable coil system and movable pivoted supporting arm M.

The movable coils are connected in series and their terminals connected across a shunt or series with the load. The electromagnets K and L are connected as shown, with their junction point connected to one side of the line, a lead from the opposite side being connected to the movable contact J. A connection from coil K is made to the upper relay contact H, and from coil L to the lower relay contact I.

The measuring coils are so arranged that when current flows through them the left-hand coil E is deflected down, and the right-hand coil F upward, so that with the recording pen at zero position on the chart the contact J will be forced against the fixed contact I. A circuit is thus completed through the right-hand solenoid L, and the resultant electromagnetic attraction causes the core L' to move downward, which movement turns M about its axis, and through its connection with O causes the pen to move across the chart toward full scale position. This movement of M places tension on the spring U, which continues to increase until the core has traveled a sufficient distance to place such a tension on U that it balances the torque of the movable measuring system E-F and draws the contact J away from I. The entire moving system, including solenoids, pen, arm and measuring coils, remains in the position assumed at the time the circuit was broken at the contacts J-I, and the pen continues to draw a line which represents the current of the circuit.

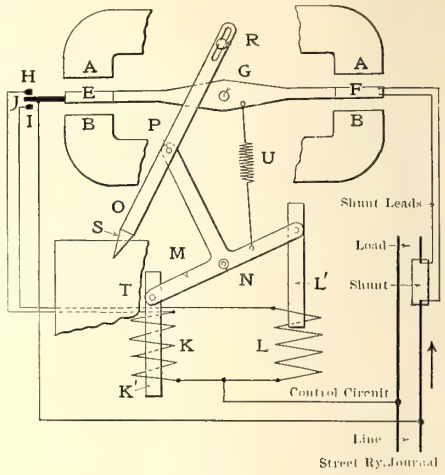


FIG. 1.—DIAGRAM OF CONNECTIONS

From the above description it will be seen that as the spring U is under tension, the position of the contact J, between contacts H and I, will represent a balance or state of equilibrium between the restraining and actuating forces. This action can readily be compared to the action of a "Siemens dynamometer" in which the tension or torsion of the control spring has drawn the movable coil-indicating pointer back to zero and the manually operated pointer will indicate the current. The indicating pointer of the dynamometer can thus be likened to the relay contact J of the graphic meter and the manually operated pointer may be likened to the solenoid operated recording pen of the graphic meter. It will be seen, therefore, that the electrical operation of the graphic meter's recording pointer replaces the manual operation of the Siemens dynamometer.

If the current of the metered circuit rises, the movable contact J is again deflected downward until it makes contact with the lower fixed contact I and the right-hand solenoid L again causes the recording pen to move across the chart until the increased tension of the spring U balances the increased torque of the measuring element, drawing the movable contact J away from I, and again opens the solenoid circuit. The recording system again remains stationary until the current of the circuit changes.

As the current in the circuit decreases, the contact J rises, and making contact with H energizes the left-hand solenoid K and its core is drawn down, thus causing the pen to move down the scale toward zero. This movement will continue until the arm M moves up sufficiently to relieve the tension on U and restore the balance between the measuring system and spring, at which instant the contact J will leave H and open the control circuit through K.

As the current varies, it will be seen that the contact J moves up and down, completing the circuit through one or

the other of the control solenoids, thus causing the recording pen to move across the chart and give a graphic record of the current variations.

In order that the charts may have rectangular co-ordinates it is essential that the pen-point move in a straight line. This straight line motion is secured by the mechanical arrangement of the solenoid arm *M* and pen arm *O*. As *M*, due to the magnetic pull of the solenoids, moves its ends up or down, the pen arm *O* slides on its guide pin *R* and rotates on pin *P*, thus imparting to the recording pen *S*, a straight line motion. By this arrangement an extremely simple and effective parallel motion is secured.

The contacts *H*, *I* and *J* are made of a special alloy metal and are shunted by a high resistance so that they will break the circuits with minimum burning or arcing.

To prevent the cores of the control magnets from overrunning, they are provided with pistons operating in oil

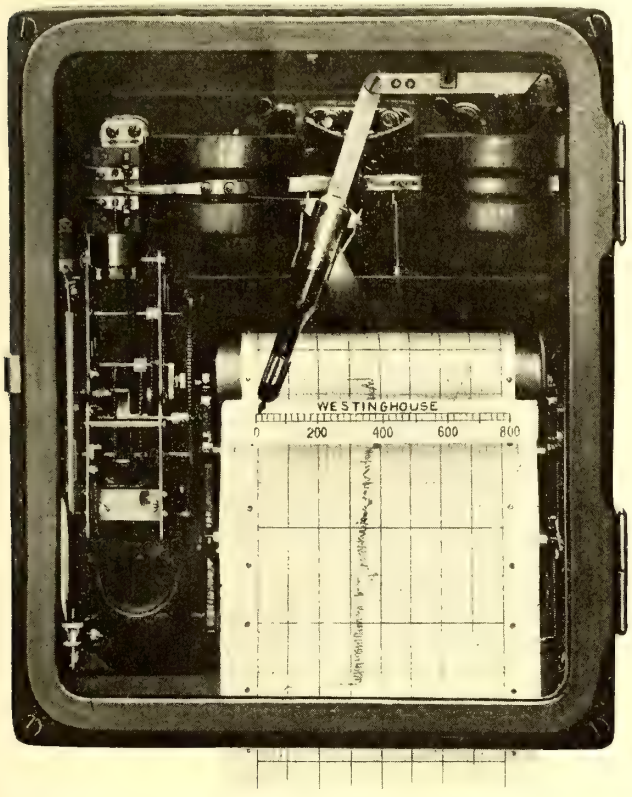


FIG. 2.—VIEW OF INSTRUMENT

dash-pots located in the solenoid cores. By adjusting the size of an opening or port hole in the pistons, the amount of damping can readily be varied. To dampen the movement of the measuring coils *E-F*, a piston is attached to this element and arranged to move in a small oil dash-pot. This arrangement prevents vibrating of the contacts and the magnitude may be varied by changing the oil density. The driving clock is a standard high-grade time piece of the electrically wound pendulum type. Its mechanism is operated from the same circuit as the pen actuating electromagnets and operates at intervals of 1 hour, the driving spring being of such a size that but a few of its outer convolutions uncoil during this period. Thus the clock mechanism is under a strong uniform force, which, together with the heavy pendulum action, gives a powerful driving force, insuring a positive feed to the record paper.

The record chart is 244 ft. in length, being sufficient for two months' use at a 2 ins. per hour speed, or a proportionately shorter time at 4 ins. or 8 ins. per hour. The rolls are 6¾ ins. wide and are perforated at each outer edge by a line of holes, which, engaging on projecting pins on the surface of the driving cylinder, insure a positively aligned feed under the recording pen. The record paper is ruled longitudinally with a set of parallel lines, representing the meter calibration, and at right angles to the calibration lines are a set of parallel lines representing hours. The paper is of such thin, tough texture that it can readily be used for reproducing the pen records by blue printing or other similar processes. Changes in speed of the chart are effected by the use of suitable gears and pinions having different ratios of teeth.

The recording pen is of the reservoir type and of such capacity that one filling suffices for several months' use. The pen-point is drawn to a capillary tube of heavy wall and small bore, giving maximum strength with minimum width of line. Filling of the pen is accomplished by inverting it and by means of a special filler inserted in opening in tube immediately behind the point, the ink is forced over into the large reservoir, and when full the pen may be righted in position.

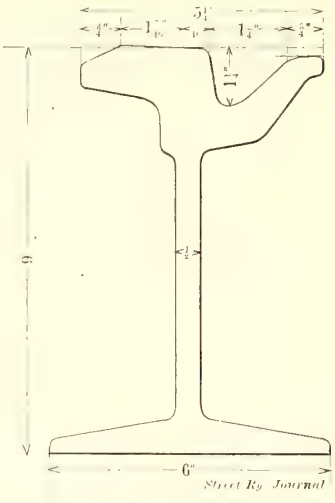
The advantages of this construction can briefly be summed up as follows: A statically arranged measuring system; small current consumption; requires but 50 millivolts for operation; only requires small flexible leads for connection to circuit; uniform scales; can be made in combination indicating and recording forms; can be operated from any shunt or section of bus giving necessary drop.

NEW ENGLAND TROLLEY CHANGES

Changes in the street railway service through the chain of towns in the Blackstone Valley which have just gone into effect are the forerunner of the through Providence and Worcester service to be given soon over the electric lines of the Rhode Island Company and the New England Securities & Investment Company, controlled in the interest of the New York, New Haven & Hartford Railroad. The service now in operation includes cars between Worcester and New City bridge in Blackstone, Mass., where the Rhode Island Company's cars make close connections and run between that point and Main Street, Woonsocket, connecting there with the direct Providence cars. The Uxbridge & Blackstone Street Railway Company has ceased to be an operating road, and its line between Plummer's Corners, in Northbridge, and Millville, in the town of Blackstone, has passed to the direct control of the new owners, who use the Worcester & Blackstone Valley Street Railway Company, a subsidiary concern, as the operating medium for the 26 miles between the heart of Worcester and Blackstone, the Valley cars and crews being employed. The connecting cars of the old Woonsocket street railway, now the Rhode Island Company, meet the Worcester cars at New City bridge, and in Woonsocket make close connection with the car for Cumberland Hill, thence through Lonsdale and Pawtucket to Providence, or, by passengers waiting from 10 to 30 minutes, connection can be made with the fast direct Providence-Woonsocket line. By the latter route the trip can be made in 3½ hours. As soon as the bridge at New City, Blackstone, is strengthened, the cars will run from Worcester to Woonsocket and the New City change will be eliminated. The fare by trolley between Providence and Worcester is 60 cents, while the fare by steam is 90 cents.

THE RAIL CONTROVERSY IN COLUMBUS SETTLED

The controversy between the Board of Trade of Columbus and the railroad companies over the type of rail to be used by the interurban companies operating in the city, has been settled by the adoption of a type of rail which is almost a full groove, with the web nearly under the center of the tread. A section of the rail is shown herewith. It is said that the board proposes soon to take up the question of rails for the regular city lines and that a standard will be adopted which shall be used hereafter for new track and where track is rebuilt. The rail question at Columbus has been under consideration for months, and the decision reached will be of general interest, especially in other cities where a decision of the rail question is yet to be made.



NEW COLUMBUS RAIL

ADDITIONAL CARS FOR CHATTANOOGA

In the Street Railway Journal of Nov. 17, 1906, attention was directed to the activity on the lines of the Chattanooga Railways Company. Since then, in addition to occupying the new car shops and car houses and completing the general overhauling of the system, several new branches have been opened necessitating new rolling stock, to meet which requirement a number of grooveless post semi-convertible cars built by the G. C. Kuhlman Car Company have been supplied. These cars are generally similar to the single-truck cars of the same type furnished by the J. G. Brill Company last year for operation on the Mission Ridge line, one of the lines which were recently relaid with new

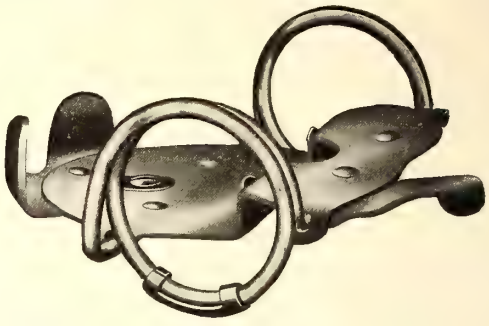


EXTERIOR OF NEW CHATTANOOGA CAR

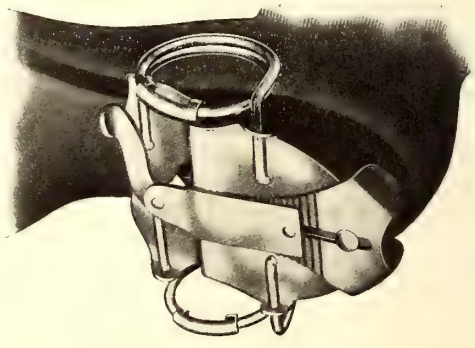
rails and ties embedded in concrete. Following are some of the dimensions of the new cars: Length over end panels, 28 ft.; width over sills, including panels, 8 ft. 1½ ins.; over posts at belt, 8 ft. 5 ins.; height from track to under side of sills, 2 ft. 8½ ins.; size of side sills, 4 ins. x 7¾ ins.; end sills, 5¼ ins. x 6⅞ ins.; sill plates, 12 ins. x ⅜ in. The trucks are of the No. 27-G1 type with 4-ft. 6-in wheel base. The seats and numerous patented specialties were also furnished by the builder named. The grooveless post semi-convertible car has proved itself to be peculiarly adapted to the short winters and long summers which prevail in this Southern climate.

A SPRING HEEL FOR MOTORMEN

Physical limitations vary greatly in different men, and while the strain incident to standing at the controller for long periods does not effect some motormen materially it does prove serious in the case of others, not only impairing the service performed by the individual, but sometimes becoming so serious as to cause a temporary suspension of work. This, of course, has long been realized, but heretofore there has been no alternative except in the case of long interurban lines where the character of the service has made it possible to permit the motormen to sit at their work during part of their run. Now comes a device designed partly to secure the comfort of a seat for motormen and so constructed as to make it practicable for use in all classes of service. It is a spring heel, designed especially to take up the jar of the car when in operation. Originally patented in 1904 by B. B. Bonney, a motorman of Pasadena, Cal., who had suffered physically in performing his duties, the rights to the device were taken over by Barney & Berry, of Springfield, Mass., who, in developing it, brought to the device the result of their extended experience in building roller skates. The heel is extremely simple in construction. A metal plate of cold rolled steel and an adjustable rear clamp form a pocket for the shoe heel, to which it is clamped securely by means of a lever. On either side are attached "Torchon" springs 2 ins. in diameter, made of finely tempered steel wire, in sizes suitable to carry the weight of the wearer. The only part subjected to much wear is the guard at the base of the spring, which may be renewed at slight expense, making the life of the spring heels almost unlimited. The range of adjustment in heel clamp makes it possible to fit the device to any size heel. It can be quickly applied and is inconspicuous, being neutral in color. Letters in the company's possession from users of the heels testify as to its satisfaction in service. The device also has the recommendation of physicians, among them the surgeon connected with the company by which Mr. Bonney was employed.



THE SPRING HEEL READY FOR USE



THE SPRING HEEL APPLIED

FINANCIAL INTELLIGENCE

Wall Street, Aug. 21, 1907.

The Money Market

Pronounced strength characterized the local money market during the past week. The continued heavy liquidation in, and consequent lower prices for, stocks were reflected in comparatively low rates for money for day-to-day use, but in the time loan department there was a further hardening of rates for all maturities up to six months. The local banks were practically out of the market, while the supply from outside sources was extremely light, thus forcing the asking charges for accommodations up to the highest of the year. Sixty-day money was in demand at 6 per cent, with little obtainable under 6½ per cent, while money for ninety days to six months commanded 7 per cent on good mixed securities. On all industrial collateral the charges were substantially higher. Shipments of currency to the West for crop-moving purposes continues, and there has been an increasing demand for money in the South, resulting in larger transfers of funds to New Orleans and other Southern points. Under ordinary conditions the high rates for money prevailing here would result in large offerings of foreign capital against exchange transactions, but thus far this season the supply of money from this source has been extremely light. Foreign bankers are not disposed to extend credit as freely as in former years, and this was largely responsible for the sharp advance in rates of exchange during the past week. Sterling exchange has risen to within a small fraction of the gold export point, but so far no shipments of the yellow metal have been made to London, and it is not considered likely that the Bank of England will force shipments from this side by allowing free advances on the gold while in transit. However, $1,100,000 gold has been exported to Germany during the week, but it is understood that these transactions were of a special nature. The demand for gold continues active at all of the principal European centers, and especially at London. The Bank of England on last Thursday advanced the official discount rate ½ per cent to 4½ per cent, in order to protect its gold supply, and as private discounts are somewhat higher than the bank rank a further advance in the official rate may soon be made.

The demand for money from merchants continues brisk, and several manufacturing concerns have been forced into the hands of receivers owing to the inability to obtain necessary credits. Corporations also continue in the market for new capital. During the week the announcement was made that the Consolidated Gas Company had sold an issue of $5,000,000 one-year 6 per cent notes, the proceeds to be used for general purposes of the company. At the close of the week the situation was not very encouraging. No action has as yet been taken by the Treasury Department to relieve the situation, but the belief prevails in banking circles that the Secretary of the Treasury will render at the proper time all the assistance necessary.

The bank statement published on last Saturday was rather favorable. Loans decreased $14,231,200, and deposits fell off $17,447,300. The reserve required was $4,361,825 less than in the previous week. The surplus increased $1 533,525 to $9,294,075, as compared with $7,101,500 in the corresponding week of last year and $9,355,675 in 1905.

The Stock Market

The address made by President Roosevelt at Provincetown had the immediate effect of a substantial recovery in values from the greatly depressed, not to say demoralized, condition into which they had fallen, but it is not yet possible accurately to gage the ultimate effect of the Chief Executive's latest utterances concerning a question that is now attracting the attention of business interests all over the world. The financial community, however, seems inclined to take a rather more cheerful view of the Administration's attitude toward the railway and industrial corporations than it has heretofore, now that it has become apparent that officials, rather than corporations, who have been guilty of violating the law are to be punished, and the wisdom of this policy is becoming manifest, as it will assure innocent stockholders that they are not to be made suffer on account of the misdeeds of law-breaking officers of the companies in which they have invested their savings. It is this, together with moderate purchases on the part of that class of investors generally described as "bargain hunters," that has served somewhat to allay apprehension in the stock market during the week and to arrest in some measure the ruthless sacrificing of securities that has been going on, and which if continued much longer must have resulted most direfully. It is argued by many that the President's stand will have a tendency to place American securities of all descriptions on a higher place before the entire investing world, and that while his determination to remain steadfast may be to the dislike of a certain class of capitalists, its final influence will be most beneficial.

Apart from the President's speech comparatively little attention was devoted to any other matter in financial circles, although, naturally, the marking up of the Bank of England's discount rate considerably in advance of the usual time for such action in the fall and the resumption of gold exports served to draw renewed attention to the foreign monetary situation, while the prospect that the demand for funds to move our crops will be larger from now on made the outlook for a let-up in the present stiffness of time money rates here rather dubious. Railway earnings reports coming to hand were again encouraging, and in some cases record-breaking, and at the same time it is noteworthy that the business of the United States Steel Corporation, which fell off considerably during July from that of the corresponding period last year, has been better in the current month.

The further sharp decline in values that took place prior to the publication of the President's speech, and which was participated in by all stocks, some of the gilt-edged investment issues suffering even more than those of lower grade, very naturally was communicated to the local traction group, and notwithstanding that there was a total absence of really unfavorable developments to account therefor, most stocks in this category fell to the lowest prices on record. The Interborough-Metropolitan securities were especially heavy, the present investigation which is being conducted into the affairs of the company having been partly responsible for the further serious declines in these stocks. However, there was renewed talk of a possible suspension of dividends on the preferred shares, and while there was no substantiation to these rumors they were none the less effective in prompting fresh liquidation in both the preferred and common.

Philadelphia

Trading in the local traction issues was upon a comparatively small scale during the past week, but prices generally sustained substantial losses in sympathy with the declines recorded in other parts of the market. Union Traction, for instance, after selling at 56½ ran off to 53⅛ on light sales, while Philadelphia Traction sold at 91 and 91½. Consolidated Traction of New Jersey lost ½ to 69½, and Philadelphia Company common and preferred sold at 39 and 44, respectively. Philadelphia Rapid Transit was about the only issue of the group to display any degree of activity, and was relatively firm, upward of 8000 shares changing hands at from 16½ to 17. American Railways was steady at 48.

Chicago

The traction shares were quiet and generally lower. Chicago City Railway sold at 155 and 150, and the 5 per cent bonds sold at 98. Metropolitan Elevated common sold at 21¾, Northwest Elevated common at 21¾ and 21, and the preferred stock at 58.

Other Traction Securities

Increased activity developed in the traction issues at Baltimore, but in most instances the dealings were accompanied by

falling prices. United Railway common lost 1¼ to 11¼, and the 4 per cent bonds declined a point to 85¾. The incomes were also lower at 50½. Lexington Street Railways 5s, after selling at par, lost a point to 99, and Baltimore City & Suburban 5s eased off ¼ to 106½. Other transactions included Norfolk Railway & Light 5s at 100, Baltimore City Passenger 5s at 102¼, and Washington City & Suburban 5s at 100. Pronounced weakness characterized the market at Boston. Boston Elevated early in the week sold at 155 ex. the dividend, and subsequently the price fell to 130. Massachusetts Electric sold at 12¼ and 12½ and the preferred at 52½, the lowest prices for these issues recorded for some time. Boston & Worcester also showed weakness, sales taking place as low as 19½. West End sold at 87 and the preferred at 101.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Aug. 14	Aug. 21
American Railways	47	47
Boston Elevated	131	a130
Brooklyn Rapid Transit	42	41½
Chicago City	160	150
Chicago Union Traction (common) certificates	—	2½
Chicago Union Traction (preferred) certificates	—	—
Cleveland Electric	49½	46
Consolidated Traction of New Jersey	69	67
Detroit United	62	62¼
Interborough-Metropolitan	8⅞	8⅞
Interborough-Metropolitan (preferred)	26½	23
International Traction (common)	45	42
International Traction (preferred), 4s	a67	a67
Manhattan Railway	115	117
Massachusetts Elec. Cos. (common)	12½	12
Massachusetts Elec. Cos. (preferred)	52	50
Metropolitan Elevated, Chicago (common)	21½	21½
Metropolitan Elevated, Chicago (preferred)	63	62½
Metropolitan Street	a70	25
North American	55	53½
North Jersey Street Railway	40	40
Philadelphia Company (common)	38	38½
Philadelphia Rapid Transit	17¼	16⅝
Philadelphia Traction	92½	—
Public Service Corporation certificates	65	64
Public Service Corporation 5 per cent notes	92	92
South Side Elevated (Chicago)	80	80
Third Avenue	75	68
Twin City, Minneapolis (common)	86	85¾
Union Traction (Philadelphia)	56	53¼

a Asked.

Metals

The "Iron Age" says that generally speaking the undertone throughout the iron trade is one of increased nervousness over the future. There is a falling off in new business in nearly all directions, but specifications against old contracts continue very heavy, and there is no indication in the finished lines of any cessation of work under way. Throughout the country the buying of pig iron is from hand to mouth, and the market has not been really seriously tested in foundry iron for some time, but prices are weakening. The steel rail trade is very quiet, and business is coming in slowly in sheet tin plate, iron bar and tube trades.

Copper metal remains unchanged at about 23 cents for Lake and 22 cents for electrolytic. Lower prices are expected in the near future.

HEARING ON AN ORDER BY THE UTILITIES BOARD

Preparatory to issuing the first order for an increase in the equipment of any road under its jurisdiction, the Public Service Commission of the first district in New York has adopted a resolution setting Sept. 4 as a date for a public hearing at which the Coney Island & Brooklyn Railroad Company might "show cause" why it should not add ten new cars to its equipment and increase the efficiency of its present rolling stock. In presenting the resolution for adoption Commissioner Bassett explained that a committee composed of Mr. Eustis, Mr. McCarroll, and himself had found, on investigation, that the cars of the Smith Street line impeded traffic frequently. To obviate this, certain changes are to be recommended in the mechanism of the cars, providing that the Commission finds at the hearing that the order for such changes will be "just, reasonable, safe, adequate and proper."

PUBLIC SERVICE CORPORATION OF NEW JERSEY FORMS SEPARATE COMPANY FOR TROLLEYS

The announcement is made that the street railway companies controlled by the Public Service Corporation of New Jersey will be merged in a corporation known as the Public Service Street Railway Company, with a capital of $38,000,000, consisting of 380,000 shares at a par value of $100 in cash. The securities of the various trolley companies now owned by the Public Service Corporation will be turned over to protect the new street railway company, which will be subordinate to the present Public Service Corporation. The parties to the plan are named in an agreement, dated July 30 last, as the North Jersey Street Railway Company, the Jersey City, Hoboken & Paterson Street Railway Company, formed by the merging of the Paterson Central Electric Company, Saddle River Traction Company, Palisade Railroad Company, White Line Traction Company, Paterson, Pasaic & Rutherford Electric Railway Company, Jersey City, Hoboken & Rutherford Electric Railway Company, and Paterson Horse Railroad Company, and the United Street Railway Company of Central Jersey, formed by merging the Elizabeth & Raritan River Street Railway Company and Elizabeth & Plainfield Central Jersey Railway Company. The officers of the consolidated company, who shall hold their respective offices for the first year or until others are chosen in their places, are:

President, Thomas N. McCarter, Rumson, N. J.; vice-presidents, Charles A. Sterling, East Orange; Albert B. Carlton, Elizabeth; John J. Burleigh, Merchantville; secretary, Frederick Evans, New York; assistant secretary, Henry C. Stevenson, Newark; treasurer, James P. Dusenberry, Newark; assistant treasurer, Robert D. Miller, Jersey City.

In explanation of the proposed merger the following has been issued:

A little more than four years ago the Public Service Corporation of New Jersey purchased nearly all the stock of the North Jersey Street Railway Company, $15,000,000; the Jersey City, Hoboken & Paterson Street Railway Company, $20,000,000, and the Elizabeth, Plainfield & Central Jersey Street Railway Company, $3,000,000. It subsequently acquired the stock of the Elizabeth & Raritan River Street Railway Company, $2,000,000, making $40,000,000 in all. All the stock which was purchased by the Public Service Corporation, except the stock of the Elizabeth & Raritan River Street Railway Company, was deposited with the Fidelity Trust Company as security for perpetual interest-bearing certificates which the Public Service Corporation had issued in payment for the stock so purchased.

The tracks of all these companies are connected and are practically operated as one system, although it is necessary to keep four sets of books and four different bodies of officials and employees. A few weeks ago the Elizabeth, Plainfield & Central Jersey Street Railway Company and the Elizabeth & Raritan River Street Railway Company were consolidated into a company called the United Street Railway Company of Central Jersey. The capital of that company was fixed at $4,000,000, or $1,000,000 less than the aggregate amount of capital of the constituent companies. More recently the directors of the North Jersey Street Railway Company, the Jersey City, Hoboken & Paterson Railway Company and the United Railway Company of Central Jersey made an agreement to consolidate these companies, subject to confirmation by the stockholders at meetings to be held next Tuesday.

The proposed capital of the new company, which is to be called the Public Service Railway Company, has been fixed at $38,000,000, or $1,000,000 less than the aggregate capital stock of the three companies, so that instead of increasing the capital, the plan when carried out will effect a decrease of $2,000,000.

All of the $38,000,000 of stock of the new company owned by the Public Service Corporation of New Jersey will be deposited with the Fidelity Trust Company in exchange for a like amount originally deposited with that company when the perpetual interest-bearing certificates were issued. The advantage to the street railway companies will be one united system, with a single set of officials and employees, in place of four connected plants not legally united.

The stockholders of the Jersey City, Hoboken & Paterson Street Railway, the North Jersey Street Railway, and the United Street Railways of Central New Jersey, on Tuesday ratified the agreement entered into by the directors of the three companies named, to consolidate the properties into one corporation, to be known as the Public Service Railway Company.

THE TRANSIT INQUIRY IN NEW YORK

The continuation of the hearing on the Brooklyn Rapid Transit Company before the Public Service Commission last Friday brought out some interesting facts regarding the expenditures made by the company to keep abreast of its growing business and also brought to light conditions hampering the company in its operation over which the company has had absolutely no control. It is stated that as a result changes may be effected that will materially assist the company, the Commission being ready to urge the city to hasten all such public work as shall tend to relieve congestion. In this connection, Mr. Ivins, counsel for the Commission, suggested a plan for relieving the congestion at the Brooklyn Bridge by carrying the trains over a loop running across the city as far as West Street and returning with several stations along the line. President Winter, of the company, said that the only difficulty was the financial question. If the city were to supply the money, he thought the plan proposed would be the best solution of the entire problem. Regarding the company's expenditures, Mr. Winter submitted a statement showing that since July 1, 1902, the company has spent for equipment, power houses, tracks, etc., a total of $29,622,625. The various items for expenditures follow:

Rights of way and easements	$844,215
Tracks and roadway construction	5,341,721
Electric line construction	1,867,642
Real estate	1,019,446
Buildings and fixtures	3,170,114
Power plant equipment	6,272,271
Tools and machinery	261,824
Cars and parts of cars	10,536,733
Miscellaneous equipment	130,733
Miscellaneous expenditures	177,926
Total	$29,622,625
Underlying securities purchased	4,022,490

Mr. Winter testified that plans had already been made for ordering 100 elevated cars and 100 motor cars, and that as soon as it was possible to get a quorum of the executive committee he would recommend the purchase of these cars. This will mean a probable expenditure of $1,800,000. Mr. Winter also stated that even with these new cars the company would be in the market for additional cars within six months. He believed that it would be possible to get delivery of these cars in from four to six months. Mr. Winter stated that there was constantly a cry for new equipment, which was needed, but that this need would have to be apparent for some time to come. Mr. Winter stated, however, that there was a limit to spending money for property that gave but little return. The Brooklyn Rapid Transit Company has never paid a dividend, but instead has put every cent of net profit and net revenue into the property.

The next great problem that would come before the company, Mr. Winter testified, was the Manhattan Bridge, which is building between the Brooklyn and the Williamsburg Bridges. The question of operating Brooklyn Rapid Transit trains into Manhattan, via the bridge and over the New York City company's tracks, and issuing transfers, is one that is not being considered, and will not be considered by the company. There are physical reasons why the operation would not be practicable, although, he added, there would be no physical reasons for not issuing transfers. He said the problem of operating into Manhattan had never been considered in connection with the transfer matter. The question of the service from the Thirty-Ninth Street Ferry was taken up by Mr. Ivins. Mr. Winter said the company was negotiating with Dock Commissioner Bensel for additional facilities at the ferry, so as to make a better connection. Such improvements as now contemplated, if authorized, could be made within a year. From this ferry there is a five cent fare line to Coney Island. If the municipal ferry, to be run to Thirty-Ninth Street, is well run, Mr. Winter said the company could take care of all of the traffic. He believed a thirty-five or forty minute schedule could be maintained from the ferry to Coney Island.

On Tuesday, the Interborough-Metropolitan hearing was resumed. Mr. Ivins concerned himself mainly with the history that centres around the newly completed Belmont tunnel under the East River from the Grand Central Station to Long Island City. Mr. Bryan, president of the Interborough Company, explained that on Jan. 1, 1905, when the old Steinway franchise expired, the governing board of the property was changed from a board of directors to a board of trustees on the advice of the legal department, and that all the assets of the company were taken into the control of the trustees as now constituted.

Mr. Ivins inquired as to what corporate form the proprietorship of these assets might have taken, and Mr. Bryan explained that there was no stock other than the $100,000 par value of the stock of the old Steinway company and no bonds, but certificates of indebtedness to the Interborough for the money spent in the construction of the tunnel. In answer to further questions, Mr. Bryan said that some $7,000,000 had been spent in the construction of the tunnel exclusive of real estate, and that the franchise had been acquired by the Interborough interests from John Pierce for $402,000. Mr. Bryan said that the total cost of the tunnel as provided for would be $7,785,500, this sum including $712,000 set apart for future expenditure. He declared that the firm of August Belmont & Company was only related to the project through the directorate of Mr. Belmont in the New York & Long Island Railway Company, as the tunnel building corporation is known officially. Mr. Ivins took the transcript of the record taken in appraisement proceedings on the property of William Steinway, on which Charles E. Lexow, as appraiser, reported on Jan. 28, 1904, that there was no property passing subject to tax. The record had to do with the disposition of 425 shares of the New York & Long Island Railroad Company having a par value of $42,500. Louis Von Bernuth, one of the executors of the Steinway estate, testified that after the death of William Steinway, negotiation in England to dispose of the stock failed, after which it was offered to the Pennsylvania Railroad, which refused it, and then to ex-Mayor Hugh Grant, who also turned it down. William P. Baldwin, then president of the Otis Elevator Company, was another prospective purchaser who did not materialize, and eventually an offer was received from George F. Harriman, a lawyer, who paid the estate $86,000, being $39,452.15 for the stock and the rest in satisfaction of debts owing to the estate by the tunnel company.

The appraiser of the Steinway estate found that the stock was worth the price paid by Harriman—$39,452.15. What happened between that time and the time of its acquisition by the Belmont interests from Mr. Pierce did not appear. Mr. Ivins again took up the story of the financing after the Belmont acquisition, asking what might be done to put the values represented by the cost of construction into tangible property that might be realized on by the Interborough. Mr. Bryan said that he expected the road would be put in operation.

Then followed an extended discussion of the possible connections for the transfer of passengers between the Steinway company and the Subway and Grand Central Stations at the western terminus. Mr. Bryan admitted that the question of connecting with the proposed Lexington Avenue subway was considered, and this brought Mr. Ivins to the matter of the bill introduced in the 1905 Legislature providing for a change in grade of the Steinway tunnel and some other things.

The original plan entertained, to connect the Belmont trolley properties in Queens with the subway at Lexington Avenue and the Grand Central and with the New York Central at that point, went smoothly enough until the threatened opposition of the Metropolitan interests in proposing to bid for the Lexington Avenue subway. It has been stated that it was largely owing to this possible competition that the Ryan and Belmont interests united to form the present Interborough-Metropolitan consolidation.

Mr. Ivins tried to draw from Henry C. Wright, secretary of the City Club, the facts underlying the report which that organization recently made on traffic conditions here. Mr. Wright was willing enough to tell, but after it had appeared that one observer had been charged with estimating the entire rush-hour crowd at Brooklyn Bridge and had reported, for example, that between 5 and 5:30 o'clock on May 19, exactly 3871 persons had been unable to obtain seats interest in that part of the investigation waned. Soon thereafter the shift was made to the Steinway tunnel history.

The main fact brought out at the continuation of the hearing on Wednesday was that the advisability is being considered of readjusting the finances of the company. It is said that there is every likelihood that the dividend on Interborough-Metro-

politan preferred will be passed. The entire situation will probably come to the crucial point on Thursday, Sept. 5, when the directors of the New York City Railway Company hold their meeting for the purpose of taking action upon the dividend on Metropolitan Street Railway stock. When the Interborough-Metropolitan Company, which is reported to hold some 96 per cent of the stock of the Metropolitan Company, is informed by the New York City Railway Company of its inability further to pay the dividend guaranteed by it on the Metropolitan Street Railway Company stock the Interborough-Metropolitan preferred dividend will be passed and the company, as a stockholder, will take its chance of getting something out of the Metropolitan Street Railway, along with the holders of the balance of the $52,000,000 outstanding.

The Public Service Commission has adopted rules to be followed by all corporations coming under its jurisdiction, in the matter of making application for the approval of the issue of stocks, bonds, notes and other evidence of indebtedness. Practically everything pertaining to the financial standing of corporations is covered. The Commission has decided to order that the gas and electric corporations, in filing their annual reports with it, shall also include a statement relative to the manner in which each franchise stated to be owned by each company was acquired.

The Public Service Commission has passed a resolution approving the proposed subway improvement at Ninety-Sixth Street and requesting the Board of Estimate to issue bonds to the amount of $850,000, the estimated cost of the work. The Commission also passed upon the form of contract which is to be given to John B. McDonald and the Interborough Rapid Transit Construction Company as a supplement to the original subway contract. The improvement, which will consist of the construction of three additional tracks, was approved by the Rapid Transit Commission before it went out of office. The approval of the Board of Estimate and Apportionment is necessary before the contract can be let. There is no doubt that the Board will approve the improvement. The next regular meeting of the Board will be held Sept. 20, but it is expected that a special meeting will be held before that time. The completion of the additional tracks is expected greatly to facilitate the handling of traffic in the subway. President Shonts of the Interborough-Metropolitan Company and President Bryan and General Manager Hedley of the Interborough Rapid Transit Company have testified that the subway is operated at present to its fullest capacity during rush hours, but that after the Ninety-Sixth Street improvement is made it will be possible to increase the number of local trains by 33 1-3 per cent and to increase the express service also.

The Public Service Commission in the Second District has issued a circular to railroad and street railway corporations embodying a copy of the law creating the Commission and also the freight and passenger tariff regulations prescribed by the Commission. If sufficient inquiries are received as to the application of these regulations the Commission announces that it will call a general conference at which opportunity for a discussion of all questions involved will be afforded. A feature to which the Commission directs attention is that joint fares over electric lines must in each instance be named in joint tariffs. All charges for baggage must be named by the railroads in tariffs filed with the Commission.

THE CLEVELAND SITUATION

Through its attorneys, John G. White, Thomas H. Hogsett and Squire, Sanders & Dempsey, the Cleveland Electric Railway Company, as a resident and tax payer of the City of Cleveland, has requested City Solicitor Newton D. Baker, as the representative of the city, to bring injunction proceedings against the execution of the ordinance passed by the City Council on Aug. 3, which is intended to cure all the defects in ordinances formerly enacted, granting the Forest City Railway Company rights in the streets to build railway lines. In the communication to Mr. Baker, it is stated that the ordinance was passed in contravention to the laws and ordinances governing such action, that it is an abuse of corporate power and that its passage was procured by fraud and corruption. Eleven reasons are given as to why suit should be brought in behalf of the city to prevent the execution of the ordinance that was passed at that time.

The communication states that the preparation of such a suit will probably disclose many other causes for its filing and reasons for the illegality of the ordinance. It is also asked that some haste be made, for the reason that the ordinance becomes operative on Aug. 15. Mr. Baker has refused to bring the suit requested, on the grounds that he does not consider these causes sufficient. The Cleveland Electric has opened the subject and given an idea of the ground on which the Forest City now stands, but will be forced to bring the injunction suit itself.

Charles S. Thrasher, of the Cleveland Construction Company, who owns five shares in the Forest City Railway Company, on Wednesday sent the officers a letter requesting the privilege of making an examination of the books and records of the company. President M. A. Fanning, of the company, replied that the officers would be glad to arrange a time for such inspection, either by Mr. Thrasher himself or his representative. Not to be outdone, City Clerk Peter Witt, owner of one share of stock in the Cleveland Electric, has made a similar request of that company.

Friday afternoon was set as the time for Thrasher and his attorney to examine the books of the Forest City Railway Company, but Secretary Alber called the meeting off, and suggested Saturday afternoon. The gentlemen were at the office, but Mr. Alber and Attorney W. H. Boyd, after a conference, announced that the books were at the office of the United Banking & Savings Company and could not be seen. They were promised for Monday of this week.

City Clerk Peter Witt went to the office of the Cleveland Electric Railway Company Saturday morning, accompanied by aids, with the intention of making an examination of the books. President Andrews told him to make himself at home and that he might examine all the books he desires and then publish his finding, if he so desires. In all probability he will have a job on his hands that will take some time, if he undertakes to investigate everything as closely as Mr. Thrasher had expected to look into the Forest City's affairs.

So far, Mr. Thrasher has not been granted the right to examine the books and accounts of the Municipal Traction Company, which is claimed to be only an auxilliary of the Forest City. Secretary Alber of the latter company and Attorney W. H. Boyd said they had nothing to do with the Municipal Traction Company and could not give them authority to examine the books.

The Isom injunction case, which involved the consents of property owners and which was decided against the Low Fare Railway Company in both the Common Pleas and Circuit Courts, has been taken to the Supreme Court on a petition in error. The claim that property owners have power further than merely to express their willingness to have a railroad in front of their property was vigorously attacked in this case. The low fare companies have advocated the idea that a property owner who gives consent for a railroad does not have power to express his choice of companies to build it. The court will not convene until October, so there is little chance of a decision until the first of next year any way.

It is possible that the railroad question will go into the campaign this fall, whether the leaders desire it or not. While no action has been taken on the report made by a committee of the League of Republican Clubs, it is said that various points have been under consideration. If a plank is made of the questions it is believed that it will include a division of profits of the company above 6 per cent on the actual investment with the city. Such a demand for a settlement of the matter is growing up that the election of Mayor this fall can hardly help but be based upon the stand the candidates take on it.

Although the ordinance re-enacting the grants to the Forest City Railway Company became operative Saturday, no attempt was made to take advantage of them on any of the streets affected. Most of the Cleveland judges are away on vacations and there could not be a better time for the company to get started, as it would probably be rather difficult to secure an immediate restraining order. In fact, some people have intimated that this is the reason for passing the ordinance at the time action was taken.

NORTHERN ELECTRIC COMPANY

The Northern Electric Company, which is building an interurban electric railway between Marysville and Sacramento, Cal., expects to have passenger trains in operation between those cities by Sept. 1. The distance between Sacramento and Oroville is about 90 miles, and it is estimated that the running time between these two divisions will be about two hours, the cars thus attaining a speed approximately 45 miles an hour. This will be lessened to a certain extent, however, owing to the fact that there will be at least ten stations between Sacramento and Oroville. Work in every department of construction on the railroad is being pushed, and it is expected that the work of ballasting and laying the third rail will be finished by Aug. 20. Already the first carload of freight has been operated over the line from Marysville to Sacramento.

As soon as the company's line is extended to Hamilton City, the 3 miles of roadbed will be replaced by permanent trestle work. In Hamilton City, a set of truck scales has been erected for the weighing of beets. On the completion of the road, hauling of sugar beets will begin and the work of building a permanent track will be completed before the rainy season. At present three grading outfits are at work, employing in the neighborhood of 200 horses and 55 men.

At a recent meeting of the California State Board of Equalization the officials of the Northern Electric Company explained the workings. The Northern Electric Company report shows 55.44 miles of track, valued, with the franchise and rolling stock, at $126,895. There are 40.30 miles in Butte County, 14.09 in Sutter, and 1.02 in Yuba. The rolling stock is valued at $22,000. The gross earnings are given as $99,315.28, the operating expenses as $61,303.44, and the net profits $38,011.84.

It is reported at Woodland, Cal., that the Northern Electric Company has purchased the Vallejo & Northern Electric Railway interests. The latter road is the one which is planning to build a line from Vallejo via Suisun to Winters and Woodland, thence northward west of the Sacramento River to a junction with the branch line now being built westward from Chico to Hamilton City. The company will also build a branch line from Cement, near Suisun, to Sacramento. The latter branch will probably be the first part of the road constructed. The road has purchased the Niclas Building, at the corner of Main and Second Streets, in Woodland, for a passenger depot, and will have its power-house and switching yard probably further south on Second Street.

AFFAIRS IN CHICAGO

In rehabilitating its street railway properties the Chicago City Railway Company has spent $683 604.69, according to the first complete certificate of expenses filed with the City Controller by the Board of Engineers. The certificate covers the months of February, March, April, May and June, and shows what credits shall be given the capital account of the street railway company. In this report it is shown that the company has earned $95,178.28 brokerage and construction profit on the sum expended in rehabilitation. The report shows the following:

Actually expended	$683,604.69
Residue of 70 per cent of gross receipts set apart for maintenance, operating and repairs	49,082.80
Balance	634,521.89
Brokerage and construction	95,178.28
Total to capital account	729,700.17

In getting the figures the engineers worked in two ways. Their field men made an "inventory" of the work done by the company and of the materials used, estimating the cost of each. Their auditors checked up the company's books and the items as disclosed by the field work were set against the items as shown by the investigation of the books. The board then took the two reports and endeavored to harmonize them. In instances where considerable variance was shown the work in the field and in the books was done over again, no figures of the company being taken without verification.

Bondholders of the West Chicago Street Railway Company have appointed a committee to act in their behalf in the reorganization of the Chicago Union Traction system. The bondholders oppose the traction settlement ordinance. The committee is composed of James N. Wallace, president of the Cenral Trust Company of New York; Hugo Blumenthal and Frederick H. Ecker. This committee has issued a circular stating that the terms of reorganization by the plan prepared by G. W. Wickersham and L. C. Krauthoff and indorsed by the arbitrators may destroy the value of the bonds, which now draw 5 per cent interest. The committee also states that bonds may be deposited with the Central Trust Company up to Sept. 16, 1907, in accordance with the terms of an agreement that will be ready for delivery at the office of the trust company within a few days.

Judge Grosscup, in the United States Circuit Court, on Monday, granted an appeal from his recent order directing that the properties of the Union Traction Company be leased to the Chicago Railway Company. The appeal will be heard on Sept. 5.

SEPTEMBER MEETING OF THE STANDARDIZATION COMMITTEE

W. H. Evans, chairman of the standardization committee of the American Street & Interurban Railway Engineering Association, has issued a notice that the next meeting of the standardization committee will be held in the offices of the American Street & Interurban Railway Association, 29 West Thirty-Ninth Street, New York, on Sept. 12, at 9:00 a. m., and will continue through Sept. 13, or until the report of the committee can be definitely decided upon. The subjects to be considered are: (a) standard axles, journals, journal bearings and journal boxes; (b) standard brake shoe and brake shoe head and keys; (c) standard section of tread and flange of wheels; (d) discussion of standard rail sections and special work as directly affecting wheel tread and flange.

The subjects will be considered in the order given, that is axles, journals, journal bearings and journal boxes will be taken up on Thursday morning, and in the afternoon, if that subject has been disposed of, subject (b) will be considered. On Friday morning the committee will reconvene at 9:00 a. m., to consider standard sections of treads and flanges of wheels. This meeting will be attended by P. H. Griffin, chairman of the wheel manufacturers' committee, which includes representatives of the various manufacturers of chilled cast iron wheels, and by E. Sidney Lewis, of the Standard Steel Works, who will act as chairman for the representatives of the manufacturers of steel wheels. At the same meeting the subject of rail sections and special work as affecting the section of wheel tread and flange will be taken up. Victor Angerer, vice-president of William Wharton, Jr., & Company, will act as chairman of the manufacturers of special work. In addition, the representatives of manufacturers, other than those mentioned above, will be present.

The chairman of the committee is especially anxious that all of the members of the committee should attend these meetings, as the time for holding the national convention is rapidly approaching and the report should be printed and circulated in advance of the convention.

INCREASE IN WAGES IN ATLANTA

An increase in wages of 10 per cent for motormen and conductors on the lines of the Georgia Railway & Electric Company, of Atlanta, is announced. The new wage scale is 16 cents an hour for the first six months of service; 17 cents an hour for the second six months; 18 cents an hour for the second year; 20 cents an hour for the third year; 21 cents an hour for the fourth year, and 22 cents an hour for the fifth year. The old wage scale was 16 cents an hour for the first year; 17 cents the second; 18 cents the third; 19 cents the fourth, and 20 cents the fifth year. The increase was announced at the regular monthly inspection of the men by Superintendent Hurt. Vice-President T. K. Glenn, who is manager of the railway department, also addressed the men, assuring them that the company appreciated their loyalty and their untiring efforts to co-operate with the officials for the good of the service. He had some remarks to make from the point of view taken by passengers, and requested the men to try and remember these things so that the public would have no cause for complaint.

INCREASE IN WAGES FOR CONSOLIDATED EMPLOYEES

Details are announced of the new wage schedule for the Consolidated Railways Company's lines in New Haven which went into effect Saturday, Aug. 17. The chief change is that the men will get 25 cents an hour after they have been with the company for five years, or at the beginning of their sixth year, whereas formerly they did not get that much until their eighth year. Then, too, there is a provision that regular men, when called on for overtime work, shall be paid at least for an hour's work, though they may not work that long. Over an hour they will be paid for the exact time. The order provides for a rate of 21 cents an hour for first-year men, 21½ cents for second-year men, 22 cents for third, 23 cents for fourth, 24 cents for fifth, and 25 for all over five. Overtime will be paid for at the rate of 30 cents for all. The other provisions are as follows:

"Regular men who are ordered to report on the second half of their run later than their regular time will be allowed time from the time called for on their regular runs, but overtime will not begin until the time called for by their regular run has been worked.

"Regular men running into a car house, or a relief point, ordered to go directly to another car house to take out a car will be allowed time from the time at which they are ordered to leave their regular car houses, or relief point, and their time will stop when their car is run into the car house.

"Regular men who have finished their run will not be ordered to report for work unless they receive at least 1 hour's time.

"When men are held for orders or on the car so as to prevent their going to their regular boarding place for meals, the company will either furnish them a lunch check or a box lunch.

"Regular men breaking in new men will be paid regular rates only."

Wage schedules in Waterbury, Bridgeport, Middletown, Torrington and other cities are slightly lower than the New Haven schedules. For Waterbury the following schedule is announced: First year, 20 cents an hour; second year, 21 cents an hour; third year, 21½ cents an hour; fourth year, 22 cents an hour; fifth year, 23 cents an hour; sixth year and thereafter, 24 cents an hour. For Middletown and Torrington lines the schedule will be: First year, 19 cents; second year, 19½ cents; third year, 20 cents; fourth year, 21 cents; fifth year, 22 cents; sixth year and thereafter, 23 cents.

AMERICANS AFTER OTTAWA TROLLEYS

American capitalists are reported to have obtained an option on the Ottawa Electric Railway, of Ottawa, Ont. The price named is $3,000,000, in addition to floating liabilities of $250,000 and a bonded indebtedness of $500,000. The capitalization is $1,000,000, and last year's net earnings were 18 per cent, out of which a dividend of 12 per cent was paid, the balance being carried to the reserve. The company's franchise has sixteen years to run, and at the end of that time the city has the right to take over the property at a valuation to be fixed by arbitration. Representatives of another American syndicate are inquiring into the terms on which the Ottawa Electric Light Company and the Ottawa Gas Company, now under one control, can also be acquired.

CHARTERS AUTHORIZED IN CONNECTICUT TO THIRTEEN COMPANIES

An inventory of the work of the recent Legislature in Connecticut shows that charters were authorized to be issued to thirteen street railway companies with a total capitalization of $8,000,000. The principal companies which were chartered are the Bridgeport & Danbury Electric Railway Company, the Danbury & New Milford Street Railway Company, the Danbury & Northern Electric Railway Company, the Meriden, Middleton & Guilford Electric Railway Company, the Norwich, Colchester & Hartford Traction Company, the Orange Street Railway Company, the Putnam & Rhode Island Street Railway Company, the Waterbury & Milldale Tramway Company, the Windsor Locks & Western Street Railway Company and the Windsorville & East Hartford Street Railway Company.

Several general laws relating to street railways were enacted. One of them provides that no electric railways shall be opened to public traffic until the operating company has first obtained from the Railroad Commissioners a certificate that the road is in a safe and suitable condition. Another act provides that when one railroad corporation is absorbed by or merged with another railroad corporation a sworn statement setting forth the facts and details of the transaction must be filed with the Secretary of State. Still another law requires that a street railway company shall supply reasonable accommodations for passengers and shall afford proper facilities for receiving passengers from and delivering them to other street railway companies. Another new statute provides that an employee of a street railway company through whose intoxication, misconduct or wilful neglect, loss of life or broken limbs are caused shall be liable to a maximum imprisonment for ten years.

ATLANTIC CITY PAMPHLETS

The American Street & Interurban Railway Association is mailing to members of the association two pamphlets descriptive and illustrative of Atlantic City. They contain typical views of the resort where the convention is to be held this fall, with a list of the hotels and other information useful to the visitor.

WHEEL GUARD TESTS IN MASSACHUSETTS

In connection with the testing of fenders and wheel-guards for street cars under the requirements of the Massachusetts Railroad Commission, the next step will be a test in actual service of a wheel-guard that is dropped into working position by the motorman in making an emergency stop with the air brake. Brake and guard are so connected that although the guard remains suspended while the brake is making ordinary service stops, it drops to the rail level when the brake is thrown for an "emergency" stop.

The test of a wheel-guard composed of separate metal prongs, extending downward in front of the wheels in such a manner as almost to sweep the ground just in front of the wheels was a failure so far as the Boston & Worcester cars are concerned. In the apportionment of devices of different kinds this one fell to the Boston & Worcester Company. The experience is that the prongs strike the high spots in the roadbed and bend or crumple, rendering the guard of no practical value. While the Boston & Worcester speeds made the test a particularly severe one, the opinion was expressed that the same result would obtain if the device were tried on cars whose routes and speeds did not exceed those of city service.

The Boston & Worcester has now received a Hunter fender and trip wheel-guard, which it will try out on certain of its big cars. It has for some time been trying a high fender of the cowcatcher shape, formed of cordage net over a metal frame.

Cars of the Springfield system are trying, among others, a fender with tilting platform, which, though set with edge near the roadbed for ordinary service, is intended to tilt backward on striking an object, with the effect of lifting and holding the object clear of the rail.

In Boston the Boston Elevated Railway Company is making an extended trial of a fender consisting of a loop-shaped metal tube, hanging low in front of the forward end, and serving as the rim to a cordage net. In some cases the front of the car is also provided with an apron of thin metal strips, to deaden the impact if a person is struck. A trial is also being made of a device similar to the well-known Liverpool wheel-guard. The box around the running gear of the Boston cars, while it encloses the wheels completely in a manner intended to plough a fallen body clear of the tracks without allowing it to come in contact with the running parts, is exciting some adverse comment for the reason that it does not enclose all the truck frame and body supports. These projections, it is claimed, would be almost as dangerous to a person under the car as actual contact with the wheels.

Railroad Commissioner George W. Bishop, to whom the Massachusetts Railroad Commission has delegated the details of arranging for the tests, has recently been in Springfield and Worcester inspecting the operation of the different devices and noting results.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED AUG. 6, 1907

862,135. Automatic Trolley Retracting Mechanism; Henry B. Clarke, Highland Park, Ill. App. filed March 1, 1906. A spring drum and ratchet and means for actuating the same to pull down the pole when the trolley leaves the wire.

862,157. Aquatic Merry-Go-Round; Henry Healy, Buffalo, N. Y. App. filed Aug. 3, 1906. A special form of boat is guided through a circuitous waterway along which scenery is arranged in imitation of prominent places.

862,159. Trolley; Aaron Hill, Lynn, Mass. App. filed March 2, 1907. The pole has a hinged section at its upper end which moves upward to trip and drop the pole when the wheel leaves the wire.

862,186. Power Controlling Mechanism; William R. McKeen, Jr., Omaha, Neb. App. filed Dec. 19, 1905. Power controlling and speed-changing means mounted upon the car axle, a supporting frame mounted on said axle and levers pivoted to the frame adapted to respectively control the power-controlling and speed-changing means.

862,191. Trolley Wheel; Piatt M. Orlopp, Indianapolis, Ind. App. filed July 12, 1906. The spokes of the wheel are double springs so as to afford resiliency.

862,198. Suspension Means for Electric Motors; Charles A. Psilander, Pittsburg, Pa. App. filed Dec. 27, 1906. The combination with an axle, bearings thereon, a truck frame, means for resiliently supporting the same comprising members seated upon the bearings, a motor, and means for supporting the same comprising a frame having side portions that are seated upon the bearings and surround said members.

862,205. Mechanism for Controlling Air Brakes; Edward G. Shortt, Carthage, N. Y. App. filed March 6, 1902. Means for constantly supplying air to the train pipe and auxiliary reservoir until the pressure therein reaches a degree nearly equal to that required to effect release of braking pressure, the difference being readily supplied when needed from the excess in the main reservoir.

862,217. Combined Rail Chair and Joint; Harvey L. Toppin, New Castle, Del. App. filed March 19, 1907. A combined rail chair and joint comprising an integral member into which the ends of the abutting rails are inserted, said member embracing the base and web of the rails.

862,277. Spring for Trolleys and Harps; Ralph E. Noble, Chicago, Ill. App. filed Jan. 13, 1905. A spring for trolley harps comprising a bent strip of spring metal having a loop at one side and having perforations adapted to engage with the pin and axle of the trolley harp.

862,395. Car Switching Mechanism; Andre Hector, East Newark, N. J. App. filed Jan. 24, 1907. A wheel is mounted in advance of the car wheels, which wheel is adapted to engage a groove in the roadbed and compel the truck to swivel in the proper direction to take the switch.

862,441. Electric Controlling System; Charles P. Breese, Norfolk, Va. App. filed Aug. 11, 1902. A block signal system for electric trolley roads having a sectional trolley conductor and relay magnets operated by the passage of current thereto from the mains.

862,442. Electric Car-Controlling System; Charles P. Breese, Norfolk, Va. App. filed Aug. 11, 1902. Relates to modifications of the above.

862,582. Trolley Switch Frog and Pole; Augustus Neubert, Elizabeth, N. J. App. filed Feb. 15, 1906. A pair of laterally projecting rolls adapted to bear on the under surface of flat plates adjacent the trolley wire at turn-outs.

862,589. Automatic Electric Signaling Device; Avila J. Roy, Providence, R. I. App. filed March 9, 1906. A semaphore signal positioned by a circuit which is closed by a mechanical tappet adjacent the track rail.

862,607. Pleasure Railway; Arthur Bragg, Brooklyn, N. Y. App. filed Jan. 2, 1907. The car is hoisted to a high elevation and descends by a series of inclined trackways arranged one above the other, one end of each incline being upturned to stop the car and cause it to switch to the next incline, thus giving the car a forward and back movement.

862,701. Trolley Wheel; William H. Bradt, Schenectady, N. Y. App. filed Dec. 5, 1906. The wheel is laterally divided along the line of the groove and the halves are spring-pressed together to afford better contact with the wire.

862,792. Brake; Paul X. Beaulieu, Presque Isle, Me. App. filed April 11, 1907. The usual brake staff wheel is provided with a lever extending beyond the periphery of the wheel so as to afford greater purchase.

862,798. Pleasure Railway; Arthur Bragg, Brooklyn, N. Y. App. filed Oct. 30, 1906. A framework of the "Ferris wheel" type is provided, to the axle of which, on both sides of the wheel, small wheels are attached which are adapted to run on a trackway. Means for operating the traction wheels and for operating the Ferris wheel through gearing from the traction wheels.

PERSONAL MENTION

MR. R. H. CONOVER, secretary and treasurer of the People's Street Railway Company, of Nanticoke, Pa., is dead.

MR. D. P. BARNES, of Denver, Col., has been appointed assistant manager of the Berkshire Street Railway, of Pittsfield, Mass.

MR. J. D. GABOURY has resigned as manager of the Gadsden, Alabama City & Attalla Street Railway and lighting and ice plant of the same company.

MR. O. H. MURLIN, formerly auditor of ticket accounts of the Dayton & Troy Electric Railway Company, of Tippecanoe City, Ohio, has been appointed general passenger agent of the company, with offices at Tippecanoe City and Dayton, Ohio, and Mr. L. D. Johnson, formerly traveling freight and passenger agent of the company, has been appointed general freight agent, with headquarters at Tippecanoe City, Ohio.

MR. E. A. STURGIS, for the past two years superintendent of equipment, Boston & Northern and Old Colony Street Railway Companies, has tendered his resignation, to accept a position as master mechanic of the Rio de Janeiro Tramway & Power Company, of Rio de Janeiro, Brazil, of which Mr. Fred A. Huntress, formerly of Worcester, is general manager. Mr. Sturgis is succeeded by Mr. E. W. Holst, formerly superintendent of car repairs, Old Colony Street Railway Company. Mr. Sturgis is a member of the executive committee of the New England Street Railway Club.

MR. L. C. BRADLEY has been appointed general manager of the Eastern Pennsylvania Railways Company, of Pottsville, Pa., which controls the electric railway lines operating in and about Pottsville. Mr. Bradley formerly was superintendent of the Scioto Valley Traction Company, of Columbus, Ohio, from which he resigned to become connected with J. G. White & Company, of New York, who are syndicate managers of the Pottsville properties. Before becoming connected with the Scioto Valley Company Mr. Bradley was superintendent of the Seattle & Tacoma Interurban Railway.

MR. F. B. MALTBY, who has been connected with the Panama Canal work as principal assistant engineer to Mr. J. F. Stevens, has resigned to go with Dodge & Day, engineers and constructors, of Philadelphia, in the capacity of chief engineer. Mr. Maltby is a graduate of the University of Illinois, class of 1882, and in 1907 received an honorary degree from the same institution. He has had a long experience in railroad construction work, municipal engineering and irrigation work, and been connected at various times with the Wisconsin Central, Missouri Pacific, Great Western and Illinois Central Railroads.

MR. MARCY L. SPERRY has been appointed manager of the Savannah Electric Company, of Savannah, Ga., to succeed Mr. L. R. Nash, transferred. Mr. Sperry formerly was connected with Messrs. Stone & Webster, the syndicate managers of the Savannah property, being from May to November, 1902, with the auditing department of the firm in Boston. In the latter month he went to Savannah as purchasing agent of the Savannah company, remaining in that city until August, 1903. Subsequently he acted as first assistant treasurer and afterwards as manager of the Ponce Railway & Light Company. From February, 1906, to July, 1907, he was superintendent of Minneapolis General Electric Company.

NEWS OF THE WEEK

CONSTRUCTION NOTES

Items in this department are classified geographically by States, with an alphabetical arrangement of cities under each State heading.

For the convenience of readers seeking information on particular subjects, the character of the individual items is indicated as follows:

* Proposed roads not previously reported.

o Additional information regarding new roads.

† Extensions and new equipment for operating roads.

Numerals preceding these signs indicate items referring to:

1. Track and roadway.
2. Cars, trucks and rolling stock equipment.
3. Power stations and sub-stations.
4. Car houses and repair shops.
5. Parks and amusement attractions.

oENSLEY, ALA.—The Ensley Street Railway Company has let a contract to Smiley Sons & Company to build its extension on Avenue E and Twenty-Seventh Street to Ensley South Highlands.

*HOT SPRINGS, ARK.—An ordinance has been passed granting Hayes Brothers, I. I. & Real Estate Company, its successors and assigns, the right to use Benton Street from its intersection with Cottage Street (West Side) to the city limits, for the building and constructing of a street railroad and erecting poles, stringing wires, etc., for the operation of same, and to operate electric street cars over said street.

oLAKEPORT, CAL.—The Sonoma & Lake County Railroad, which has been granted an exclusive franchise by the Lakeport Board of Trustees, is about to build an electric railway from Lakeport to Cloverdale, which will pass through Adams Springs, Highland Springs, Saratoga and Bartlett. The company will commence the construction of the line as soon as arrangements are completed for a connection with San Francisco. President A. E. Dickinson, J. F. Fulton, vice-president and general manager, and Engineer D. F. McIntyre are seeking to establish communication through the California & Northwestern Railroad or one of the other lines tapping their territory. Work will be commenced immediately the connections have been arranged. The line will cover a distance of 27 miles, the highest point traversed being the 1800-ft. altitude between Highland Springs and Pieta Creek, about 11 miles from Lakeport. The line will handle passenger and freight traffic and will cater to tourist trade. The company is composed of nine Lake County and Ukiah capitalists, who hold the entire 10,000 shares.

1†LOS ANGELES, CAL.—The ship "Skogstad" has reached San Pedro harbor with a cargo of 2,000,000 ft. of oak lumber in logs, the first cargo of that kind of timber ever brought across the Pacific. The vessel was loaded at Mororan, Japan, and is under charter to the China Import & Export Lumber Company, of Shanghai. From the logs will be made 72,000 ties for Huntington's new electric lines. Construction work already under way will be hastened by the shipment. Lack of ties has delayed the completion of extensions and new work on several parts of the Pacific Electric system. The Huntington companies now are forced to depend upon the Orient for the major portion of their ties. W. Edwards, agent for the importing company, declares that this shipment of oak wood is the opening wedge for a business which will mean the importing of 10,000,000 ft. of lumber annually. Local agents will build a mill at San Pedro for sawing the oak logs for the market.

oMERCED, CAL.—The Yosemite Valley Railroad is about to start a survey over its entire line. For that purpose, the engineering crew which has for months past been stationed at El Portal has been ordered to report at Merced. The crew consists of eight men under Head Surveyor John C. Reeves. The actual work has commenced in Merced, and it is expected that it will be fully two months before the end of the line at El Portal is again reached. All minor defects along the line are to be corrected, the centers of all the bridges are to be lined up, mile posts will be established and section lines are to be located.

1†PASADENA, CAL.—At a recent meeting there was presented to the City Council an application by the Pacific Electric Railroad Company for a double-track franchise on Colorado Street, in the business district of the city.

oSACRAMENTO, CAL.—The Sacramento & Lake Tahoe Railway Company has filed several notices of location in Placer County for water rights, dam and reservoir sites, etc., on the middle fork of the American River, for the storage of water for the generation of electric power. The railway will cross the American River near Folsom, and use the old railroad grade at the Owen King place, running east of Loomis and continuing up through Long Valley. It is expected that by another year the road will be in operation over the Sierras to beautiful Lake Tahoe.

1†SAN BERNARDINO, CAL.—The Pacific Electric Railroad is rushing the completion of its system between Covina and Pomona, and it is said that plans are being made for the continuance of the line to San Bernardino.

oSAN FRANCISCO, CAL.—The bridge across the Pajaro River for the San Joaquin Valley Western Railroad is practically completed, and the work of laying rails will begin soon. The railroad company expects to have the road finished between Chittenden and San Juan within sixty days, although some trouble is being experienced in securing rights of way. A survey for the permanent line from Chittenden to Watsonville is to be made at once, and then a line will be surveyed from the San Benito River through Hollister to Fresno and Hanford. Information is given out that the Ocean Shore is to be pushed rapidly to completion.

oSTOCKTON, CAL.—The first cars over the Central California Traction Company's interurban line were run Aug. 5 as far as the Hildreth place, about 7 miles beyond Stockton. Two cars were put on the line, and they made thirty-minute trips. The line will soon be completed to a point about 3 miles from Lodi. Work on the new line is being rushed.

oDANBURY, CONN.—Frank S. Bishop, of New Haven, who is identified with the Danbury-New Milford Electric Railway, says that preliminary engineering will probably be the only work done upon the line before next spring. Mr. Bishop says the company will be formally organized soon, and plans for the construction of the road gotten under way.

†WILMINGTON, DEL.—The People's Railway Company has planned a new system for the Eleventh Ward, and has made application to the Board of Directors of the Street and Sewer Department for permission to build the proposed system.

1-2†ST. AUGUSTINE, FLA.—It is understood that the St. Johns Light & Power Company expects to build about 5 miles of track during the next three months. It is said that the company will also purchase considerable rolling stock.

oBOISE, IDAHO.—The Boise & Interurban Railway has been placed in operation.

oBOISE, IDA.—The Boise Valley Electric Railway Company, which is building a line from Boise to Nampa, a part of which is already constructed and being operated, has just secured a franchise to run its line over the streets of Caldwell. This railway will connect Boise with Caldwell, going via Nampa and Deer Flat Reservoir, and thence over the Caldwell Interurban to Caldwell.

*CHICAGO, ILL.—The Chicago & Interurban Railway Company, with a capital stock of $100,000, has secured a license to incorporate. The road is to be constructed from Chicago south through Harvey, South Holland, Calumet, Thornton, Chicago Heights, Crete, to Joliet, Blue Island, Riverdale, Dalton, Hammond and other towns. The incorporators are: J. W. McGill, John W. Humphrey, Claude E. Fitch, L. E. Eaton, J. M. Miller, H. D. Moreland and Fred F. Myers.

*SPRINGFIELD, ILL.—The Secretary of State has authorized the incorporation of the East St. Louis & Eastern Railway Company, with headquarters at East St. Louis, and a capital stock of $2,500. The line is to be constructed from a point near Belleville in a westerly direction to East St. Louis. The incorporators are: L. C. Haynes, T. W. Gregory, G. C. Pierce, F. H. Thomas and F. H Kruger.

oSPRINGFIELD, ILL.—A certificate has been filed with the Secretary of State of an increase in the capital stock of the Springfield Belt Railway Company from $5,000 to $500,0000. This company is to construct a belt railroad from the interurban's line east of Springfield, to connect with the line south of the city limits, in order that it will not be necessary to run express cars through Springfield. The Danville & Eastern Illinois Railway Company certified to an increase of capital stock from $5,000 to $500,000. This road is to be built from Danville to Terre Haute, Ind.

1†EVANSVILLE, IND.—The Evansville & Mt. Vernon Traction Company has decided to ballast the line between this city and Mt. Vernon with broken stone and make a number of betterments.

oNAPPANEE, IND.—The matter of underwriting the bonds in aid of the construction of the Nappanee-Syracuse section of the Fort Wayne & South Bend Interurban Railroad is progressing satisfactorily.

oNEW CASTLE, IND.—The concrete stack at the power house of the Indianapolis, New Castle & Toledo Traction Company has been completed. Work on the power house proper is nearing completion, and, after the laying of a few miles of rails, the line will be ready for operation.

oSOUTH BEND, IND.—The City Council has granted the Chicago, South Bend & Northern Indiana Railway Company the right to allow the Winona Interurban Company to come in over its local tracks, and within a week through service will be established between this city and Warsaw. The Wabash division will next be completed, thus enabling through connection between this city and Indianapolis.

†DES MOINES, IA.—The Des Moines City Railway intends to extend its line across the new Sixth Avenue bridge over the Des Moines River to Highland Park.

oMUSCATINE, IA.—A survey is under way for a projected electric railway to Davenport. It is reported that R. A. Roberts, of St. Louis, is the promoter.

3†OSKALOOSA, IA.—The Oskaloosa Traction & Light Company has just contracted for the following apparatus: One 500-hp Buckeye cross-compound engine, one 300-kw G. E. three-phase alternator belted, one 200-kw 5000-volt railway generator; also switchboard, exciters and instruments.

oPARSONS, KAN.—The City Council has granted C. L. Brinser, representing Harrisburg (Pa.) interests, a franchise for a street railway line which is to be part of an interurban system. There will be two lines, one extending north to Chanute and Pittsburg and the other south to Altamount and Edna, and then on to Coffeyville. Work is to begin in sixty days, and the system is to be completed in one year.

oDANVILLE, KY.—The Danville Light, Power & Traction Company, which has been operating a lighting system in Danville for some time, is reported to be considering the construction of an electric railway and a line taking in Lancaster, Stanford, Hustonville, Junction City and Harrodsburg. Representatives of the Westinghouse Company have been in the city in the interest of the local company to prepare estimates of the cost of building the proposed system.

*SOMERSET, KY.—The Somerset & Nashville Railroad Company has been incorporated, with a capital stock of $10,000, to build an electric railway from Somerset to Nashville.

oALGIERS, LA.—It is promised that the first electric cars on the new line between Algiers and Gretna will be operated over the line Aug. 25. The work on the road is now progressing satisfactorily, and it is hoped it will be completed in the near future.

2-3-4†LAKE CHARLES, LA.—It is reported that the Lake Charles Street Railway Company is actively engaged in erecting a brick car house 55 ft. x 150 ft., and a brick addition to its power station. The company has recently placed a contract for one 1000-kw Westinghouse steam turbine, to be delivered in September; also for two Brill semi-convertible 28-ft. motor cars for October delivery.

†BOSTON, MASS.—The Boston Elevated Railway Company has filed plans with the Railroad Commissioners showing the proposed alterations of elevated stations due to the running of eight-car trains.

1†SHELBURNE FALLS, MASS.—The Shelburne Falls & Colrain Street Railway Company has received the franchise from the Selectmen of Buckland for the proposed extension across the river from Bridge Street to the Boston & Maine station.

1†EXCELSIOR, MINN.—The Minneapolis & St. Paul Suburban Railway Company has started work for the extension of the line to Birch Bluff, 2 miles. Geo. Turnham, of Orono, will do the grading.

1†NATCHEZ, MISS.—The Southern Light & Traction Company proposes to relay its tracks with heavy rails.

1†ST. LOUIS, MO.—Extensive improvements are under way on the Hodiamont branch of the United Railways Company system. The entire line from De Hodiamont to Kirkwood will be practically rebuilt.

1†BUTTE, MONT.—The Butte Electric Railway Company has recently placed contracts for the following construction work: East Centerville extension, Gallatin addition to city of Butte, 2½ miles, and the Silver Bow Park addition, all of which are to be finished by Oct. 1, 1907.

oRENO, NEV.—The rails and poles for the Nevada Interurban Railroad, which is being constructed from this city to Moana Springs, have arrived. The road leads to two suburban tracts and to Moana Springs, a popular resort 2 miles from the southern limits of the city.

1†CATSKILL, N. Y.—The Catskill Electric Railway Company expects to build within the next five weeks about 500 ft. of track across the bridge over the Catskill Creek.

1†DUNKIRK, N. Y.—The Buffalo & Lake Erie Traction Company is reported to be considering the construction of a branch from North East to Findley Lake.

oHEMPSTEAD, N. Y.—Arthur P. Heinze has been elected a director of the South Shore Traction Company, of Long Island. This company has obtained a new franchise from the Town Board and Highway Commissioners of Hempsted, L. I., and now has an uninterrupted chain of franchise from Patchogue, L. I., to the New York city line. The company proposes to enter the city of New York by way of the Fifty-Ninth Street Bridge. Among the other associates in the company are: James T. Wood, William P. Youngs, F. D. Kilburne and Paul T. Brady.

1†ITHACA, N. Y.—The Ithaca Common Council has granted a franchise to the Ithaca Street Railway Company for a double track. The feature of the franchise was a provision that tickets be sold six for 25 cents. Two months ago the company abolished a commutation-book rate of twenty-three tickets for $1 and one hundred tickets for $4.

oNEW YORK, N. Y.—As the result of a decision handed down in the Supreme Court by Justice Dayton, the Board of Estimate and Apportionment is prohibited from granting the application of the New York & Port Chester Railroad Company to alter its route to connect with that of the New York, Westchester & Boston Railway Company until the application for a permanent injunction brought by Robert E. Robinson, a minority stockholder in the latter company, is tried out, which will probably be early in the fall.

oPATCHOGUE, N. Y. The Patchogue Village Trustees have denied the application made last April by the South Shore Traction Company for an electric railway franchise within this village.

oASHEVILLE, N. C.—It is stated that the Champion Fibre Company, of Canton, is interested in building an electric railway between Canton and Waynesville. The distance between the two places is about 10 miles, and the proposed line will run through one of the richest agricultural sections in Western North Carolina, with water power close at hand.

oFAYETTEVILLE, N. C.—It is reported that construction will begin immediately upon the line of the Fayetteville Street Railway & Power Company, from Fayetteville to Hope Mills, 7 miles.

oGREENSBORO, N. C.—Construction is reported to have begun on the electric railway to connect Greensboro with High Point and Winston-Salem. A. H. Jones, of Greensboro, has a contract for part of the construction.

1†RALEIGH, N. C.—The Raleigh Electric Company, it is reported, may extend its line to Crabtree Creek, 2½ miles.

*SALISBURY, N. C.—The New South Investment Company has been chartered to build and operate street railways, etc.; capital, $5,000,000, but it may begin business when $3,000 are subscribed. Those interested are Cornelius O'Connor, of New York; Frederick H. Payne, of Williamsport, Pa.; Dix W. Noel, of New York, and L. L. Gaskill, of Salisbury.

oSALISBURY, N. C.—The Board of Aldermen has granted a franchise to the Piedmont-Carolina Railway Company to build a belt-line railway from Newton Heights, in Spencer, to Inniss Street, in Salisbury, and thence to a point near the new Fair Grounds.

*GRAND FORKS, N. D.—J. L. Lambrecht, president of the Traction Securities Company, and Dr. Stewart, both of Minneapolis, are at work on plans for the incorporation of the Northwestern Interurban Railway Company, with a capital of $1,000,000, for the purpose of building electric railways in Grand Forks and Crookston, an interurban line connecting the two cities, and a line eastward from Crookston to connect with the Soo. They propose to have on their board of directors business men of Grand Forks and Crookston, in order that the interests of the two cities may be properly represented.

1†CINCINNATI, OHIO.—A committee of citizens of Bond Hill, a village of 2000, near Cincinnati, called upon President W. Kelsey Schoepf a few days ago and requested that he extend the tracks of the Cincinnati Traction Company to the town. Mr. Schoepf explained to them that the 2 miles of track would be a losing proposition to his company for some time to come. When the committee put up the argument that the road would develop the town and cause an appreciation in the value of property through the demand for it, Mr. Schoepf made a proposition to the effect that if the people of the town would organize a company, subscribe $100,000 to the capital stock, which will be required to build it, he will operate it and assume all the duties of having it built, and that when it reaches a point where it will pay 6 per cent on the investment his company will take the stock at par. To show his good faith in the proposition he offered to take $25,000 of the capital stock himself. The committee will report at a public meeting of the villagers.

†CLEVELAND, OHIO.—An announcement has been made by the Lake Shore Electric Railway Company to the effect that on and after Aug. 19 the purchasing for the Lake Shore Electric Railway Company will be done in the office of the general manager at Norwalk, Ohio, instead of in Cleveland, as heretofore. Purchases will be made over the signature of F. J. Stout, general manager.

†COLUMBUS, OHIO.—The rails have all been laid on the London cut-off of the Indiana, Columbus & Eastern, and the work of ballasting will begin at once. It will probably be ready for use by Nov. 1.

2†FINDLAY, OHIO.—The management of the Toledo, Fostoria & Findlay Railway Company has closed a contract with the Niles Car Company, of Niles, for four new cars, to be used when the extension to Toledo from Pemberville is completed. The cars will be very similar to those now in use by the company.

*MANSFIELD, OHIO.—The Massillon, Wooster & Mansfield Traction Company has been incorporated, with a capital stock of $10,000, by G. A. Bartholomew, W. C. Rhodes, O. Halm, J. H. Cousins and E. R. Lewis. The purpose of the company is to build and operate an electric railway between Mansfield and Massillon through Richland, Ashland, Wayne and Stark Counties.

oMARIETTA, OHIO.—The organization of the Muskingum Valley Traction Company has been completed under the laws of this State. The company is building an electric railway up the Muskingum Valley toward Zanesville, and it is thought that it will be completed as far as Beverly by next spring. The intention is to connect at Zanesville with the Columbus, Newark & Zanesville line of the Indiana, Columbus & Eastern, and thus complete the road to the river, and an east and west line between the river and Indianapolis. The roadbed is now being graded, and it is probable that the work of laying steel will be begun by Sept. 1.

oORRVILLE, OHIO.—James B. Meech, of Doylestown, is at work securing the right of way for the Orrville, Doylestown & Barberton Electric Railroad, and has reached the old Conrad homestead south of Marshallville. It is also said that the line will cross underneath the C. A. & C. Railroad north of Marshallville.

†TOLEDO, OHIO.—At a meeting of the City Council last week the ordinance granting the Lima & Toledo Traction Company the right to cross certain streets in the southern part of the city in gaining an entrance to the business district was referred back to the committee on railroads and telegraphs, in order that two amendments suggested might be considered further. One amendment will provide that inbound limited cars shall stop at some point between South and City Park Avenues. The ordinance provided for stops for local cars. The other amendment will be to the effect that if at any time within ten years the city shall decide to elevate the grade of the boulevard, South and Western Avenues so that they shall pass over the canal, and the tracks of the Lima & Toledo and the Clover Leaf Roads at a height of 10 ft., the companies shall lower their tracks and pay for the bridges and viaducts. This latter amendment imposes an element of expense that may be considered by the company before accepting the franchise as amended, since the City Council will have arbitrary power to make this change whenever it sees fit, without consulting the company about the matter. The original franchise provides for the separation of the grades at the points named within ten years.

1-2-3-4†TOLEDO, OHIO.—It is reported that the Marion-Bucyrus Railway & Light Company expects to place contracts during the next twenty weeks for the following construction work and apparatus: Twenty miles of roadbed and track, car house, power plant and equipment for same; also four passenger and one flat car.

oWELLINGTON, OHIO.—Right of way has been secured through Penfield Township, east of here, for the new Elyria Southern Electric Railway. This road has been laid out through Lorain, Medina, Wayne, Ashland and Knox Counties. The company has been incorporated by W. E. Elliott, W. E. Moser, F. N. Carpenter, J. M. Starr and F. L. Sargent, with $100,000 capital stock.

3†PORTLAND, ORE.—The United Railways Company is reported to have secured water-power rights on the Upper Sandy River for the purpose of erecting an important new power plant.

oCOLUMBIA, PA.—Construction work on the Columbia & Manor Electric Railway is to be commenced shortly, in order to have the line in operation by Jan. 1, 1908. Stock books are about ready to close.

oCORRY, PA.—Preliminary surveys have been made for an electric railway from this city to Wattsburg and Findley Lake.

oDRAVOSBURG, PA.—The Council of Dravosburg passed an ordinance over the veto of Burgess J. H. W. Simpson, giving the Dravosburg Street Railway Company rights in the borough.

1-2-4†EASTON, PA.—Manager H. R. Fehr informs the STREET RAILWAY JOURNAL that the Easton Transit Company expects to build two steel and concrete car houses. One is to be built in Phillipsburg, N. J., and the other will be located at Sixteenth and Washington Streets, Easton. In addition, Mr. Fehr states that the company has recently placed an order with J. G. Brill Company for six semi-convertible cars, to be used on the Phillipsburg lines. A contract has also been awarded to T. M. Lesher, of Easton, to build an extension on Heckman Street.

4†GREENSBURG, PA.—A heavy electrical storm Aug. 9 wrecked the West Penn Electric Company's sub-station near Youngwood. The three-story brick building was racked from the foundations to the top, great cracks appearing in the walls, and the interior of the second and third floors was ignited by fire following the stroke.

oIRWIN, PA.—The Pittsburg & Westmoreland Railroad Company hopes to have cars running into Irwin by Sept. 1 and is doing everything possible to bring this about. When the connection is made at Bryn Mawr cars will run through to Irwin.

4†LANCASTER, PA.—The improvements to the Colemanville power plant have been finished, and the new 400-hp Westinghouse dynamo has been put into service, doubling the capacity of the plant, which supplies power to the York Furnace and the Lancaster Southern lines.

†NORRISTOWN, PA.—The Montgomery County Rapid Transit Company, which recently began operating its Lederochville & Pennsburg line between this city and Centre Point, expects to extend operations to Cedars in a few weeks. The ultimate terminus of this line is Souderton. The company is planning other important construction work in this county.

†ROYERSFORD, PA.—At a mass meeting of Royersford citizens last week a committee was appointed to confer with the officers of the Schuylkill Valley Traction Company regarding desired connections for an electric railway and the obtaining of power from the power house at Collegeville. The terminal of the road here will be at the corner of Second Avenue and Walnut Street. The line, when built, will give a direct line to Philadelphia.

1-2†SCRANTON, PA.—It is stated that the Northern Electric Street Railway Company will soon build a steel viaduct 500 ft. long, of 50-ton capacity; also 6 miles of rail and overhead construction. The company contemplates placing orders for ten double-truck combination smoking and passenger cars, with electrical equipment.

1†SPRING CITY, PA.—The Montgomery & Chester Electric Railway Company, operating an electric line between Spring City and Phœnixville, has decided to erect a bridge over the Pickering Valley Railroad at Ironsides.

†SPRING GROVE, PA.—The Hanover & York Street Railway Company has agreed to put an overhead bridge over its line where the York and Hanover public road crosses it about a mile west of town.

3†STROUDSBURG, PA.—It is reported that the new power station of the Stroudsburg Passenger Railway Company is rapidly nearing completion. The company is planning to purchase a storage battery in the near future.

TARENTUM, PA.—A franchise has been granted the Tarentum, Saxonburg & Butler Street Railway Company by the Tarentum Council.

†WAYNESBORO, PA.—The Chambersburg, Greencastle & Waynesboro Street Railway Company and the Blue Mountain House Company are negotiating the project of building an electric railway extension from Pen Mar to the Blue Mountain House and High Rock.

†WAYNESBURG, PA.—The franchise recently granted by Council to the Brownsville, Carmichaels & Waynesburg Street Railway Company has been returned by the company, which makes numerous objections to the various clauses in the ordinance. A meeting will shortly be held to consider the company's objections.

4†PROVIDENCE, R. I.—It is learned that a contract will be awarded this week for the construction of a car house on Social Street, in Woonsocket. The building is to be 495 ft. x 125 ft., and will be of mill type construction. The company has recently commenced work on a new car house on Thurber's Avenue, and is now working on plans for one on Academy Avenue, Providence.

†COLUMBIA, S. C.—The link in the electric railway operated by the Anderson Traction Company necessary to join Belton, Greenville and Anderson will be built at once. This statement was made by Wm. Elliott, Jr., general manager of the Columbia Street Railway Company and the Anderson Traction Company, upon his return from a trip to Anderson, where he went to have a conference with Engineer J. E. Surane. He states that work on the new line will be started at several points early in September.

*MEMPHIS, TENN.—The Southern Memphis Traction & Light Company has been incorporated, with a capital stock of $50,000, for the purpose of building and operating lines on several streets.

DALLAS, TEX.—The estimate made to the directors of the Dallas Interurban Electric Railway Company regarding the cost of construction of the road, by the engineers, places the figure at $859,000. D. E. Waggoner is president of the company.

oMINERAL WELLS, TEX.—Major Beardsley has signed the contract with E. W. Barrows, secretary and treasurer of the American Engineers' Company, of Indianapolis, for the construction of the Fort Worth & Mineral Wells Interurban line. Work is to commence at once.

1†ROANOKE, VA.—The Roanoke Street Railway & Electric Company, it is said, will build an extensive line in the southwestern part of the city.

*KENNEWICK, WASH.—The Priest Rapids Railway has filed papers of incorporation with the Secretary of State at Olympia, declaring its purpose to build an electric railway from Kennewick to Wenatchee. The company is capitalized at $1,000,000. The officers and incorporators are: W. R. Rust, president; M. B. Haines, vice-president and treasurer; E. H. Guie, of Seattle, secretary; H. K. Owens, engineer. The principal office of the company will be at Seattle. The route of the new road is down the Columbia River Valley almost on a straight line from Wenatchee to Kennewick. The distance is more than 100 miles.

†PALOUSE, WASH.—The Spokane & Inland Railway is now electrically equipped to this city. The Palouse depot is to be the largest on the line outside of Spokane, and will be built during the coming fall and winter.

oSEATTLE, WASH.—L. H. Griffith and other Seattle men are working on a plan for a complete system of subways for rapid transit in Seattle. Application will soon be made to the City Council for a tunnel through the hills of the city.

oVANCOUVER, WASH.—The Washington Railway & Power Company, which is building the street railway in this city, will complete the system here first and then extend the line to La Center, and immediately after build on to Orchards. The cost will be about $20,000 per mile in the city and one-half that outside.

oGRAFTON, W. VA.—It is stated on reliable authority that the Grafton Traction Company will extend its line now building in this city to Blueville, the eastern suburb of Grafton. Rails, ties, etc., for the extension have already been ordered, and will be put down as soon as the line reaches the East End. Work on the street railway is progressing rapidly now that the workmen are on the paved streets in the west end of the city. Probably 1 mile of track is now laid. It is expected that the line will be in operation by not later than Dec. 1.

2†GREEN BAY, WIS.—General Manager G. W. Knox states that the Green Bay Traction Company will purchase four new cars between September and next spring.

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Of this issue of the Street Railway Journal 8000 copies are printed. Total circulation for 1907 to date 287,550 copies, an average of 8215 copies per week.

Graphic Methods of Watching Rolling Stock

The clerical labor of keeping track of the condition of cars, trucks and motors on the ordinary street railway usually involves more or less waste of time when the master mechanic or operating department wishes to know, as it often does, just how many cars are in service or ready for operation and how many are in the shops at any given moment. On some lines a daily report of the car numbers available for service is laid on the dispatcher's desk each morning, and that is the end of the matter for the day. Breakdowns, accidents, sudden increases of traffic, and weather changes often necessitate instant knowledge of the car numbers on hand at the car houses, and much valuable time can be consumed in telephoning for different employees to count and report the cars in the car house at any specific time.

There is room for the use of simple, positive bulletin boards in many instances, which will indicate at a glance the condition of every car on the system or division. Rows of numbered brass checks hung on hooks, or card slips, colored pegs or colored buttons can be pressed into service in such cases, and it is a simple matter thus to keep an up-to-date minute record of each car or equipment part. One section or color will indicate equipment in the machine shop, another will apply to the paint shop, to the storage tracks, armature room, and so on. With such a bulletin board close by the shop or car house telephone, it is a matter of a few seconds to give any official the exact status of all the equipment on the road or division.

The percentage of equipment laid up for repairs is also worth following closely, and the plan mentioned affords an opportunity of doing this as well as a check upon frequently recurring trouble on any single car, motor or truck.

Electrification and the Smoke Nuisance

A recent order of the Massachusetts Railroad Commission in reference to the smoke nuisance of steam locomotives in the Boston suburban districts emphasizes again the value of electricity for such service. Complaints have lately poured in upon the Board thick and fast from residents of Brookline and the Newtons in regard to the annoyances to persons and injury to property caused by locomotive smoke. The situation has grown acute through the increase in number, speed and load of trains, the construction of new stations and the building of new blocks and houses upon lands adjacent to railroad premises.

The Board finds that it is practically beyond question that soft coal of a high grade is the fuel best adapted for the fast and heavy train service of steam roads, and it emphasizes the need of better smoke-consuming devices and more careful firing. An additional inspector experienced in locomotive firing has been employed by the Board, but we are glad to note that the Commission recognizes the fact that all such measures are merely palliative in comparison with the certain cure which electricity affords. The Board states that "from time to time for many years the electrification of railroads has been the theme for active discussion and the subject of sanguine prophecy. In suburban service this improvement may be confidently predicted as an event of the near future, the practical tests being made in New York between the two advanced systems of equipment assuming a solution of the question as to the best method of operating railroads with electric power. The new service will be a boon in other ways, but in none so much as in complete relief from the smoke and cinders and dust and gases of coal and coke." This utterance is in accord with both anticipation and experience—the improved conditions on the elevated lines of New York and Chicago, in tunnels and subways on interurban routes, mountain roads and already in the partially electrified steam service at New York—all

these indicate beyond question that the steam locomotive is doomed as a transportation agent in metropolitan communities.

Up to the present the applications of electric power to transportation systems in this country have all been in thickly settled communities, where the frequent service afforded has been of great importance. In the proposed utilization of electric power on the Sacramento division of the Southern Pacific Railway, described elsewhere in this issue, an entirely different duty is desired. Here it is a question of increasing the track capacity on a single section of the large transcontinental railway system of the company, a section which limits the capacity of the entire road, and of combating grades, distances, snow-falls and other obstacles which have not been present in the notable Eastern installations. The results of the study of the board of engineers appointed to consider this subject will be of the greatest value, but with the opportunity which electricity affords of applying any amount of power to the driving wheels, of dividing that power into as many units as may be desirable, of eliminating smoke, of recuperating power on the down-grades and of utilizing any waterpower which may be available in the neighborhood, it would seem as if it might afford the solution to the problem sought.

Power Stations for Single-Phase Railways

One of the striking things about the New York, New Haven & Hartford power station, shared, indeed, with some other single-phase lines, is the use of three-phase generators. This practice has two reasons for being. In the first place, it enables polyphase power to be supplied to motors and rotary converters when and where it may be now or hereafter necessary. In the second place it is generally believed to result in a better generator than if the winding were simply single-phase. The plan is really an old one, first brought into notice some years ago in Dresden, where single-phase lighting was carried on from three-phase generators, motors being worked from all three lines. As regards convenience it is certainly useful to be able to operate three-phase motors along the line, as these machines are for many purposes preferable to any commutator motors, either for alternating or direct current. It gives, too, opportunity for ready exchange of power with other stations, or for an entirely different utilization of the power if such a step should be locally desirable. There is, therefore, a flexibility about the system which is highly desirable at this particular stage of proceedings.

Another strong reason is the second one. While a simple consideration of the currents would lead to a considerably reduced capacity if one phase of the star-wound machines is unutilized, yet practice seems to have shown that the loss of capacity is much smaller than would be at first supposed. Owing to the distribution of the windings the armature heating as regards steady temperature is somewhat reduced and heavier current can be carried than if all the windings were alike sources of heat. There is, too, an advantage over the ordinary single-phase winding in the matter of heating and armature reaction for equal current density and equally favorable wave shape. Just how much this amounts to is difficult to say, but some designs go so far as to claim that a well distributed three-phase winding gives for an equally good machine enough excess capacity to almost or quite nullify the evident loss in failing to use one set of coils. Be this as it may, in the case in hand no coils are really idle and there may well be enough use of the relatively inactive set to make the machines at least equal to single-phase machines designed for the railway work alone. With the additional gain in flexibility it is not difficult to see the reason for the choice. It would be interesting to know exactly the effect of the high rotative speed (1500 r. p. m) upon the elements of design of the generators. Speaking broadly, a two-pole alternator is a troublesome thing to lay out and is apt to give an e. m. f. wave very rich in harmonics. When it comes to using the lower frequency of 15 cycles, often of late advised for commutating motors, the turbine speeds will have to come down to 900 r. p. m., which, while it can be managed, particularly with more stages than are now standard, will be still more awkward in the matter of generator design.

The present work on the New Haven road will probably throw considerable light upon the question of the proper frequency. If the performance of the locomotives is all that is hoped and claimed for them, it will be apparent that a lowered frequency will be of value principally in increasing motor capacity, a condition which in cases of light service might involve some difficulties for small gains. On the other hand, if the commutation can be considerably improved by coming down to 15 cycles, this will constitute another reason for doing so.

The Expansion of Auxiliary Power Plant Equipment

In the majority of the better class of power plant designs at the present time ample provision is made for the expansion of the main generating units along symmetrical lines, both in the boiler room and the engine or turbine section. Plants built on the isolated unit idea with each group of boilers serving one or two engines, and so on to the switchboard, often are designed without a symmetrical arrangement of auxiliaries, however, the result being a mixed layout when the inevitable growth of equipment takes place. The importance of symmetrically adding new auxiliary equipment may well be emphasized at this time, for the increasing volume of business which faces railway plants in growing cities and towns justifies careful planning in advance of the contract awards for augmented capacity.

Obviously the proper place to provide for subsequent auxiliary additions is in the original plans of the plant, but in a good many instances the problem is one of adding auxiliaries to an old station which is unfavorably arranged for any logical development. Individual conditions vary so much that it is hard to lay down any detailed scheme in these suggestions, but there is good ground for encouragement in the fact that, on the whole, power plant auxiliaries take up a small space individually in proportion to their output. A small unused piece of land at one side of the power plant can therefore be pressed into service, or a section of the basement remodelled if the original layout of condensers, pumps and piping is not too intricate. The original installation is, as a rule, left intact in the main, for it would scarcely pay to rip it out unless improved machinery is to be substituted for the old apparatus. The addition of new apparatus, however, in the line of increased capacity, ought to take place along symmetrical lines.

Appearance is vastly improved by the addition of auxiliaries on a predetermined scheme, but the question of looks is not the controlling factor. The point is simply that the regular increase enables the first cost of the installation in labor and material to be reduced over that of a heterogeneous installation, and the operating problem is also simplified. Piping is shortened, losses in steam lines through radiation, conduction, and in some cases from convection, are decreased; space is economized, clearance between pumps and condensing units can be made adequate, accessibility for inspection and repairs may be improved, safety made more certain, and the fire risk diminished. Apparatus planned for logical expansion can be disposed in locations accessible to the engine room crane; feed pumps, sump pumps and auxiliary motors can be located in places where they will not have to be torn up and relocated because of standing in the direct line of advance when the boilers are extended or the coal pockets enlarged. And, finally, the wiring cost will be reduced in a symmetrical layout, and the auxiliary plant as a whole will be more immediately under the eyes of the operating shifts than if no special symmetry were followed in the plant expansion. The problem is quite as important in the reciprocating engine as in the turbine plant, though the multiplication of auxiliaries in the latter installations needs to be handled with great care if the piping is to be cut to the lowest initial cost consistent with flexibility of operation. In the electrical side of the modern power-plant designers are straining their wits to produce switchboards which minimize blunders and facilitate control at a glance. Power-plant wiring is much simpler on the whole than it used to be, if we leave the back of the switchboard as a debatable question. The piping and auxiliary arrangement in general should be simple and straightforward in the same way.

Valuations and Rates

Nearly everyone who is interested in street railway properties and who read the President's speech at Provincetown last week, and that of Secretary Taft a day earlier at Columbus, must have been struck with the similarity of street and steam railroad problems in some respects and their antithesis in others. The burden of both of these addresses, so far as they concerned railroad companies, related principally to the present anti-monopoly and anti-rebate policy of the Government, and its effect upon the operation and management of the transportation companies. In this connection Secretary Taft devoted considerable attention to the subject of physical valuations. Such a valuation, it has been argued, in the case of both steam and street railway companies, is necessary to determine whether the corporation is overcapitalized, and whether it properly can reduce its rates.

Now the valuation of a railway property is an extremely difficult undertaking to complete satisfactorily, because of the variety of ways in which the work can be done, no two of which will produce the same result. If we should take either the original cost, or the cost less the usual allowance for depreciation, in other words, the replacement value, we lose sight entirely of the earning power, which itself depends partly upon the location of the road and its connections, and partly upon the ability of the management to secure from the property its maximum earnings. On the other hand, if we take as a basis the market price of all of the securities issued against the property, a value which might be considered to be founded upon its earning power, we face the other horn of the dilemma; what is the market value? Is it that of to-day or of yesterday or of to-morrow?

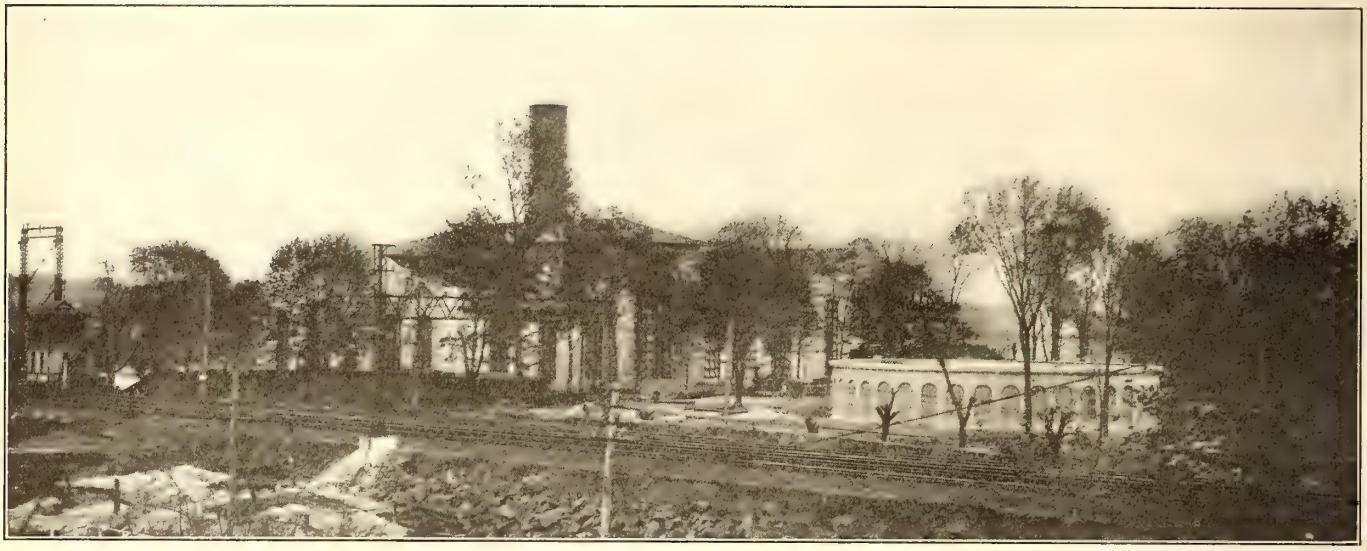
Again, the values at which a road may be appraised will, and should, vary according to the purpose for which the appraisement is made. This is a point not often realized by tax assessors. Expenses, for instance, connected with the organization of the company, outlay for apparatus now obsolete and in use or discarded, payments for city paving or other improvements required by the franchise but not the property of the company; all are legitimate charges against the cost of the property, but can not properly be included in its assessed value for taxation purposes. Moreover, the real value of a property, assuming it to be either its replacement value or some multiple of its earning power, will vary from year to year, even from day to day, depending upon actual or potential competition, the cost of material and labor and a thousand other factors which concern the cost of construction and operation or affect the receipts. The only State valuations that have never been successfully combatted, so far as we know, are those of the New York State authorities, and the reason in that case is that the assessors have never divulged the methods employed by them. So far as the public or the companies are concerned, these assessments have been absolutely arbitrary. The Secretary of War evidently recognized these difficulties and also points out that a valuation is, after all, of small benefit in deciding what is a fair profit upon the investment. That is, the proper relation between the rate and the total net profit of operation is so complicated with an infinite variety of other circumstances that it is most difficult in rate fixing to use the latter to affect the former.

There is then a similarity between the steam and street railroad, so far as the relation between valuation and rates is concerned, but a striking difference in the monopoly feature, if we agree with the President and his Secretary. This was the second point to which both gave attention. It is not new, as the present administration has gone on record as opposed to permitting a company engaged in interstate traffic acquiring stock in a competing line.

Without going into the merits of the case with the trunk lines of the country, it is safe to say that the interests of the public lie in the direction of street railway monopolies. The economies of operation are so great, and the facilities which can be offered the public are so numerous that consolidation within well defined geographical limits has been well nigh universal. How far this principle can be extended to include connecting interurban railways, and whether proper limits can be fixed, are still questions to be determined by railway economists. We recognize the fact that the conditions presented in the case of large territory are different from those in the case of a smaller area, but doubt whether the best boundaries of corporate enterprise are necessarily coincident with those of the State. They have not proved so in many cases, and inability on the part of an electric railway company to operate contiguous lines, as well as extensions, would often restrict the service which it could furnish the public.

COS COB POWER STATION, NEW YORK, NEW HAVEN & HARTFORD RAILROAD COMPANY

The power house of the New York, New Haven & Hartford Railroad Company, at Cos Cob, Conn., which has just been completed, is of interest as being a part of the first installation of single-phase electric equipment for the operation of trains over a trunk line railway system whose overhead and motor equipment has been described in the last two issues of this paper. The station, in addition to furnishing single-phase current for the operation of electric trains over the New Haven Railroad, also delivers three-phase current to the Port Morris power house of the New York Central to compensate for the energy required to operate the New Haven trains over the line of the New York Central system.



GENERAL VIEW OF THE COS COB POWER STATION



COALING BRIDGE AND APPARATUS AT THE COS COB POWER STATION

POWER-HOUSE BUILDING

The power house is located adjacent to the main line of the railroad and on the bank of the Mianus River at a point on the river about 1 mile from Long Island Sound. The location is such that coal can be delivered either by water or rail, and an unlimited amount of salt water for condensing purposes is available from the Mianus River. By the erection of a dam in this river at a point about a mile upstream from the power house an abundant supply of exceptionally pure boiler feed-water was also readily obtained.

The general style of architecture of the power house building is Spanish mission; the walls being constructed of plain-faced concrete blocks, the color of which forms a pleasing contrast with the red Spanish tile roof.

The entire area of the site selected was practically solid rock with but a few inches of earth above it, and necessitated blasting the excavation for the basement and the condenser intake and discharge flumes.

The material excavated was a gneiss rock, which proved excellent for concrete aggregate; furnishing, after crushing and screening, all the broken stone required for the building, and sufficient quantity of crusher screenings in lieu of

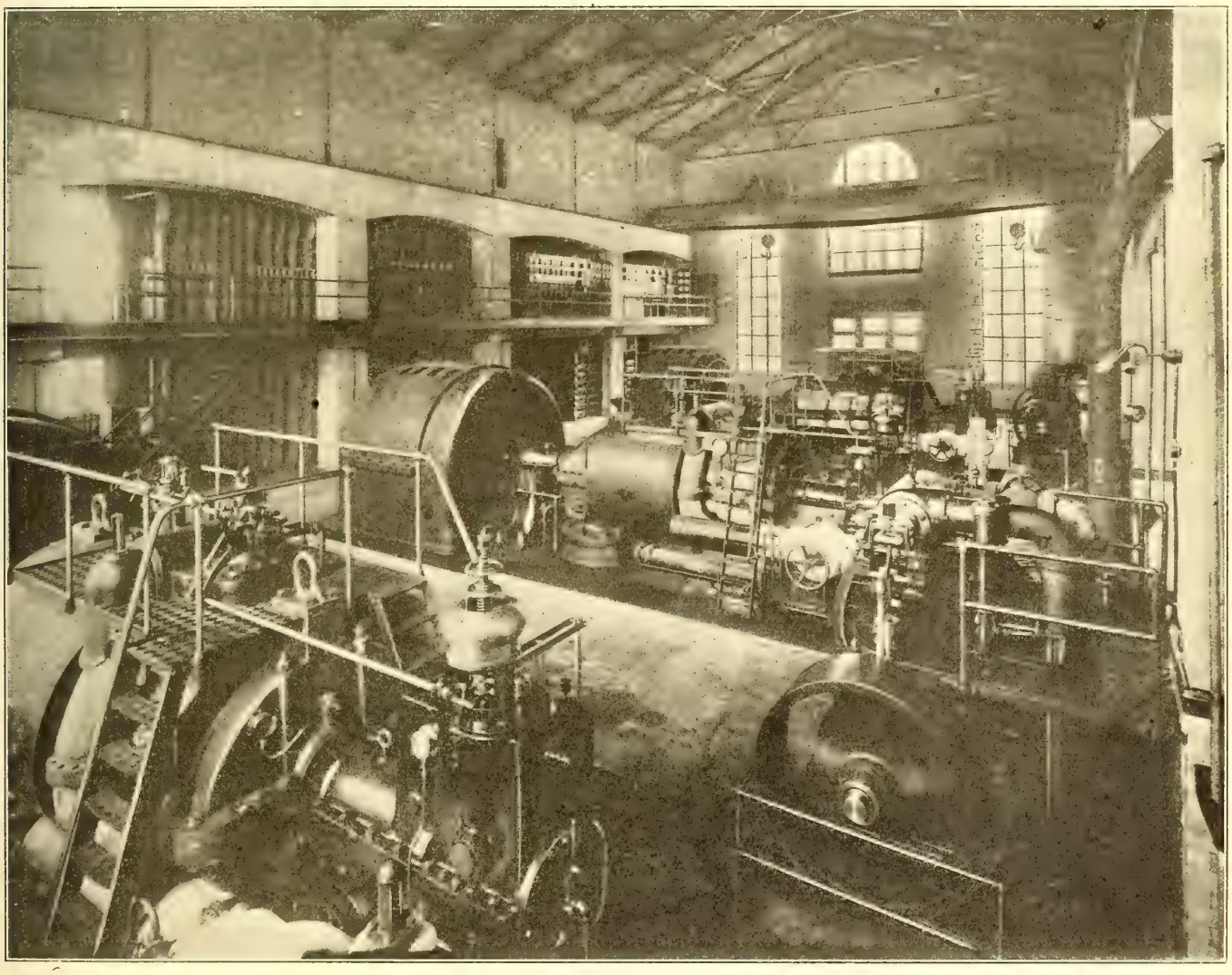
sand for the concrete of the exterior walls. The building walls, below the water-table, and the machinery foundations are monolithic concrete. The water-table and the walls above it, including the window arches and coping, are of concrete blocks. Below the water-table the walls where exposed have a "bush hammered" finish. The interior columns in the boiler room are of structural steel, but all other columns required in the building are of concrete blocks. The steel roof trusses over the turbine room are supported on concrete block pilasters formed in the building walls, while over the boiler room they are carried by the pilastered

A monitor, provided with windows for light and ventilation, extends lengthwise over the boiler room.

A self-supporting steel stack 13 ft. 6 ins. in diameter, extending to a height of 100 ft. from the engine room floor, is carried by the steel columns which support the fan room floor, leaving the space below, on the boiler room floor, entirely clear.

The building is exceptionally well lighted by large windows glazed with wire glass set in cast-iron sash.

The turbine room is 60 ft. wide by 112 ft. long, and the switchboard occupies a space next the turbine room which



PART INTERIOR VIEW OF THE COS COB POWER STATION

building walls and by the interior steel columns, which also support the boilers, the mechanical draft equipment and the stack. The front of the switchboard gallery, at the south end of the turbine room is carried on concrete block columns, which also support a reinforced concrete girder forming one of the crane runways. The other crane runway is formed by another reinforced concrete girder built into the partition wall between the engine room and boiler room, and is supported upon pilasters formed in this wall. The column footings below the engine room and boiler room floors are of monolithic concrete.

The basement floor is of concrete, laid upon the foundation rock. All other floors in the building are of reinforced concrete; and the roof, which has a pitch of 4½ ins. per foot, is of reinforced cinder concrete finished on the exterior with Ludowici tile.

is 25 ft. wide by 110 ft. long. The boiler room is 160 ft. long and 110 ft. wide.

The reduced head room needed for horizontal turbine equipment is shown by the fact that the distance from the floor to the top of the crane runway rail is but 27 ft. 2 ins., and the height from the turbine room floor to the bottom of the roof trusses is but 39 ft. 2 ins. The interior walls of the engine room are finished with a wainscoting of Faience tile 6 ft. in height.

TURBO GENERATORS

The initial generating equipment of the power house consists of three multiple-expansion parallel-flow Parsons steam turbines direct-connected to single-phase Westinghouse generators. Provision has been made for the installation of a fourth unit of corresponding size. The turbines

are rated at 4500 bhp each, and the generators at 3000 kw each, at 80 per cent power factor.

The turbines are operated at 1500 r. p. m. by steam at 200 lbs. pressure and 100 degs. superheat. The continuous overload capacity of the units is 50 per cent, and momentary overloads of 100 per cent can be taken care of when operating condensing. The turbines are equipped with the latest accessories in the way of automatic safety stops water-packed glands for the turbine shaft, and adjustable water-cooled bearings equipped with a continuous circulation oiling system.

As the requirements necessitated the generation of three-phase current for delivery to the New York Central system as well as single-phase current for the operation of the electric locomotives over the New Haven Railroad, the generators are wound for three-phase current, but arranged for the delivery of both three-phase and single-phase current.

The generators are entirely enclosed by a casing, into which air is drawn through suitable ducts from a fresh air chamber under the switchboard gallery, and from which the air is discharged through other ducts into the basement. This system of generator ventilation renders the operation of the generators practically noiseless.

The excitation of the generator fields is provided for by two 125-kw direct-current generators, direct-connected to Westinghouse engines; and one motor-driven exciter.

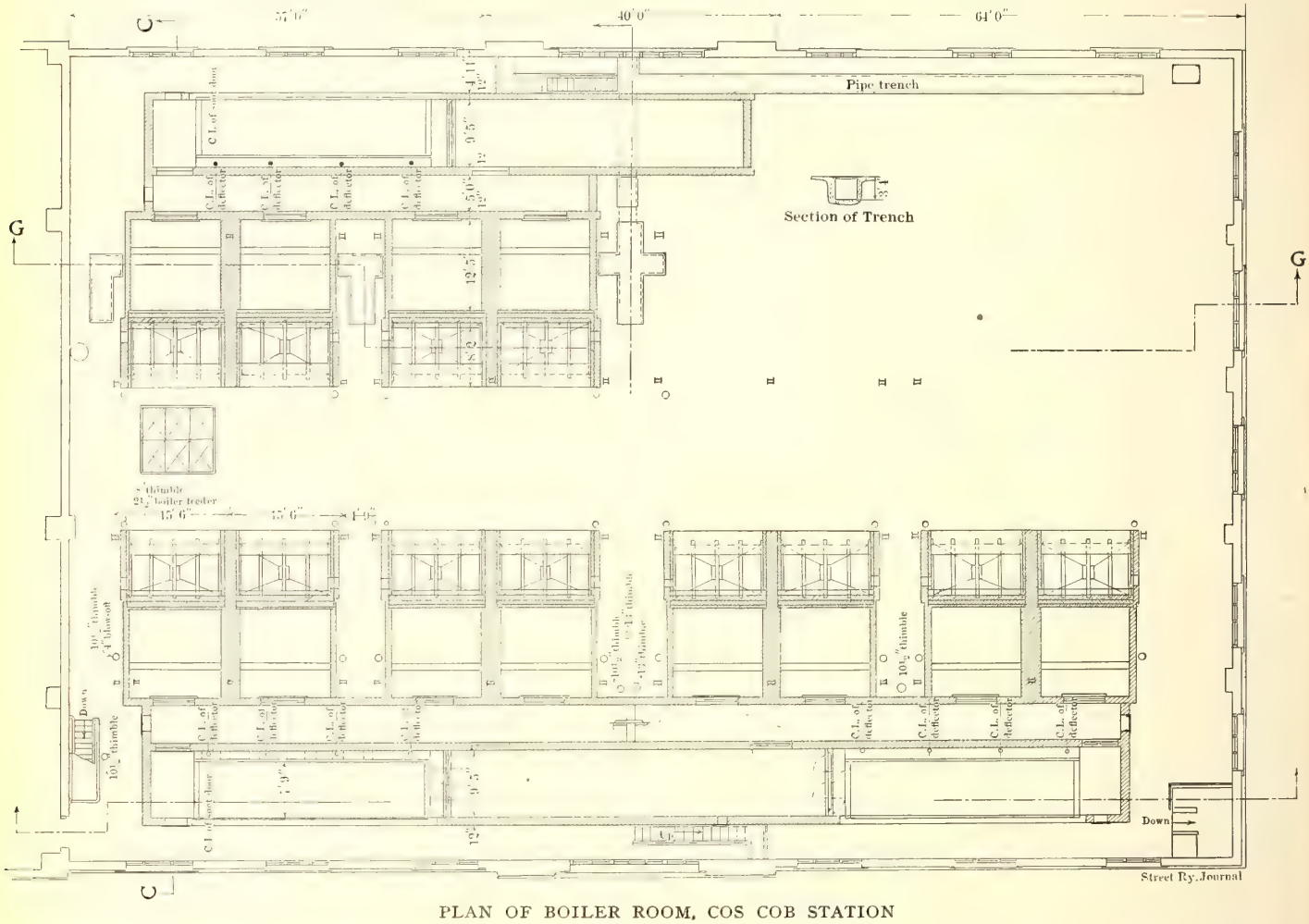
CONDENSERS

A separate condensing outfit is provided for each turbine consisting of an Alberger three-phase counter-current surface condenser, a two-stage dry-air pump, a centrifugal circulating pump direct-connected to a Westinghouse engine, and a Monitor hot-well pump, the speed of which is automatically controlled by a float.

Condensing water for all the condensers is furnished by a single flume, which is constructed of timber having a lining of creosoted lumber from the intake at the face of the dock to the shore line, and of concrete for the remainder of its length to and under the generator room. A discharge flume of similar construction parallels the intake flume under the turbine room, and then diverging from it discharges the condensing water into the river. Each condenser is installed directly beneath the corresponding turbine and over the discharge flume, while the circulating pumps are located over the intake flume, thus making all the connections as short as possible.

The pipes leading from the condenser to the discharge flume have a submerged discharge, thus decreasing the head under which the circulating pumps work.

To prevent the rapid deterioration of the brass condenser tubes by the galvanic action which usually occurs where salt water is employed for condensing purposes and which is often aggravated by stray currents passing through the water pipes into the station, and from thence to the condensers and out through the pipes leading into the intake and discharge flumes, a motor generator set has been installed and provided with suitable controlling apparatus for maintaining in each condenser a counter electromotive force slightly in excess of the electromotive force due to the galvanic action and the stray currents.



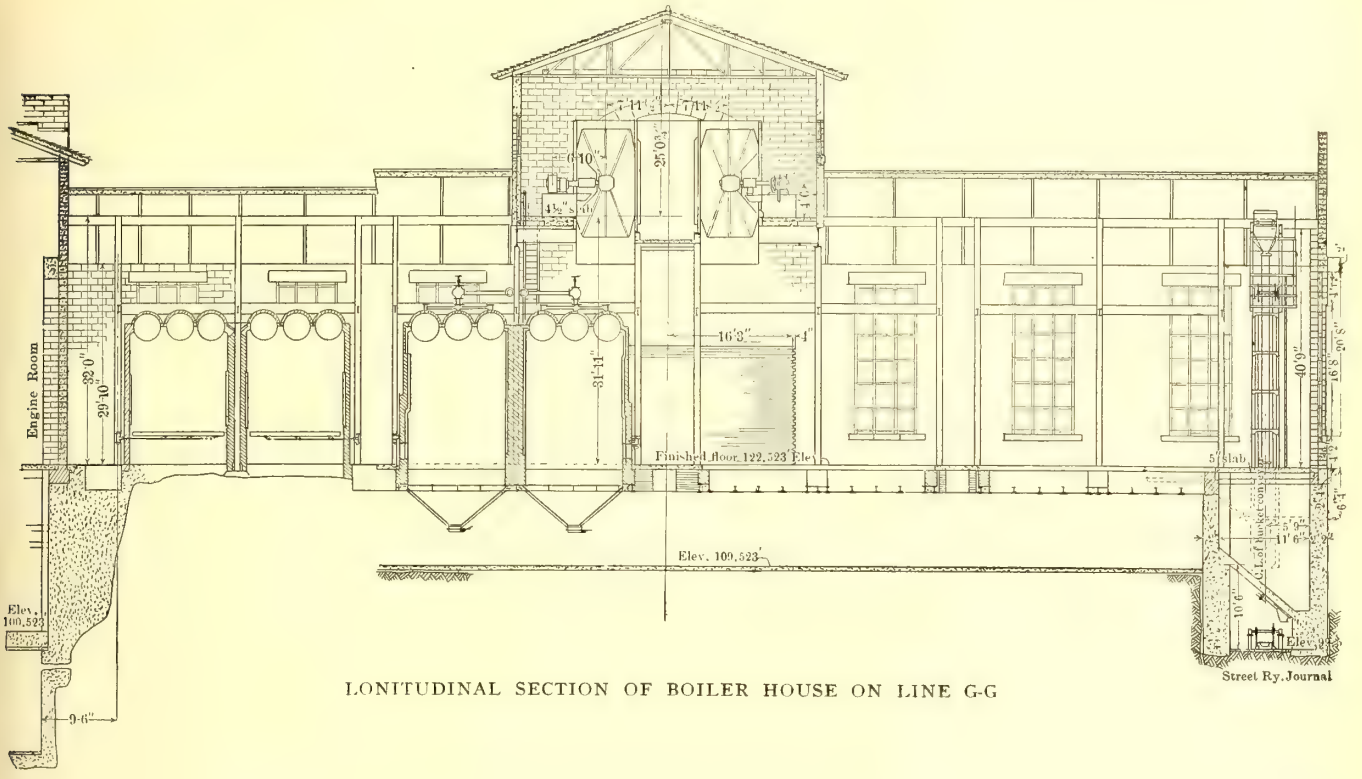
PLAN OF BOILER ROOM, COS COB STATION

BOILERS

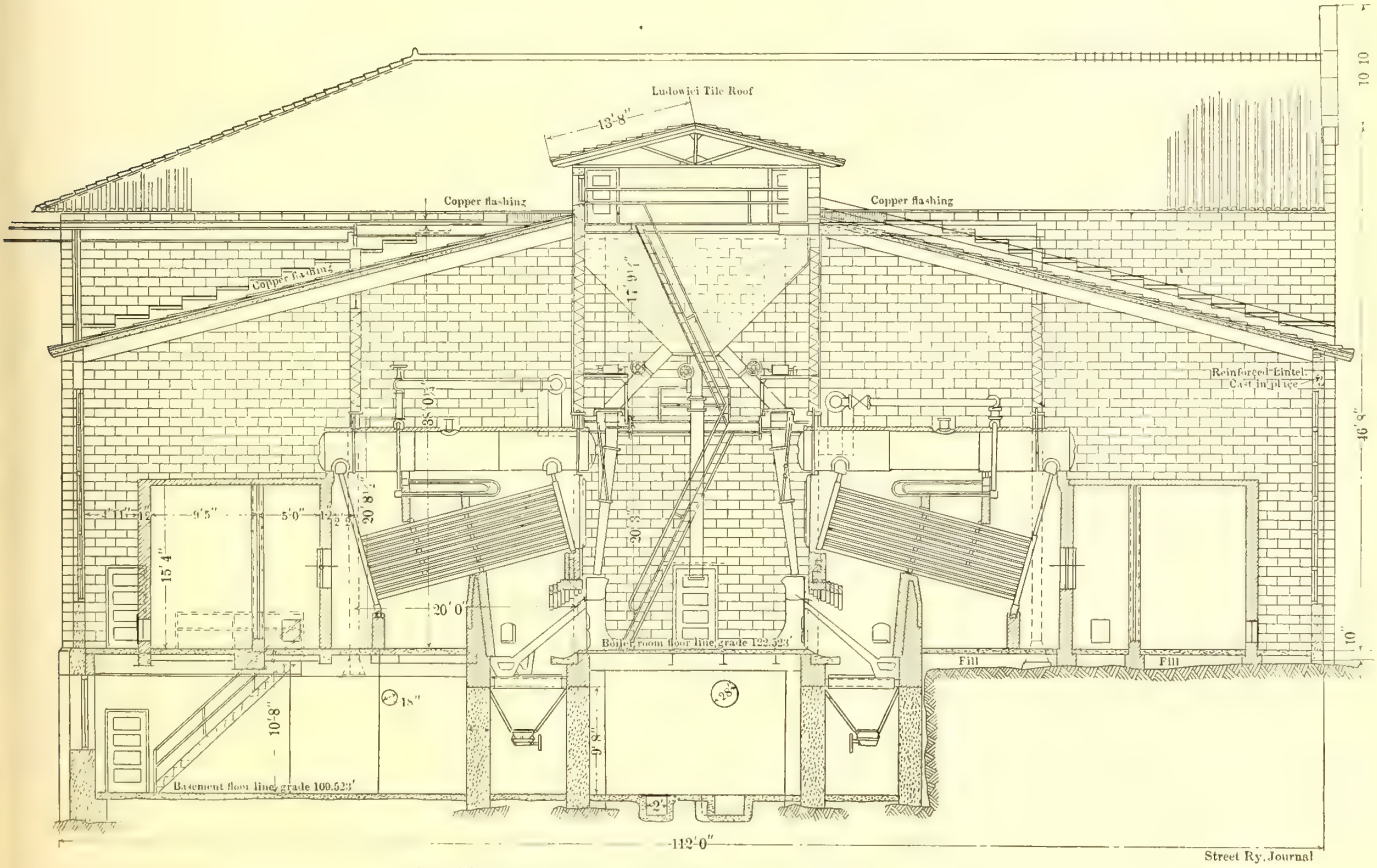
The initial installation consists of twelve 525-hp Babcock & Wilcox water-tube boilers set in batteries of two boilers

each, and arranged with eight boilers on one side and four boilers on the other side of the boiler room, separated by a 21-ft. firing floor. Provision is made for four additional boilers to take care of the fourth turbo-generator unit when installed. These boilers are equipped with Roney mechanical stokers and Babcock & Wilcox superheaters and deliver steam at 200 lbs. gage pressure and 125 degs. superheat.

A novel feature of the boiler settings is the installation of an external steel casing entirely enclosing the brickwork, thus rendering the settings impervious to air leaks.



LONITUDINAL SECTION OF BOILER HOUSE ON LINE G-G



CROSS SECTION OF BOILER HOUSE ON LINE C. C.

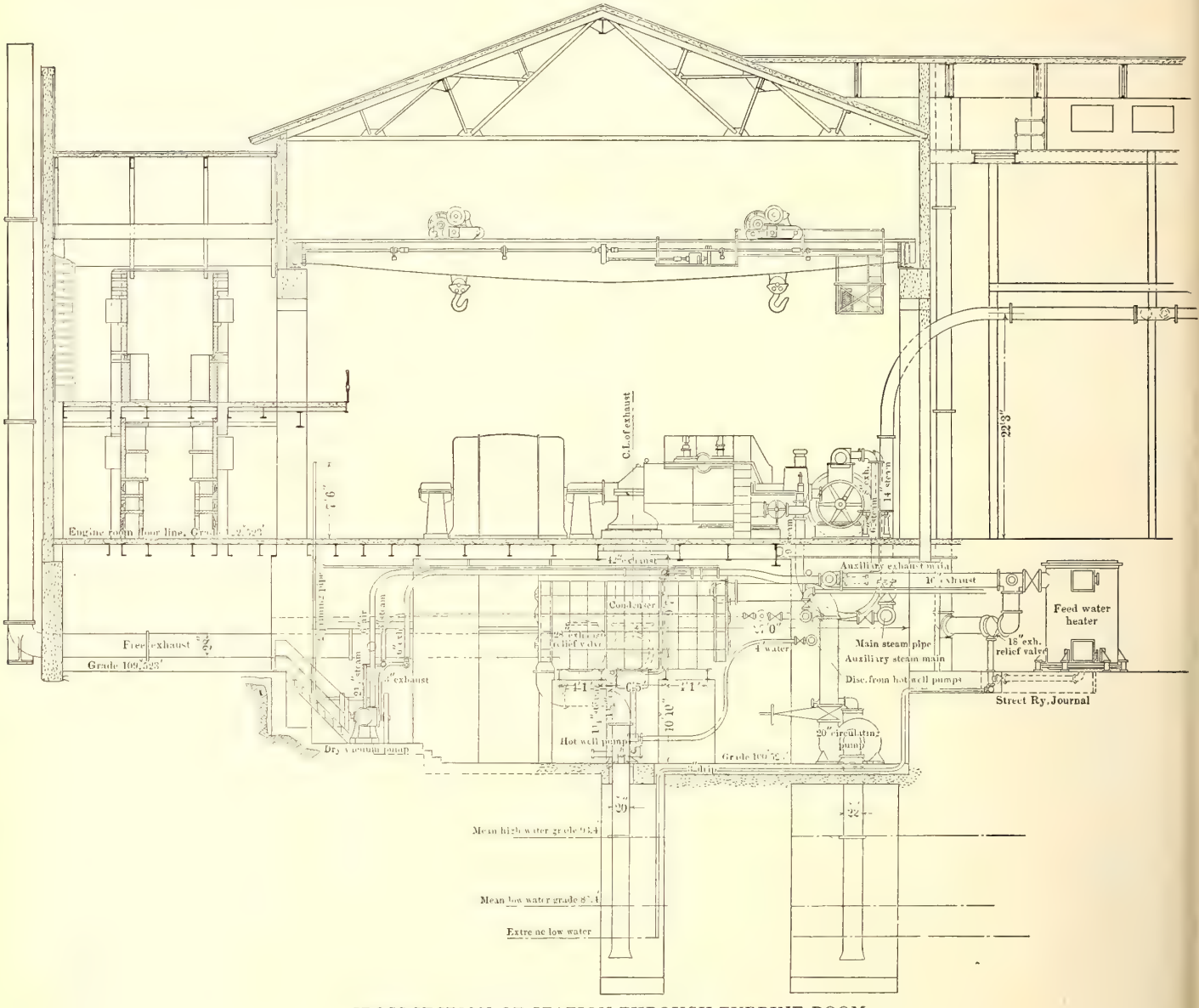
ECONOMIZERS

Three Green fuel economizers are provided, and the boiler flues leading to the economizers are arranged with by-passes so that one or all of the economizers can be cut out

and the flue gases from either two or four batteries may be passed through either one or two of the economizers, thus adapting the economizer installation to the changing demand upon the boilers. The economizers are enclosed by means of metal sectional covering insulated with prepared asbestos blocks.

FEED-WATER SYSTEM

Under ordinary conditions the boiler feed-water is delivered from the pump house at Mianus through a 10-in. main to a concrete reservoir of 600,000 gals. capacity situated just outside the power house. From this reservoir the



CROSS-SECTION OF STATION THROUGH TURBINE ROOM

or the economizers. An emergency feed-water supply system is also provided, consisting of two Hancock inspirators, taking water from either source of supply and delivering it through an independent line to the boilers.

The pumping equipment at Mianus comprises two single-acting vertical triplex plunger pumps, geared to Westinghouse three-phase motors. One of these is of sufficient capacity to meet the requirements of the plant running non-condensing, and the other to supply all the fresh water needed when running condensing. These pumps are operated by current obtained from the power house.

make-up water flows by gravity to two 13,000-gal. feed-water tanks located in the boiler room basement. These tanks also receive the discharge from the hot-well pumps. The water is then drawn from these tanks by the feed pumps and delivered through the feed-water heaters and the economizers into the boilers. An auxiliary source of feed-water supply is provided for by a connection to the mains of the Greenwich Water Company.

The feed pumps, which are three in number, are of the compound direct connected duplex outside-packed plunger type. Provision is made for connecting either source of feed-water supply direct to the suction side of the feed-water pumps, and also for by-passing the feed-water heater

INDUCED-DRAFT SYSTEM

After leaving the economizers the flue gases pass through sheet-iron flues to the fan chamber over the center of the boiler room. Here four 14-ft fans, direct connected to horizontal high-speed engines, deliver the flue gases to the stack, which is only of sufficient height to carry the gases away from the building. The speed of the fans is adjusted to the demand on the boiler by automatic regulating valves controlling the fan engines.

COAL-HANDLING INSTALLATION

All coal received by water is unloaded from the barges by a steel derrick operating a clam-shell bucket and delivered

into a hopper of 15 tons capacity at a height of 55 ft. above the dock. This bucket is operated by an engine on the dock, supplied with steam from the power house. From this hopper the coal is fed by gravity into a coal crusher, and from the crusher it drops into steel cars where it is weighed. The cars are then drawn by cable up an inclined single-track railway of 13 per cent grade and into the boiler room through an opening near the roof. This track is supported upon structural steel towers and is designed so that two cars can be operated upon it, passing each other through an automatic turnout at the center. The cars discharge the coal into a hopper, from which it is delivered into two flight conveyors extending the length of the boiler room. Openings in the bottom of the flight conveyors discharge the coal into spouts leading to the stoker hoppers of the boilers. The capacity of the flight conveyors is in excess of the amount of coal required to operate the boilers, and the surplus coal is discharged at the further end of the boiler room into a concrete storage bin below the boiler room floor.

Coal received by rail is dumped from the car directly into a chute leading to this same storage bin. When the boilers are to be supplied from this source, the coal is discharged from the bin by gravity into a coal crusher and from that into a bucket conveyor located in a tunnel underneath the bin, by which it is delivered to the flight conveyors above the boilers and thence through the chutes to the stoker hoppers.

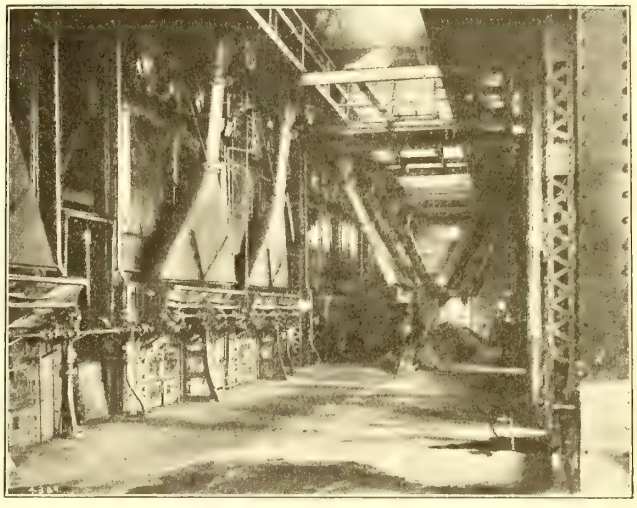
The cable railway and the flight and bucket conveyor are operated by three-phase induction motors taking current from the "station service" line.

The ashes are disposed of by gravity from the dumping grates of the stokers into chutes leading to narrow-gage cars in the basement, by which they are at present carried to the low ground in the neighborhood of the power house and used for filling in.

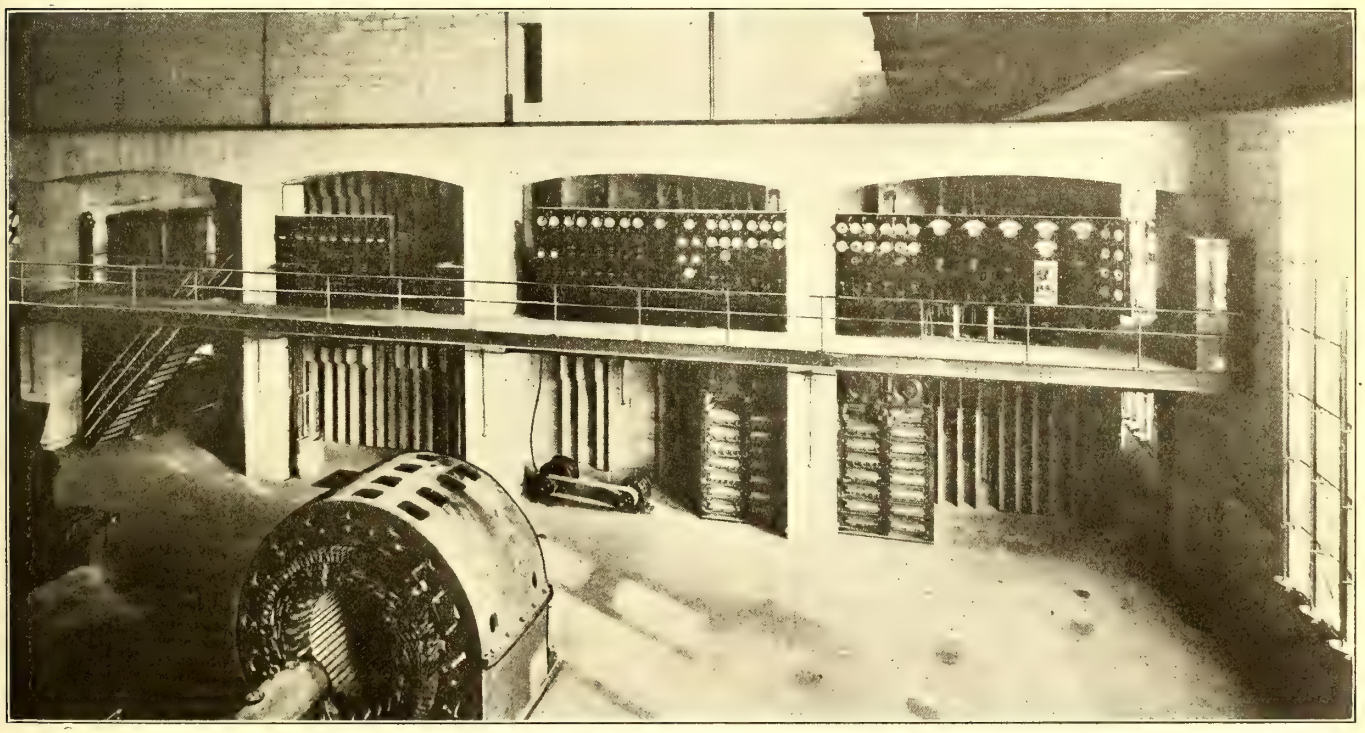
PIPING

A steam main is carried over the boilers on each side of the boiler house, each of the two mains crossing over to the opposite side at the center of the boiler room. Provision is made for cross-connecting these two mains. From the boiler room the mains extend through the partition wall into the turbine room, thence downward into the basement, connecting to a header under the floor. From this header connections are made to each turbine. In addition to the throttle valves and the automatic stop valves, shut-off valves are provided for each turbine under the boiler room floor. These valves are controlled by hand wheels mounted on stands in the turbine room. A separate steam main is provided for the steam-driven auxiliaries, which are all designed to use superheated steam. Steel pipe with extra heavy welded flanged joints is used for all high-pressure steam lines, contraction and expansion being provided for by the use of long radius bends.

An exhaust line leads from each turbine directly down to its condenser and is connected by an automatic relief valve to an individual outboard exhaust line, which passes through



BOILER ROOM IN THE COS COB POWER STATION



SWITCHBOARD GALLERY IN THE COS COB POWER STATION

the engine room basement to the outside of the building and thence to a point above the roof.

The piping from the pumps to the feed-water heaters and economizers is of cast iron, while that from the economizers to the boilers, with the exception of a cast-iron header below the floor, is of brass.

FEED-WATER HEATER, SERVICE PUMPS AND FIRE PUMP

A closed feed-water containing 2000 sq. ft. of surface and utilizing the exhaust from the steam-driven auxiliaries is provided.

A suitable service pump furnishes the water necessary for toilet purposes, wetting down ashes, etc., while a standard Underwriter's steam pump of a capacity of 10,000 gals. per minute is installed in the basement for fire protection.

AIR-CLEANING SYSTEM

For cleaning generators, switches, etc., compressed air is furnished throughout the engine room and switchboard gallery by means of a Westinghouse Air Brake Company's locomotive type of air compressor, supplying air at 100 lbs. pressure.

OILING SYSTEM

A continuous circulating oiling system for the turbine and generator bearing is installed. The oil is elevated by a small steam pump into a tank situated in the fan room and flows from this tank by gravity to the various bearings. After passing through the bearings it is discharged into a filter, and from the filtered oil passes to a receiving tank in the engine room basement to which the suction of the oil pump is connected. Taps are placed in this line at convenient points for filling the oil cups on the auxiliary engines and pumps.

HIGH-PRESSURE DRIPS

The drips from the high-pressure steam line are returned to the boilers by a Holly gravity return system, the receiver of which is located in the engine room basement, and the discharge chamber, at the highest point of the boiler room.

TRAVELING CRANE

The turbine room is equipped with an electric traveling crane, provided with two 37½-ton trolleys, operated from the exciter circuit.

MACHINE SHOP

A large room in the basement of the boiler room has been furnished with a full machine equipment of lathes, shapers, drill-presses, planers, etc., for general repairs. The machinery is driven from an overhead line shaft operated by an induction motor.

TOILET ROOMS, ETC.

Separate toilet rooms are provided in the basement for the fire room and engine room forces, each containing individual lockers, shower baths, wash basins, etc.

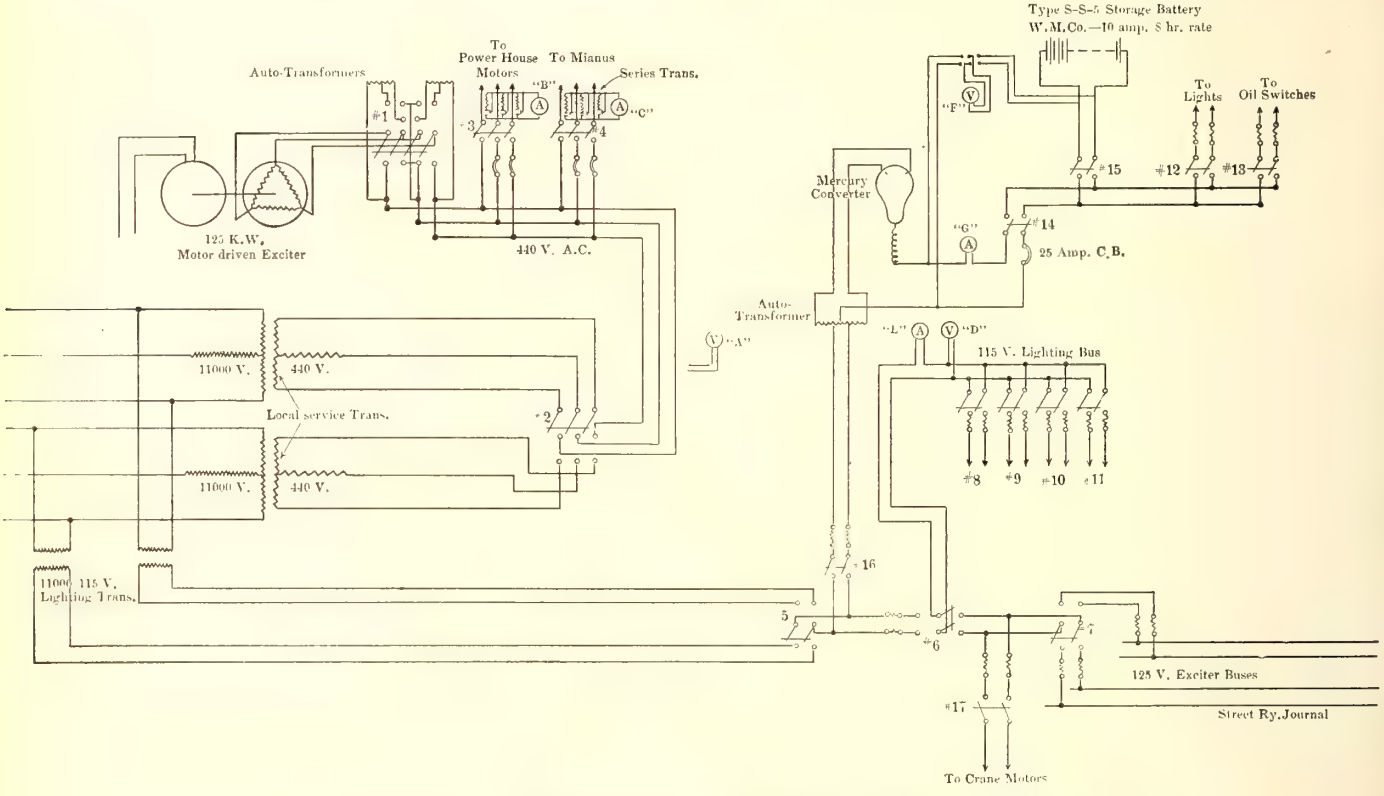


DIAGRAM OF CONNECTIONS OF LOCAL-SERVICE SWITCHBOARD

ELECTRICAL DISTRIBUTION

The main cables from each generator are run in the air chamber under the turbine room floor, up to the switchboard gallery and thence through selector oil-circuit breakers down to the high-tension buses under the switchboard gallery. These circuit breakers are electrically interlocked so that the buses cannot be paralleled.

The two high-tension buses, with their accompanying switching equipment are interchangeable and are arranged so that each can be used separately: one supplying three-phase current to the Port Morris feeders, and the other supplying principally single-phase current for the locomotives. Each bus is further divided by knife switches into three sections; each end section containing generator leads and propulsion feeders, and the center section containing the Port Morris feeders, so that in an emergency a still further subdivision can be affected.

When a bus section, or the entire bus, is used for supplying single-phase propulsion current, one leg is grounded

directly to the track rails of the right of way through suitable switches; another leg supplies the outgoing feeders, which are run in duplicate, connecting directly to the trolley and thus completing the single-phase circuit. The third leg of this bus is connected to a feeder which is carried along the right of way for the purpose of supplying power for local purposes. This gives three-phase circuit along the line. The capacity of the generators is, of course, somewhat reduced by the unbalancing of the circuits. If there is current on only one leg of a three-phase generator the theoretical capacity is, of course, only 57.7 per cent of that with balanced three-phase operation. On the New Haven system, however, the power taken from the third conductor tends to increase this percentage considerably.

The voltage of each high-tension bus is maintained constant by a Tirrill regulator controlling the exciter field circuits.

LIGHTNING ARRESTERS

The arresters used in the generating station are of the multigap non-arcing low-equivalent type, in which respect they do not differ essentially from standard arrester equipments. An unusual feature resides in the use of a double auxiliary series of non-arcing gaps which are connected to the ground through fuses, as shown in the illustration herewith. Considering the arrester in detail, it is to be noted that the main series of gaps is connected between the line wire and the ground with a resistance in series on the ground side; an additional resistance is placed in shunt to certain of the main gaps. The two series of auxiliary gaps with their separate fuses are joined in series with the main gaps on the ground side, and hence are in parallel with the resistance which is in series with the main gaps. It will be observed that if only one of the fuses blows, the other continues to be in operative condition; while if both fuses blow, the arrester is merely converted into a protective device of the low-equivalent type. It is expected that minor discharges will pass across the arrester without damaging the fuses, and that the fuses will blow only in the case of excessive discharges, which with the more usual arrester arrangement would probably cause the station to

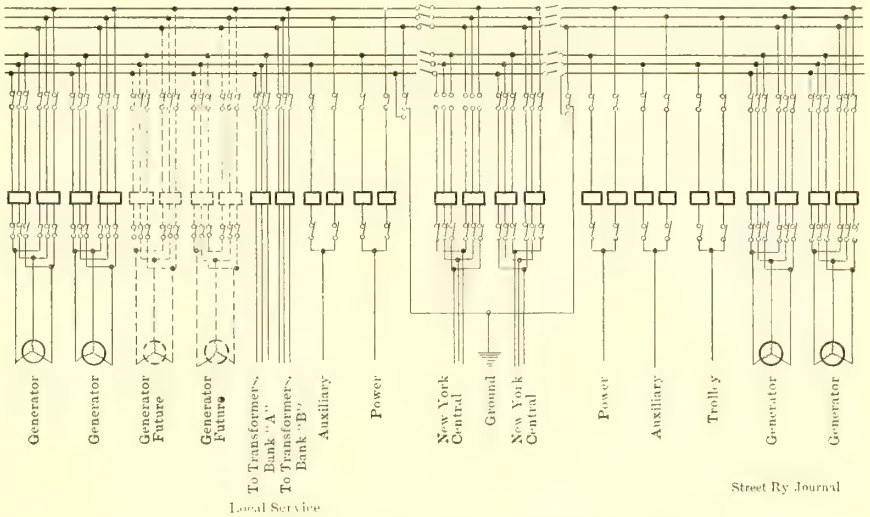
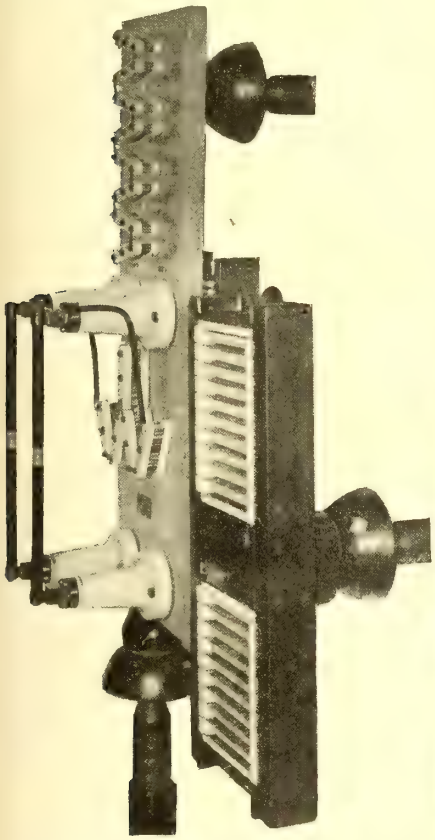
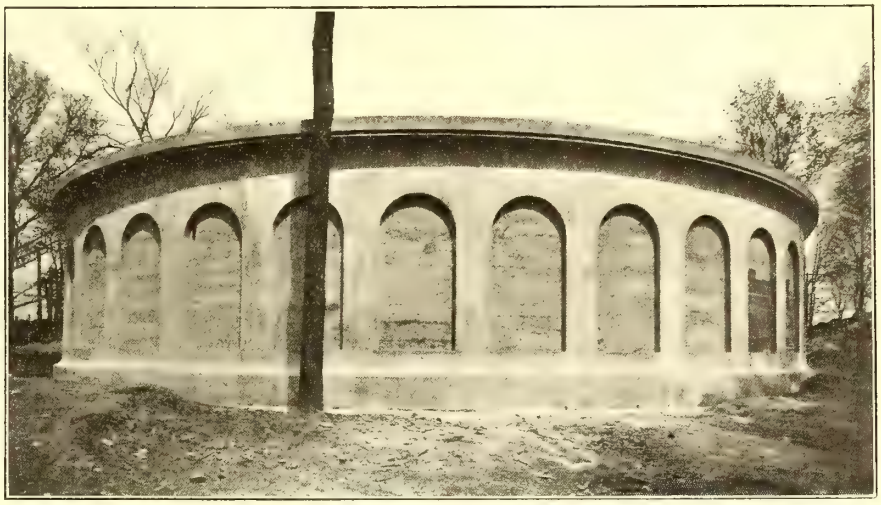


DIAGRAM OF HIGH-TENSION CONNECTIONS



FUSED LOW-EQUIPMENT LIGHTNING ARRESTER FOR NEW HAVEN POWER STATION



FERRO-CONCRETE WATER TANK

Each leg of the high-tension bus, consisting of two 3-in. x ¼-in. copper bars, is enclosed in a separate masonry compartment composed of pressed brick and soapstone, and is supported on porcelain pillars and bushings projecting from the side wall of the compartment, the bushings providing for cable connections to the bus. Removable glass doors are provided in the bus compartments at small openings opposite all connections and supports. The connections between the bus-bars and the circuit breakers consist of insulated cable and are carried up in separate brick septums on the back of the bus-bar and oil circuit breaker structure. Each oil circuit breaker can be disconnected from the bus and circuit by hook-type knife switches located on the rear of the structure.

The feeder cables pass along the top of the circuit breaker structure, thence to choke coils in the arrester gallery and through special windows to the line.

be thrown out of commission due to the opening of circuit breakers.

SWITCHBOARD

The main switchboard is made up of marble slabs carrying Westinghouse instruments and switching apparatus. It contains four panels for the operation of the generators, three panels for the control of the exciters, two panels for the Tirrill regulators, one load panel, one inclined station panel for the synchroscope and a. c. voltmeters, and five panels for the apparatus controlling the outgoing feeder system and the local high-tension circuits.

Each generator panel is equipped with instruments indicating the current per phase, the power factor, the indicated watts, and the field current. Receptacles are also provided on each generator panel for making connections with the synchroscope and the voltmeters on the inclined panel. This panel contains the main field switch and rheostat hand wheel, together with an electric governor controller for changing the speed of the generators from the switchboard gallery for the purpose of synchronizing when it is desired to throw two or more generators in parallel. The oil circuit breakers between the generator and the buses are also electrically controlled from these panels. Watt-hour meters are placed in the bus sections in such a way as to register the total output of the generators or of any group of feeders.

Each feeder is equipped with an ammeter, overload relay and controllers for its oil circuit breakers. Colored lamps on the switchboard indicate the position of the circuit breakers.

An interesting detail of the switchboard equipment for the feeders is found in the time-limit feature of the overload relay. Each overload relay is shunted by a fuse, which must blow before the fuse can act. The impedance of the fuse is so small compared to that of the relay that most of the current passes through the fuse. It will be seen, therefore, that the relay mechanism as a whole possesses a "time limit" exactly equivalent to a fuse. If for any reason it is desirable to operate without a "time limit," the fuse can be omitted. Moreover, the relay can be reset at any time without inserting a fuse, and yet the apparatus will be adequately protected.

STATION CIRCUITS

For supplying power to the various motors throughout the station, duplicate sets of two transformers each are used. They are T-connected and supply three-phase current at 440 volts.

For the control of the station circuits a local service switchboard is installed containing apparatus for controlling the motor of a motor-driven exciter, the station lamp circuit, the motor circuit and the storage battery circuit. The storage battery, which is located in the basement below the switchboard gallery, consists of fifty-five cells of the Westinghouse Machine Company's 5-S-5 type of 10 amps. capacity for 8 hours, and is used for operating the control circuits of the circuit breakers and the switchboard signal lamps. The battery is charged through a Cooper-Hewitt mercury converter, taking current from the alternating current lighting circuit.

LIGHTING

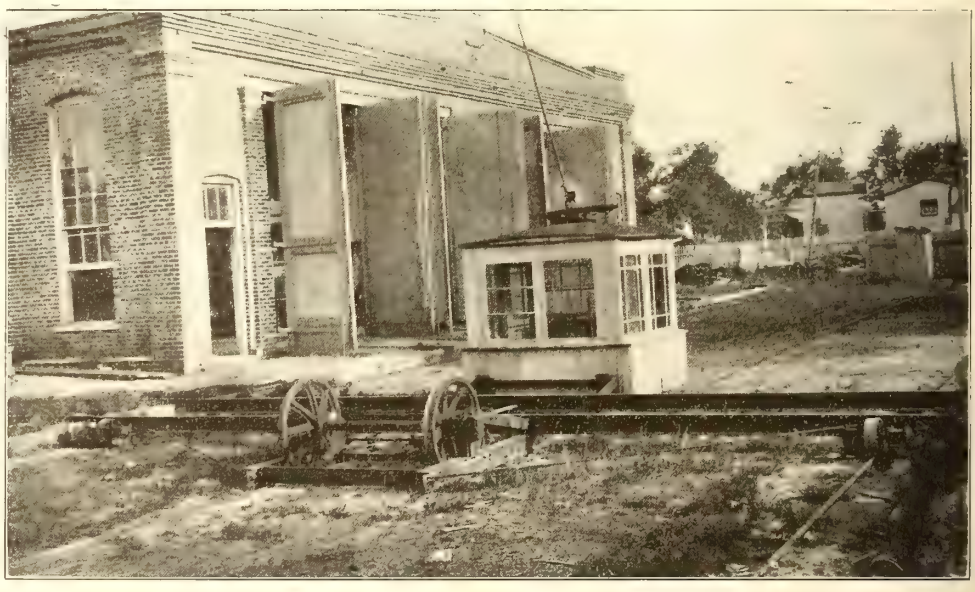
Cooper-Hewitt mercury arc lamps are used for general illumination and incandescent lamps for restricted locations. Alternating current for these lamps is supplied by duplicate single-phase 75-kw transformers delivering current at 115 volts.

ENGINEERING AND CONTRACTING

The power plant was designed and constructed under the administration of the engineering department of the New Haven Railroad Company. The regular engineering facilities of the road were supplemented by the services of Westinghouse, Church, Kerr & Company, who were associated in the design of the plant, and who, in behalf of the road, erected the building and installed the equipment with the exception of the turbo-generators and exciters. These machines were assembled in place by the Westinghouse Electric & Manufacturing Company.

A HOME-MADE TRANSFER TABLE

A transfer table made in the shops of the Mobile Light & Railroad Company largely out of materials found about the shops is shown in the accompanying reproduction. It consists primarily of a four-wheel truck supporting the track rails which are further supported at the ends. The track rails are 30-ft. 7-in. rails. The truck was made by suspending from the two axles a frame made up largely of T-rails. To one axle is geared in the usual manner a discarded W. P. 50 motor. This is controlled by means of the old type rheostat and reverse. The truck is equipped with a brake rigging similar to that found on a single truck car. The house protecting the motor carries the customary type of trolley stand. The table was designed and built by S. M. Coffin, master mechanic. In its design effort was made to keep down the height as much as possible, and it may be noted that at the center the depth of the pit is only deep enough to allow two 7-in. rails to be placed one on top of another and clear the ground.



TRANSFER TABLE MADE OF DISCARDED MATERIALS

CITY TRACK CONSTRUCTION AT MILWAUKEE

In all its new construction in paved streets the Milwaukee Electric Railway & Light Company has adopted a method of letting the paving brick or block project under the inside of the head of the T-rail instead of beveling the ends of the brick or block or using specially molded brick so as to form a groove alongside the rail. The argument for the construction adopted is that when the wheels of a wagon or other vehicle is traveling in the flangeways and attempt is made to turn out the wheels do not have to climb out over a shoulder on both sides.



TRACK CONSTRUCTION IN MILWAUKEE STREETS

In the construction a 7-in., 95-lb. rail is used. The ties are completely immersed in concrete, the bed extending down about 6 ins. or 8 ins. below them. For brick paving a sand cushion is placed above the concrete. In asphalted streets granite blocks are used adjacent to the rail.

Where traffic is heavy, special work with hardened centers is used. In suburban municipalities where the single-truck cars are used, or where the cars are run under a headway of 15 minutes or more, special work built up in the company's shops is employed.

LOST ARTICLE TAG AT NASHVILLE

When turning lost articles in to the office at Nashville, the conductor or motorman attaches to them and fills out a blank giving facts which are often useful when having patrons identify the property. The card is signed by the motorman or conductor and the dispatcher who receives it. When the article is returned the owner is requested to receipt for it on the card.

5m-12-06 FORM 279

NASHVILLE RY. & LIGHT CO.

LOST ARTICLE

Car No. .....

Time Found ..... *M.*

Date ..... *190* .....

Line .....

Signed

..... *Cond*

Motr

Received by

..... *Dis*

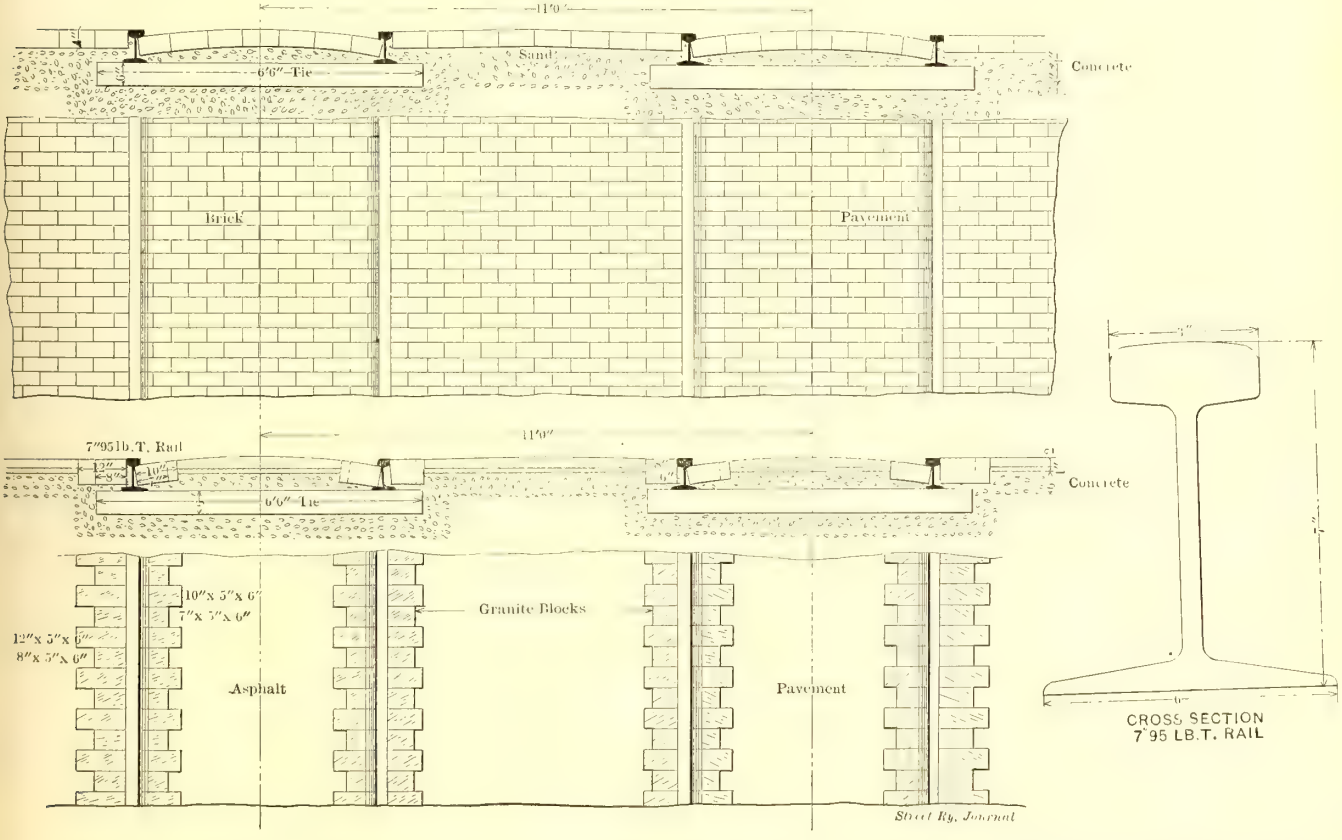
Received ..... *M.*

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OWNER.

LOST-ARTICLE TAG



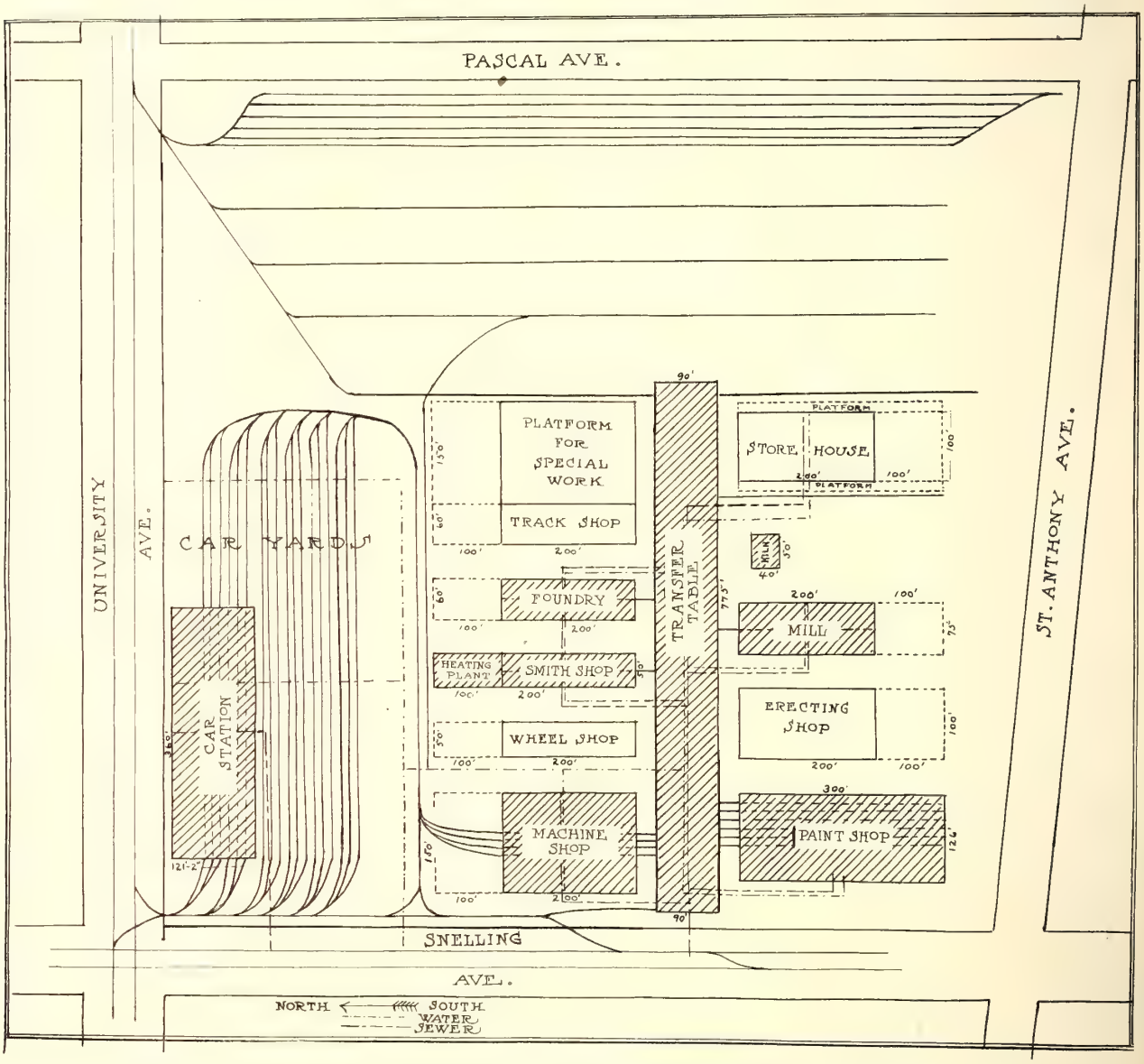
SECTIONS AND TOP VIEWS OF MILWAUKEE T-RAIL CONSTRUCTION FOR BRICK AND FOR ASPHALT PAVEMENT

TWIN CITY RAPID TRANSIT COMPANY'S NEW SHOPS

The Twin City Rapid Transit Company, of Minneapolis and St. Paul, has recently been engaged in building a large new shop system almost in the heart of the district it now serves, and that which will be served when future extensions now in contemplation have been made. The structures are not only large enough for the demands of to-day and of the immediate future, but are so arranged as to leave room for ample enlargement without impairing the efficiency of any part of the plant as it now stands.

The site of the new plant is almost exactly midway between Minneapolis and St. Paul, on the main electric line between the two cities, and at the junction of a cross-town line which connects by about a 5 minutes' run with two other trunk lines between the cities. It is, therefore, easily accessible from every part of the system, despite the fact that the company's lines are spread over a large area. The company was fortunate in being able to obtain the site—forty acres in all—while it was still wholly unoccupied and required only a moderate amount of grading to bring it to the street level.

Almost before the grading was done, the company set to work on six of the eleven large buildings that are to make up the completed plant as at present planned. These six buildings are now almost completed and are being equipped, a seventh is well under way, and the remaining four will be pushed along as rapidly as circumstances will permit. A plan of the shops is presented herewith. The structures already completed or nearing completion are indicated by the diagonal lines. The buildings outlined merely are yet to be built. The parts of buildings indicated by dotted lines are additions to be made as needed. The water system as arranged at present is shown by the dot and dash lines, and the sewer system by the short and long dash lines. Solid lines, except where indicating parts of buildings, stand for trackage. The plant as mapped covers forty acres, the diagram being drawn to a scale of 250 ft. to the inch.



GENERAL PLAN OF THE TWIN CITY RAPID TRANSIT COMPANY'S NEW SHOP AND CAR HOUSE

The buildings up and those to be put up are, or are to be, of reinforced concrete throughout. The foundations are of monolithic construction and the superstructures of hollow cement blocks and cement brick, made on the grounds as needed. The designs for the buildings and the plans for the grouping of the buildings were prepared after careful consultations by the heads of all the departments in any way interested. Practically every department of the system, therefore, had some part in deciding the character of the plant, for it has long been the policy of the company not

only to make all of its own repairs, but to build all of its own rolling stock after patterns peculiar to its needs as determined by experience and climatic conditions. Throughout, in both designs and groupings, the aim has been to obtain a maximum of efficiency with a minimum of expense, time and energy in operation.

The plant may be considered in two main divisions—the car station and trainmen's headquarters, and the supply storage facilities and shops proper.

The car station, with the trainmen's headquarters, stands just at the corner of the plant at the intersection of the University Avenue trunk line between Minneapolis and St. Paul and the Snelling Avenue cross-town line. In the men's quarters, which open on University Avenue, are lockers, shower baths, toilet rooms, a dormitory, and a large lounging room, which opens into the office of the head of the lines centering at this station. At the front of the building, opening on Snelling Avenue, is a large room used as a converter sub-station. Men's quarters, office and converter station occupy about one-third of the building. The other two-thirds are taken up with space for cars.

The car station, which differs from a car house, as it is not used exclusively for storage, is 360 ft. in length and contains accommodations for forty-two cars. This may seem like a limited space, but outside and to the south and east of the building are storage tracks for three or four times as many cars, and distributed through the two cities are several large car houses. All of the tracks in the car station are provided with pits, which extend the entire length, and light repairs will be made there. If extensive repairs are needed on trucks or motors they are sent to the machine shop, and all the work of the car station is under the eye of one foreman.

The truck interchange system used by the company has proved thoroughly successful and has been the more feasible because of the uniformity of the equipment used.

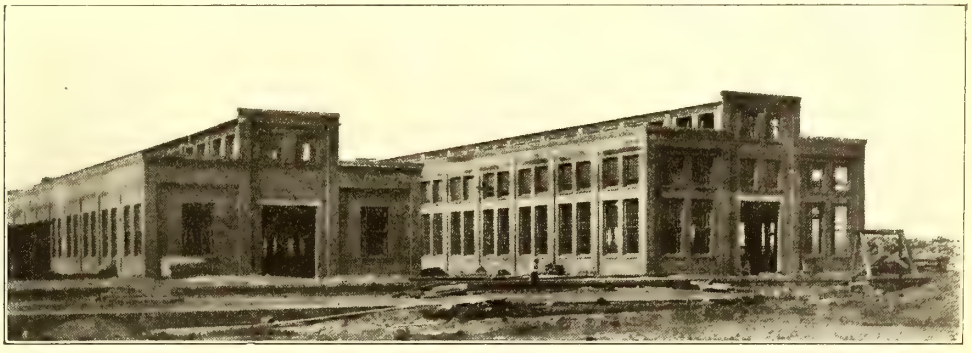


MACHINE SHOP, WITH PAINT SHOP IN THE REAR

Another plan that contributes to efficiency is the weekly shift of cars from regular to trip service and vice versa. By this plan cars that one week are on regular duty and put into the station only at night, and therefore get only night inspection and repairs, the next week are put on trip service, being out only two or three hours at a time and getting day inspection and repairs at the car station.

If a car body needs considerable repairs, not admitted of in the station proper, it is run to the erecting department in the paint shop, the separate erecting shop not yet having been begun, and there lifted from its trucks, which are run out for use under other car bodies, or, if they need repairs, to the machine shop. Under the truck interchange system either car body or trucks go into service as soon as ready and demanded.

The machine shop is equipped for heavy work, such as the use of unusually large cars demands and is provided with three traveling cranes of 12,000 lbs. capacity each. These command the entire central bay, 50 x 200 ft., which is given up wholly to motor and truck repair and construction work. No pits are used as the motors employed are designed for top inspection. On the second floor the lighter work is done—armature winding and air-pump work. Access to the second floor is provided by two stairways and two electric elevators on opposite sides of the building.



THE NEW FOUNDRY AND BLACKSMITH SHOP OF THE TWIN CITY RAPID TRANSIT CO.

The machinery of the machine shop, as of the entire plant, is electrically driven at 230 volts d. c. Machines of less than 3 hp are grouped. Others are run on independent motors.

Just east of the machine shop is the site of the wheel shop, as yet not begun, its work for the present going to the machine shop. Next up the row is the smithy, with the usual equipment of such a shop, but on a large scale to meet the demands of a manufacturer as well as a repair plant.

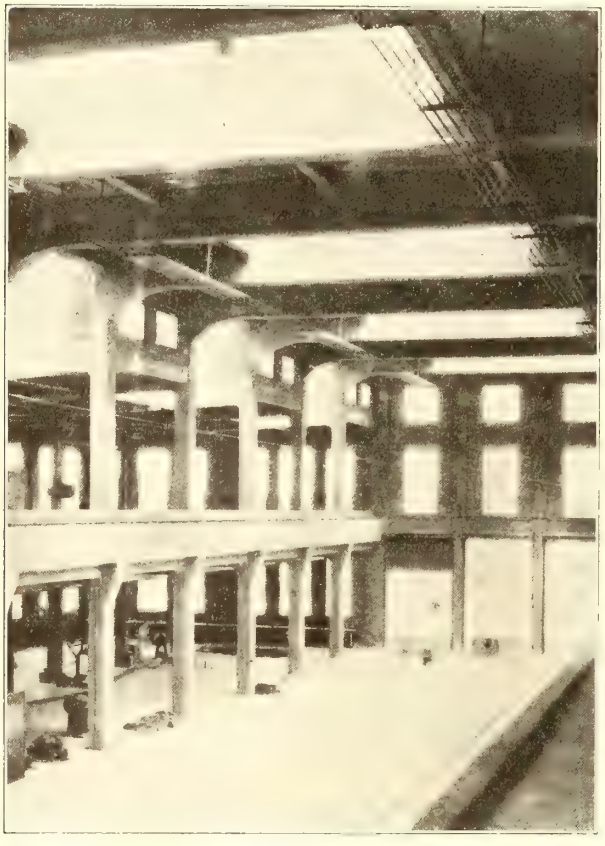
The foundry is a structure of special interest as a part of a street railway shop system. It is being equipped for the manufacture of all of the company's castings except those of malleable iron and wheels. The regular demand of the company for castings such as it will hereafter manufacture for itself, as shown by last year's record, runs: brass 90 tons, steel 300 tons, gray iron 900 tons. With the increase in the company's business and the expansion of its territory already alluded to, these figures are likely soon to be largely increased.

Beyond the foundry is the site of the track shop for the manufacture of track special work, and a large paved yard for the laying out of such work. This yard will have direct trackage facilities and will adjoin the supply yards and sheds, giving both paved yard and track shop ready access to the material they will use.

In the rear of the smithy is the heating plant for the

whole layout, saving only the car station, which has a heating system of its own of the fan type. The general system, however, is of the vacuum type. The radiation pipes for the different buildings are placed for the most part overhead, out of the way and saving in the aggregate much valuable space.

Across the transfer table, along which the buildings



INTERIOR OF MACHINE SHOP JUST AFTER COMPLETION

named are lined up, is another group of buildings. First, on the east, adjoining the supply yard tracks is to be a large storehouse two stories in height and 100 ft. x 200 ft. in area at first, and eventually 100 ft. x 300 ft. exclusive of platforms. This will be provided within and without with cranes for the handling of heavy material, as will the track shop and yard across the way. Next to the storehouse, toward Snelling Avenue, stands the dry kiln, now building, and to the south of that is the site of the lumber yard. Heat for the dry kiln will be supplied from a steam coil, and fans will give circulation. Further to the west comes the site of the erecting shop, yet to be built, and after that the paint shop, for the present to serve, as stated, both as paint and erecting shop.

The arrangement of the buildings on both sides of the transfer table will at once be seen to be logical and natural, whether for repairs or for the construction of new rolling stock. First on the east are the sources of supplies, the open yards, the sheds and the storehouses. From these may be sent to any of the buildings with facility and dispatch, materials needed for repair work. Likewise, if large construction work is in order, supplies go down along the line to the foundry, the smithy, the wheel shop, and the machine shop, the place of the final assembling of the heavy work, or, on the other side of the transfer table, materials go from storehouse and dry kiln to the mill for the manufacture of all of the woodwork of the cars, thence to the erecting department, and thence again to the paint shop, where the cars receive their final touches and are shunted out to the car station. The transfer table itself is 90 ft. wide and has a run of 775 ft. Power is taken from a wire carried against the side of the pit and protected by a projecting ledge of concrete and wooden guard.

At the side of the transfer table pit are 30-ft. planked platforms extending each side of the pit for its full length. These make possible the trucking of material or work from one shop to another without calling upon the transfer table.

An office building and men's room is to be added to those shown in the plan on page 318. It will probably be placed along the Snelling Avenue side of the machine shop. The feature of special interest in this is the contemplated men's room. This is to be provided with lockers, toilet facilities in addition to those in the separate buildings, chairs and tables. It is, in short, to be the lunch room of all the employees of the shops; the company is considering the plan of serving, along with the lunches brought by the men, hot soup and coffee.

OBSERVATION CAR RESULTS IN MONTREAL

The Montreal Street Railway Company operates two fine observation cars on what is known as the Round-the-Mountain line. The cars run every afternoon and evening, Sundays and holidays, weather permitting. They pass the corner of Peel and St. Catherine Streets on the hour, but also stop at other points when signaled. The trip is through some of the most attractive parts of the city and then around Mt. Royal. The time is 1 hour, and the cost 25 cents. The cars are built entirely open, and this, with the step arrangement of the seats, give the passenger an unobstructed view from any position. Arches of colored incandescent lamps make the car attractive also for evening tours.

The construction cost of the cars was about $5,500 each, and the total income for the summer months of 1906 was



BUILDING FOR CAR STORAGE, OFFICES, TRAINMEN'S QUARTERS AND SUB-STATIONS

$6,645, or about $3,323 per car. The total wages paid for the operation of both cars was approximately $753. The average income on ordinary days is about 45 cents per car-mile, but as high as 60 cents on Sundays and holidays. As the cars have been in use but a short time, the cost of maintenance and repair has been negligible, and is likely to remain so for years to come because they are very substantially constructed.

EIGHT-CAR TRAINS ON THE BOSTON "L"

The Boston Elevated Railway Company has filed its plans and petitions with the Railroad Commission for the operation of eight-car trains. When the new Washington Street tunnel is completed the eight-car train will be used exclusively, and the Tremont Street subway will be devoted to surface cars only. The company hopes by this change to avoid congestion at the stations. The change will also benefit greatly passengers who enter the cars at the Dudley Street transfer station. It necessitates that every platform along the line be lengthened and new structures be erected. At the South station a new stairway is in contemplation for the approaches, as the present stairway is hardly wide enough to accommodate the crowds. Especial attention will be given to the elevated road in Charlestown, and the City Square station will, to an extent, be remodelled.

EXTENDING THE INLAND EMPIRE SYSTEM

The Inland Empire System, of Spokane, Wash., has recently made a very material addition to its mileage and has inaugurated a number of new and interesting operating features, among them a splendid parlor car service. On Aug. 1, as previously noted in the STREET RAILWAY JOURNAL, passenger and freight service was begun between Rosalia and Colfax on the Spokane & Inland division of the Inland Empire System. The distance between Rosalia and Colfax is 30 miles, and with this additional trackage the Inland Empire System's lines now aggregate 200 miles. The Spokane & Inland division is now operating between Spokane and Colfax and Spokane and Palouse, a distance of 76 miles to either southern terminal, and an extension is being graded from Palouse, Wash., to Moscow, Idaho, a distance of 16 miles, and will be in operation about Jan. 1. On the Coeur d'Alene Hayden Lake and Liberty Lake divisions of the Inland Empire System, traffic is showing a very large increase over last season. Parlor car service was inaugurated on the Coeur d'Alene division June 29, and has proved a decided success. The first trip out of Spokane the parlor car was oversold six seats, and the second trip twenty-nine out of thirty chairs were taken. A view of the "Shoshone Flyer," which carries the parlor car, is presented herewith, also a view of the interior of the car. They show the general character of the equipment. The parlor cars are especially elaborate, the equipment including individual rattan seats with plush cushions and plush at the back where contact is made with the chair. The observation end is a feature that has appealed to the public and has been, in a large measure, responsible for the extraordinary popularity of the cars. Four trains run in either direction between Spokane and Coeur d'Alene daily, with parlor car attached, one of these trains known as "The Campers' Limited," operating through to Hayden Lake, which is one of Spokane's popular summer resorts.



INTERIOR OF SHOSHONE FLYER



THE SHOSHONE FLYER

SERVICE TESTS ON COLUMBUS CITY CARS OPERATED SINGLY AND IN TWO-CAR TRAINS WITH MULTIPLE UNIT CONTROL

A little over a year ago the Columbus (Ohio) Railway & Light Company started a two-car train service to reduce the congestion on its High Street line. Instead of attaching a trailer to a motor car, or coupling two straight motor cars, the company resorted to the then novel expedient of placing two motors on each car, but using type M multiple-unit control on the leading car, and a K-10 controller on the rear car. This was done to save the cost of an additional multiple-unit equipment, as it was found that regular train control could be obtained by tapping the usual leads for motors Nos. 3 and 4 into a common bus line, connected to the second equipment and making a few other changes. A full description of the company's practice with the corresponding wiring diagram was published in the Street Railway Journal of June 30, 1906, and brief reference made to it also in the Oct. 13, 1906, issue.

This practice of the Columbus company led to the interesting comparative service tests of train and single-car operation by the Ohio State University's Department of Electrical Engineering, of which a summary is presented in this article. The tests were made for thesis purposes under the direction of Prof. F. C. Caldwell, by F. F. Sheldrick, H. D. Cranston, E. S. Zuck and C. P. Galleher.

The experiments were carried out on the High Street line, which is about 6.6 miles long. The leading car used both in the single car and train tests is specified by the following: weight of body, 20,185 lbs.; trucks, 6175 lbs.; motors and gearing, 4920 lbs.; air and electric equipment, 3176 lbs.; total weight, 34,366 lbs.; seating capacity, 40; length over the vestibules, 40 ft. 8 5/16 ins.; length over the body, 28 ft. 8 5/16 ins.; width over the posts, 7 ft. 11¼ ins.; height, 9 ft.; wheel diameter, 33 ins.; Brill maximum traction trucks; two GE-67 motors, 40 hp each and geared 67:17. The trail car was similar to the leading car except that its platforms were each 1 ft. shorter. Both cars were in ordinary operating condition and picked at random.

On the type M car, power is consumed in the motor, control and air compressor circuits; on the K-10 car, power is consumed only in the motor and air circuits. The general scheme of the test was to place the proper power-recording instruments in these circuits in addition to several special instruments for recording speed, etc.

After preliminary runs on April 4, 1907, the two-car train was tested on April 5, and the single car on April 6. The test car left the North High Street car house at 6:10 a. m. and made its regular schedule on the High Street line until about 11 a. m., when three round trips were completed. Some extra trips were made, however, to secure additional data.

The following tables Nos. 1, 2, 3, 4, 5 and 6, summarize the calculated results of all tests.

The data for the individual runs differ somewhat, but the discrepancies are very small when the varying conditions of load, track, etc., are considered. The fact, however, that both the train and single car were operated over the same route and on the same general schedule facilitates comparison.

In comparing the results, several interesting conclusions are obtained.

1. The kw-hours per car-mile (motor circuit only) were 2.20 on Friday, April 5, and 2.01 on Saturday, April 6 (Tables 4 and 5); the respective watt-hours per ton-mile (motor circuit) were 122.6 and 103.4. The results show that 52 watt-hours per car-mile were consumed on Friday, and 50.6 on Saturday. In this connection it should be noted

TABLE No. 1.—CALCULATED RESULTS OF TESTS.
Two-Car Train, Friday, April 5, 1907.

Number of Run	(1)	(2)	(3)	(4)	(5)	(6)
1. Average amperes	147	158	136	158	151	143
2. Average volts	509	508	513	521	524	528
3. Average watts	75000	80300	69800	82200	79400	75400
4. Length of time power is on (seconds)	1366	1402	1351	1317	1343	1313
5. Total watt hours	28450	31300	26250	30050	29670	27500
6. Length of run (miles)	6.63	6.63	6.25	6.63	6.63	6.63
7. Kw-hours per car mile	2.14	2.36	2.10	2.27	2.24	2.07
8. Total number passengers	102	101	63	90	85	84
9. Average number on car	35.2	40.8	26.2	29.3	29.1	23.8
10. Weight of car and live load (tons)	36.15	36.50	35.50	35.75	35.72	35.41
11. Watt hours per ton mile	118.6	129 5	118.4	126.8	125.2	117.2
12. Total number of stops	55	56	48	54	57	54
13. Stops per mile	8.3	8.4	7.2	8.2	8.6	8.2
14. Total time of stops (seconds)	248	215	185	230	252	220
15. Average time of stop	4.5	3.8	3.8	4.3	4.4	4.1
16. Average speed (m. p. h.)	11.10	10.90	11.04	10.70	11.11	10.36
17. Schedule speed (m. p. h.)	9.95	9.94	10.03	9.71	9.95	9.60
18. Kw-hours per car mile	2.21	2.43	2.16	2.33	2 30	2.14
19. Watt hours per ton mile	122.2	133.1	121.9	130.4	129.0	120.8
20. Watt hours per passenger (total)	287	319	429	343	359	338

Note.—"Kw-hours per car mile" and "Watt-hours per ton mile" (items No. 5, No. 7 and No. 11) do not include the energy used in the air nor control circuit. Items No. 18, No. 19 and No. 20 take these quantities into consideration.

TABLE No. 2.—RESULTS FROM RECORDING WATTMETERS

Number of Run	(1)	(2)	(3)	(4)	(5)	(6)
1. Total watt hours	29900	31900	24900	25900	28900	29900
2. Watt hours (air circuit)	550	560	440	520	600	490
3. Watt hours (control circuit)	340	380	340	330	300	360
4. Watt hours (motor circuit)	29000	30960	24100	25050	28000	29050
5. Kw-hours per car mile	2.19	2.33	1.82	1.89	2.11	2.19
6. Watt hours per ton mile	121.0	128.0	108.6	105.8	118.2	123.8

TABLE No. 3.—CALCULATED RESULTS OF TESTS.
Single Car, Saturday, April 6, 1907.

Number of Run	(1)	(2)	(3)	(4)	(5)	(6)
1. Average amperes	67	70	81	69	67	71
2. Average volts	507	504	519	527	538	531
3. Average watts	34000	35300	41800	36400	36100	37700
4. Length of time power is on (seconds)	1343	1353	1386	1265	1271	1176
5. Total watt hours	12690	13300	16090	12800	12740	12300
6. Length of run (miles)	6.63	6.63	6.63	6.63	6.63	6.63
7. Kw-hours per car mile	1.91	2.00	2.43	1.93	1.92	1.86
8. Total number passengers	76	88	98	82	74	55
9. Average number on car	33.2	35.6	36.8	27.7	34.0	24.0
10. Weight of car and live load (tons)	19.52	19.67	19.73	19.15	19.56	18.91
11. Watt hours per ton mile	98 0	101.8	123.0	100.8	98.3	98.4
12. Total number of stops	47	51	58	45	46	40
13. Stops per mile	7.1	7.7	8.8	6.8	6.9	6.0
14. Total time of stops (seconds)	173	222	247	299	200	193
15. Average time of stop	3.7	4.4	3.3	6.6	4.4	4.8
16. Average speed (m. p. h.)	10.91	10.48	10.18	11.35	10.84	11.44
17. Schedule speed (m. p. h.)	10.11	9.60	9.32	9.95	9.95	10.48
18. Kw-hours per car mile	2.03	2.10	2.54	2.03	2.01	1.94
19. Watt hours per ton mile	104 0	106.9	128.6	105.9	103.0	102.8
20. Watt hours per passenger (total)	177	158	172	164	180	234

Note.—"Kw-hours per car mile" and "Watt hours per ton mile" (items No. 5, No. 7 and No. 11) do not include the energy used in the air and control circuits. Items No. 18, No. 19 and No. 20 take these quantities into consideration.

TABLE No. 4.—RESULTS FROM RECORDING WATTMETERS.

Number of Run	(1)	(2)	(3)	(4)	(5)	(6)
1. Total watt hours	20900	18900	19900	15900	11900	12900
2. Watt hours (air circuit)	330	310	400	290	300	290
3. Watt hours (control circuit)	420	310	340	340	310	290
4. Watt hours (motor circuit)	20150	18280	19160	15290	11330	12360
5. Kw-hours per car mile	3.05	2.76	2.89	2.31	1.71	1.86
6. Watt hours per ton mile	156.5	140.3	146.5	120.4	87.3	98.6

TABLE No. 5.—AVERAGE LOG SHEET FOR FRIDAY, APRIL 5, 1907.
Two-Car Train.

Condition of track	Dry and clean.
Route	Entire length of High Street.
Length of single run	6.63 miles.
Number of runs	6.
Time of runs	From 6:10 a. m. to 10:39 a. m.
Passengers carried	Total per trip, 88; average number on the train, 30.6.
Stops per mile	Average per trip, 8.1.
Voltage measurements	Average per trip, 517 volts.
Current measurements	Average per trip, 149 amperes.
Power measurements	Average per trip, 77000 watts.
Time measurements	Time power is on; average per trip, 1349 seconds.
Energy measurements	Average per trip, 28900 watt hours; kw-hours per car mile, 2.20; watt hours per ton mile, 122.6.
Control circuit	Watt hours per car mile; average per trip, 52.0.
Air circuit	Watt hours per mile; average per trip, 80.5. Watt hours per car mile; average per trip, 40.3.
Total energy per trip	Including motor, air and control circuits, 2.29 kw-hours per car mile.
Total energy per trip	Including motor, air and control circuits, 345 watt hours per passenger.
Total energy per trip	Including motor, air, control and heater circuits, 3.04 kw-hours per car mile.

that the average stops per mile were 8.1 on Friday, and 7.4 on Saturday.

2. The energy charged against the heater is based on the measured resistance of the heater circuits and on the assumption that if continuously operated they would have used .75 and .73 kw-hours per car-mile respectively, for Friday and Saturday.

3. The total energy per trip, including the motor, air control and heater circuits, was 3.04 kw-hours on Friday, and 2.84 kw-hours on Saturday. The watt-hours per ton-mile on Friday were 146, and on Saturday 169.8; watt-hours per passenger were 345 on Friday, and 177 on Saturday.

TABLE No. 6.—AVERAGE LOG SHEET FOR SATURDAY, APRIL 6, 1907. SINGLE CAR.

Condition of track	Dry and clean.
Route	Entire length of High Street.
Length of single run	6.63 miles.
Number of runs	6.
Time of runs	From 6:10 a.m. to 10:36 a.m.
Passengers carried	Total per trip, 79; average number on the car, 31.9.
Stops per mile	Average per trip, 7.4.
Voltage measurements	Average per trip, 521 volts.
Current measurements	Average per trip, 70.8 amperes.
Power measurements	Average per trip, 36900 watts.
Time measurements	Time power is on; average per trip, 1299 seconds.
Energy measurements	Average per trip, 13300 watt hours; kw-hours per car mile, 2.01; watt hours per ton mile, 103.4.
Control circuit	Watt hours per car mile; average per trip, 50.6.
Air circuit	Watt hours per car mile; average per trip, 48.2.
Total energy per trip	Including motor, air and control circuits, 2.11 kw-hours per car mile.
Total energy per trip	Including motor, air and control circuits, 177 watt hours per passenger.
Total energy per trip	Including motor, air, control and heater circuits, 2.84 kw-hours per car mile.

It is seen from the foregoing that the two-car train is the more economical on the ton basis, but from the standpoint of energy per car-mile and passenger, the single car shows a decided advantage, and especially in regard to the watt-hours per passenger. The traffic conditions, however, were such that the two-car train was not worked at the same relative load, the number of passengers being about the same for both days. If there had been the same number of passengers on each car in the two-car train as there were in the single car on Saturday, the results would have been quite different; instead of the watt-hours being 345, they would have been nearly halved. The watt-hours per ton-mile would also have been still lower on Friday than on Saturday, and the two-car train would then show up better than it does. This leads to the conclusion that the trains should be operated only when traffic is dense enough to fill both cars. Only the power consumption has been considered in this connection and no account is taken of any differences in other operating expenses such as labor and maintenance.

It will be noticed from tables Nos. 2 and 3 that the data from the recording wattmeters do not check with those from the voltmeter and ammeter measurements; neither are they consistent. For these reasons their indications were not regarded as reliable. As the wattmeters were carefully calibrated before and after the test, the discrepancies are attributed to the conditions of the test, since recording wattmeters are constructed with jewel bearings and should be mounted free from vibration. Evidently the frame of a moving car does not fulfil this requirement.

TEST OF THE CONTROL SYSTEM

The control system was tested to determine definitely how much power it required. A wattmeter was placed in the control circuit, the resistance of the contactors measured and the current consumption determined for each step. This test was comparatively short and simple, but proved the statement of the control manufacturer that the current taken by the master controller is about 2.5 amps. for an equipment of 400 hp or less. The power measurements are found in tables Nos. 2 and 4 and show that the power taken by the control apparatus is very small.

TEST OF THE AIR-BRAKING EQUIPMENT

The air-brake trial was also a service test and was taken principally to learn over what distance a car passed from the brake application until standstill; to compare the performance of a single car with a two-car train; and to determine the power used in braking.

The brake equipment was made by the General Electric Company. The cylinders were 8 ins. in diameter and the compressor motor took 4 amps. at 500 volts. The ratio of the brake levers was 8½ ins to 10½ ins., the 10½-in. end being connected to the rod from the brake cylinder. On the two-car train all the air was supplied from the reservoir of the leading car and the trail car reservoir was cut out to be used only in emergencies.

The results of the tests, which were made with the usual stop-watch, speed indicator, etc., were averaged and then plotted as curves in the following manner. In averaging, the results for each run were recapitulated by placing in one column all the time readings which lay between values differing by unity, as, for instance, all readings between 10 and 11 seconds; the corresponding readings of distance, speed and load were arranged in three other columns and all were then averaged, securing an average time with the corresponding average speed, distance and load. Then curves for each run were plotted with these values between time and distance as well as time and initial speed. The average load also was indicated on the same sheet.

TABLE No. 7.—POWER CONSUMPTION OF BRAKES.

CAR No. 524. APRIL 6, 1907. CONDITION OF TRACK, GOOD.

NUMBER OF RUN.	Number of Stops.	Watt Hours.	Watt Hours per Stop.	Weight in Tons.	Watt Hours per Ton.	Watt Hours per Ton per Stop.
1	47	330	7.02	19.52	16.90	.360
2	51	310	6.07	19.67	15.75	.309
3	88	400	6.90	19.73	20.25	.349
4	45	290	6.45	19.15	15.15	.337
5	46	300	6.52	19.56	15.33	.333
6	40	290	7.25	18.91	15.32	.383

CARS NOS. 524 AND 452. APRIL 5, 1907. CONDITION OF TRACK, GOOD.

1	55	550	10.00	36.15	15.20	.276
2	56	560	10.00	36.50	15.32	.274
3	48	440	9.17	35.50	12.39	.258
4	54	520	9.63	35.75	14.55	.270
5	57	600	10.51	35.72	16.80	.295
6	54	490	9.07	35.41	13.81	.256
					Average...	.272

CAR No. 524. APRIL 4, 1907. CONDITION OF TRACK, WET.

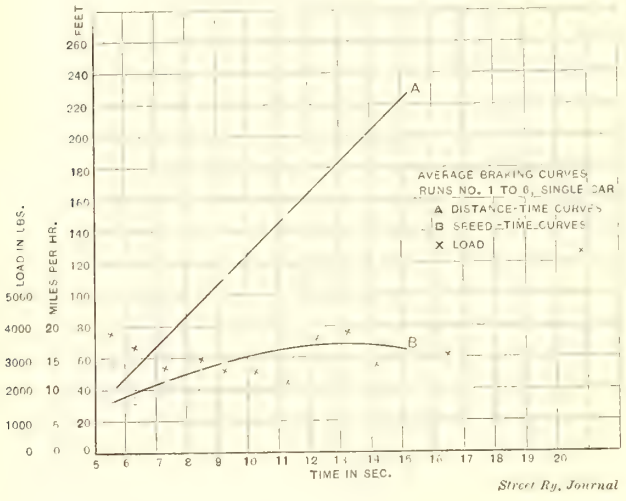
4	48	300	6.25	18.08	16.60	.346
5	46	310	6.74	18.97	16.35	.356
6	48	300	6.25	17.86	16.80	.350
					Average...	.351

To enable comparison of single cars with two-car trains, average curves were plotted by averaging all the runs with the single car and with the train. These averages of averages then were plotted in the same way as the others.

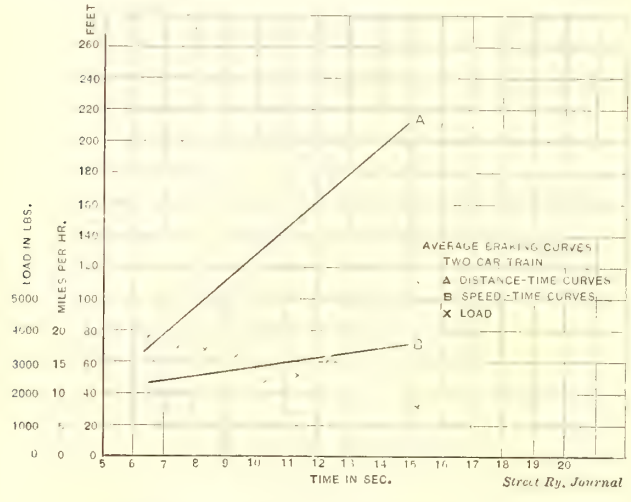
The following results were obtained from the power readings of the recording wattmeter in the air-brake circuit: Total watt-hours, watt-hours per stop, watt-hours per ton and watt-hours per ton per stop. It was also possible to compare the work of the single car on both wet and dry track. To obtain the watt-hours per stop, the total watt-hours were divided by the total number of stops in the particular run.

So far as the performance of the two-car train is concerned, the curves show that it gives more uniform braking, namely, the distances covered in different stops do not vary over as wide a range as the single car. Neither does the time of braking vary as much in the case of the train. The average curves show little difference in the performance of the two cases. On the average, it takes about the same time to stop a two-car train as a single car, and the distance also is about the same for similar speeds.

The greater uniformity of the results with the two-car train can be explained as follows: All the air used in braking the two-car train was stored and drawn from the reservoir on the leading car only, but the air was received by the brake cylinders on both cars. Hence, it is evident that the motorman has no more energy available for braking with two cars than with the single car, but he has approximately twice as much kinetic energy to destroy. In other words,



BRAKING CURVES FOR SINGLE CAR



BRAKING CURVES FOR TWO-CAR TRAIN

the ratio of energy available for braking to the energy destroyed is much smaller for the two-car train than for the single car, and therefore the range over which the motorman can vary the braking characteristics of the two-car train is limited.

The value of the braking curves lies in their showing the average performance of the equipment tested when in normal service. No emergency trials were made.

It appears that the load does not affect the results noticeably nor do the low grades of the track seem to have any bearing on them.

In general, the condition of the track was good throughout the test, excepting three runs over wet track on Thursday, April 4. Readings were taken for these runs to obtain comparative data for the two conditions. Only the power reading data of these runs were worked up and they show little difference in the power consumption per ton per stop, which was .351 watt-hours, as against .345 watt-hours for dry track.

In the case of the two-car train versus the single car, the results show a marked difference in the watt-hours per ton per stop, averaging .272 for the train and .345 for the single car. In the energy required for braking, the two-car train is more economical by about 27 per cent.

THE CLEVELAND SITUATION

For the past week attorneys and accountants for Charles S. Thrasher have been going through the books and records of the Forest City Railway Company in an attempt to discover the source of the cash resources upon which it has existed. Attorney Harrison B. McGraw and a stenographer undertook the work, but later on the Audit Company of Cleveland was employed to do the work. This investigation is being made by Mr. Thrasher as a stockholder.

Attorney McGraw stated that, while Secretary Fred C. Alber of the company owned only 147 shares of stock in the beginning, he had later voted 633½ shares. He said there was evidence that Mr. Alber had in his possession $1,900,000 stock at one time, and that there still remains about $1,000,000 in his name. There is nothing to show that anything was paid for what he still holds. The $900,000, Mr. Alber is said to have stated, was sold for cash, and the proceeds used to build and equip the road. The $1,000,000 remaining, Mr. Alber stated, could be sold and the proceeds used for the same purpose.

Another block of $200,000 stock was found to stand in the name of Max J. Rudolph, who is associated with Attorney Westenhaver, an attorney for the low fare companies. Albert E. Greene, who first obtained the franchises for the Forest City Railway Company, is supposed to have received this stock for his services and to have turned it over to Mr. Rudolph. The point here is that the amount paid for such services is excessive, even if Mr. Rudolph shared attorney's services with Mr. Greene.

As the property of the Forest City Railway Company is leased to the Municipal Traction Company, Mr. Thrasher, as a stockholder in the former, made a demand to be allowed to investigate the books of the leasing company also, but Secretary W. B. Colver refused on the ground that Mr. Thrasher is not a bona fide stockholder of the Forest City, but acquired stock for the purpose of making such a demand and investigation. He said any stockholder or citizen would have the right to make an examination of the company, but that Mr. Thrasher and his attorneys are disqualified. Thereupon Charles A. Otis, owner of the "Cleveland News," and well known as a broker and business man, accepted the offer, as a citizen, and employed expert accountants to go over the books.

City Clerk Peter Witt, and Ernest Bitterlich, an accountant, have been engaged for some days in going over the books and records of the Cleveland Electric Railway Company. Mr. Witt, who owns one share of stock in the company, says he will give out nothing until he is through with the work.

SOUTHERN PACIFIC TO CONSIDER ELECTRIFICATION

The important announcement was made this week that the Southern Pacific Railroad Company, through Vice-President Kruttschnitt, director of maintenance and operation of the Harriman lines, has requested Frank J. Sprague to associate himself with Allen H. Babcock, the electrical engineer of the company, in a study of all the data bearing upon the question of the feasibility of electrifying the Sacramento division of the Southern Pacific system, i e., the section from Rocklin to Sparks. For some three years past Mr. Babcock has been devoting his attention to this problem, while the engineers of the great electrical manufacturing companies have also made a special study of the subject. It is now proposed to refer Mr. Sprague's report on this subject to a board of five engineers, of whom Mr. Sprague and Mr. Babcock will be two members. The other three members will be appointed from the staff of the company. The duties of the board, it is understood, will be to go over the data upon this subject compiled by Mr. Babcock and Mr. Sprague, and to prepare detailed information and a general plan of electrification, without reference at present to details of installation. This board will submit its report to Mr. Kruttschnitt, and his recommendations as to final action, with the report of the engineering board, will be passed upon by the directors of the company. If the decision is in favor of electricity, Mr. Sprague will continue as consulting engineer during the period of installation, which would naturally be carried on by the railroad company's organization.

In many respects the problem of increasing the capacity of the division in question is one of the most important in the railroad world. It is over this division that the entire freight and passenger traffic of the transcontinental Union Pacific system, for Central California, is carried, and likewise the eastbound traffic. Some idea of the difficulties may be judged from the fact that in a distance of 83 miles there is a rise of nearly 7000 ft., this section forming a part of the division on the west and east slopes respectively. The distance between Rockline and Sparks is about 136 miles, it is single track, has very sharp curves, and over 31 miles of tunnels and snow-sheds, the latter in winter being the equivalents of tunnels. The traffic, while heavy, is very irregular, and is made more difficult of maintenance in the winter by the heavy snows, often 15 ft. to 20 ft. deep. The present service of traffic, both passenger and freight, is maintained by means of very powerful oil-burning locomotives of the best type extant, with which good results are obtained; but although the road is kept up to a high degree of efficiency, it is only with difficulty that the traffic is maintained; and at times there is absolute blockade. Moreover, at some periods the traffic is so great it had already reached the limits of the present capacity of the system.

The New York Central and the New Haven installations have come very naturally to be looked upon as not only the largest, but the most important electric railway installations, not only undertaken, but even considered; but here is a case where the distance is almost the same as between New York and Albany, where the elevation to be surmounted is greater than that of the highest peak in the White Mountains above sea level, and where the difficulties presented by the topography of the country, the temperature and the snowfalls are tremendous. Nevertheless this link of the Union Pacific transcontinental system is the throttle on the entire traffic, and an increase of capacity is vital either by new construction with lower grades, perhaps tunneling the Sierra Nevadas, by the construction of a second track, which would be very expensive, or by a change of motive power This latter has seemed likely to be effective, and derives some special significance because of various published comments by Mr. Harriman to the effect that inasmuch as widening the gage of railways was impracticable, electricity seemed the obvious general solution of the problem of increase of capacity of railroads.

Mr. Sprague, when seen, said he was not prepared in any way to make a statement on the subject, other than confirm the news of his appointment, which he had accepted. He believed it altogether feasible and possible to operate the division electrically, but as to methods applicable to the unique conditions involved, he approached the subject with an open mind, and the best solution of the problem would depend upon the existing or probable development of the art when details were taken up. The vital questions were whether the existing and probable traffic would warrant the cost of an electric equipment, and whether the adoption of electric operation would solve the problem of increase of capacity more satisfactorily than some other method.

QUESTION BOX OF ENGINEERING ASSOCIATION

The secretary of the American Street and Interurban Railway Engineering Association has issued the Question Box for the 1907 convention. It is as follows:

POWER HOUSES

1. Is the use of jet condensers on turbine installation advisable?
2. Have you had any trouble with stripping of blades in a turbine of either the Parsons or Curtis type? If so, to what did you lay the cause? What do you suggest as a remedy?
3. Have you had any trouble caused by deposits of foreign matter forming on the blades of the turbine? How do you remedy this?
4. What success have you had with motor-generators wound for 6000 to 16,000 volts on the a. c. side? Is any difficulty experienced due to direct exposure of windings to lightning?
5. What is the smallest size of boiler plant or minimum coal consumption which warrants the use of automatic stokers?
6. Is it advisable to use gaskets for superheated steam headers?
7. In a small or medium size plant what is the best method of increasing boiler capacity during heavy peak loads? Give details and results obtained.
8. What schemes are there for inducing firemen to take greater interest in their work? Please give details and results secured.
9. How can coal pile fires be prevented?

SHOP CONSTRUCTION

10. Allowing for additional cost, is it not advisable to have creosote blocks, or a wood floor, on concrete foundation, in the machine, blacksmith and wheel section of a shop, in preference to ordinary concrete floor, which becomes uneven quickly and is hard on workmen walking about?
11. Owing to the breaking of concrete around pit tracks, the inability to secure a safe jacking base and the possibility of shocks to workmen, is not a plank floor preferable to concrete?
12. What is the most desirable construction for an operating car barn, considering cost, maintenance, operating and insurance?
    (1) Brick walls, mill construction roof.
    (2) Brick walls, roof iron trusses—2-inch boards, tar and gravel.
    (3) Brick walls, reinforced concrete roof.
    (4) Brick walls, reinforced concrete walls and roof.

TRACK

13. What is the life of ties or timber imbedded in concrete?
14. Is there a standardized specification for track and roadbed?
15. Which is the best material for ballast on interurban lines, gravel, crushed rock or stone?
16. What is the best method of handling weeds on interurban roadbeds?
17. Has the sprinkling of crude oil on the roadbed been

tried to lay the dust and kill weeds, and have the results been satisfactory?

18. Some companies have laid their tracks with joints directly opposite one another, and as they continue the practice, it must have some advantages; what are they?

OVERHEAD WORK

19. Is there a standard and reliable specification form for overhead trolley construction?

20. What should be the dimensions of a substantial lightning arrester ground plate for the purpose of grounding station arresters?

21. What experience have you had with a fuse arrester, viz.: an arrester of the type composed of one or more pieces of 18 to 20 d. c. c. m. w., 16 inches or 18 inches in length, bared at one end and suspended over the positive bus to ground?

22. What is the most efficient method of preventing short circuits by reason of low tension feeders coming in contact with trees?

23. Can sleet be prevented from forming on the trolley by greasing the wires? Has such an idea ever been tried?

CAR BODIES

24. What is a good form of monitor deck ventilator for suburban cars, one that will change the air in the car sufficiently and yet not allow annoying draughts in winter?

CAR EQUIPMENT

25. What is done to prevent brush and brush holder troubles by operators of fast and heavy equipments?

26. Will controller blow-outs be reduced if the fields are connected ahead of the armatures, and why?

27. Which are preferable, solid or split gears, and why?

28. What are the best methods of wiring on open city cars?

29. Which is the most economical, all things considered, hot water or electric heating for cars?

30. What in your opinion should be the requisites and general design for a car coupler for interurban car service?

31. Are the results obtained from the use of a high grade brass motor bearing so much more satisfactory than a babbitted bearing to warrant the additional cost?

32. Is there any motor lid for the railway motor that can be removed and replaced daily without any danger of losing in streets or into motor?

33. Is there any method by which carbon brushes for railway motors can be tested without a running test to determine whether they are of the same grade as before used?

34. Has anyone experienced trouble with loose field coils in the newer types of motors, and what can be done to prevent it?

35. What is the best way to straighten armature shafts that are sprung between pinions and bearings without removing the winding or shaft from the core?

36. Should armatures rewound or repaired be balanced before being put in service?

37. Which is the more economical for finishing armatures, the higher priced, smooth, hard oil-proof varnish at about $1.50 per gallon, or a grade costing about 75 cents per gallon, and which has not all the qualities mentioned above?

38. What is the average cost of equipping double-track cars with four motors and air brakes, including the wiring, mounting motors, piping, etc.?

39. Give formula of babbitt used for your own journals.

40. Give formula of material used in trolley wheels.

41. Is it practical to use the same kind of a fender on city and interurban cars?

42. What are the arguments in favor of a pilot for purely interurban service?

WHEELS AND AXLES

43. Why are chilled iron wheels preferable in interurban service to steel tired wheels?

44. What causes car axles to crack and break?

45. Is a drop test sufficient to detect flaws in axles, provided it is calculated to be about equal to service conditions plus a proper factor of safety?

46. What is the average life of 4, 4¼ and 5-inch cold rolled steel axles under cars having four motor equipments, ranging from 15 to 27 tons?

47. What is the chief factor in determining when a steel wheel should be turned down in the lathe, *i. e.*, is it flange wear, tread wear, diameter or what? About how often is it found necessary to turn them?

INSPECTION

48. How often should clearance of motors be taken?

49. In maintaining rolling stock, what is a fair average in cars per man for the maintenance of trucks and electrical equipments at car houses?

50. What is a fair average in motors per man?

LUBRICATION

51. What is the most economical depth of oil to use in the oil wells of the armature bearings of the G. E. 80 or 101-B motors? State length of time between oilings for the various depths to be mentioned.

52. Which gives the best results for lubrication of gears, grease or a heavy oil?

53. What is the best simple shop test of lubricating oils and greases, including gear grease?

MISCELLANEOUS

54. What is the best way of cleaning cars?

55. As the operating department deals with and receives complaints from the public as to the cleanly condition of the cars, why is not best to have our cleaning come under the operating end, provided the advice of the master mechanic is adhered to regarding the use of proper cleaning compounds which will not prove injurious to the paint?

56. What systematic and periodic method have you for taking up with the general manager or transportation department a record of the cars turned in off the road due to the fault of negligent operation on the part of the trainmen? What is done to prevent a repetition of the faults?

57. On a belt line, cars weighing 23,000 lbs. loaded, and having two G. E. 67 motors, pass one way around a 50-ft. radius spiral curve on an unpaved street, no grade, at a 10-minute headway. A curve having a 60-ft. radius would decrease the operating expenses for current, car and motor repairs and wear on curve. What prices could be paid for enough of the corner property to construct a curve 60-ft. radius, so that interest on the cost of the property at 6 per cent would be offset by the saving in operating expenses, assuming feed wire and return was sufficient and assuming both curves to cost the same?

58. Is a long or short pull register preferable, and why?

59. What is the best method for checking motormen on the operation of controller with reference to care of equipment and saving of power?

60. What is the best manner of instructing student motormen in the mechanical operating of both city and interurban cars?

61. In how great detail should the mileage of parts of equipment be kept?

62. What should be the angle between trolley pole and wire?

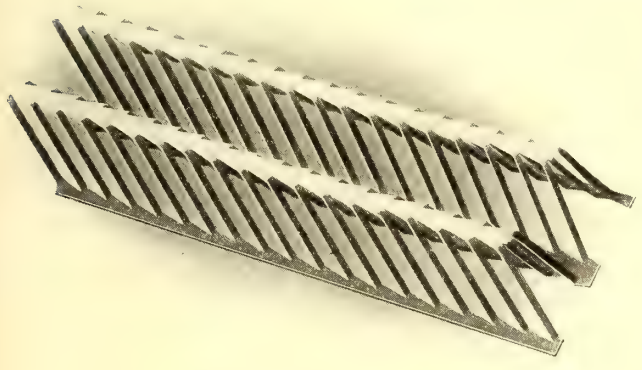
FREE TROLLEY EXCURSIONS FOR CHILDREN IN MONTREAL AND QUEBEC

The Montreal Street Railway Company, through Managing Director W. G. Ross, inaugurated last summer a system of free trolley excursions for children under the care of different public institutions. During July and August of 1906, fully 50,000 youngsters were taken on the picturesque line around Mt. Royal, with several hours' stop-over to give the children a chance to disport themselves in the public park on the mountain. The trips are usually made between 9 and 12:30 a. m. to interfere as little as possible with the regular service. Similar excursions are being given this year on an even larger scale. On Aug. 26, for example, an eleven-car excursion was made to Dominion Park. It goes without saying that the liberality shown by the company in arranging these trips is highly appreciated by both the children and their guardians. Thus the company secures the good feeling of the present generation and is in a fair way to obtain the good will of the rising one.

What has been said here of the Montreal Street Railway Company applies with equal force to the Quebec Railway, Light & Power Company, where similar excursions are provided by Manager E. A. Evans.

A NEW FORM OF ROOF CONSTRUCTION

The question of material best suited for durable fireproof roof construction has always been one hard to settle. In recent years, the application of concrete to building construction has overcome many of the disadvantages of former methods of construction, but two considerations were left that in some cases worked materially to its disadvantage. These were the great weight of the reinforced material and the necessity for centering it. Since the non-inflammability and permanence of concrete make it valuable as a satisfactory roofing material, the problem remaining for solution was how to design a form of construction that would retain these features and still meet the demand for a light and strong roof which could be put up without centering. Among those who took up the detailed study of this question was the General Fireproofing Company, of Youngstown, Ohio, with the result that it now offers what it calls Trussit reinforcement. In this system the design is expanded from light steel and is trussed as shown in the accompanying illustration. Erected on 4-ft.



NEW TRUSSED-ROOF CONSTRUCTION

centers and plastered on both sides, it does not separate the upper and under coats of the concrete into two layers; in fact, there are no upper and under coats, except as these terms indicate the method of application. Concrete keys through the mesh of the reinforcement completely envelop it and sustain the trussed formation of the steel. This construction results in a light reinforced concrete slab very strong in proportion to its weight, as clearly indicated in the following report on the behavior of Trussit under severe strain. The tests were made on four slabs reinforced with the General Fireproofing Company's cold-twisted lug bar. In the case of slab No. 1, for instance, which was tested to destruction, it went down under a load of 464 lbs. per sq. ft. This slab was 1-3-5 gravel concrete and was 1⅞ ins. thick. Inasmuch as snow load on a roof is figured as 35 lbs. per sq. ft., this indicates how light a slab will meet all roofing requirements and permit a considerable saving in the steel of the roof trusses and purlins.

As previously stated, the usual practice is to erect this reinforcement on 4-ft. centers, and it may be attached to the purlins either by bolts, wire or clips. There are quite a variety of methods of waterproofing a roof of this character, but any of them satisfactory on the ordinary types reinforced concrete roofs works equally well with the new construction. This material also has been used for the erection of solid partitions without the use of studding; that is, temporary studding is used to sustain the metal until one coat of plaster has been applied, then the studding is removed and the plastering is completed. The result is a very rigid wall and yet an extremely light one. The material comes in sheets, the stock size of which is 15½ ins. x 96 ins., but 4, 5, 6 and 7 ft. lengths may be had at a slight increase in cost.

ANNUAL MONTREAL PICNIC

One of the great carnival events in Montreal is the annual celebration for the Benefit Association of the Montreal Street Railway Company's employees, as the popularity of the company has made these occasions of wide public interest. The fourth annual picnic, which was held at Dominion Park from Aug. 19 to 25, inclusive, created even more interest than the previous affairs, and over 150,000 10-cent general entrance tickets were sold. Dominion Park is the biggest pleasure resort in Montreal and offers a wide variety of attractions from scenic railways to automobile "leaps of death."

By arrangement between the managements of the Benefit Association and Dominion Park, all members and employees received a ticket of admission to the park for themselves and lady, good on any one afternoon or night during the picnic. All employees in uniform were admitted free to the park at any time during the picnic. Conductors selling thirty tickets, and all other employees selling twenty tickets of admission to the park received in addition to the ticket of admission mentioned above, a ticket for themselves and lady to fifteen attractions in the park for use at any one time the holder desired during the week of the picnic. Conductors and motormen were not required to be in uniform when making use of the tickets.

Fifteen tickets were given to each employee to sell, and as soon as these were paid for, fifteen more could be had and so on. The tickets were secured by conductors and motormen from their respective depot clerks; by car house employees from their respective foremen; by power house employees from the clerk at the power house; by employees in the Hochelaga shops from the purchasing agent, and by men in the construction department from the rail inspector.

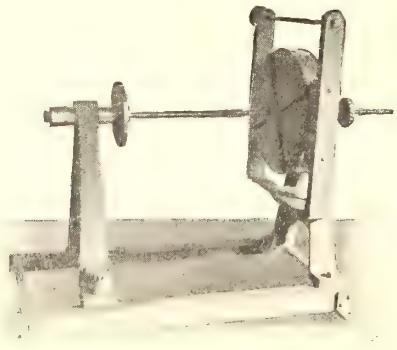
There will be a general distribution of prizes on Sept. 6. All employees selling fifteen tickets are entitled to draw for fifteen valuable prizes, the first prize being $15. Those selling thirty tickets may draw for ten valuable prizes, including the right to draw in the first mentioned drawing, the first prize being $20. Those selling sixty tickets may draw for ten valuable prizes, including the right to draw in the first two drawings before mentioned, the first prize being $25, and it is understood that any employees selling 1000 tickets are entitled to ten different chances in drawing of $5 each, an employee selling 900 tickets is entitled to nine different chances in drawings of $5 each, 800 tickets to eight different chances in drawings of $5 each, and so on down the list, in addition to the chances in the drawings previously mentioned. All money prizes are in gold.

The following prizes are also given to employees selling the greatest number of tickets: First prize, a gold watch or $50 in gold; second prize, $25; third prize, $15, and fourth prize, $10. The depot selling the greatest number of tickets is given $100 in gold, which is divided in money prizes as may be mutually agreed between them.

The management of the Montreal Street Railway Company has always given enthusiastic support and encouragement to the Benefit Association, and this co-operation with the rank and file, combined with the good feeling of the company's patrons, has made this event so popular with all classes.

A NEW REEL STAND AND BRAKE

To facilitate field and armature coil winding the Device Improvement Company, of Hanover, Pa., has designed a special stand which it calls its Peerless, upon which to mount reel holding magnet wire. This stand will accommodate a reel 30 ins. in diameter and any reasonable width, and is equipped with a brake to produce a tension easily regulated as the wire is reeled off. Thus the wire can be used for winding field coils, or if passed over large drum on the Peerless tension machine the stand acts as the retard brake for the wire around the large drum exactly as the band wire is retarded in the tension machine. This method produces a uniform tension throughout the whole operation of winding the



REEL STAND AND BRAKE

field coil irrespective of the varying depth of the wire on the reel. The stand and brake will, however, produce an exceedingly reliable tension alone. The device consists of two standards mounted on angle steel sills, one standard bolted stationary at one end, the other quickly adjustable for any width reel. The brake is wide-faced and contains two pointed pins which engage the wooden reel for the braking effect. The stand may be bolted solidly to the floor or wall; all adjustments are made by hand nuts, obviating the use of a monkey wrench. The brake-shoes are leather-faced, giving long life with little wear.

INCREASE IN FARE ON THE COLUMBUS, DELAWARE & MARION

An advance in fare over certain portions of the line has been announced by the Columbus, Delaware & Marion Company, to take effect Aug. 31. The change will apply to points between Columbus and Glenmary. The fare between Columbus and Worthing, which has been 10 cents, has been advanced to 15 cents, or the round trip for 25 cents. The management says that the Market Street line in Columbus receives 2½ cents of each fare for carrying passengers between North Columbus and the corner of Gay and High Streets, and that no money can be made at 10 cents for the trips named.

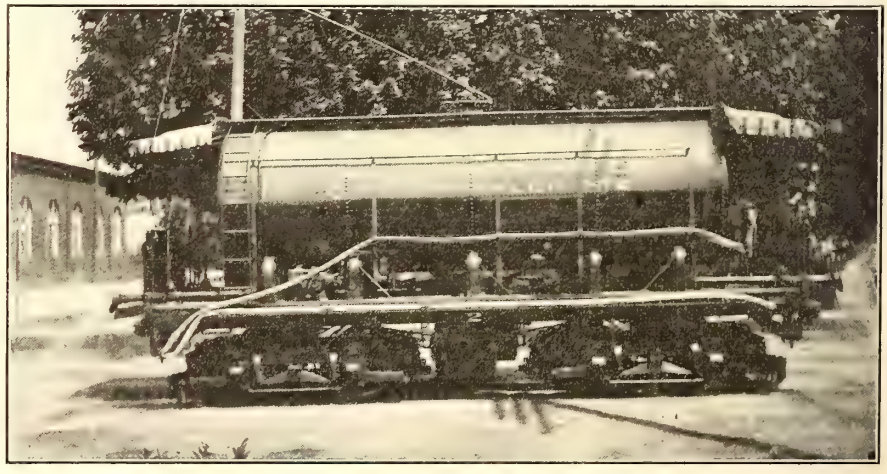
Superintendent Akin, of the Los Angeles Railway Company, has announced that hereafter no transfers are to be issued by the conductor unless they are asked for at the time the fare is paid. Heretofore it has been customary for conductors to issue transfers whenever and wherever requested.

DOUBLE-TRUCK CENTRIFUGAL SPRINKLER FOR GRAND RAPIDS

Although the streets of Grand Rapids, Mich., average about 46 ft. in width, the Grand Rapids Railway Company, with its 2480 gal. single-truck Brill centrifugal sprinkler, with a range of 50 ft., purchased last year, has averaged 50 miles of sprinkling per day. With a new machine, which has a 6-ft. x 20-ft. tank with a capacity of 4224 gals., a better record still will be established since the fillings will be less frequent. The Grand Rapids Railway Company has the contract for sprinkling all of the streets over which cars operate for a period of three years on a mileage basis for each sprinkling, all streets to be sprinkled twice daily and as many more times as the city officials may direct. The weight of this new centrifugal sprinkler with trucks, including the entire equipment with the exception of the truck and pump motors, is 30,600 lbs.; the weight of 4224 gals. of water is 35,150 lbs. The type of truck is the Brill No. 27-G2 with 4-ft. 6-in. wheel base; four motors of 40-hp capacity each were installed. The York Street Railway and the Long Island Company have lately received double-truck centrifugal sprinklers of about the same capacity. The Lehigh Valley Traction Company and the Interborough Railway Company, of New York, also are among the users of these centrifugal sprinklers, but the ones used by these companies are of the single-truck type. This sprinkler has also been successful abroad, especially in Milan and Malta.



FRONT END VIEW OF SPRINKLER



A SIDE VIEW OF THE SPRINKLER

FINANCIAL INTELLIGENCE

WALL STREET, Aug. 28, 1907.

The Money Market

There has been a decided change for the better in the monetary situation during the past week, due largely to the action of the Secretary of the Treasury in deciding to render substantial relief and thus end the stringency in money that has existed for more than a month past. According to the plan of the Treasury Department, government funds will be deposited in the national banks at New York, Boston, and at the other principal centers. Deposits will be made weekly, the amounts to be deposited to be determined by the conditions prevailing at the various points. It is expected that this arrangement will afford substantial relief and will guarantee in a measure that the money will go into mercantile, rather than speculative, channels. It is generally expected that the deposits will begin this week, and while nothing definite regarding the amount of money to be deposited with the New York banks weekly has been made, it is believed in banking circles that upwards of $5,000,000 will be placed here for the next three or four weeks. The improvement in the situation is reflected in the willingness of local bankers to come to the relief of the City of New York and to take up a large amount of the bonds which will enable the city to continue its work of improvements, etc. Within the last two months the City of New York has made two unsuccessful attempts to sell a large amount of bonds, but assurances are said to have been given that the $40,000,000 4½ per cent bonds to be offered on Sept. 10 will be taken care of. Inquiries for these bonds have been received from out of town sources, and there is a possibility that a part of the issue will be placed abroad. The demand for money from Stock Exchange houses has been comparatively light, and in some instances prospective borrowers have withdrawn their bids in anticipation of lower rates. Corporations, however, continue in the market, and during the past week the American Light & Traction Company announced its intention to offer to its shareholders the opportunity to subscribe for $1,500,000 short term notes. The foreign situation is somewhat improved, although the demand for gold continues, especially at Berlin. During the week $1,000,000 has been exported to Germany, but these transactions have been of a purely special nature, and were made regardless of the exchange situation. The foreign exchange market has displayed decided weakness during the week, rates for sterling falling more than 1 cent on the pound as a result of the more liberal offerings of foreign capital in the local market. Money on call has loaned at 3 and at 1¾ per cent, the average rate for the week being about 2¼ per cent. Rates for time loans have declined ½ and ¾ per cent, and the situation at the close may be said to be more encouraging than at any previous time for more than a month past.

The bank statement published on last Saturday was rather better than expected. Loans decreased $8,070,100, and deposits decreased $11,073,700. Cash has decreased $2,086,100, but owing to the heavy decrease in deposits, which lessened the reserve required by $2,768,425, the reserve was increased by $382,325, and the surplus now stands at $9,976,400, against $1,290,075 in the corresponding week of last year, and $8,978,175 in 1905.

The Stock Market

Confidence in the stock market has in a measure been restored during the past week, partly as a result of the action of the Secretary of the Treasury in offering to deposit government funds with national banks in the larger cities during the period of crop moving, but more particularly perhaps by the later announcement that the $40,000,000 bond issue of the City of New York would all be taken up by a syndicate of large capitalists. Of course, the fact that the city had raised its interest rate to 4½ per cent had very much to do with the offering of the bankers alluded to. Nevertheless, it indicated that large investors were disposed to place their surplus funds in any security which is immune from attack by executive or legislative authorities, whether State or Federal. Rumors of impending failure among banking, brokerage and commercial houses served to keep the market in a more or less unsettled condition throughout the greater portion of the week, especially as the stories were accompanied by talk of a coming reduction or suspension of dividends by certain railroads, which, needless to say, was given more than ordinary credence on account of the cutting of the dividend on Southern Railway preferred from a 5 to a 3 per cent annual basis. In the gossip concerning curtailed or suspended dividends the New York Central and Erie figured most conspicuously, and in consequence the shares of these roads have been especially depressed. In common with pretty much all other stocks, however, they displayed a rallying tendency toward the close of the week under the influence of the factors above set forth, though when buying was almost wholly to cover short contracts, there were renewed purchases on the part of many small investors who were tempted by the unusually large returns now being offered by the general run of stable railway and industrial stocks. There was a moderate relaxation in the time money market, so far as short dates are concerned, and this in conjunction with evidence that buyers and sellers in the copper metal trade are gradually getting closer together, had something of a reassuring effect. However, the prospect that money will continue dear for some time to come, and that we may be called upon to ship greater or less quantities of gold to Europe to help out the situation there, especially at Berlin, offset these influences in a considerable degree, and while as before stated, a little more confidence prevailed at the end of the week, a great deal of doubt existed as to the permanency of the rally, particularly as the Administration shows no disposition whatever to recede from its avowed policy of proceeding against all railroads and officials thereof that have been guilty of violating existing statutes. At the close of the week the Erie directors declared the usual dividend on the first and second preferred stocks, payable in dividend warrants to carry interest at 4 per cent.

Developments among the local traction shares during the week have been more than ordinarily interesting. In at least two instances—Metropolitan Street Railway and Third Avenue—stocks in this category were sold at the lowest figures on record and all have been under heavy pressure, though recovering moderately from the extreme low points in sympathy with the late general rally in other stocks. Brooklyn Rapid Transit continues to pile up large earnings, but for the time being the discussion of a possible dividend on the stock of that company has been suspended, and it has acted very much in sympathy with the other members of the group.

Philadelphia

The depression prevailing in all quarters of the securities market was reflected to a great extent in the local traction issues during the past week. Trading was not very active, but such transactions as were recorded were at generally lower prices. Philadelphia Rapid Transit was again the leader of the group in point of activity, the stock declining to 15½, the lowest price on the present movement, on sales aggregating 5,000 shares. United Companies of New Jersey fell 5 points to 240, although at the close there was a partial recovery to 241½. Union Traction was unusually active and irregular. After an early advance from 53½ to 54, it subsequently lost all the improvement. Philadelphia Traction sold at 90 and 91, Philadelphia Company common at 39 and 38½, American Railways at 48, and Consolidated Traction at 68.

Chicago

Very little interest was manifest in the local traction issues during the past week, and apart from a sale of small lots of Chicago City Railway stock at 155 and 150, the trading was without noteworthy feature. South Side Elevated sold at 80, and Metropolitan Elevated common brought 22¾.

Interests friendly to the proposed reorganization of the Chicago Union Traction Company are urging the deposits of securities under the terms of the plan, and while appeals from the awards of the arbitrators are likely, it is generally believed that unless something unforeseen develops the plan will go through.

Other Traction Securities

Trading in the tractions of Baltimore, while not very active, was accompanied by a higher range of values. The United Railway issues were firm on reports that the company's earnings for the month of July will show an increase of 12½ per cent over those for the corresponding month of last year. The 4 per cent bonds advanced from 85 to 85⅞ on light purchases, while the incomes sold at 50½ and 50¼, and the funding 5s at 78. The stock was about steady at 11¼. Other sales included Baltimore Traction 5s at 108, and Lexington Street Railway 5s at 99. There were no important developments in the Boston market. Trading was quiet, and price movements were more or less irregular. Boston Elevator declined a point to 129. Massachusetts Electric lost ½ to 12, while the preferred declined a point to 50. Boston and Worcester rose from 19¾ to 20¼. West End sold at 85, and the preferred at 101 and 100.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Aug. 21	Aug. 28
American Railways	47	51
Boston Elevated	a130	a130
Brooklyn Rapid Transit	41½	42⅞
Chicago City	150	150
Chicago Union Traction (common) certificates	2½	—
Chicago Union Traction (preferred) certificates	—	—
Cleveland Electric	46	a49
Consolidated Traction of New Jersey	67	67
Detroit United	62¼	63
Interborough-Metropolitan	8⅞	9¼
Interborough-Metropolitan (preferred)	23	25½
International Traction (common)	42	—
International Traction (preferred), 4s	a67	—
Manhattan Railway	117	118
Massachusetts Elec. Cos. (common)	12	12¾
Massachusetts Elec. Cos. (preferred)	50	50
Metropolitan Elevated, Chicago (common)	21½	21½
Metropolitan Elevated, Chicago (preferred)	62½	63
Metropolitan Street	25	39
North American	53½	54½
North Jersey Street Railway	40	40
Philadelphia Company (common)	38½	38
Philadelphia Rapid Transit	16⅝	15¾
Philadelphia Traction	—	41
Public Service Corporation certificates	64	62
Public Service Corporation 5 per cent notes	92	92
South Side Elevated (Chicago)	80	80
Third Avenue	68	50
Twin City, Minneapolis (common)	85¾	90½
Union Traction (Philadelphia)	53¼	53½

a Asked.

Metals

The principal anxiety of producers of iron and steel is that of collections, and these appear to be more unsatisfactory the closer the buyer is to the railroad interests. The financial situation is dominating the industry, yet there are surprisingly few concellations. The great majority of sellers are not forcing the market, but there are a sufficient number, particularly in the territory east of the Allegheny Mountains and north of the Potomac, to cause a crumbling away of prices. Some Southern makers reduced their asking prices to $19 at furnace for the balance of the third quarter and to $18.50 for the fourth quarter.

The deadlock between producers and consumers is unbroken. Lake sold at 18¼c. and electrolytic at 17½c. during the week.

ARKANSAS INTERURBAN LINE READY FOR BIDS

The Little Rock & Pine Bluff Traction Company is ready to receive figures from railroad contractors upon the grading in sections, bridging, track laying, overhead construction and erection of power house, either in part or as a whole, etc., for its proposed line, and is also ready to receive estimates from manufacturers and supply houses for wire, structural steel, for bridges, overhead construction material, power house equipment, cars, etc. The company plans to build approximately 50 miles of electric interurban railway between Little Rock and Pine Bluff, Ark. The company may be addressed at suite 8 and 9, 501½ Main Street, Little Rock, Ark.

CLEVELAND ROAD SEEKS SUBURBAN GRANT

A twenty-five-year franchise along the Wooster Pike from the city limits to Depot Road in Strongsville Center has been asked for by the Cleveland, Brooklyn & Elyria Railway Company. From there to the county line on the west a private right of way will be used. Consents of property owners were filed with the County Commissioners. The Parma & Brooklyn Plank Road Company sold its road to the county some time ago in order that the electric railway might be given a franchise over the route. Two years ago Charles H. Hubbell was granted a franchise over the same route, but this was allowed to expire.

THE NEW ENGLAND STREET RAILWAY CLUB OUTING

The September outing of the New England Street Railway Club will take place Thursday, Sept. 5, at the Pomham Club House, on Narragansett Bay, near Providence, R. I. A most interesting itinerary is being arranged.

SCHOEPF COMPANY INCREASES CAPITAL

The Ohio Electric Railway Company, which was incorporated in May, 1907, to take over the Schoepf traction properties, including the Columbus, London & Springfield, on Aug. 27 increased its capital stock from $100,000 to $25,000,000, half of which is preferred.

The original incorporators of the company were E. H. Berry, D. J. Downing, S. M. Murray, W. H. Shunert and C. Wilson, most of whom are connected with the Cincinnati Traction Company. The Schoepf lines are divided into three groups. The Indiana, Columbus & Eastern controls the roads about Columbus and Springfield, to the west from Dayton and northwest by way of Lima and Defiance; the Lima & Toledo is in the extreme Northern part of the State, and the Cincinnati Northern commands the situation between Cincinnati and Dayton.

TOLEDO, ANN ARBOR & DETROIT RAILROAD TO BE SOLD SEPT. 16

The property of the Toledo, Ann Harbor & Detroit Railway Company is to be sold at receiver's sale, under the orders of the courts of Michigan and Ohio, Sept. 16.

Briefly, the property consists of 50 miles of line, 2¾ miles in Ohio, and the remainder in Michigan. Of this, 46 miles have been graded. The abutments for bridges are of concrete, and are all in place except one across a small stream at Milan, Mich. A power house, of cement and brick, is so far advanced that it is within a few feet of the roof. The floors in the basement and the foundations for the machinery are of concrete. The right of way has all been purchased and paid for, except about a mile. The entire length of the line, except where the railway passes through villages, is built upon private right of way, 32 to 100 feet in width, according to location and conditions. The track is constructed to one side of the right of way, in order to make room for an additional track when necessary. In addition to the right of way, the company owns 16 acres of land at Petersburg, for power house and car barns and yard purposes. Nineteen to twenty miles of main, side and supply tracks have been constructed with 60-lb. T-rails, with oak and chestnut ties. This distance includes the entire line from Toledo, Ohio, to Petersburg, Mich., and side tracks in the latter place where connections are made with the Lake Shore & Michigan Southern Railway. Seven miles of chestnut trolley poles are in place. Twelve to fifteen miles of the line have been bonded with soldered copper rail bonds. A Lamb woven wire fence, with cedar posts, has been constructed for fully one-half of the entire line. The sale will take place at a point where the line crosses the Ohio and Michigan State line, and will be made free from all encumbrances. It would cost $350,000 to duplicate the property as it now stands, exclusive of franchises and several other valuable rights. The 2¾ miles in Ohio are appraised at $20,550, and under the laws of Ohio must sell for at least two-thirds of the appraised value, and for cash. An up-set price of $80,000 has been set on the balance of the property in Michigan. Ten per cent of the bid must be paid at the time of sale, enough more on confirmation to amount to $25,000, and balance in payments of $25,000 every ninety days thereafter, until the whole sum is paid. All deferred payments are to draw interest at 4 per cent. John O. Zabel, of Southard, Zabel & Carr, of Toledo, Ohio, is attorney for receivers.

AFFAIRS IN CHICAGO

It has been decided by the executive committee of the St. Paul Railroad to accept the ordinance passed by the City Council of Chicago, which provides for the electrification of the road from Wilson Avenue to the city limits. The fare via the new route will be 5 cents between the city limits and the loop and 10 cents between Evanston and the loop. The division of revenue under the agreement will be 50 per cent to each company. It is the intention to establish express service, making the distance from the Davis Street depot, Evanston, to the center of the loop in forty-three minutes. It is not probable that this service will be established at once for the entire distance, though all trains will run express from Wilson Avenue. In order to augment the service it will be necessary to lay a third track and relay the present tracks, so as to establish "island stations" at express stops. The cost of making the changes and buying equipment is estimated at $1,000,000. The Northwestern L will furnish the additional equipment, and the cost of electrification will be borne by both companies. At Wilson Avenue it will be necessary to construct a new four track incline, which will cost about $90,000. According to E. N. McKenna, second vice-president of the St. Paul Company, the road will be ready in ninety days.

It is officially estimated that the city's share of the net earnings of the Chicago City Railways for the year ending Feb. 11, 1908, will be $800,000. Two audits have been made, one by the company, and the other by the city, and a third audit is being made by a firm of chartered accountants. The result of the three audits will be made known within two weeks.

Two plans are proposed for the solution of the loop problem. One of them is advanced by Alderman Foreman, while the other is proposed by B. J. Arnold, head of the board of supervising engineers in charge of the surface line rehabilitation work. Mr. Foreman proposes that the loop be permitted to stand and that a subway be built. Mr. Arnold advocates taking the loop down entirely and substituting a comprehensive subway, which will take care of all "L" trains in the downtown district as well as what present surface cars will have to be put underground. Mr. Foreman also has in mind a system of "shuttle trains" on the loop, a kind of belt line which would act as a sort of temporary relief while the subway is being built. Mr. Arnold opposes this. He says the subways which would afford permanent relief can be built in three years. Mr. Foreman and Mr. Arnold unite on one proposition. Whether it be for either temporary or permanent relief, there must be no more additions to the loop structure. They would simply congest traffic in the downtown district. It is already extending to the north and west sides and as far south as Twenty-Second Street, and is interfering not only with ordinary pedestrian and street locomotion but with the prompt service by the street railway companies as well. The interests of the "L" roads which use the loop differ, The Northwestern, which virtually owns the loop, although the legal title is in an independent company, wants to enlarge the loop by the building of longer platforms, so that more cars can stop at a station, and perhaps build additions to it in Clark or some other street. It is unalterably opposed to taking the structure out entirely. The Lake Street "L" or the Oak Park road, as it is now called, is of the same opinion. The Northwestern owns it. The Metropolitan Elevated Company's attitude is different. It is a tenant of the union loop, and is now in the courts claiming it cannot get enough space on the loop to accommodate its passengers.

A call for the deposit of bonds of the several companies underlying the Union Traction Company was issued Saturday, Aug. 24, by the committee appointed to carry out the plan of reorganization lately agreed upon and approved by Judge Grosscup and Professor John C. Gray. The committee, consisting of L. C. Krauthoff and George W. Wickersham of New York, and John C. Hately, Seymour Morris and W. T. Fenton of Chicago, requests that bonds be deposited, beginning Wednesday, Aug. 28, with the Harris Trust & Savings Bank as depositary under the plan.

"By force of the decision of the United States Supreme Court in the so-called ninety-nine-year case," says the call, "we are advised that with respect to lines of railway of the various companies above named (embracing 306.04 miles) in the systems operated by the receivers of the Chicago Union Traction Company, all rights to operate 136.44 miles absolutely expired on or before July 1, 1907, rights of operation over 70.35 miles are subject to termination by the city on six months' notice and upon payment of the appraised value of the physical properties, and the rights on 99.25 miles expire from time to time, beginning in the early part of 1908. The right to operate by electrical power in the principal business section of Chicago is subject to termination on sixty days' notice at the will of the city. A sale of the various properties, thus deprived of operating rights, in the enforcement of the several mortgage liens, could hardly be expected to realize enough to discharge more than a fraction of the mortgage debts.

"An opportunity is, however, offered to the holders of the bonds and other securities of the above named companies to participate in the grant of new rights by ordinance of the City of Chicago to the Chicago Railways Company, upon the terms of a plan of reorganization and readjustment, prepared and approved in conformity with the ordinance."

A list of the several bond issues and the rate of exchange for new securities provided in the plan follows in the call. Enough stocks are in the custody of the Chicago Title & Trust Company, it is said, to assure the adoption of the plan without advertising for more shares, although the plan of reorganization ultimately will be extended to every shareholder and bondholder.

Judge Grosscup has certified to the record in the appeal from his decree ordering the receivers of the Union Traction Company to lease the lines operated by them to the Chicago Railways Company. The case will come up for a hearing on appeal Sept. 5.

The Chicago City Railway Company is now operating a new line on Ashland Avenue, between Thirty-First and Twenty-Second Streets. This line is to be an extension of the "Archer Avenue," from Archer Avenue and Twenty-First Street to Ashland Avenue and Twenty-Third Street, and is intended to give better street car transportation to the residents of the populous districts on each side of the Chicago River in the vicinity of Ashland Avenue.

SAN FRANCISCO NOTES

The new cable line of the United Railroads of San Francisco, over the Castro Street hill, has been opened from Eighteenth to Twenty-Seventh Street. A three-minute schedule is furnished and power is supplied from a cable plant near Cactro and Twenty-Fifth Streets. General Manager Thornwell Mullally states that within six weeks he hopes to have the Sacramento Street line in operation with a newly-equipped cable system over the hills from the ferry to Fillmore Street. The running of the road will be reversed, however, from the old days, as the cars will now run out Sacramento to Fillmore, back to Larkin, then to Clay and down Clay to the ferry. This is done in order to give another direct downtown line from the ferry out to the western portion of the city.

At a recent meeting of the carmen's union, President Cornelius reported that the general strike committee sinks $50,000 worth of the strike fund in maintaining the 'buses that are operated in opposition to the United Railway cars. The patronage of these 'buses has decreased perceptibly recently and the street cars are carrying an increasing number of passengers each day.

The Geary Street Railway Company desires to resume service upon its road, and through its president, Horace E. Platt, has petitioned the Supervisors for permission to begin running its cars again on the old tracks pending the use of the street by the city in carrying out the plan of municipalizing the road or the grant of a franchise to another company.

With a view to hastening the construction of the Geary Street road as a municipal system the Supervisors' public utilities committee has requested the city engineer to make a report at its next meeting on the condition of the rails and roadbed and the amount of damage done thereto; also what the cost would be to construct the road under the plans covered by last year's appropriation of $325,000, and what changes he would recommend with a view to improving the plans so prepared.

The Board of Supervisors at its meeting on Aug. 12 denied the application of the Sutter Street Railway Company, owned by the United Railways, to install the trolley on its line on lower Market Street, between Sausame and East Streets, and also notified the company that it would not be permitted to rebuild the outside tracks on Market Street. Moreover, the Supervisors have decided that all overhead wires in the business district east of Devisadero Street, must be abolished eighteen months hence.

EXHIBITS AT THE ATLANTIC CITY CONVENTION

The plans for the annual exhibits at the Atlantic City convention are being pushed forward rapidly by the American Street and Interurban Railway Manufacturers' Association. The space available on the Steel Pier, where the exhibits are to be held, is between 5500 and 6000 sq. ft., and applications are pouring in rapidly to the secretary of the association, George Keegan, Park Row Building, New York. Mr. Keegan announces that the following manufacturers have already applied for space:

Adams & Westlake Co.
Allis-Chalmers Co.
American Blower Co.
American Brake Shoe & Fdy. Co.
American Ferrofix Brazing Co.
American Locomotive Co.
American Mason Safety Tread Co.
American Railway Supply Co.
Anderson, A. & J. M., Mfg. Co.
Atha Steel Casting Co.
Atlas Railway Supply Co.
Bache, Semon & Co.
Bayonet Trolley Harp Co.
Berry Brothers.
Bishop Gutta Percha Co.
Blake Signal & Mfg. Co.
Booth, L. B., Co.
Brady Brass Co.
Briyy, J. G., Co.
Brown, Harold P.
Buckeye Engine Co.
Buhne Metal Pkg. Co.
Burroughs Adding Mach. Co.
Calman, Emil, & Co.
Carey, Philip, Mfg. Co.
Carnegie Steel Co.
Chicago Pneumatic Tool Co.
Chicago Varnish Co.
Climax Stock Guard Co.
Columbia Machine Works & Malleable Iron Co.
Consolidated Car Fender Co.
Consolidated Car Heating Co.
Cook Standard Tool Co.
Crouse-Hinds Co.
Curtain Supply Co.
Danville Car Co.
Dearborn Drug & Chemical Works.
Device Improvement Co.
Dixon Crucible Co., Jos.
Dossert & Co.
Dressel Railway Lamp Works.
Duff Mfg. Co.
Durkin Controller Handle Co.
Earll, Chas. I.
Edwards, O. M.
Electrical Review.
Electric Railway Improvement Co.
Electric Service Supply Co.
Electric Storage Battery Co.
Electric Railway Review.
Electric Traction Supply Co.
Eureka Automatic Electric Signal Co.
Eureka Tempered Copper Works.
Flexible Compound Co.
Franklin Car Heating Co.
Franklin Electric Mfg. Co.
Galena Signal Oil Co.
Garlock Pkg. Co.
General Electric Co.
Globe Ticket Co.
Gold Car Heating & Lighting Co.
Goldschmidt Thermit Co.
Gould Storage Battery Co.
Grip Nut Co.
Hale & Kilburn Co.
Hanna, J. A., Co.
Harrison, F. P., Electric & Mfg. Co.
Heany Fireproof Wire Co.
Holophane Co.
Heywood Bros. & Wakefield Co.
Ingersoll, Fred.
International Register Co.
Johns-Manville Co.
Johnson, Chas. F.
Jones & Laughlin Co.
Justice, P. S., & Co.
Kalamazoo Railway Supply Co.
Kenfield-Fairchild Publishing Co.
Keystone Brake Shoe Co.
Kinnear Mfg. Co.
Lorain Steel Co.
Lord Electric Co.
Lord, Geo. W., Co.
Lumen Bearing Co.
McCardell, J. R., & Co.
McConway & Torley Co.
MacDonald Ticket & Ticket Box Co.
Maryland Railway Supply Co.
Masury, John W., & Co.
Moran Flexible Steam Joint Co.
Morris, Elmer P., Co.
National Brake Co.
National Brake & Electric Co.
National Carbon Co.
National Car Wheel Co.
National Lock Washer Co.
New Departure Mfg. Co.
Newman Clock Co.
New York Car & Truck Co.
Norton Grinding Co.
Nuttall, R. D., Co.
Ohio Brass Co.
Ohmer Fare Register Co.
Oliver Machinery Co.
Palmetto Metal Co.
Pantasote Co.
Peerless Rubber Co.
Pennsylvania Steel Co.
Peter Smith Heater Co.
Philadelphia Air Brake & Machine Co.
Pittsburg Insulating Co.
Plomo Specialty Mfg. Co.
Pratt & Lambert.
Rail Joint Co.
Railroad Gazette.
Railway Audit & Inspection Co.
Recording Fare Register Co.
Riverside Metal Co.
Rooke Automatic Register Co.
Rubberset Brush Co.
St. Louis Car Co.
Samson Cordage Works.
Schoen Steel Wheel Co.
Security Register Co.
Sherwin-Williams Co.
Southern Exchange Co.
Speer Carbon Co.
Standard Motor Truck Co.
Standard Paint Co.
Standard Roller Bearing Co.
Standard Steel Works.
Standard Varnish Works.
Star Brass Co.
Sterling-Meaker Co.
Sterling Varnish Co.
Street Railway Journal.
Symington, T. H., Co.
Taylor Electric Truck Co.
Traction Railroad Equipment Co.
Underfeed Stoker Co.
Underwood, H. B., & Co.
Union Electric Co.
United Copper Foundry Co.
U. S. Electric Signal Co.
U. S. Engineering Co.
U. S. Metal & Mfg. Co.
Van Dorn Electric & Mfg. Co.
Van Dorn, W. T., Co.
Wallace Supply Co.
Washburn Steel Castings & Coupler Co.
Watson-Stillman Co.
Wendell & MacDuffie.
Western Tube Co.
Westinghouse Cos.
Weston Electrical Instrument Co.
Wharton, Wm., Jr., & Co.
Wheel Truing Brake Shoe Co.
Wilson, Jas. G., Mfg. Co.
Wilson Trolley Catcher Co.
Yale & Towne Mfg. Co.

NASHVILLE INTERURBAN ARRANGING TO ENTER CITY

It is understood that arrangements are being made with the Nashville Railway & Light Company whereby the Nashville Interurban Company is to enter Nashville over the lines of the former company. Under the proposed arrangements the interurban cars will enter the city over the Spruce Street line, the interurban tracks connecting with the Spruce Street line where the Spruce Street tracks cross the Franklin Turnpike. It is also stated on good authority that the interurban company will use the street railway transfer station as a depot, and power for the city run will be supplied by the railway and light company. Percy Warner, president of the Nashville Railway & Light Company, is reported to have said that while the contracts had not been signed for such arrangements between the two companies, it is quite probable that such an arrangement will be consummated. President Warner stated that the cars of the interurban company will probably enter Nashville over the Spruce Street line, which is a direct route into the city.

NEW CAR HOUSES AT LONG ISLAND CITY

The New York & Queens County Railroad will develop a tract of about ten acres of meadow land on the north side of Jackson Avenue, about an eighth of a mile west of the new Flushing bridge, which was recently purchased from the Degmon Contracting Company. It is the intention of the company to spend about $250,000 in establishing at this point a large and complete storage yard and repair shop for cars in Queens Borough. The plant is to care for the cars on the Jackson Avenue, Corona, Jamaica and College Point lines, and on the Whitestone and Bayside extensions when completed. These lines are the most important belonging to the company.

The plans for this work are in anticipation of the increase in traffic that will follow the opening of the tunnel under the East River to Forty-Second Street, New York, and is in keeping with the policy of the company for keeping up the physical property. In Long Island City and environs at present there is much territory as yet unsettled, and it is this property that it is expected will develop rapidly as a result of the better facilities which the new tunnel will afford. In addition, the new Blackwell's Island Bridge will also effect the company in the not distant future, and important developments are looked for, especially in the territory adjacent to Long Island Sound.

EARNINGS OF THE DETROIT UNITED RAILWAYS

The Detroit United Railway system reports for July and seven months ended July 31, 1907, as follows:

July	1907	1906
Gross receipts	$669,915	$598,575
Expenses and taxes	383,624	337,576
Net earnings	$280,291	$260,999
Other income	4,636	4,607
Total income	$284,927	$265,606
Fixed charges	117,009	105,463
Surplus	$167,918	$160,143
Seven Months:		
Gross receipts	$3,759,279	$3,354,729
Expenses and taxes	2,329,767	2,015,646
Net earnings	$1,429,512	$1,339,083
Other income	31,975	26,332
Total income	$1,461,487	$1,365,415
Fixed charges	796,012	710,206
Surplus	$665,475	$655,209

Figures for 1907 and 1906 include Rapid Railway system, Sandwich, Windsor & Amherstburg Railway, and Detroit, Toledo & Monroe Short Line.

TWIN CITY RAPID TRANSIT SCORES VICTORY OVER CITY

The Twin City Rapid Transit Company has won a sweeping victory in the court decision which recognizes the right of the company in the fifty-year franchise and the 5-cent fare. The court order restrains the city of Minneapolis from enforcing or publishing the six-for-a-quarter fare ordinance recently passed by the City Council. Should the city desire to continue the fight the matter would have to be taken to the United States Supreme Court. It is probable that the matter will be dropped.

The franchise with the right to charge a 5-cent fare is good for fifty years from date of issuance, July 1, 1873. President Thomas Lowry says:

"The decision just rendered by the United States Circuit Court in the suit between the Minneapolis Street Railway Company and the City of Minneapolis, holds that the ordinance granting the company the right to use the streets of the city for street railway purposes, both as to the length and exclusive character of the company's franchise and to the company's right to charge and collect 5-cent fares, is a contract which cannot be changed or modified in any respect without the consent of the company. The decision is very comprehensive and sustains every claim the company made under its charter and franchise.

"This decision, together with the one rendered heretofore in the City of St. Paul, in the United States Circuit Court, fixing the company's right for all times, in both cities, together with the right to receive and collect 5 cents for each passenger riding upon its cars is absolute and cannot be modified or changed without the company's consent."

REPORT ON ROCHESTER LINES BY UTILITIES EXPERT

Charles R. Barnes, electrical expert for the Public Utilities Commission, has made a report to the Commission as a result of his recent trip over the suburban lines about Rochester. In his report Mr. Barnes speaks in complimentary terms of the management and equipment of the lines as a whole. Mr. Barnes' report consists of six letters in all, one letter being devoted to each railway. The roads covered in his report are: Rochester & Eastern Rapid Railway, Rochester Electric Railway, or Charlotte line, Rochester & Sodus Bay Railway, Summerville division of the Rochester & Suburban Railway, Sea Breeze division of the Rochester & Suburban Railway, and Irondequoit Park Railway. The report embodies all the specifications of the different roads, both roadbed and rolling stock, under the heads cars, power, operation, track and roadbed maintenance and structures. Each head contains remarks as to the condition in which Mr. Barnes found the different structures or details, praise and censure alike being impartially distributed. At the end of each letter are recommendations made as to ways by which the railway might better its service. It is suggested in the case of certain of these recommendations that the Commission issue specific instructions to the railways; others merely request the Commission to call the attention of the officers of the roads to certain changes that would work to the benefit of the roads. None of these suggestions is with reference to radical changes. Some of them are as follows:

1. That it separate the lap track under the Clifford Street bridge so as to make a continuous double track at this point, that this work be completed not later than Jan. 1, 1908.

2. That all curves on this line be equipped with rail braces; this work to be completed not later than Oct. 1, 1907. Also that the Public Service Commission, second district, State of New York, recommend to the Irondequoit Park Railway Company.

1. That it cause all the cars operated on the line to be equipped with air brakes.

2. That all of the original ties in its track be replaced with standard ties; this work to be completed as soon as possible.

3. That the necessary legal proceedings be instituted by this company to bring about a change of grade of the highway at Helendale.

The following is suggested in reference to the Sea Breeze line:

1. That it equip all of the curves not so equipped with rail braces; this order to be fully complied with by May 1, 1908.

Suggestions by the Commission:

1. That the work of tie removals at present in progress on this division be continued, and that all curves be equipped with standard ties as soon as possible.

2. That a loop be constructed at the Sea Breeze terminal of this division.

Other statements relate to the reballasting, aligning, and surfacing of tracks. Train crews are required to register the time of their arrival at and departure from certain points. Companies are required to increase the number of their cars to provide for the "maximum requirements of traffic."

The Rochester & Eastern Company is asked to remove the high tension transmission line from the village limits of Canandaigua; to construct an additional telephone line along its entire length; to have an examination made of its bridges by a bridge engineer, and its grades reduced.

The Rochester Electric Railway is recommended to construct double lap tracks over the New York Central tracks where there is lap track at present, and to build a loop at the Charlotte terminus of its line.

CHICAGO & MILWAUKEE ROAD COMPLETE

The Chicago & Milwaukee Electric Railway Company will be operating trains between Chicago and Milwaukee on a two and one-half hour schedule by the middle of October, according to a statement made by A. C. Frost, president of the company. The time made by the steam roads is two hours. The line is completed and ballasted and all the equipment necessary for the added service has been delivered so there is nothing to prevent the inauguration of through service between Evanston and Milwaukee. When the St. Paul road is electrified to Evanston and through cars run in connection with the Northwestern L, the Chicago & Milwaukee Company will establish a connection at Evanston.

ANOTHER IMPORTANT INTERURBAN FOR MASSACHUSETTS

Another electric interurban railway company has been organized in Massachusetts, and has petitioned the Board of Railroad Commissioners for the right to build between Waltham and Marlborough, passing through Weston, Wayland and Sudbury, with a branch line running from South Sudbury to Maynard. The main line of the proposed road is 16.5 miles in length, while the branch line will be 6 miles long. The new company is styled the Boston, Waltham & Western Electric Railway Company, and it is organized under the interurban act of 1906. Its capital stock consists of 2400 shares of a par value of $100 each. Of the 16.5 miles of main line, about 12 miles will be over a private right of way, the public streets and State highway of Waltham, Weston, Sudbury and Marlborough being occupied for short distances. The running time between Waltham and Marlborough is intended to be 45 minutes, the company having found it necessary to conform to local speed regulations wherever the road runs in a public highway, and local authorities will also, under Massachusetts law, have authority to compel such stops as they desire in the public highways. The road will have only four passenger stations besides its three termini, one each in Walthan and Marlborough, one in Sudbury, and the fourth in Wayland, near the Weston line. The estimated cost of the road is $1,444,640, made up as follows:

RIGHT OF WAY		
Real estate		$38,600
CONSTRUCTION AND EQUIPMENT		
Grading, surfacing, etc.	$396,000	
Bridges	138,530	
Track and track equipment	190,300	
Passenger stations	18,700	
Fencing	9,000	
Generating station and line	296,670	
Cars and car equipment	125,840	
Car house	11,000	
Engineering, interest, miscellaneous	220,000	
		$1,406,040
Total cost		$1,444,640

The directors of the company are Atherton W. Rogers, of South Sudbury; Charles E. Stevens, of Sudbury; George A. Haynes, of South Sudbury; Winthrop H. Fairbanks, of Sudbury, and Rowland P. Harriman, of Sudbury. Charles E. Stevens, who is the treasurer of the company, has subscribed for 2375 of the 2400 shares of capital stock, the remaining 25 shares being subscribed for by fifteen others.

THE TRANSIT HEARING IN NEW YORK

At the hearing on Thursday before the New York Public Service Commission, the fact was brought out that the books of the Metropolitan Street Railway Company had all been destroyed, after the lease in 1902 of the company to the New York City Railway Company, they being considered of no further value. In this connection the authority of the Commission in the whole premises was questioned by counsel for the Interborough-Metropolitan Company, and it is said that the matter may be carried to the courts. Nothing important regarding methods of operation or plans for betterments was brought out. At the close of the hearing the date for continuing was set for Tuesday, Aug. 27, but a postponement was agreed upon for a week or ten days on account of the death of Prof. Root, the father of Oren Root, Jr., vice-president and general manager of the New York City Railway Company, whom it was proposed to make a witness.

The Public Service Commission proposes to take up for serious consideration a scheme to turn the Second Avenue elevated line into a purely express road, at least during the rush hours, and to let the Third Avenue line take care of the local traffic below the Harlem River. It is proposed that the Second Avenue trains shall run as they do now between South Ferry and Chatham Square. From Chatham Square north, during the rush hours at least, they shall run as expresses to 129th Street, where the Second and Third Avenue lines join. There may possibly be stops at Thirty-Fourth Street or at Twenty-Third Street and at Forty-Second Street. It is planned that at 129th Street the northbound expresses will become locals, just as the subway expresses become locals at Ninety-Sixth Street now. The whole of the trackage to the north, however, in that case will be devoted to the use of these trains, and no Third Avenue trains will run above the Harlem River. That is to say, every train that comes through the Bronx in the rush hours in the morning will be an express after it passes the 129th Street station, and will make not more than two stops at most between 129th Street and Chatham Square. Every train that starts from South Ferry on the east side in the evening rush hour will run as an express above Chatham Square, making possibly two stops between that point and the Harlem River.

Meetings of the directors of the Interborough-Metropolitan and Interborough Rapid Transit Companies were held Wednesday, Aug. 28. After the meetings the following statement was given out by the directors of the Interborough-Metropolitan Company:

"The usual meetings of the board of directors and executive committee were held at the office of the company this morning. The subject of receivership of any company was not even mentioned. It was officially announced that all such talk is entirely without foundation."

INTERBOROUGH IS EXEMPT FROM TAXES ON SUBWAY

The special franchise tax of $9,000,000 levied on the Interborough Rapid Transit Company, of New York, in 1905, by the State Tax Commissioners is declared to be in error by Justice Fitts, in a decision handed down Aug. 27. The court decides that the Interborough operates the subway as lessee, and that, in any event, the Interborough is exempt under Sec. 35 of the Rapid Transit act. Justice Fitts asserts that the City of New York is the absolute owner of the subway, including not only the tangible property, but the franchise as well, the property having been leased to the company by the city for a period of thirty-five years.

The case was begun in 1905 by certiorari proceedings to review of the decision of the State Board. In 1906 the State Commission fixed the valuation at $18,000,000, and 1907 at $24,000,000.

I have reached the conclusion that the consents and franchises under which the underground railway was constructed and is now being maintained is vested in and belongs to the city of New York.

That the contract and lease providing for the equipment, maintenance and operation of the railway by the relator is not a special franchise within the meaning of subdivision 3 of section 2 of the tax law.

But, even though it might be held that the right exercised by the relator to operate the railroad was a special franchise, the same is not taxable, as the interests of the relator therein were exempt from taxation under section 35 of the rapid transit act as amended.

DATA SHEET ON MUNICIPAL OWNERSHIP

The committee on Municipal Ownership of the American Street & Interurban Railway Association has sent a letter to the various member companies as follows:

"At the 1906 convention of the association, held at Columbus, Ohio, a committee presented a report on the subject of Municipal Ownership. Doubtless you have read this report as published in the minutes of the association. The officers of the association have seen fit to continue the same committee for this year, and have asked that another report on the same subject be presented at the convention to be held in October next.

"It has been deemed unnecessary in the making of this report to discuss to any great extent the question from an academic point of view. The literature on this subject has been so multiplied during the past year by the publication of the results of investigators of social economics, and by the reports of various committees who have made investigation of it, that the members of the association are undoubtedly quite familiar with the arguments for and against municipal socialism in any form, and especially as it would affect the interests of our particular industry. It does, however, seem desirable that the report should cover any progress made either for or against the movement in our respective fields, as well as some statement in regard to general conditions here and abroad, and to this end we are enclosing you a sheet covering a few questions designed to ascertain the condition of affairs with respect to Municipal Ownership in your immediate vicinity. The committee would be greatly pleased to receive your answers to these questions, and any statement which you may choose to make touching your individual opinion as to this Municipal Ownership proposition."

The letter is signed Charles D. Wyman, chairman; John A. Beeler, H. M. Sloan, John J. Stanley, members of the committee. The data sheet follows:

DATA SHEET

Company, City, State. Operating city or interurban line. Population served. 1. Does the company do any lighting business? 2. If so, state general character. 3. What municipality owned utilities are now in operation in your company's field? 4. What, if any, agitation or movement has arisen or been progressed during the past year for the extension of municipal public utilities? 5. Has there been any movement looking toward the municipalization of your company's business or any part thereof? 6. If any such agitation has arisen please state its cause or causes. 7. What seems to be the present status of public opinion in your vicinity touching Municipal Ownership of public utilities such as street railways and lighting companies?

STEAM RAILROAD STATISTICS FOR 1906

Poor's Manual for 1907, just issued, contains 2000 pages, and its statistics of the American railway systems for the year ending 1906 are highly interesting and instructive.

The average receipts per passenger per mile in 1906 was 2.011 cents, as against 2.028 cents in 1905. The average revenue per ton per mile in 1906 was 0.766 cents, as against 0.784 cents in 1905. Other receipts, however, have increased, as shown in the following table:

	1905	1906
Receipts per mile of track, passenger	$2,381	$2,560
Receipts per mile of track, freight	6,840	7,521
Receipts per train-mile, passenger	1.5181	1.6672
Receipts per train-mile, freight	2.6267	2.7287
Receipts per passenger	.7790	.8326

The total length of steam railroads completed on Dec. 31, 1906, was 222,635.18 miles, as against 217,341.02 miles at the close of 1905, an increase of 5,294.16 miles. The actual construction during the year was 5,516.70 miles, but the net increase was smaller owing to mileage abandoned, transferred to side track, or equipped with electricity.

The increase in bonded debt during 1906 was $425,845,877, the total funded debt of the steam railroads of the United States being $7,851,107,778 at the close of 1906, as against $7,425,261,901 at the close of 1905. The increase in capital stock was $364,452,151, total stock at the close of 1906 being $7,106,408,976, as against $6,741,956,825 at the close of 1905. The total increase in liabilities of all kinds, including stock, mortgage bonds, real estate and equipment bonds and floating debt, was $1,199,615,367.

The total assets of the steam railroads of the United States at the close of 1906 was $17,534,381,633, an increase of $1,241,500,810. The surplus of assets over liabilities was $766,014,237, an increase of $41,885,443 during 1906.

STREET RAILWAY PATENTS

UNITED STATES PATENTS ISSUED AUG. 13, 1907

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

862,891. Trolley Pole Support; Hugh W. Fellows, Cahuenga, and Ira A. Cammett, Hollywood, Cal. App. filed Sept. 12, 1906. The trolley pole has a ling support, one of the members of which is very heavy so as to move slowly, and in case of rapid upward movement of the pole, such slow movement causes its disengagement.

862,898. Fastening Device; William D. Forsyth, Pittsburg, Pa. App. filed May 11, 1907. A sleeve for the reception of rail spikes, adapted to be embedded in a concrete of metallic tie.

862,912. Metallic Tie and Rail Fastener; Joseph L. Hickle, Fairchance, Pa. App. filed April 25, 1907. Two I-beams spaced apart and having a concrete filling there between. Hock-shaped bolts engage the base of the rail and extend through the outer flanges of the I-beams.

962,934. Trolley Catcher and Retriever; Julian L. Perkins, Springfield, Mass. App. filed Feb. 21, 1906. Details of a spring drum and ratchet device for retrieving the trolley cord.

862,952. Pneumatic Track Sander; John H. Watters, Augusta, Ga. App. filed May 23, 1907. A casing having a nipple arranged for attachment to a sand-box and provided with a pair of diametrically alined discharge openings, and an air jet nozzle extending into the casing and provided with a jet opening at the end, and with a pair of openings at the side, the latter openings being diametrically opposite each other and in alinement with the lateral discharge openings of the casing.

863,148. Railway Signal; Walter W. Brown, Schenectady, N. Y. App. filed Feb. 14, 1906. Relates to mechanical details of construction of an arrangement whereby a single operating means may be employed to move a home and distant signal successively.

863,198. Car Fender and Guard; Lowell M. Maxham, Boston, Mass. App. filed Nov. 16, 1904. Details of construction.

863,237. Machine for Controlling Power-Operated Apparatus Connected with Railway Switches and Signals. Covers means for automatically moving a lever to final position after electrical locks have been actuated to release the lever.

863,238. Indication Apparatus for Switch and Lock Movements; Louis H. Thullen, Edgewood Park, Pa. App. filed March 30, 1906. Relates more especially to that class of indication apparatus used in electric interlocking railway systems and operated by alternating currents, an object being to provide means whereby the operation of the indicator is only effected by an alternating current of one predetermined frequency, the several parts or appliances comprised in the indication mechanism being so arranged as to render them neutral, and not responsive, to alternating currents of any other frequency.

863,263. Railway Signal Mechanism; John P. Coleman, Edgewood, Pa. App. filed March 13, 1907. Semaphore signals operated by liquid carbonic gas and having electrically controlled valves by which the gas is admitted to the operating cylinders.

863,267. Adjustable Brake Head; Nathan H. Davis, Philadelphia, Pa. App. filed Feb. 18, 1907. A brake head having an opening receiving the end of the brake beam and provided with locking ribs, a locking key provided with ribs and means for securing the key in fixed relation to the beam with its ribs interlocked with the ribs of the brake beam.

863,277. Non-Chattering Brake Hanger for Car Trucks; Engelhardt W. Holst, Brockton, Mass. App. filed Nov. 20, 1906. Automatic means for compensating for the wear of the different parts so that a non-chattering device can be maintained.

863,332. Electro-Magnetic Apparatus for Railway Purposes; Louis H. Thullen, Edgewood Park, Pa. App. filed March 24, 1906. Relates to electro-magnetic apparatus comprising electro-magnets and co-acting armatures, the same being so constructed and arranged as to be operable at a small or medium of potential of current and adaptable for controlling circuits through which heavy currents flow.

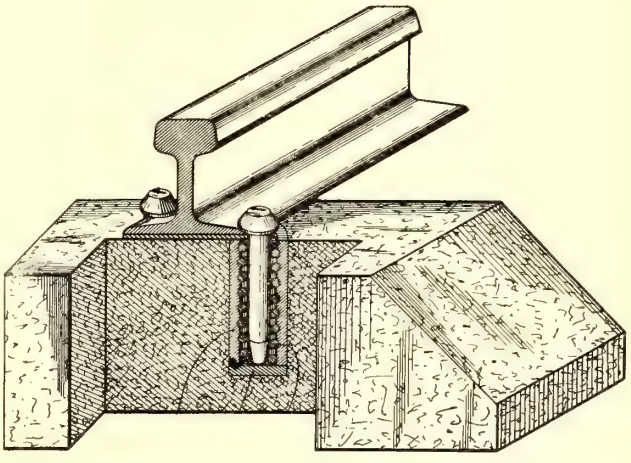
863,359. Brake; Nicholas J. Clute Schenectady, N. Y. App. filed April 23, 1907. An auxiliary emergency brake having shoes engaging the top of the car wheel and operated through the momentum of said wheels.

863,418. Railway Signal; Nicola Mucci and Alfonso Colenza, New York, N. Y. App. filed March 23, 1907. A signal apparatus for single-track railways by which trainmen are notified in case error has been made by a train improperly taking a side track. Special trolleys or conductors adjacent the track rails which are engaged by brushes depending from the locomotive.

863,475. Switch-Operating Device for Street Railways; Richard M. Van Eaton and Julia M. Van Eaton, Pueblo, Col. App. filed Jan. 7, 1907. Two horizontally movable levers in the roadbed, one of which operates through suitable connections, when actuated from an approaching car, to open the switch and the other to close the same.

863,509. Electric Railway Signaling System; Charles M. Cleveland, Wausau, Wis. App. filed April 8, 1907. Special trolley wires or conductors are laid between the track rails and means are provided for completing circuits to the trains for automatically operating the train controller.

863,531. Rail-Bond; Marshall Hawkins, Gypsy, W. Va. App. filed Nov. 7, 1906. A U-shaped link, the ends of which are received in holes in the webs of the rails and which are grooved to receive pyramidal drift pins with "opposite cutting edges."



PATENT NO. 862,898

863,540. Train Controlling Apparatus; Joseph L. Jones, Kizer, Tenn. App. filed Dec. 10, 1906. A wireless system by which trains approaching a danger zone will be warned, or when trains continue to travel after receiving one or more warnings, the brakes or controlling mechanism will be actuated to stop both trains.

863,569. Signal Mechanism; Ellsworth E. Flora, Chicago, Ill. App. filed June 18, 1906. An apparatus for exploding a torpedo in the path of a train when a switch is open. An electrical circuit positions a depressible plate in the path of the wheel flange so that it is operative to detonate a torpedo.

12,680. Original No. 715,088, serial No. 144,533. Automatic Release Mechanism for Air Brakes; reissue; Leopold Krimmelbein, Baltimore, Md., assignor to Westinghouse Air Brake Company, Pittsburg. A valve mechanism for air-brake systems designed to provide means whereby the train pipe pressure acting to release the brakes can never become so depleted as to fail to effect a quick release of the brakes. A further object is to provide means to recharge the auxiliary reservoirs of the several cars of the train nearly to the maximum pressure while the brakes are applied and without releasing them.

PERSONAL MENTION

MR. GEO. A. STANION, formerly with the Brooklyn Rapid Transit Company, has been appointed superintendent of the new plant of the Lake Shore Engine Works, at Marquette, Mich.

MR. C. F. BRYANT has resigned his position as auditor of the Mohawk Valley Company, of New York. Mr. Bryant was formerly assistant treasurer of the Connecticut Railway & Lighting Company, of Bridgeport, Conn.

MR. GEO. E. MORINE, of the Electrical Installation Company, of Chicago, has been appointed general superintendent of the new "Ben Hur" line, the Indianapolis & Crawfordsville Interurban Railway, running between Indianapolis and Crawfordsville.

MR. L. C. SHIPPERD, formerly of Cleveland, Ohio, and for several years treasurer of the Evansville Electric Railway, has been appointed superintendent of the Evansville, Princeton & Mt. Vernon Traction Company, to succeed Mr. W. P. Larcey, formerly roadmaster of the Southern Railroad.

MR. H. H. DE PEW, for several years superintendent of the Penn Yan, Keuka Park & Branchport Electric Railway, has resigned that place, owing to failing health. Mr. William Tylee, who has been connected with the road in a clerical capacity for about ten years, is acting superintendent.

MR. WILLIAM WALKER COLKET, of Philadelphia, is dead, in his 68th year. Mr. Colket was at one time president of the old City Passenger Railway, now the Chestnut and Walnut Streets division of the Philadelphia Rapid Transit Company, and president of the old Chestnut Hill Railroad, of Philadelphia.

MR. WILLIAM G. YOUNG, of Port Chester, who for several years has been assistant superintendent of the New York & Stamford Electric Railway, has been appointed superintendent of the company in place of Mr. George W. Pierce, resigned. Mr. Young is a native of Port Chester and has been in the employ of the company eight years.

MR. NELSON MORRIS, of Chicago, a prominent stockholder of the Chicago City Railway Company and formerly a director of the company who took an active interest in its affairs, is dead. Mr. Morris was a member of the packing firm that bore his name, and was connected with many local Chicago commercial and industrial enterprises.

MR. JOHN HANF has been appointed master mechanic of the Southern division of the Public Service Corporation, with headquarters at Camden, N. J. Mr. Hanf formerly was master mechanic of the International Railway Company, of Buffalo, and previous to his connection with that company was with the Philadelphia Rapid Transit Company, Wilmington City Railway Company, and the J. G. Brill Company.

MR. J. C. HOFFMAN has retired from the position of electrical engineer of the Oneonta & Mohawk Valley Railroad, with headquarters at Hartwick, and the electrical department is now in charge of Mr. Charles Stanton, who has been the engineer in charge of the company's power station, while Mr. M. J. Bogardus, the purchasing agent, is temporarily in charge of the mechanical department. Mr. Bruce Robinson, of the company, who has been agent at Mt. Vision, has been appointed to succeed Mr. John Wallaban as dispatcher.

MR. W. J. RAMSEY has been appointed to succeed Mr. Albert Eastman, resigned, as superintendent of employment of the Public Service Corporation. Mr. Ramsey has been connected with the street and electric railway operation since 1886, during which time he has been continuously connected with the operating end of the business, filling different positions. His connection with the Public Service Corporation dates from December, 1893. Until his appointment to succeed Mr. Eastman, Mr. Ramsey had represented the auditing department in the shops.

MR. WILLIAM DARBEE, for the past year general manager of the Albany & Hudson Railroad, was presented with a handsome diamond pin and a traveling bag by the employees of the company and the attaches of Electric Park on Friday, Aug. 23, as a token of their esteem. As previously stated in the STREET RAILWAY JOURNAL, Mr. Darbee leaves Albany for Baltimore, Md., where he is to become assistant general manager of the Consolidated Gas, Electric Light & Power Company. Mr. Raymond H. Smith succeeds him as manager of the Albany & Hudson system.

PROF. OREN ROOT, D. D., L. H. D., of Hamilton College, and father of Mr. Oren Root, Jr., vice-president and general manager of the New York City Railway Company, died at his home in Utica, N. Y., Aug. 26. Prof. Root was graduated from Hamilton College in 1856, and was prominent in Central New York State as a clergyman and also as an educator, having been professor of mathematics and physics at Hamilton College since 1880. He was also a high degree Mason and grand chaplain of the Grand Lodge of F. and A. M., N. Y. Prof. Root was a brother of Mr. Elihu Root, Secretary of State.

MR. CHARLES T. MORDOCK, formerly manager of the Terre Haute Traction & Light Company, at Terre Haute, Ind., for Messrs. Stone & Webster, has been appointed a permanent member in the field of the board of expert engineers of the Stone & Webster Engineering Corporation, of Boston, owing to the increased demand for the services of its expert engineers and the large amount of development work now contemplated and in course of construction in the West and Middle West. Mr. Mordock will make his headquarters in Boston. The Engineering Corporation is now actively engaged in the construction of many important electric railway, power and lighting systems.

MR. W. J. WILGUS, vice-president of the New York Central & Hudson River Railroad, under whose direction, as chairman of the Electric Traction Commission of the company, the electrification of the lines out of New York has been carried out, has been asked by Mayor Busse, of Chicago, to make a study of the problem of electrifying the trunk lines out of Chicago, and to report to him on the subject. The whole matter will be brought to the attention of the Council by Mayor Busse at once, as Mr. Wilgus, after Oct. 1, when his resignation from the Central Company takes effect, will be at liberty to entertain any proposition to act in a consulting capacity that may be made to him. Chicago's trunk system embraces twenty-three lines, all of which are now being elevated to avoid grade crossings.

MR CHARLES E. MARLOW, secretary and treasurer of the Chicago Consolidated Traction Company, is dead. Mr. Marlow was born in Philadelphia, Pa., and was educated in the public schools of that city. In 1879 he entered the employ of the freight department of the Pennsylvania Railroad, where he remained until 1893. Then he was for a year a clerk in the employ of William Wharton, Jr., & Company, of Philadelphia. In 1896 he became assistant treasurer of the Siemens-Halske Electric Company in Chicago, and in 1898 auditor of the street railway properties controlled by the late Mr. C. T. Yerkes. When the Chicago Consolidated Traction Company was organized, in February, 1899, he became its secretary and treasurer, a position he held until his death. Mr. Marlow is survived by a widow and one son.

MR. ALBERT EASTMAN has resigned as superintendent of employment of the Public Service Corporation of New Jersey to assume charge of the express and freight business on certain of the lines of the Andrews-Vanderbilt syndicate in Central New York, including the electrified division of the West Shore Railroad, between Utica and Syracuse. Mr. Eastman was originally engaged in steam railroad work, in which he served from 1892 to 1901, first for a long period with the Grand Trunk Railroad, as freight and ticket clerk and telegraph operator at Detroit, and later with the Michigan Central Railroad, as assistant agent at Detroit. It was from the latter position that he resigned in November, 1901, to become traveling express and passenger agent on the Detroit United Railways. In December, of the following year, Mr. Eastman resigned from the Detroit Company to become general express agent of what now is the Utica & Mohawk Valley Railway, under Mr. C. Loomis Allen. Returning to Detroit in May, 1903, Mr. Eastman became a division superintendent on the Detroit United system, and in November, of the same year resigned from the Detroit Company to accept the position of superintendent of employment of the Public Service Corporation under Mr. Albert H. Stanley, with whom he had been associated in the management of the Detroit property.

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BACK COPIES.—No copies of issues prior to September, 1904, are kept on sale, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

CHANGE IN ADDRESS

Commencing with this issue the address of the main office of the Street Railway Journal is

239 West Thirty-Ninth Street, New York City

Of this issue of the Street Railway Journal 8300 *copies are printed. Total circulation for* 1907 *to date* 295,850 *copies, an average of* 8218 *copies per week.*

Traffic Circulars

A few years ago railway literature issued for the promotion of traffic was confined to timetables, which were of the most matter of fact kind. No pretense was made at artistic effect, and nothing was printed but the running or leaving times of the trains. Steam railroads have made a great advance since that time, but the most attractive circulars issued at present to attract travel are those published by the electric roads. Whether this is due to the fact that the electric railway managers are less bound down by rules of conservatism we are unable to say. But while the electric railway circulars may not sometimes rival in size those issued by the large steam railroads, they nearly always show an effort to put the information contained in them in an attractive way. It is rare now to find an electric road depending largely on pleasure traffic which does not publish some kind of a circular, with usually a map, to attract the business of the traveler or pleasure seeker. Sometimes these circulars are issued annually, sometimes monthly, and occasionally at weekly or shorter intervals. Many are historical treatises of the territory traversed; others are less pretentious, but all appeal to some need of the traveling public. As a promoter of traffic the illustrated circular now holds a recognized position.

Standardizing Fuses in the Power Plant

The increasing use of auxiliary power circuits in the generating plant has led to the installation of special switchboard panels for the control of auxiliary motors and lights in a number of recently-built stations. The grouping together of these services at a central point is a great convenience from the standpoint of operating ease, and the practice tends to reduce waste of current with the further gain of lower first cost of the auxiliary wiring control than is likely to be the case where lighting and motor circuits are provided with switches, fuses and other fittings scattered all over the plant. Of course, a certain amount of switch and fuse subdivision is sure to be necessary in a large plant, but in almost every instance the use of a central controlling panel is also desirable.

In a large plant the number of fuses needed in auxiliary service is surprising. Coal-handling equipment when motor driven, pump motors, small shop motors, ventilating circuits, oil-switch motors, possibly valve and crane motors and all the important lighting branches require fuses of a certain capacity which varies with the current demands of each case. In a recent plant no less than eighty auxiliary motors were counted, and every one of these circuits, or at least every group of circuits of any operating importance, had to be separately fused. The subdivision of lighting circuits in the boiler and turbine rooms, on the switchboard galleries, in the high-tension switch house, coal pocket, machine shop and laboratory, still further complicated the fuse question. In such cases the importance of standardizing the fuses as far as possible is well worth considering, and in the plant in question a well directed scheme of using but one make or two at the outside, with as few separate fuse sizes as possible, was being carried into effect.

The advantages of having a single make and few sizes

standard in a plant are obvious after a little thought. A large number of different fuse sizes and of varying makes complicates the store room problem, and takes up valuable space. Too great an assortment ties up money which ought to be released for other uses; but the chief gain in using a few sizes is the greater speed with which auxiliary shutdowns can be repaired, and the reduced danger of getting the wrong style or size of fuse into the circuits in trouble in times of emergency. The fewer the number of fuses to select from, the more quickly can the auxiliary circuits be placed again in service, and the reduction in store room annoyances is, as mentioned above, a boon. The number of spare parts which have to be kept in stock in a large station is well worth reducing, whenever it can be done without danger of going to the extreme of having too few supplementary pieces of apparatus on hand to insure practically continuous service.

Handling Traffic While Double Tracking

The difficulties of maintaining regular and punctual service under the hindrances of construction work are appreciated by all operating men who have had experience with extensions or alterations of their track systems. To carry out a given piece of construction on an electric road is a straight enough problem if labor and supplies are not scarce, but to keep the service in good shape under these conditions is a very different matter, considering the frequency of car movement on street and interurban railways.

In city service, when double tracking is to be done, it is often possible to do a large part of the work at night. Travel can also be deflected to its destination by alternative routes in many instances. A certain amount of inconvenience cannot well be avoided in double tracking a line in a city street, but if passengers are advised of route changes, and if the flag signaling arrangements are good at points where both forward and reverse movements of cars are necessary, the service ought not to be seriously impaired. Definite fixing of responsibility at passing points is essential, and there is no doubt that if a temporary telephone line were installed more frequently at the place where the work is being done, the chances of delay and accident would be much reduced. On account of the slow speeds usually necessary in passing through city track construction work, the dangers of accident are probably much less than in interurban service, and the chief problem is the avoidance of blockades.

The double tracking of an interurban line necessitates the most careful handling of the car movements, especially when part of the new track is utilized during construction by the regular service. It may be necessary to station starters or extra dispatchers at the work itself, and extra telephone facilities are almost imperative. If it is possible to map out a set of special instructions to train service employees in advance of the beginning of construction, so much the better. Usually, however, the variations from the normal in car movements have to be handled on a day by day basis, as on one day the construction may require the use of part of the old track and part of the new; on another, temporary cross-overs may be shifted in position, and on a third, the old track alone may be passable. The result is that either the regular dispatchers have a large amount of extra work on their hands, or extra men are located in the construction territory, with power to control car movements in the abnormal zone. At such times a niggardly policy with regard to the location of telephones is almost certain to interfere with the giving of good service. In cases where it is possible to complete the second track from one or both ends, working toward the middle, the flexibility of operation can be increased, particularly if temporary cross-overs can be installed as needed If the double tracking of the line involves shifting the position of the first track, the quality of the service can be kept high by providing for partial movement on sections of the second track as fast as it is completed. It is a mistake to think that the second track must be completely built for severe service at fast speeds before it can be utilized effectively in by-passing part of the construction work. Often a slow run of a few hundred feet on a temporary track, or on a section of the second pair of rails where high speed is out of the question enables a car to cross back to a high-speed track and continue its trip without much loss of time. A little planning of special movements in advance of the beginning of construction is certain to be profitable.

Superheating Steam

In all developments of old-established arts there is frequently apt to be great divergence of opinion as to the way in which details should be arranged. Thus in regard to the question of superheat, there are many different ideas as to how superheaters should be designed, and how they should be controlled. Those ideas range from the use of elaborate and efficient, but costly apparatus, to that which is simple and individually inefficient but is cheap to install and operate, or both. Every gradation may be met between these extremes.

In the most elaborate class of such apparatus each individual superheater is equipped with its own automatic controlling device, which serves to cut off steam from that individual apparatus that is practically constant in temperature. Ten such superheaters worked in parallel will give results very little better than the simple superheater. Such an efficient apparatus is, of course, costly, but it is very reliable. At the other end of the scale is the small tube superheater, made of the cheapest tubes, entirely devoid of any control of temperature. Its output of superheated steam one minute may be coming away at 50 degs. of superheat; next moment it may be coming away at 200 degs. or 250 degs. Obviously such an apparatus is not well fitted to work alone. But let us suppose that a dozen such superheaters are turning out the steam from as many boilers and that each one of the dozen superheaters is giving an output as variable as just stated. The object of the engineer is to supply two engines with steam superheated, say to 140 degs. F. His engines are taking steam from a dozen different superheaters, but the output of these is all mingled in one steam main, and the supply of steam which reaches the engines is practically of fairly uniform temperature, because with a dozen apparatus no two of them at one time are in maximum or minimum phase together, for they are all fired at a different time and the many variations combine with a fairly level average of temperature. The Germans, who know perfectly well that the crude, small tube

superheater, entirely unfrilled with control devices, will burn out in a few months, continue to employ such apparatus because the gain is greater than the expense of replacing the burned-out tubes. We know no American or English makers of small tube apparatus, however, who take the German view. They do not employ cheap tubes, but seek for the best tubes that can be got, solid, weldless steel of high quality, and probably they secure better commercial results than if they used tubes of the cheaper classes.

The mere act of superheating may appear simple enough, but it differs essentially from all other operations in steam production. The fluids are so different to which heat is to be applied. Water may be heated in a tube, and so long as, by flow or other means, the water and the tube are maintained in contact, it would seem that an excess of temperature can scarcely be applied. There is even reason to believe that the hotter the water the better it will take heat from the tube, and there are certainly good reasons to suppose that water just ready to flash into steam is even better as a receptive agent because of its latent heat absorption. Water of itself has, per pound, a heat absorption about double that of steam. Per cubic foot the heat absorbed by water is enormously greater, but even this difference is many times multiplied when the cubic foot of water is becoming steam.

Thus in heating steam in hot pipes the steam has a low cooling effect. As it dries it ceases to acquire heat by radiation from the hot metal; it can only acquire it by contact and friction. Being of small mass, however, it is apt to become overheated, especially since the tubes must be very much hotter than the desired temperature of superheat if any commercial efficiency of apparatus is to be secured. At every turn there are difficulties to be met, and the operation of superheating is one that has to be carried out on a basis of continual compromise between conflicting factors.

The Mileage Basis of Inspecting Cars and the Elimination of Guess Work in Inspection

There is a decided tendency in the larger electric railway repair shops to adopt the mileage system of inspecting and overhauling cars. Usually the change from the time basis results in a considerable decrease in operating expenses, caused by a reduction in both labor and materials required to keep the cars in order. Moreover there are usually fewer detentions and delays when the mileage basis of overhauling is used.

Common sense and reason uphold the mileage rather than the time system, and the only wonder is that it has not always been employed on both large and small roads. The time basis is too indefinite and the element of guesswork is too prominent in it. Some actual figures from one road which uses the mileage basis shows that the cars make 1200 miles, the limit for oiling and inspection, in from three to seven days. Probably if the time system were in use on this road the cars would be inspected, say, every five days. But this would result in over-inspecting some of the cars and under-inspecting others. Over-inspection would mean, of course, direct loss of a great deal of labor and materials and under-inspection would endanger the apparatus and increase the liability of detentions.

The argument might be brought up that the interval between inspections can be made of such a length that none of the cars will be under-inspected, and, further, that over-inspection simply decreases to a greater extent the liability to break down. Both sides of this argument are badly at fault. In the first place, if inspecting a car that makes the 1200 miles in three days, at five days or 2000-mile intervals, is not under-inspection, then, assuming all the cars to be of the same type and to be in similar service, to inspect on a 1200-mile basis is to increase the cost of inspection 40 per cent over that necessary. The second part of the argument, that over-inspection decreases the liability to break down, does not work out in practice. The inspectors on such cars will soon realize that the cars do not really need inspection and they will be less thorough with their work. Carelessness will soon be extended to those cars needing inspection, and soon the whole force is likely to become slipshod in its methods.

About the only objection to the mileage basis is the trouble of obtaining the mileage reports and then of getting cars into the shops when they are reported for inspection. Keeping records, it is true, does cost money and can be carried too far, as the political economist puts it, "beyond the point of diminishing returns," but it is safe to say that keeping car mileage for the purpose of inspecting on a mileage basis will certainly yield good returns for the money spent.

Even when the mileage basis is used, it is usually the best plan to depend as little as possible on the discretionary powers of the inspector. Where cars of the same type are in the same service and are in good condition, it stands to reason that for equal mileage, the bearings of all cars require equal amounts of oil, that the waste should be subjected to the same treatment, that about the same amount of dust will collect on the controller parts, and in general that all parts of all cars will require the same treatment. Rather than allow an oiler to open a bearing and judge of the amount of oil required and then tip his can and judge again as to the amount of oil he puts in, reason dictates that it would be far better to give instructions that bearings are to receive, say a gill of oil and then to supply him with a gill measure and make him use it.

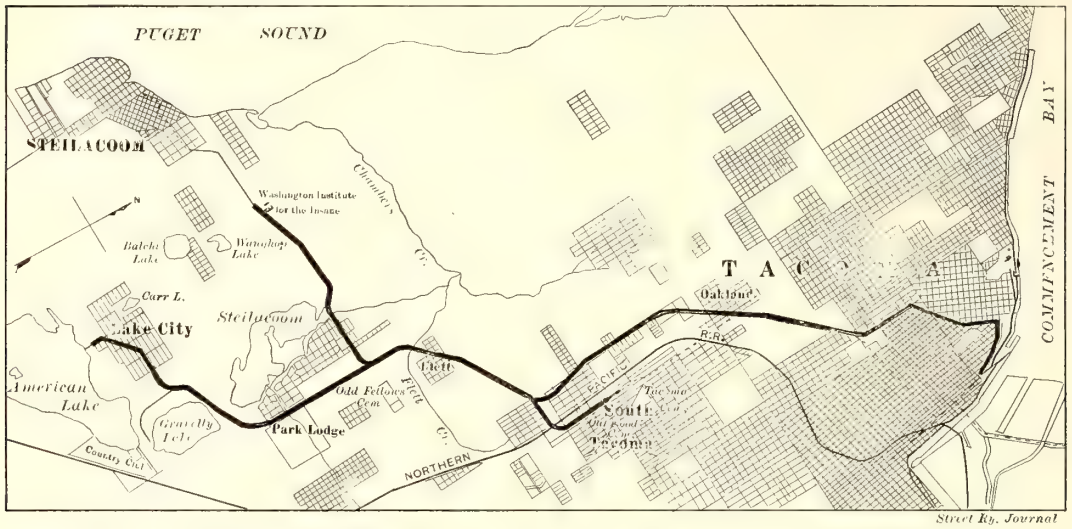
In the same manner, dependence on the judgment of the inspector can be eliminated with regard to armature clearance. When it comes to estimating sixteenths or thirty-seconds of an inch in a dark motor with the head turned sidewise and the eye not on a line with the pole face, the judgment of most men is likely to be rather misleading. Moreover what one man thinks is likely to differ considerably from what another one believes to be proper clearance. The use of a gage which will take probably half an hour of a machinist's time to make, will eliminate all uncertainty regarding clearance.

There are many other features of car inspection that can, in a similar manner, be reduced to definiteness, and the company that continues to let guess work and dependence on the judgment of the inspector or workman continue to exist, it is very safe to say, is losing a great deal of money.

No work about a car shop is more important than the inspection of cars, and master mechanics do wrong when they turn this work over to subordinates and then do not bother themselves with the way in which it is executed.

THE PACIFIC TRACTION COMPANY, TACOMA, WASHINGTON

Twelve miles south of Tacoma, Wash., lies American Lake, which has long been a summer play ground for the people of Tacoma, but was difficult of access until the construction of the Pacific Traction Company's line. Heretofore the lake could be reached only by the local trains of the Northern Pacific Railway, and these did not run at convenient hours. Appreciating that there lay a profitable field for an electric railway, several enterprising Tacoma business men, among them E. J. Felt, interested Eastern capital in the project and in the fall of 1905 organized the Pacific Traction Company, nominally to build a suburban electric railway from Tacoma to American Lake. Work was commenced on the new system the following May, but was delayed considerably last winter by bad weather. However, the first passenger cars were run from Tacoma to Lake City, July 4, 1907. The new system is independent and in fact is in competition with the present city and suburban lines of the Tacoma Railway & Power Company.



MAP OF TERRITORY COVERED BY THE PACIFIC TRACTION COMPANY OF TACOMA

The constructed main line from Tacoma to Lake City is 12½ miles long, and outside of the corporate limits of the city is built on a private right of way 60 ft. wide. A 4-mile branch to Steilacoom, a suburb of Tacoma, on Puget Sound, and a 1½-mile branch to the suburb of South Tacoma bring the total constructed mileage up to 18. In addition to this there is under construction a 1½-mile extension of the South Tacoma branch, and also a 2-mile double-track line down Fifteenth Street and up Pacific Avenue to the terminus of the main line. The company has exceeded the bounds of its original plans and is now engaged in buying right of way for a 35-mile extension to Olympia, the State capital.

In the streets the track follows the established grades, some of which are as heavy as 6 per cent. The track construction through the paved district is worthy of note. No ties are used. The 7-in., 70-lb., 60-ft. rails are laid directly on top of a 10-in. x 14-in. continuous concrete stringer. The concrete mixture is 1:3:5, cement, sand and clean beach gravel respectively. Every 10 ft. a ⅝-in. rod is used. The tops of the stringers were laid about ½ in. below grade for base of rail as given by the profile; then the track was laid and the rails brought up to grade with light shims; a rich grout of 1 to 1 cement and sand then was poured in between the rail and stringer and around the base of the rail. The whole was finally surrounded with 6-in. concrete paving and allowed to set. The ball of the rail is faced on both sides with vitrified brick; on the outside the bricks are laid parallel to the rail; on the inside they are set at right angles to it with one corner chipped for the flangeway.



CROSSING UNDER THE NORTHERN PACIFIC RAILWAY



A VIEW OF AMERICAN LAKE AT THE TERMINUS OF THE PACIFIC TRACTION COMPANY'S LINE

Beyond the city the track is standard, light construction, using 60-lb. steel rails, not braced on curves. The track is surfaced with gravel, which is abundant and cheap. The grades are light; with the exception of a few velocity grades approaching the crossings of narrow ravines they do not exceed 1.5 per cent. There is one commendable feature

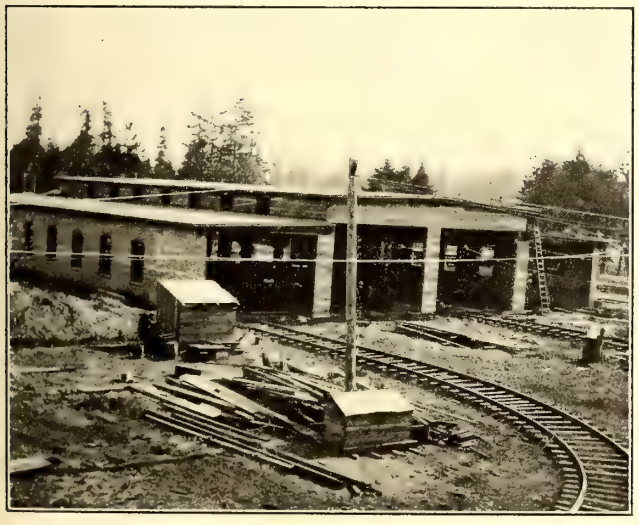
about the line in general that differentiates it from many other electric railways in the Far West; this is that the company has not sacrificed its alignment or grade to avoid expensive cuts and fills, and aside from a few curves, the line compares favorably with Western steam railroads.

Folowing the standard practice of the region the bridges are all wooden trestles; they are strongly built and could carry 100-ton locomotives with safety. The most notable is the Cliff Avenue viaduct near Third Street S. This is 350 ft. long and 60 ft. high, double track, planked and furnished with sidewalks. Between the rails the planks are laid 45 degs. to the rail. Just west of this bridge is a bulkhead 300 ft. long and 18 ft. high, built to keep the tracks from sliding down into the bay several hundred feet below. The bulkhead is unusually massive, being constructed of long 12-in. x 12-in. timbers tied into the roadbed by 6-in. x 8-in. cross-braces.

The overhead construction is neat and strong and with two exceptions standard in design and construction. The insulators, guy and supporting wires and cables are heavily galvanized; usually in this locality they are black, but it is expected that the galvanized work will withstand the damp, salt, foggy weather of winter better than if it were unprotected; the trolley wire used is No. 0000 Fig. 8 hard-drawn copper and is said to be the heaviest wire now in service on the Pacific Coast.

Near South Tacoma the company has purchased three acres and built a 150-ft. x 150-ft. brick car house for sixteen cars on eight tracks. Slow-burning mill construction is used throughout.

Near the car house is a $20,000 two-track concrete crossing, under the four-track main line of the Northern Pacific Railway. The four railway tracks are carried on concrete girders supported by concrete abutment walls. A grade crossing would have been much cheaper at this point, but in constructing the under-crossing, the company has shown a wise desire to avoid accidents, and, again, builded better than the average electric railway. The track was laid by a machine of local design. Good results were obtained with

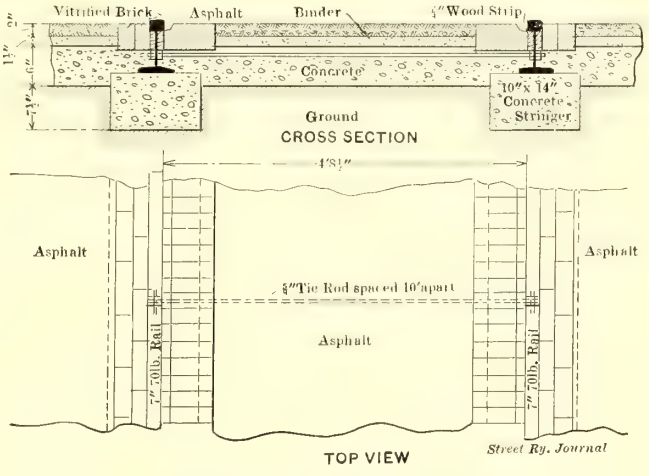


THE SOUTH TACOMA CAR HOUSE

it and 1½ miles laid a day at a cost considerably below what it would have been had the work been done entirely by hand.

The cars are among the largest in street railway service on the coast. They are 55 ft. long, weigh 56,000 lbs., are fitted with four 40-hp motors, air brakes, two controllers and trolleys. They were built by the American Car Company.

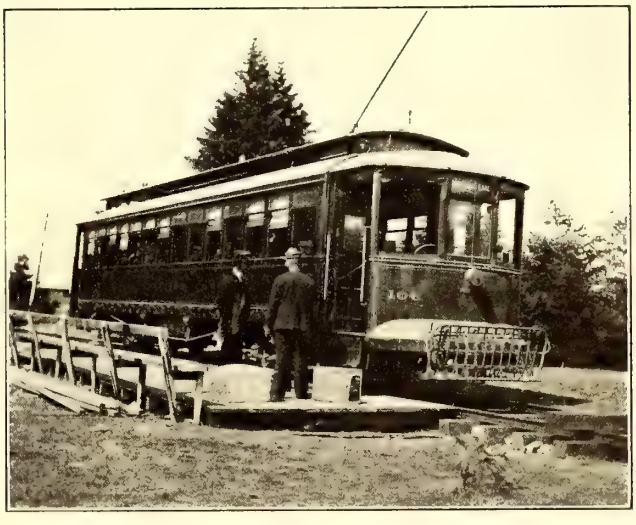
Except on Cliff Avenue the line is single track with automatic turnouts. Spring-rail frogs are used with the free flangeway leading onto the turnout from one end on to the main line from the other. The cars are run on schedule, protected by United States automatic electric block signals. Telephones are installed at convenient intervals.



TRACK CONSTRUCTION ON THE CITY LINES OF THE PACIFIC TRACTION COMPANY

Little has been done so far on the terminal work at either end. The company owns considerable property at American Lake which it is selling to summer residents. It is the policy of the company to foster an increase of permanent residents who will patronize the line rather than to establish any amusement features of a Coney Island nature at American Lake. The company has no power plant, as it purchases all of its power at 600 volts d. c. from the Seattle-Tacoma Power Company.

The officers of the Pacific Traction Company are: President, A. G. Corbett; vice-president and secretary, E. J. Felt; second vice-president, G. M. Smilaix; general manager, Benj. J. Weeks.



STANDARD 55-FT. INTERURBAN CAR OF THE PACIFIC TRACTION COMPANY

General Manager McCulloch, of the United Railways of St. Louis, has presented to the employees' band a set of new instruments, costing $8,000.

NOTES ON PHILADELPHIA ELEVATED PRACTICE

The recent opening of regular service on the Market Street subway-elevated line of the Philadelphia Rapid Transit Company makes appropriate some references to the practice adopted by the company in connection with this branch of its service.

WEST PHILADELPHIA SHOPS

All of the rolling stock used on the Market Street line is cared for in the shops especially built for them at the West Philadelphia terminal. As the constructional features of these shops were described in the STREET RAILWAY JOURNAL for Sept. 23, 1905, it is only necessary now to mention the operating equipment and the methods for doing the work, which will be of maintenance character only. The machine tools were all furnished by the Niles-Bement-Pond Company, excepting a Bickford radial drill. They embrace a wheel-turning lathe, wheel press, radial boring drill, radial drill, a 24-in. and a 36-in. lathe, Bement-Niles shaper, and a LeBlond lathe. All of these tools are driven by the Electro Dynamic Company's inter-pole motors, which are operating very satisfactorily. In addition to the tools mentioned, there is one Diamond Machine Company's grinder. There is no other apparatus in the shop proper in addition to the foregoing except a 15-ton Box crane for the carriage of parts from tool to tool.

Some of the accompanying forms indicate the methods of caring for labor and material. Every shopman is furnished with a daily time card on which he assigns the number of hours spent on different jobs. This information is afterward transferred to a large sheet covering the distribution of elevated car shop labor as

STATEMENT OF

OILS AND GREASE CONSUMED DURING MONTH OF_____190

BY_____

MR._____

_____190

	On Hand		Received During Month of		On Hand First Day of		Amount Consumed for Month of	
	Gallons	Pounds	Gallons	Pounds	Gallons	Pounds	Gallons	Pounds
Galena P. H. Valvo Oil								
" " Engine "								
" Dynamo "								
" Turbine "								
" Crank Case "								
" Air Compressor "								
" Electric Car "								
" Track "								
" Gear Grease								
" Perf. Signal								
" Motor Grease								
Miscellaneous								

YOURS VERY TRULY,

KILOWATTS_____ _____DIV. NO._____

MILEAGE_____ _____FOREMAN OR ENGINEER.

RECORD OF GREASE AND OIL CONSUMED, ON HAND, ETC.

Philadelphia Rapid Transit Company,
ELEVATED DIVISION.

Date, _____ 190

MR. F. H. LINCOLN,
Asst. General Manager.

We have this day charged the following to Maintenance of the Elevated Division:

CHARGE	Amount
Bodies,	
Trucks,	
Motors,	
Control,	
Air Brakes,	
Air Doors,	
Headlights and Markers,	
Tail-lights and Lanterns,	
Third Rail,	
Cleaning and Supplies,	
M of E Miscellaneous,	
Depot Expense,	
Trans. Miscellaneous,	
Office Expense,	
Total.	

Purchasing Agent.

DAILY REPORT TO ASSISTANT GENERAL MANAGER ON MATERIAL USED BY THE ELEVATED DIVISION

PHILADELPHIA RAPID TRANSIT COMPANY. Distribution of Elevated Car Shop Labor, 190

NAMES	Bodies	Trucks	Motors	Control	Air Brakes	Air Doors	Headlights & Markers	Tail lights & Lanterns	Third Rail	Supplies	M. of E. Miscellan's	Clean'g & Supplies	Transp'n Miscellan's	Depot Expense	Office Expense	Heat	Light	Store Profits & Taxes	Car Equipment	TOTAL	REMARKS
	Pcs. Amount	Pcs. Amount	Pcs. Amount	Pcs. Amount	Pcs. Amount	Pcs. Amount	Pcs. Amount	Pcs. Amount	Pcs. Amount	Pcs. Amount	Pcs. Amount	Pcs. Amount	Pcs. Amount	Pcs. Amount	Pcs. Amount	Pcs. Amount	Pcs. Amount	Pcs. Amount	Pcs. Amount	Pcs. Amount	

DISTRIBUTION OF ELEVATED CAR-SHOP LABOR

RECORD OILING CARS. Month of_____190__

DAY OF MONTH

Car No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	REMARKS

_____Barn_____Division

_____Foreman

NOTE: Mark / indicates Motor Bearings have been oiled that day.

" X " " Journal " " " " " " "

" ✖ " " Both Motor and Journal Bearings have been oiled that day.

CAR OILING RECORD WITH SYMBOLS COVERING DIFFERENT KINDS OF LUBRICATING WORK

performed by every employee, but the proper account numbers are assigned only by the main office to which the sheet is sent. Another form illustrates the method adopted in charging up material taken from the storeroom for the maintenance of elevated equipment. This is inspected

Philadelphia Rapid Transit Co.
ELEVATED DIVISION.

Motorman's Report of Defects and Train Detentions.

THIS COPY TO SUPERINTENDENT AT TERMINAL.

Date,.....190 Train No.

Total Length of Detention,.....

Conductor,..... Motorman,

CAR No.	MINUTES	PLACE OF DETENTION	CAUSE OF DETENTION

One of these to be filled out in Duplicate for each Car upon leaving train.

MOTORMAN'S REPORT OF DEFECTS AND TRAIN DETENTIONS

every day by the purchasing agent of the company and then sent to the assistant general manager for his attention.

The company has a cost-per-mile contract with the Galena Signal Oil Company, and particular care is taken, therefore, to keep track of the amounts of each kind of oil used. Two

Form 530. 5000. 3-29-07

TIME CARD.

Phila. Rapid Transit Company.

ELEVATED DIVISION.

This Card must be made out each night before leaving.

.....Hours on.....
.....Hours on.....
.....Hours on.....
.....Hours on.....
.....Hours on.....
.....Hours on.....
.....Hours on.....

.....Workman.

Rate per hour,.....

.....Foreman.

Date,.....190

SHOP EMPLOYEE'S TIME CARD

forms are employed in this connection, one covering the amounts received, used and on hand; the other is a lubrication record of every car. An inspection of the latter will show some of the convenient symbols adopted to simplify the work of the shopmen in making out oiling reports. This form is a large sheet, which is kept on a board covered with a piece of oilcloth lifted only whenever the shopman wishes to indicate the class of lubrication done on certain cars.

CAR-MAINTENANCE PRACTICE

Every motorman is furnished with a book pad 4 ins. x 8 ins., which contains a form called "Motorman's Report

REPORTS OF

Defects and Train Detentions

ELEVATED DIVISION

Philadelphia Rapid Transit Company

COVER OF MOTORMAN'S REPORT BOOK

LIST OF DEFECTIVE EQUIPMENT FOR USE IN REPORTING TRAIN DETENTIONS

MASTER CONTROL
Control Fuse Blown
Controller Switch
Circuit Breaker Switch
Train Cable
Train Cable Jumper
Current Limit Relay
Potential Relay
Controller
Jumps in Series
Jumps in Parallel
Slow in Parallel
Slow in Series
MOTOR CONTROL
Main Fuse
Shoe Fuse
Contactors Sticking
Reverser
Resistance Grids
Circuit Breaker
MOTORS
Flash Overs
Grounded Armature
Short Circuited Armature
Open Circuited Armature
Grounded Field
Dropped Brush Holder
Motor Leads
Motors Cut Out
Broken Gears
Loose Gears
Broken Pinion
HEAD LIGHT:
Burnt Out
Fuse Blown
GAUGE LIGHTS.
Burnt Out
TAIL LIGHTS: (Oil)
Will Not Burn
HOT BEARINGS:
Armature
Motor Axle
Journal
Compressor Motor
COUPLERS.
Defective
TRUCK TROUBLES
Contact Shoes
Contact Shoe Beam
AIR BRAKES:
Compressor Fuse Blown
Brake and Buzzer Resistance
Governor Does Not Cut Out
Brakes Failed to Release
Brakes Equalizing
Brake Rigging
Defective Coupler
Defective Piping
Brakes Cut Out
Emergency Attachment Cut Out
Feed, Triple, Brake Valves
Drain Cock
WHISTLE:
Whistle Out of Order
CLASSIFICATION LAMPS AND BUZZER
MISCELLANEOUS:

DATA ON INSIDE COVER OF MOTORMAN'S REPORT BOOK

Market St. Elevated Pass. Ry. Co.

CONDUCTOR'S DAILY MILEAGE SLIP.

Name.....

Badge. ... Date. ...

RUN	CAR Nos.	TRIPS	TERMINAL Left	TERMINAL Arrived

This Slip must be made out each day and turned in to Office.

CONDUCTOR'S DAILY MILEAGE SLIP

of Defects and Train Detentions." This is submitted in duplicate to the division superintendent at the terminal and must cover separately each car affected. One copy of the report is sent to the mechanical department while the other is retained by the operating department. After the necessary repairs have been made the shop copy is forwarded for filing to the superintendent's office. For the convenience of the motorman in making out reports the inside cover of the report book contains a list of troubles to which different parts of the equipment are liable to be subjected. The method of making up the report forms has been found very convenient, because a large number of blanks can be kept in shape so easily in the pocket and there is less trouble in writing than if detached sheets were used.

Form [illegible]

ELEVATED DIVISION,
69th Street Shop.

Date,.....190

.....
Superintendent.

The following Cars were inspected this date and are now ready for service:

Car No.	Car No.	Car No.	REMARKS

.....
Shop Sup't.

FORM USED IN RETURNING CARS TO SERVICE

The motorman's reports on defective equipment are supplemented by the yardmaster's daily report on "Trains

taken off." This gives the superintendent an opportunity of knowing whether the motormen are turning in correct reports or simply making groundless complaints.

The cars are inspected thoroughly after running 1200 miles, whether or not defects have been reported. This work is done by the shop on receipt of a notice from the superintendent of the elevated division that cars numbered so and so are due for inspection. The yardmaster then takes the cars out of service and inspection is made the following day.

The information upon which the division superintendent orders cars to be inspected is collated from the daily report slips turned in by the conductors, which, in turn, are transferred to a monthly mileage sheet covering every car on the system. On completion, this monthly sheet is sent to the main office of the company for record.

In connection with the maintenance of the cars it is interesting to note that the monolithic flooring used in the latter has proved very economical from the cleaning standpoint, as but six men are required to keep the flooring of the forty cars in perfect shape.

Form 518. 500. 3-6-07

Market Street Elevated Passenger Railway Company,

PHILADELPHIA RAPID TRANSIT COMPANY,—Lessee.

MILEAGE SHEET.

Date, _____ 190

Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
CAR 1																																
2																																
3																																
4																																
5																																
6																																

MONTHLY MILEAGE SHEET COVERING ALL THE CARS ON THE MARKET STREET ELEVATED-SUBWAY LINE OF THE PHILADELPHIA RAPID TRANSIT COMPANY

Market Street Elevated Passenger Railway Co.,

OPERATING DEPARTMENT.

NSTRUCTION BLANK.

MOTORMAN.

Date, ____ *190*

Motorman ____ *Badge No.* ____

Mr. ____, Student Motorman, has been assigned to you to be instructed in the duties of a Motorman on this Division.

All Instructing Motormen must see that Students thoroughly understand the operation of trains in accordance with Rules and Regulations of this Company, and are fully acquainted with all conditions, a knowledge of which is necessary for safe operation over this Division.

Instructing Motormen will be in charge of trains and will be responsible for their safe operation. They will permit Students to operate trains only when in their judgment it is safe for them to do so.

I have instructed Student Motorman ____ Badge No. ____ in the safe operation of a train in service and have fully acquainted him with all signals, speed limits, station stops and general conditions existing on the Elevated Division:

DATE	LINE	No. TRIPS	SIGNATURE INSTRUCTOR	BADGE No.

I have received instruction from all Motormen whose names appear above, in the safe operation of a train in service, and have been fully advised as to all signals, speed limits, station stops and general conditions existing on the Elevated Division.

____ *190* *Signature,* ____

Sup't Elevated Division.

I have examined the Student whose name appears above, and am fully satisfied that he is competent to operate a train with safety and according to Rules and Regulations of this Company.

Inspector.

MOTORMAN'S INSTRUCTION BLANK

Market Street Elevated Passenger Railway Co.,

OPERATING DEPARTMENT.

INSTRUCTION BLANK.

CONDUCTOR.

Date, ____ *190*

Conductor ____ *Badge* ____ *Badge* ____ *Badge* ____ *Badge*

Mr. ____ has been assigned to you to be instructed in the duties of Conductor on this Division.

DATE	DIVISION	No. TRIPS	INSTRUCTOR	BADGE	REMARKS

Mr. L. McCOUBRIE,
Sup't Elevated Division.

Dear Sir:—I have instructed Mr. ____ in the duties of Conductor on this Division, and pronounce him to be fully competent to act as such.

(*Badge*)

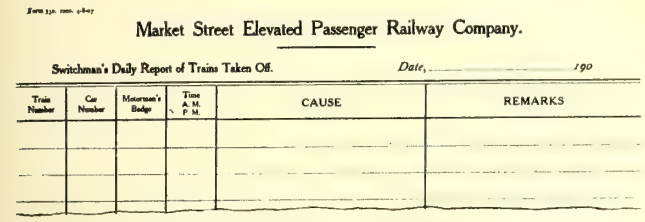
Conductor ____

CONDUCTOR'S INSTRUCTION BLANK

EMPLOYING TRAINMEN

Thus far, all of the trainmen in the elevated service are former employees of the surface division, as the company preferred to begin operation with tried men. Ten hours make up the usual day's work. Applicants for the position of conductor are first taken on as trainmen.

Motormen are instructed for fifteen to eighteen days under different men, after which they are turned over to an inspector, who takes the student to the shops and puts him through a course of trouble-hunting and correction. After a satisfactory number of trials he is turned over to the division superintendent for assignment. Trainmen are also instructed by several conductors before they are turned over to the superintendent.



Market Street Elevated Passenger Railway Company.

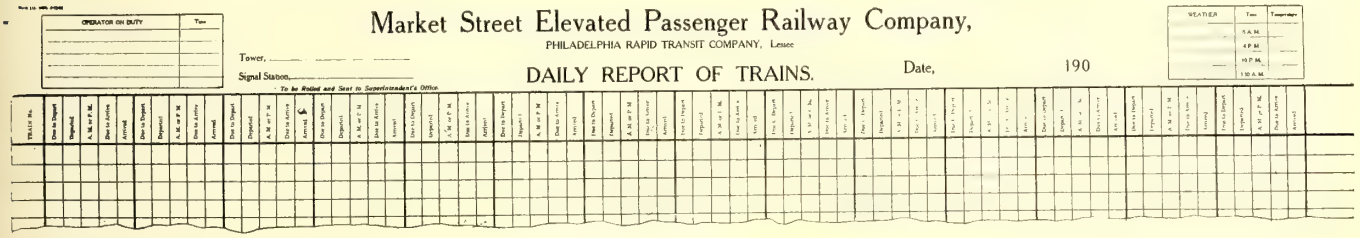
Switchman's Daily Report of Trains Taken Off. Date, ____ 190

Train Number	Car Number	Motorman's Badge	Time A.M. P.M.	CAUSE	REMARKS

YARDMAN'S DAILY REPORT OF TRAINS TAKEN OFF

TRAIN OPERATION

All trains are dispatched from the Sixty-Ninth Street terminal, from which point a daily report is made for the superintendent's office. The dispatcher indicates how many trains were operated during the day, whether of two or three cars and how close they kept to the schedule. At the present time the trip is made in 19 minutes and the headway during rush hours is 4 minutes. There have been no serious delays of any kind ever since opening of the service.



Market Street Elevated Passenger Railway Company,

PHILADELPHIA RAPID TRANSIT COMPANY, Lessee

DAILY REPORT OF TRAINS. Date, 190

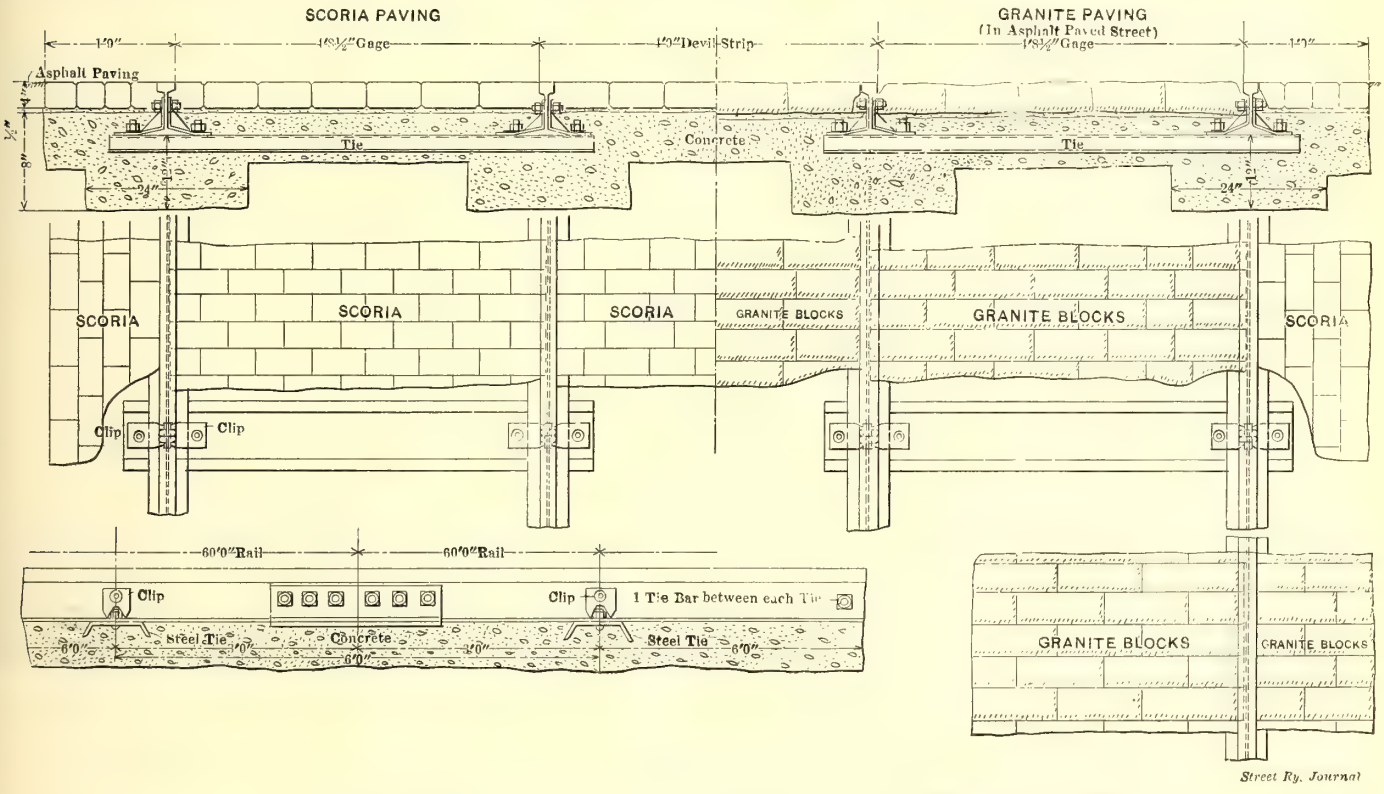
Tower, ____ Signal Station, ____

To be Rolled and Sent to Superintendent's Office.

DISPATCHER'S DAILY REPORT OF TRAINS

MONTREAL TRACK RECONSTRUCTION WITH STEEL TIES

During the last two years the Montreal Street Railway Company has relaid 75 per cent of its city track, replacing 70-lb. grooved rail with 90-lb. T-rail and continuous joints. The accompanying drawing shows the type of track construction with both scoria and granite paving. In both cases steel ties are laid 6-ft. centers in an 8-in. concrete foundation, with one tie-rod between each pair of ties. The concrete is separated from the paving blocks by a ½ in. layer of sand. The cost of this renewal work is about $25,000 per mile, this high cost being ascribed principally to the advance in rails.



TWO TYPES OF STEEL-TIE TRACK CONSTRUCTION ADOPTED IN MONTREAL

As a test of long distance speed endurance Union Pacific motor car No. 12 had made a continuous run from Omaha to Denver in 16 hours 34 minutes. The running time of the regular Denver fast train is 17 hours 15 minutes for 570 miles.

HIGHLAND PARK, YORK, PA.

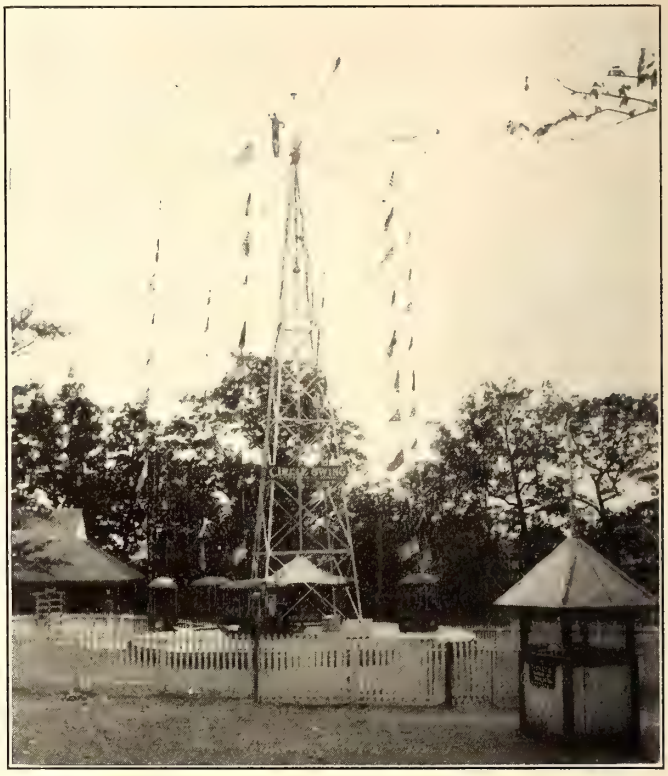
The York Street Railway Company has transformed Highland Park, York, from an obscure wooded hillside to a popular pleasure park, where there is now almost every form of amusement and entertainment. The resort is situated about 2 miles from the center of the city and is reached by either of two trolley lines in about fifteen minutes for a single fare, which includes admission to the park. Thirty thousand



THE RESTAURANT AND LUNCH ROOM

dollars was the outlay in money to effect the change. Highland is a picturesque spot, its natural elements alone making it attractive. Coursing along the edge of the wooded land is the famous old Codorus Creek. This stream traverses the city in the form of an S, and is crossed by a bridge at every street that is extended. It has been taken advantage of by the railway management, which has provided small boats and keepers to look after those who desire to enjoy boating and other water pastimes.

The most important and pretentious attraction is a new theatre, which has a seating capacity of about 1500. This structure is modern in all its details, as shown in the view presented herewith of the stage and the interior of the building. Entertainments are given twice daily, in the



THE CIRCLE SWING, A POPULAR AMUSEMENT DEVICE

afternoon and the evening. The average daily attendance is about 1000. On Saturday evening, however, this is swelled to the number of about 1300 to 1500. The admission charged is 10 and 20 cents for reserved seats. Matinees are held every Wednesday and Saturday afternoon and holidays. The attractions at the theatre include drama, melodrama and comedy, given by a stock company of fourteen



THE ENTRANCE TO THE PARK, SHOWING TROLLEY TERMINUS

people. There is a regular orchestra of eight pieces every evening and piano music during the matinee. The stage is 48 ft. wide, 34 ft. deep and 40 ft. high. All the latest improvements for electrical effects in the hanging of scenery and curtain moving have been installed. The theater is lighted with 500 8-cp, 220-volt lamps and 200 16-cp, 110-volt lamps.



EXTERIOR OF THE THEATER

Among the other attractions are a dancing pavilion, circle swing, merry-go-round, roller coaster and penny arcade. The dancing pavilion is especially popular. It will accommodate about 2000 people. An admission is charged at the door and a numbered tag given so as to identify the dancer. The dancing is continued from 7:30 to 11:30. The admission is 15 cents for gentlemen and 10 cents for ladies.

The skating rink is one of the finest in the vicinity of York. The skater is charged 10 cents for admission and 20 cents for skates. Booths are arranged for the comfort of the skaters, and the stock rooms so placed that skates can be obtained with little or no trouble. In addition, there are cloak rooms, umbrella stands and other checking stations for the accommodation of patrons. A new skating rink is being constructed, however, at a cost of $18,000. This will be 250 ft. long by 75 ft. wide, and will be operated both summer and winter.

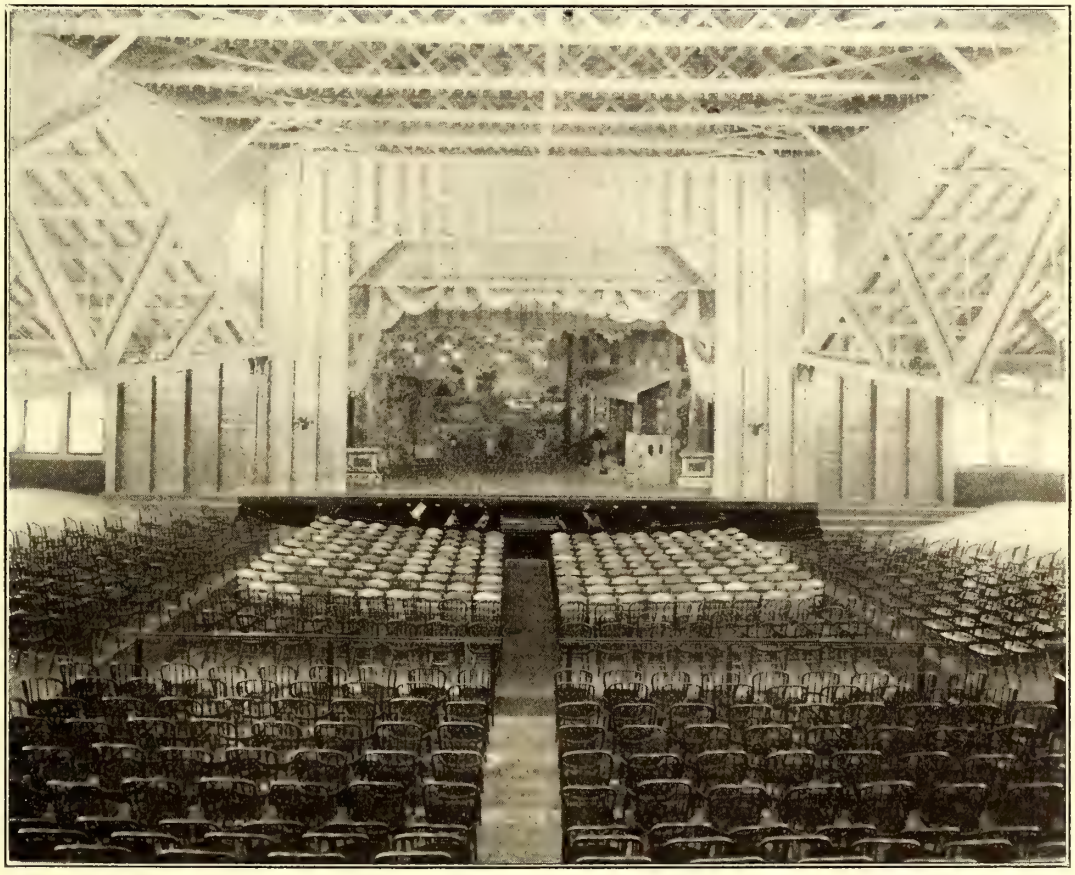
The penny arcade, slot machines and other forms of amusement are rented to individuals who make their own charges and pay to the company a percentage of their daily receipts, thus insuring the company a fixed income from these sources.

A lunch room is located on the grounds not far distant from the theater, and here quick lunch and soft drinks are furnished. About one hundred people can be accommodated at a time. This, too, is a concession, and is awarded to outside interests who are under special obligation to the street railway company.

A picnic grove has been provided and is especially popular, whole families from York and neighboring towns coming to the park time and again to enjoy the freedom of the grounds, and to permit the children to romp through the grove. The only expenditure required in this section was for tables.

The park is lighted at night with approximately 10,000 electric lights furnished by one of the local electric light companies at York, which secures power from the plant of the York Haven Water & Power Company at York Haven.

This is the first season for these various forms of amusement, and although the weather has been unfavorable, the attractions operated by the company have more than met the expectations of David Young, Jr., general manager, and J. E. Wayne, superintendent of the York Street Railway, who are solely in charge of the park, and whose purpose it is to make the park an enticing place of amusement and so convert it into a source of steady revenue to the company. The fact that a single fare only is charged, which includes admission to the park, and that



INTERIOR OF THEATER, SHOWING SEATING ARRANGEMENT AND STAGE SETTING

patrons are not prevented from legitimately enjoying themselves has made the park extremely popular with all classes. Taking into consideration the fact that York is a city of only 35,000, the average daily attendance at the park of 7000 illustrates the popularity of the resort. The Sunday attendance is about 15,000. On holidays the attendance varies between 12,000 and 15,000.



INTERIOR OF PARK, SHOWING ARRANGEMENT OF BUILDINGS

TRACK AND WHEEL BRAKE PRACTICE IN ENGLAND AND GERMANY COMPARED

A recent number of the "Zeitschrift für Kleinbahnen" contained an article by W. Hildebrand discussing the reasons for difference in British and German braking practice, especially the wide use of the track or slipper brake in the United Kingdom, while the wheel brake is preferred in Germany. Mr. Hildebrand groups his arguments under four heads:

(1) The moist British atmosphere and the fine coal dust held in suspension make the rails slippery and so greatly reduce the holding power of the wheel on the rail.

(2) The motor cars in Great Britain are usually of the double-deck type with a high center of gravity. Consequently during braking the load on the rear axles or truck is greatly reduced and the wheels slide unless the braking weight to be cared for by the wheel brake is very low from the start.

(3) Trailers are not used in England, so track brakes are more easily manipulated; moreover their high cost is confined to one car only in place of a train as in Germany.

(4) The English Board of Trade rules make the use of a track brake compulsory, the traction managers being obliged to use some brake of that type. Among them the Westinghouse-Newell track brake, which is also a wheel brake, appears to have many advantages. Nevertheless it is noteworthy that the simple track brake in which the shoes are pressed against the rails to relieve the wheels is still extensively used in England although long discarded by German engineers.

Even in England, track brakes are used mainly for emergencies, apparently because they operate with too much shock to passengers and cars to be used for ordinary braking. The use of two independent sets of brakes cannot be considered advisable as too much reliance is placed on the motorman's presence of mind in emergencies.

In this connection the question of automatic track sanding is of importance, particularly to prevent the wheels from sliding when maximum braking pressure is applied. The sliding of the wheels so greatly diminishes the effective braking power that many accidents are due to it. It is a striking fact that this sliding depends upon the abruptness of the application of braking power. This accounts for the fewer flat wheels under air-brake operation, because the air pressure requires an appreciable period to attain the maximum and in this respect air is superior to electric braking.

NEW POWER EQUIPMENT FOR HARTFORD

The Consolidated Railway Company, of Connecticut, has just decided upon an important extension to its power station in Hartford. A new intake tunnel 200 ft. long will be built to the Connecticut River, new apparatus will be installed and a water-side coal pocket erected. The new generating apparatus will include turbines and alternators aggregating 750 kw. The alternating current will be used for the new Rockline-Hartford service soon to be begun, but until the new machines are ready, the Hartford Electric Light Company will supply power for this line from its plant at Dutch Point. The sub-stations for the line are all in, and as previously stated, the service is about ready to be started.

The "Tri-State Tourist" publishes the following schedule of the trip by trolley from Scollay Square, Boston, to Portland, Me., recently made possible by the opening of the Atlantic Shore Line's extension, which shows the entire route with the miles, fare, running time and changing points:

To	Miles	Fare	Time
*Salem	14½	$ .20	1:15
*Beverly	16½	.25	1:35
Ipswich Junction	23½	.35	2:07
*Newburyport	43½	.55	3:39
Salisbury	46	.60	3:54
*Hampton Beach	55	.70	4:39
Little Boar's Head	59	.80	4:59
Rye Beach	60	.80	5:04
Rye Centre	63	.85	5:24
*Portsmouth	69	.90	5:54
*Kittery	70	.95	6:04
*York Beach	85	1.15	7:24
Ogunquit	90½	1.30	7:54
*Kennebunk	101	1.55	8:24
*Town House		1.60	
*Kennebunkport		1.65	8:46
*Biddeford	113	1.70	9:09
Old Orchard	119	1.80	9:54
Portland	133	2.00	10:54

*Change cars at these points.

REPORTING BAD ORDER CARS AT NASHVILLE

As a result of misunderstandings concerning the reports of defective cars, the Nashville Railway & Light Company has adopted a double-car tag. The tags, which are of heavy manila, are joined by perforations. One tag is filled out by the motorman or conductor when the car is turned in for

Form 276.

NASHVILLE RAILWAY & LIGHT CO.

CAR TAG No. 12350

CAR No. _____

Arrived at Car Barn _____ M.

Date _____ 190__

The following Repairs were completed _____ M.

Date _____ 190__

_____

_____

_____

_____

_____

Signed _____

Nature of trouble reported by _____

was as follows _____

_____

_____

Car No. _____ is repaired as stated above and ready for service.

Signed _____

Barn Foreman.

NASHVILLE RAILWAY & LIGHT CO.

CAR TAG No. 12350

LINE _____

CAR No. _____

Time reported _____ M. _____ 190__

Nature of trouble reported _____

_____

_____

_____

_____

Reported by _____

Received by _____

How reported _____ Telephone _____

Written _____ Verbal _____

Reported by _____ MOTORMAN CONDUCTOR

CAR-TROUBLE TAGS. THE ONE ON THE RIGHT IS MADE OUT BY CARMEN, AND THE ONE ON THE LEFT BY THE SHOP FOREMAN AFTER REPAIRS

repairs and both are attached to the car. The blanks on the other card are filled in when the repairs are completed. The car house foreman completes the report by declaring the car ready for service over his signature.

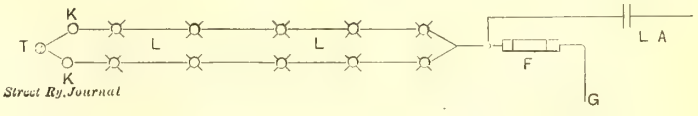
Bad order cars are also kept track of on a special blank kept in the dispatcher's office. This report is kept largely to assure of a car being reported to the car house foreman and taken off the line as soon as possible after it has been reported in bad order to the dispatcher. The car number, time reported to the dispatcher and to the car house foreman, the time the car is due at the transfer station and when taken off the line, together with the nature of the trouble, are reported. The report is made out in duplicate, one copy going to the car house foreman and the other is sent to the superintendent of transportation.

A PARTIAL CHECK ON LIGHTNING ARRESTER OPERATION

BY JOHN HOBBS

One of the best indications of a lightning arrester having worked is to find it "all blowed up." In some arresters successive lightning discharges melt fuses, which are arranged to come into action one after the other as they may be needed, but if there are more discharges than fuses it is possible that they may all go in a single storm. The following plan is tentatively proposed as a method of having ordinary arresters indicate their operation:

In the diagram L, L are two car lamp circuits protected by the usual combination switches and fuses K, K', respectively. These two lamp circuits have a common ground wire leading to a 3-amp. fuse F, which is grounded at G. The lightning arrester ground wire, which ordinarily connects to the ground direct, is connected to the positive side of this fuse. Normally the current of the lamp circuit is insufficient to melt fuse F; as the lightning arrester circuit is normally open, F is simply part of the arrester ground wire. However, if the operation of the arrester and its subsequent after current amounts to 3 amps. or more, fuse F will melt, thereby extinguishing lamps L and L. It will then be necessary to replace the fuse and thereby requalify the arrester circuit before the lamps will burn. It is, of course, possible that the arrester might operate to extinguish the arc before the current reached a value sufficient to melt fuse F, and there would then be no record of arrester operation. The limits between which this condition could obtain would be minimized by making the fusing value of F as small as possible—utilize one lamp circuit and make fuse F of as nearly 1 amp. capacity as possible. F would be placed in an accessible position and the conductor would be instructed in regard to reporting any cases of operation of the fuse.



LAMP AND FUSE CIRCUIT TO TEST LIGHTNING ARRESTERS

NASHVILLE RAILWAY & LIGHT COMPANY.

DISPATCHER'S OFFICE. TROUBLE REPORTS OF CARS.

LINE	CAR NOS.	REPORTED TO DISPATCHER	REPORTED TO BARN FOREMAN	DUE AT TRANSFER STATION	TAKEN OFF LINE	NATURE OF TROUBLE REPORTED
BROAD STREET,		M. M. M.	M. M. M.	M. M. M.	M. M. M.	
BELMONT AVENUE,		M. M. M.	M. M. M.	M. M. M.	M. M. M.	
BUENA VISTA,		M. M. M.	M. M. M.	M. M. M.	M. M. M.	
CEDAR STREET,		M M. M	M. M. M.	M. M. M.	M M M	
FOURTH AVENUE, S.,		M M. M.	M M M.	M. M. M	M. M M	
FATHERLAND STREET,		M. M. M.	M. M. M.	M. M. M.	M M. M	
FIRST STREET,		M. M M.	M. M M.	M M. M.	M M. M	
FAIRFIELD,		M. M. M.	M. M M	M M. M.	M M M	
SIXTH AVENUE, S.,		M M. M.	M. M. M.	M. M M	M M M	
JEFFERSON STREET,		M M M	M M M	M M M	M M M	
JO JOHNSTON AVENUE,		M. M. M.	M. M M.	M. M. M	M. M. M.	
ELEVENTH AVENUE, S.,		M M M	M M M	M M M	M M M	
MERIDIAN STREET,		M M. M	M M M	M M M	M M M	
MAIN STREET,		M M M	M M M.	M. M. M.	M M M	

ASSEMBLY SHEET OF CAR TROUBLES COVERING ALL NASHVILLE LINES

METROPOLITAN RAILWAY ELECTRIC LOCOMOTIVES

Of the ten electric locomotives for passenger and freight service which are being supplied by the British Thomson-Houston Company, Ltd., of Rugby, to the Metropolitan Railway Company, of London, three have been delivered up to date.

These locomotives are of the double-truck type with box-shaped cab, and weigh, in running order, 47 tons. The motors with which they are equipped are of the GE 69 type with one-turn armatures, the gear ratio being 19:64 = 3.36, one motor being mounted on each of the four axles. They are of 200 hp each, and weigh, complete with gearing and gear case approximately 6100 lbs. The control is the Sprague General Electric multiple unit system.

The collector gear consists of twelve shoes arranged as follows: Two positive shoes in parallel on each side of each truck which are supported by oak beams bolted to the journal boxes. There are four negative shoes, one being attached by a suitable insulated bracket to each motor.



END VIEW OF LOCOMOTIVE, SHOWING THIRD AND FOURTH RAILS

The following are the leading dimensions:

	Ft.	Ins.
Gage	4	8½
Length over cab and headstocks	30	
Length over buffers	33	6
Truck base	17	
Wheel base of each truck	7	6
Width over cab	8	¼
Width over side sills	8	
Width overall	8	7
Height from rails to top of cab	12	3⅞
Height from rails to top of floor	4	7½
Diameter of wheels	3	2
Diameter of axles at center and in motor suspension bearings		6½
Diameter of axles at gear-wheel seat		7½
Diameter of axles at wheel seats		7 7/16
Diameter of axles at journals		5½
Length of journal		9

TRUCKS

These are of the pressed steel type strengthened with reinforcing plates, steel angles and gussets: they are fitted with a swinging bolster, built up with steel sections and steel castings. The bolster is supported on two nests of coil springs of circular section, each nest consisting of three springs. The bolster is also provided with cast-steel wearing plates, center and side-bearing plates. The side frames are supported on the axle boxes by laminated springs of heavy design. The axle boxes are of steel castings, machined to work in the pedestals which are also of steel castings and machined, being riveted to the side frames which are cut out to receive them. The side frames are further strengthened at this point by a doubling plate. The axle boxes are provided with removable fronts, each front of which is fitted with an inspection door. The bearings are of anti-friction metal. The axle boxes are provided with lugs at the bottom, to which the collector shoe-beams are attached. Very ample provision is made for lubrication and the exclusion of dust.

The brake gear is of the inside type, one shoe being provided per wheel. The wheels have centers of wrought iron with nine open spokes forged into them and are fitted with rolled steel tires 5 ins. wide by 3¼ ins. deep, held in place by retaining rings, and also by four set screws.

The motors are carried on the transoms by means of cast-steel brackets riveted thereto in which the nose on the motor rests, being held there by a forged strap. The collector shoe-beams are of oak and bolted to the boxes on each side of each truck, the collector shoes being hung inside the wheel base.

UNDERFRAME

This is constructed of steel members of sufficiently heavy section to bring up the locomotives to the weight desired. Each side sill is formed by a channel 12 ins. x 3 ins. x ½ in. section connected together at the ends by end sills of the same section. The underframe bolster is formed by two channels 10 ins. x 3½ ins. x ½ in. section, and between the two bolsters there are two cross sills of channel section 10 ins. x 3 ins. x ⅜ in. Between end sills, bolsters and cross sills there are two longitudinal channels parallel to one another and of 10 ins. x 3 ins. x ⅜ in. section. To strengthen the ends of the frame against buffing strains still

further, there are two struts, diagonally placed, of channel 10 ins. x 3 ins. x ⅜ in. section. The whole frame is firmly riveted together with steel angles and gussets. The top of this main underframe is covered with steel plate ¼ in. thick. Above this is a sub-floor 6 ins. deep, formed by channels, in which is laid the whole of the piping containing the wiring, besides the piping for the brakes. On the top of this sub-floor is a floor of steel plates ¼ in. thick, made in removable sections. At each end at the driving positions and down the center of the locomotive this floor is covered with wooden walking grids ⅞ in. thick. At each end of the underframe are placed buffers and draw hooks with screw coupling of standard English pattern, besides a central automatic coupler, so that the locomotive can be used for hauling either standard coaches or electric stock.

CAB

The cab, which is of the English box-car shape with curved roof, is constructed of steel plates ⅛ in. thick, riveted to supporting vertical and longitudinal angles, which are in turn riveted to the underframe. The upper portion of the cabs on each side between the doorways are fitted with louvres of pressed steel for ventilation. All lines of rivets are covered with neat metal mouldings so as to improve the appearance of the outside of the cab. At each end of the cab there are four movable windows, three being dropping lights, and one hinging inwards. There is also one dropping light at each side in the corners.



INTERIOR OF LOCOMOTIVE

Hinged doors are fitted at each side of the locomotive at the ends, there being two single doors and two double doors. The double doors are for use whenever it is necessary to remove the exhausters, compressors, etc., from inside the cab. All windows are glazed with 3/16-in. glass, the doors being fitted at the bottom with steel frames.

The locomotive is fitted at each end with complete driving equipment consisting of master controller, provided with "deadman's" handle, air and vacuum brake, brake valves, starting switches for fan motors, valves for air-operated whistle and sanding gear, air and vacuum gages and ammeter: also at each end of the cab to the right of the driving equipment is fitted a column to carry the hand brake gear.



SIDE VIEW OF LOCOMOTIVE

The control and brake equipment is, as far as possible, divided into two sets and placed on either side of the locomotive, leaving a gangway down the center. The control itself is entirely divided into two sets, one set for each two motor equipments.

Taking each side of the locomotive the arrangement is as follows:

On one side, switchboard containing the necessary main control and cutout switches, compressor motor switch and main lighting switch, control gear consisting of contactors, resistances and circuit breaker, all mounted on a strong steel frame rigidly connected to the cab sides and underframe. Underneath this is fixed the reverser. The air compressor, main air and vacuum reservoirs being placed in line with the supporting frame.

On the opposite side of the locomotive, looking from the same end are two motor-driven exhaust fans, and the control gear on a framework arranged as above, together with switchboard containing the necessary control switches, etc., with the addition of the main switches for the fans. The auxiliary reservoir for the air brake is fixed in the cab over the fans.

The air brake is of the quick-acting pattern, air being supplied by a B. T. H. electrically-driven compressor of the C. P. 23 type. This set will operate against a pressure of 90 lbs. per square inch, and has a cylinder displacement of 50 cu. ft. per minute.

In connection with the vacuum brake there are provided two exhausters each electrically driven by a B. T. H. type DA motor. One of these exhausters is used for creating the vacuum when starting the train, the other (continuously in operation at half speed), for maintaining the vacuum while running.

In the underframe there are fixed two air-brake cylinders of the vertical type 13 ins. diameter, and two vacuum cylinders 22 ins. diameter. Immediately under the above

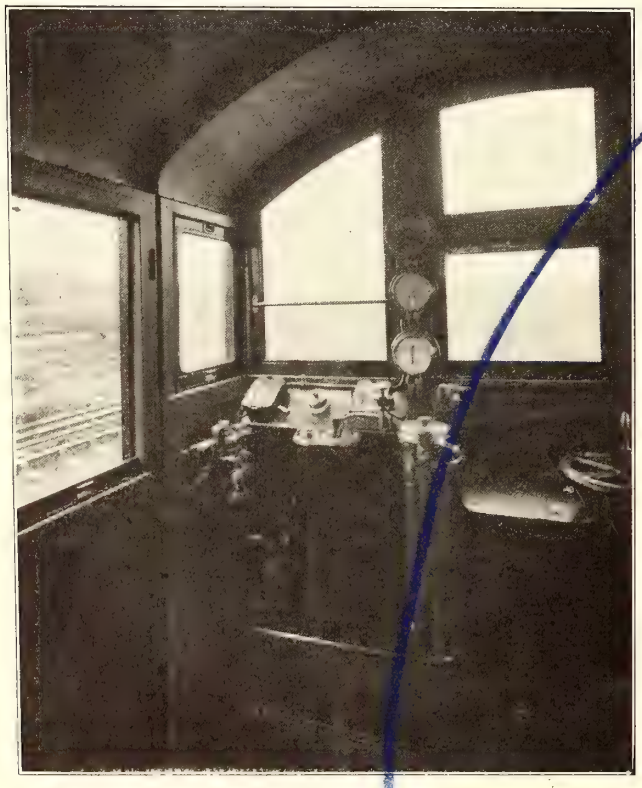
the two transverse rocking shafts to which the pistons of the cylinders are connected, viz: one air and one vacuum to each shaft, each set in turn being connected to the rigging for one truck. It should be noted, however, that the hand-brake wheel at either end of the cab operates the brake rigging on both trucks.

Trip cocks, one for air and one for vacuum, are fitted on each truck.

Power sanding gear is provided, a sand hopper being fitted at each end of the locomotive in the cab, under which is fixed a combined air and sand valve, the sand and air being carried by a flexible pipe to the fixed delivery pipes on the leading end of each bogie.

LIGHTING

Four lighting circuits are provided, one of five lamps placed in the roof down each side of the locomotives, and



MOTORMAN'S CAB

one of five lamps at each end of the locomotive, the distribution of the light in the latter being four lights in the destination indicator and one in the headlight. All the lamps are of 16 cp, and are arranged for working five in series on a 600-volt circuit. Provision is also made at each end of the locomotive for the reception of the necessary oil signal lamps to suit the traffic requirements.

WIRING

All cables are asbestos covered and are run in drawn-steel tubing fitted in the sub-floor wherever possible. The connections between contactors and rheostats are of copper rod. The necessary connection boxes are fitted in the sub-floor and underframe for connecting to the motors and collector shoes.

CAPACITY

Each locomotive when operating on a 600-volt circuit is capable of hauling a 120-ton passenger train on the level at a speed of 35 m. p. h., and of starting with the same load on a grade of 1 in 44, also of hauling a 250-ton goods train up a grade of 1 in 44 and starting with the same load on a grade of 1 in 90.

ELEVENTH ANNUAL MEETING OF GERMAN STREET AND INTERURBAN RAILWAY ASSOCIATION

The eleventh annual meeting of the German Street and Interurban Railway Association (Verein Deutscher Strassenbahn und Kleinbahn-Verwaltungen) was scheduled to be held at Mannheim, Germany, on Sept. 4, 5 and 6. On Wednesday, Sept. 4, Messrs. Stahl and Vellguth were to present a report on the auto-bus and committee B to present suggestions on track specifications and standard rail sections for street and interurban railways. The latest track specifications adopted by the association were published in the Street Railway Journal of Jan. 5, 1907.

On Thursday the association was to discuss means for standardizing the duties and examination of employees of interurban steam railways, and the Prussian State regulations for the public using interurban railways. Committee B also was scheduled to report on corrugation, track crossings and the data on standardization published on page 353 of this issue. It was planned to leave Friday open for the disposition of unfinished business and to entertainment.

STREET AND ELEVATED RAILWAY STATISTICS FOR THE UNITED STATES, CANADA, CUBA AND THE INSULAR POSSESSIONS OF THE UNITED STATES

The accompanying table shows the mileage, number of cars and capitalization of the street, elevated and electric interurban railway companies in the United States and its insular possessions, including Porto Rico, Hawaii and the Philippines; also in Canada (including Newfoundland) and Cuba. The figures are given for the last two years, and are compiled from the last two editions of the Red Book of American Street Railway Investments. The dates of the reports from the different companies as given in the Red Book vary, but practically all of those in the 1907 edition are within the limits of June 30, 1906, and May 1, 1907. The average is believed to be not far from Dec. 30, 1906, so that for this reason the figures given in the table for 1906 may be considered as fairly representing the conditions of the industry at the close of that year.

Where reliable reports could not be obtained of the capital stock and funded debt of the companies, estimates have been made, based upon the known physical property of the separate companies. As the roads not thus reporting were very small, however, both in number and importance, these estimates do not vitally affect the accuracy of the table. More important estimates had to be made of the outstanding stock and funded debt in cases where holding or leased companies owned a portion of the outstanding obligations or capital of sub-operating companies. These estimates were required, as many of the holding companies do not report the proportion of the capitalization of sub-companies controlled by them. In a few cases the inclusion in the 1905 figures of some small steam dummy lines or estimates made in the advance of official figures cause a seeming, but not actual, decrease in the figures of 1906 over those of 1905.

It will be noticed that the cars used in electric railway service in the United States form over 96 per cent of the total number of cars. The greater part of the horse, cable and steam mileage is confined to a few cities, notably, New York, Chicago, Kansas City, San Francisco, Denver, Seattle and Tacoma. The total capital liabilities have increased over 11 per cent during the year in the United States; 61 per cent for the United States insular possessions; 12 per cent for Canada, and 20 per cent for Cuba.

STREET AND ELEVATED RAILWAY MILEAGE, CARS AND CAPITALIZATION IN UNITED STATES AND CANADA.

COMPILED FROM THE STATISTICS OF THE VARIOUS PROPERTIES CONTAINED IN "AMERICAN STREET RAILWAY INVESTMENTS," EDITION OF 1907

STATES.	No. of Ry. Co.	ELECTRIC RAILWAYS.						CABLE, STEAM AND HORSE RAILWAYS.						TOTAL RAILWAYS.				CAPITAL STOCK.			FUNDED DEBT.			CAPITAL LIABILITIES.			STATES.
		TRACK MILEAGE.		MOTOR CARS.		TRAIL AND SERVICE CARS.		TRACK MILEAGE.		GRIP CARS OR LOCOMOTIVES.		TRAIL CARS OR HORSE CARS.		TRACK MILEAGE.		CARS.		TOTAL.		INCREASE FOR YEAR.	TOTAL.		INCREASE FOR YEAR.	TOTAL.		INCREASE FOR YEAR.	
	1906	1905	1906	1905	1906	1905	1906	1905	1906	1905	1906	1905	1906	1905	1906	1905	1906	1905	1906		1905	1906		1905	1906		
New England States.																											**New England States.**
Maine	19	457	474	473	498	247	275	3	3	....	....	6	6	460	477	726	779	$6,614,713	$8,612,981	$1,998,268	$7,770,500	$9,051,500	$1,281,000	$14,385,213	$17,664,481	$3,279,268	Maine
New Hampshire	18	292	296	348	358	74	78	....	....	....	....	....	....	292	296	422	436	7,077,660	7,207,006	129,346	6,296,000	6,637,000	341,000	13,373,660	13,844,006	470,346	New Hampshire
Vermont	10	121	122	121	122	4	21	....	....	....	2	....	....	121	122	125	145	2,365,600	3,721,510	1,355,910	1,533,000	3,293,000	1,760,000	3,898,600	7,014,510	3,115,910	Vermont
Massachusetts	78	2,778	2,810	7,792	7,853	1,219	2,392	....	8	....	....	25	25	2,778	2,818	9,036	10,270	97,386,000	107,638,100	10,252,100	44,950,000	61,374,000	16,424,000	142,336,000	169,012,100	26,676,100	Massachusetts
Rhode Island	13	445	458	956	972	71	149	....	3	....	2	....	....	445	461	1,027	1,123	17,357,100	21,813,000	4,455,900	20,847,957	20,894,700	46,743	38,205,057	42,707,700	4,502,643	Rhode Island
Connecticut	20	687	774	1,443	1,682	265	293	....	....	....	....	....	....	687	774	1,708	1,975	28,934,240	29,107,500	173,260	22,015,492	18,251,593	26,236,101	50,949,732	77,359,093	26,409,361	Connecticut
TOTAL	158	4,780	4,934	11,133	11,485	1,880	3,208	3	14	....	4	31	31	4,783	4,948	13,044	14,728	159,735,313	178,100,097	18,364,784	103,412,949	149,501,793	46,088,844	263,148,262	327,601,890	64,453,628	TOTAL
Eastern States.																											**Eastern States.**
New York	142	3,304	3,385	12,225	12,198	3,867	3,985	119	163	12	22	516	557	3,423	3,548	16,620	16,762	347,156,970	384,114,356	36,957,386	301,480,926	355,906,083	54,425,157	648,637,896	740,020,439	91,382,543	New York
New Jersey	37	1,123	1,198	2,156	2,200	161	200	6	15	2	3	31	23	1,129	1,213	2,350	2,426	89,697,880	105,348,880	15,651,000	80,925,501	94,714,088	13,788,587	170,623,381	200,062,968	29,439,587	New Jersey
Pennsylvania	145	3,469	3,626	7,981	8,084	1,016	1,086	10	10	3	2	....	4	3,479	3,636	9,000	9,176	236,002,144	237,734,120	1,731,976	174,545,800	175,694,797	1,150,997	410,547,944	413,430,917	2,882,973	Pennsylvania
Delaware	6	146	111	263	200	5	10	....	....	....	....	....	....	146	111	268	210	4,970,000	4,924,040	—45,960	7,084,000	6,474,050	—609,950	12,054,000	11,398,090	655,910	Delaware
District of Columbia	7	326	326	1,003	1,063	312	316	....	....	....	24	....	....	326	326	1,315	1,403	33,205,000	33,205,000	....	24,162,100	27,208,439	3,046,339	57,367,100	60,413,439	3,046,339	District of Columbia
Maryland	12	496	538	1,875	1,930	69	173	10	10	6	6	....	....	506	548	1,950	2,109	17,818,000	19,991,400	2,173,400	52,559,000	59,270,000	6,711,000	70,377,000	79,261,400	8,884,400	Maryland
Virginia	25	481	497	633	642	146	180	....	....	....	....	....	1	481	497	779	823	27,473,950	32,407,850	4,933,900	29,856,500	33,078,500	3 222,000	57,330,450	65,486,350	8,155,900	Virginia
West Virginia	15	225	310	335	364	3	31	....	....	....	....	....	....	225	310	338	395	8,453,000	10,775,200	2,322,200	7,904,500	8,232,000	327,500	16,357,500	19,007,200	2,649,700	West Virginia
TOTAL	389	9,570	9,991	26,471	26,681	5,579	5,981	145	198	23	57	547	585	9,715	10,190	32,620	33,304	764,776,944	828,500,846	63,723,902	678,518,327	760,579,957	82,061,630	1,443,295,271	1,589,080,803	145,785,532	TOTAL
Central States.																											**Central States.**
Michigan	41	1,509	1,682	2,052	2,073	236	263	....	....	....	....	....	....	1,509	1,682	2,288	2,336	40,556,000	43,191,000	2,635,000	45,893,000	46,735,500	842,500	86,449,000	89,926,500	3,477,500	Michigan
Ohio	103	3,832	4,495	4,627	4,958	529	778	7	8	....	1	....	14	3,839	4,503	5,156	5,751	184,264,450	208,550,875	24,286,425	115,319,000	120,093,000	4,774,000	299,583,450	328,643,875	29,060,425	Ohio
Indiana	52	1,695	2,008	1,690	1,733	228	266	7	2	3	4	13	42	1,702	2,010	1,934	2,045	55,585,417	70,107,590	14,522,173	52,441,100	59,100,250	6,659,150	108,026,517	129,207,840	21,181,323	Indiana
Kentucky	12	296	337	587	590	285	291	....	2	....	....	....	....	296	339	872	881	17,890,900	20,128,050	2,237,150	11,680,300	13,142,000	1,461,700	29,571,200	33,270,050	3,698,850	Kentucky
Wisconsin	21	543	776	819	821	63	120	....	....	....	....	....	....	543	776	882	941	21,518,300	25,176,200	3,657,900	19,928,000	24,860,000	4,932,000	41,446,300	50,036,200	8,589,900	Wisconsin
Illinois	62	2,293	2,806	4,783	5,595	2,029	1,625	94	24	367	10	1,095	683	2,387	2,830	8,274	7,913	180,654,200	181,960 200	1,306,000	119,072,000	126,095,000	7,023,000	299,726,200	308,055,200	8,329,000	Illinois
Minnesota	7	413	538	844	1,031	366	184	....	....	....	....	....	....	413	538	1,210	1,215	26,453 000	29,955,000	3,502,000	19,554,000	21,071 000	1,517,000	46,007,000	51,026,000	5,019,000	Minnesota
Iowa	29	578	752	794	877	141	178	2	50	5	3	....	40	580	802	940	1,098	17,507,000	31,700,000	14,193,000	11,193,000	15 951,000	4,758,000	28,700,000	47,651,000	18,951,000	Iowa
Missouri	23	1,097	1,129	2,530	2,220	154	438	9	3	56	28	120	200	1,106	1,132	2,860	2,886	77,049,500	85,462,000	8,412,500	90,022,000	97,632,000	7,610,000	167,071,500	183,094,000	16,022,500	Missouri
TOTAL	350	12,256	14 523	18,726	19,898	4,031	4,143	119	89	431	46	1,228	979	12,375	14,612	24,416	25,066	621,478,767	696,230,915	74,752,148	485,102,400	524,679,750	39,577,350	1,106,581,167	1 220,910,665	114,329,498	TOTAL
Southern States.																											**Southern States**
North Carolina	11	94	107	151	168	8	22	....	8	....	....	3	3	94	115	162	193	2,577,100	2,593,500	16,400	2,762,250	3,138,000	375,750	5,339,350	5,731,500	392,150	North Carolina
South Carolina	8	129	133	132	134	16	24	5	5	....	....	10	10	134	138	158	168	2,848,000	3,893,000	1,045,000	5,180,000	5,493,000	313,000	8,028,000	9,386,000	1,358,000	South Carolina
Georgia	13	364	364	469	475	82	88	7	7	....	....	7	13	371	371	558	576	20 229,894	20,904,894	675 000	18,322,000	18,903,500	581,500	38,551,894	39,808,394	1,256,500	Georgia
Florida	12	101	168	111	137	22	40	13	13	....	3	4	11	114	181	137	191	2 666,000	4,271,000	1,605,000	1,958,000	2,304,000	346,000	4,624,000	6,575,000	1,951,000	Florida
Alabama	10	246	263	334	379	128	103	9	11	3	3	10	10	255	274	475	495	10,256,700	11 340,900	1,074,200	11,821,000	13,336,000	1,515,000	22,077,700	24,666,900	2,589,200	Alabama
Mississippi	9	55	79	106	113	7	16	....	....	....	....	....	....	55	79	113	129	2,527,700	3,486,400	958,700	2,533,000	3,119,000	586,000	5,060,700	6,605,400	1,544,700	Mississippi
Tennessee	11	309	337	507	620	127	115	6	....	15	....	....	....	315	337	649	735	14,543,500	18,085,500	3,542,000	11,357,500	19,681,500	8,324,000	25,901,000	37,767,000	11,866,000	Tennessee
Louisiana	9	229	243	701	663	4	54	5	4	....	....	4	4	234	247	709	721	36,856,500	32,805,000	—4,051 500	31,389,000	28,508,000	—2,881,000	68,245,500	61,313,000	—6,932,500	Louisiana
Arkansas	9	100	120	177	180	41	40	....	....	....	....	....	....	100	120	218	220	5,212,900	5,333,400	120,500	3,546,500	4,702,500	1,156,000	8,759,400	10,035,900	1,276,500	Arkansas
TOTAL	92	1,627	1,814	2,688	2,869	435	502	45	48	18	6	38	51	1,672	1,862	3,179	3,428	97,718,294	102,703,594	4,985,300	88,869,250	99,185,500	10,316,250	186,587,544	201,889,094	15,301,550	TOTAL
Western States.																											**Western States.**
North Dakota	2	12	16	32	35	....	5	....	....	....	....	....	....	12	16	32	40	350,000	350,000	.....	300,000	300,000	.....	650,000	650,000	.....	North Dakota
South Dakota	1	39	4	30	3	2	2	....	....	....	....	....	....	39	4	32	5	50,000	50,000	.....	.....	.....	.....	50,000	50,000	.....	South Dakota
Nebraska	9	255	271	357	434	86	50	13	11	....	....	16	12	268	282	459	496	10,592,500	10,832,500	240,000	8,375,000	8,425,000	50,000	18,967,500	19,257,500	290,000	Nebraska
Nevada	1	5	5	5	5	....	....	....	....	....	....	....	....	5	5	5	5	100,000	100,000	.....	300,000	300,000	.....	400,000	400,000	....	Nevada
Kansas	18	182	268	127	186	64	54	10	13	....	....	26	20	192	281	217	260	3,615,000	7,200,000	3,585,000	2,578,000	5,915,000	3,337,000	6,193,000	13,115,000	6,922,000	Kansas
Indian Territory	2	27	34	30	30	....	....	....	....	....	....	....	....	27	34	30	30	600,000	700,000	100,000	608,000	650,000	42,000	1,208,000	1,350,000	142,000	Indian Territory
Oklahoma	7	150	175	43	65	3	22	....	....	....	....	....	....	150	175	46	87	1,500,000	2,300,000	800,000	750,000	1,150,000	400,000	2,250,000	3,450,000	1,200,000	Oklahoma
Texas	24	446	532	663	672	66	80	8	10	....	....	12	20	454	542	741	772	15,966,305	22,507,500	6,541,195	16,277,000	15,892,000	—385,000	32,243,305	38,399,500	6,156,195	Texas
Colorado	13	334	350	386	387	192	238	57	73	15	15	62	66	391	423	655	706	19,312,000	19,369,100	57,100	20,538,000	20,737,000	199,000	39,850,000	40,106,100	256,100	Colorado
Montana	6	74	75	81	107	25	26	....	....	....	....	....	....	74	75	106	133	2,455,613	2,725,613	270,000	1,500,000	1,645,000	145,000	3,955,613	4,370 613	415,000	Montana
New Mexico	2	19	19	12	14	3	3	....	....	....	....	....	....	19	19	15	17	350,000	350,000	....	350,000	350,000	.....	700,000	700,000	.....	New Mexico
Idaho	4	94	166	15	36	9	9	21	21	2	2	....	70	115	187	26	117	588,400	598,400	10,000	640,000	670,000	30,000	1,228,400	1,268,400	40,000	Idaho
Utah	4	104	160	143	187	7	13	....	8	3	3	....	....	104	168	153	203	10,150,000	7,712,500	—2,437 500	7,293,000	8,840,000	1,547,000	17,443,000	16,552,500	—890,500	Utah
Washington	17	461	715	406	587	269	381	21	21	66	73	....	308	482	736	741	1,349	25,850,400	28,674 310	2,823,910	15,620,000	16,473,000	844,000	41,479,400	45,147,310	3,667,910	Washington
Oregon	11	228	299	307	309	197	198	7	4	4	2	4	4	235	303	512	513	9,035,000	21,830,000	12,795,000	12,345,000	20,156,000	7,811,000	21,380,000	41,986,000	20,606,000	Oregon
California	50	1,840	1,829	1,726	2,194	204	527	174	203	522	499	243	224	2,014	2,032	2,695	3,444	100,003,500	108 513,500	8,510,000	80,886,000	89,819,000	8,933,000	180,889,500	198,332,500	17,443,000	California
Arizona	4	14	32	10	22	7	....	10	6	....	....	10	7	24	38	27	29	337,100	600,000	262,900	100,000	100,000	.....	437,100	700,000	262,900	Arizona
TOTAL	175	4,284	4,945	4,373	5,273	1,134	1,608	321	370	612	594	373	731	4,605	5,320	6,492	8,206	200,855,818	234,413,423	33,557,605	168,469,000	191,422 000	22,953,000	369,324,818	425,835,423	56,510,605	TOTAL
United States	1,164	32,517	36,212	63,391	66,206	13,059	15,442	633	719	1,084	707	2,217	2,377	33,150	36,932	79,751	84,732	1,844,565,136	2,039,948,875	195,383,739	1,524,371,926	1,725,369,000	200,997,074	3,368,937,062	3,765,317,875	396,380,813	**United States**
Insular Possessions of U. S.—Hawaii, Porto Rico and Philippines	10	87	119	166	2 6	12	30	3	62	....	12	14	137	90	181	192	385	3,391,500	3,871,000	479,500	2,033,000	5,050,000	3,017,000	5,424,500	8,921,000	3,496,500	Insular Possessions of U. S.—Hawaii, Porto Rico and Philippines
Canada, including Newfoundland	48	901	1,073	2,506	2,554	136	280	55	77	5	3	50	83	956	1,150	2,697	2,920	42,935,636	49,423,146	6,487,510	30,906,597	33,732,525	2,825,928	73,842,233	83,155,671	9,313,438	Canada, including Newfoundland
Cuba	3	175	187	195	225	....	460	.. .	....	10	5	....	....	175	187	205	690	18,750,000	22,162,500	3,412,500	14.800,000	18,311,561	3,511,561	33,550,000	40,474,061	6,924.061	Cuba

REPORT OF THE GERMAN STREET AND INTERURBAN RAILWAY ASSOCIATION'S COMMITTEE ON STANDARDIZATION

The subject of the standardization of wheels, axles, journals, brake-shoes and rails, which is now occupying the attention of the American Street & Interurban Railway Engineering Association, is also being actively taken up by committee B (on way and rolling stock) of the Verein Deutscher Strassenbahn und Kleinbahn Verwaltungen. This association corresponds both in name and purpose to the American Street & Interurban Railway Association, and its membership includes the street and interurban railway companies in Germany. The first subject reported upon by the committee was that of rail specifications, and the specifications adopted were published on page 25 of the STREET RAILWAY JOURNAL for Jan. 5, 1907. The report on rolling stock, including trucks, axles, gears, brake-shoes, etc., has recently been prepared and will be considered at the Manheim Convention on Sept. 4-6. It is based on information secured from a data sheet sent to the member-companies on March 1, 1906, and is presented in abstract below:

STATEMENT OF CONDITIONS

The street railway lines in Germany reporting to the committee vary in length from 2.37 and 231 km (1.47 to 143.2 miles); twenty-nine railways are less than 10 km (6.2 miles); twenty-nine are between 10 and 20 km (6.2 and 12.4 miles); twenty-two between 20 and 50 km (12.4 and 31 miles), while the rest are longer. About 10 per cent of the track is on right of way, and the remainder is on city streets or highways where it is subject to use by other vehicles. About 50 per cent of the track operated has no serious grades, 40 per cent grades less than 3 per cent, 7 per cent grades between 3 per cent and 5 per cent, and 3 per cent grades over 5 per cent. Forty-five railways are narrow gage and twenty-five are standard gage. There are also six railways with gages wider than standard. The operating speeds can be grouped into three divisions: city lines, between 6 and 16 km (3.12 and 9.32 miles) an hour; suburban lines, between 11 and 22 km (6.8 and 13.6 miles) an hour, and roads on right of way between 13 and 30 km (8.1 and 18.6 miles) an hour. The average respective speeds under the conditions mentioned are 11.31 km, 14.94 km, and 18.48 km (7.92, 9.34 and 11.5 miles) an hour.

The usual single-track motor cars weigh empty between 6 and 10.5 metric tons (2200 lbs.) each, as shown in the following table:

Railways.	Weight of Car.		
	Total in Metric Tons.	Per Seat (Kg.).	Per Seat (Lbs.).
5	6	206	444
18	7	232	510
28	8	252	554
27	9	260	572
7	10	291	640

It will be seen from the foregoing table that on the average the weight per seat is 250 kg (550 lbs.), and that it increases about 9 per cent for every additional ton in the weight of the car. On single-truck cars weighing between 4 and 8 tons, the average weight per seat is 220 kg (484 lbs.). Ninety-two companies operate single-truck cars exclusively, but fifteen also have double-truck cars. Four of the companies have cars weighing 13 tons, and three have cars weighing 11 and 12 tons empty. In this case the average weight per seat is 293 kg (644 lbs.), or 17 per cent higher than for single-truck cars.

The weight of closed trailers varies between 2 and 6 tons as shown in the following table:

Railways.	Weight of Car.		
	Total in Metric Tons.	Per Seat (Kg.).	Per Seat (Lbs.).
4	2	83	183
24	3	105	231
19	4	120	264
15	5	130	286
11	6	158	348

The average weight per seat in these closed trailers is 124 kg (273 lbs.). Naturally the open trailers are considerably lighter, and their average weight per seat is 93 kg (204 lbs.), or about 25 per cent less than the closed type. Three-ton trailers are used on twenty-one railways, 2-ton cars on thirteen railways, 4-ton cars on eleven railways, and 5-ton cars on eight railways. The weights per seat are respectively 82, 68, 107 and 148 kg (180, 150, 235 and 325 lbs.).

On single-truck motor cars the weight per wheel is between 1.5 and 2.5 tons; on double-truck motor cars, 1.4 to 1.6 tons; on closed trailers, .5 to 1.5 tons, and on open trailers, .5 to 1.5 tons.

As the consumption of power increases with the weight of the car, and the life of the track is influenced largely by the pressure on the wheels, it important to keep the weight of the car down to a minimum. Of course in the case of the motor cars, it is essential that they should be heavy enough to secure proper traction, but much can still be done toward the elimination of unnecessary weight, especially on trailers.

The following averages are given as to the seating capacity of the cars: Single-truck motor cars, 30; double-truck motor cars, 42; single-truck trailers, 32; double-truck trailers, 50. The distance covered by a motor car naturally depends largely on the reserve rolling stock, but the following figures may be of interest. The minimum service per car owned is stated to be 24,000 car-km (14,880 car-miles) per annum, the maximum is 62,800 car-km (38,936 car-miles), and the average 36,000 car-km (22,320 car-miles), which corresponds to about 100 km (62 miles) a day.

AXLES

The section of the report devoted to axles and journal bearings states that the diameter of axles of single-truck cars varies from 80 to 120 mm (3.15 to 4.72 ins.), and reaches 130 mm (5.12 ins.) on double-truck cars. Two railways use axles of 80 mm (3.15 ins.) diameter, nine of 90 mm (3.54 ins.), nine of 95 mm (3.73 ins.), twenty-eight of 100 mm (3.93 ins.), twenty-four of 105 mm (4.13 ins.), forty-one of 110 mm (4.33 ins.), one of 115 mm (4.53 ins.), and four of 120 mm (4.72 ins.). From the foregoing it will be seen that the most common axle diameter is 110 mm (4.33 ins.), and it is worth noting that eight of the operating railways will adopt this diameter in place of smaller axles now used. Railways having many steam railroad crossings do not consider an axle of 110 mm (4.33 ins.) diameter strong enough, and prefer one of 120 mm (4.72 ins.).

The diameter of journals varies from 70 to 100 mm (2.76 to 3.94 ins.). Seventeen railways have journals of 70 mm (2.76 ins.) diameter, fifteen of 75 mm (2.96 ins.), forty-nine of 80 mm (3.15 ins.), two of 85 mm (3.34 ins.), thirteen of 90 mm (3.54 ins.), one of 95 mm (3.73 ins.), and one of 100 mm (3.93 ins.). It will be seen from this that forty-

nine companies consider 80 mm (3.15 ins.) diameter satisfactory. The length of the journal also shows great differences, the length varying from 120 to 280 mm (4.72 to 11 ins.). Twenty-three railways have journals 120 mm to 150 mm (4.72 to 5.89 ins.), two of 160 mm (6.29 ins.), five of 170 mm (6.68 ins.), fifteen of 180 mm (7.08 ins.), two of 190 mm (7.47 ins.), six of 200 mm (7.86 ins.), twenty of 210 mm (8.25 ins.), ten of 220 mm (8. 64 ins.), and nineteen of 230 mm to 280 mm (9.04 to 11 ins.).

The following are recommended as standards to replace the varieties of axles and journals given in the foregoing figures:

Axle Diameter.		Journal Diameter.		Journal Length.	
Mm.	Inches.	Mm.	Inches.	Mm.	Inches.
100	3.93	75	2.96	150	5.89
105	4.13	80	3.15	180	7.08
110	4.33	80	3.15	210	8.25
120	4.72	90	3.54	250	9.84

The journal pressure allowed by most of the railways is given as 20 kg per square cm (285 lbs. per sq. in.).

One of the questions asked was on axle breakage. The companies were requested to give the number of axle breakages in 1903, 1904 and 1905. In 1903 twenty-four railways had 285 breakages; in 1904 thirty-five railways had 324 breakages, and in 1905 forty-one railways had 380 breakages. Relatively, these troubles have decreased, owing to the use of better material and improved methods of mounting the gears. The accidents on fifteen railways are ascribed to weak axles, on seven to crossings with steam railroads, on four to inferior material, while eleven railways think the trouble was caused either by excessive speed over switches or improper construction of the key-way. Five railways had no reasons to offer. The principal material used for the axles is Siemens-Martin steel, but recently six railways have adopted nickel steel. The latest orders placed by twelve companies call for Siemens-Martin steel with a tensile strength of 50 kg to 70 kg per sq. mm (71,115 to 99,561 lbs. per sq. in.), 18 to 20 per cent expansion, and 30 to 40 per cent contraction. Seven railways demand nickel steel having 60 kg to 80 kg per sq. mm (85,338 to 113,784 lbs. per sq. in.), 15 per cent expansion and 45 per cent contraction. Two railways consider "excelsior" steel to be the best for their conditions.

On the whole it is believed that for normal operation the Siemens-Martin steel with a tensile stress of 50 kg to 60 kg per sq. mm (71,115 to 85,338 lbs. per sq. in.) 18 to 22 per cent expansion and 35 to 40 per cent contraction will be satisfactory, but the cross-sections of the axle must not be weakened at the wheel fit or key-way; on the contrary, the axles should be thicker at these points.

JOURNAL BOXES

Seventy-four railways use the ordinary journal boxes, some with fixed and others with loose bearings, but twenty-one railways are using, to some extent, the Corbuly journal box. All railways find the usual box satisfactory on the whole. Of those using the special type mentioned, two have found it unsatisfactory, but the others consider it all right. Lubrication is with either cotton or wool waste, and only five railways use other material.

It is very difficult to come to any definite decision on the question of ball bearings. Only five railways have experimented with them and all finally rejected them, due either to little or no saving in current or excessive cost of maintenance. Roller bearings are being tried by eight railways. On four of these lines good results are reported, on one the bearings broke, and on the other three the experiments are still in progress.

TRUCKS

The wheel base on motor cars varies from 1.4 m to 33.2 m (4.6 ft. to 10.5 ft.), but the latter dimension occurs only on one railway which has no curves under 50 m (164 ft. radius). Of the railways reporting, thirty-four have a wheel base of 1.8 m (5.9 ft.), twenty-five of 1.7 m (5.57 ft.), fourteen of 1.6 m (5.25 ft.), twelve of 1.5 m (4.92 ft.), nine of 2. m (6.56 ft.), one of 2.3 m (7.54 ft.), three of 2.5 m (8.2 ft.), and one of 2.8 m (9.18 ft.). The wheel base of trailers varies between 1.2 to 3,2 m (3.91 to 10.5 ft.). The largest number of railways (twenty-four) use a wheel base for trailers of 1.8 m (5.9 ft.), nineteen of 1.6 m (5.25 ft.), and fifteen of 1.7 m (5.57 ft.). Wheel bases for trailers greater than those mentioned are employed in some cases, and seven railways use wheel bases up to 2.5 m (8.2 ft.).

CURVES

It was considered desirable to learn the radii of curves on the reporting lines, particularly the minimum radii, to determine the relation between the radii of curves and the wheel bases of trucks. On most of the railways the radii range from 10 m to 150 m (32.8 to 492 ft.). Only two lines report a radius of 10 m (32.8 ft.) and of 11 m (36.1 ft.), respectively, while three report 12 m (39.36 ft.), one 12.5 m (41 ft.), four 13 m (424.6 ft.), three 13.5 m (44.3 ft.), two 14 m (46 ft.), and two 14.5 m (47.6 ft.), twenty-six railways report 15 m (49.2 ft.) as the smallest radius. Further, there are fifteen lines with 20 m (65.6 ft.) radius, and only one line each with 40 m to 50 m (131.2 to 164 ft.), and 75 m and 150 m (246 ft. and 492 ft.), respectively. The others run between 15 m and 20 m (49.2 ft. and 65.6 ft.). The question as to the sharpest curve that can be used by a maximum rigid wheel base is answered as follows:

Radius in		Wheel Base in		To What Extent can the Wheel Base be Increased on the Same Curve.
M.	Feet.	M.	Feet.	
13.5	44.3	1.6	5 25	Not at all.
12.	39.36	1.8	5.9	Not at all.
18.	59.	2.48	8.2	Not at all.
15.	49.2	2.	6 56	Not at all.
13.5	44.3	1.8	5.9	Not at all.
18.	59.	2.	6.56	Not at all.
15.	49.2	2.	6 56	Not at all.
15.	49.2	1.7	5 58	Not at all.
12.	39.36	1.7	5.58	To 1.90 m., 6.2 feet.
16.	52.5	2.8	9.18	Not at all.
12.5	41.	1.55	5.1	To 1.70 m., 5.58 feet.
15.	49.2	2.4	7.87	To 2.2 m., 7.22 feet.
15.	49.2	2.5	8.2	Not at all.

From this it will be seen that for 12.5 m (41 ft.) radius, the maximum practicable wheel base is 1.55 m (5.1 ft.), for 13 m (42.6 ft.) radius, 1.6 m (5.25 ft.), from 13.5 m to 15 m (44.3 to 49.2 ft.) 1.8 m, from 16 m to 18 m (52 to 59) radius 2 m (6.56 ft.).

RADIAL TRUCKS

It is impossible to give any definite decision regarding radial truck. Eleven companies have installed such trucks under motor cars, and eight are satisfied with the result. Eleven companies use radial trucks under trailers. The reports in both cases are given in the following tables:

Radial Truck.		Motor Cars.		Opinion
Minimum Radius in		Wheel Base in		
M.	Feet.	M.	Feet.	
20.	65.6	2.8 to 3	9.2 to 9.84	Good.
19.	62.	2.	6.56	Cars swing heavily on curves.
18.	59.	1.8	5.9	Good.
17.	55.8	2.5	8.2	Good.
16.	52.5	2.	6.56	Less quite than rigid axles.
15.	49.2	2.	6.56	Good.
12.5	41.	2.8	9.18	Good.
11.	36.1	2.8	9.18	Nothing special

Radial Truck.		Trail Cars.		Opinion.
Minimum Radius in		Wheel Base in		
M.	Feet.	M.	Feet.	
50	164.	3.5	11.48	In general good results were achieved.
20	65.6	3 to 3.2	9.84 to 10.5	
19	62.	2.	6.56	
18	59.	2.48	8.2	
17	55.8	2.5	8.2	
16	52.5	2.8	9.18	
15	49.2	2.5 to 3	8.2 to 9.84	

On comparing the figures given for radial and rigid trucks it will be seen that with the former it is possible to operate on much sharper curves and that according to eight railways the use of radial axles is more advantageous on the whole.

SINGLE-AXLE RUNNING GEAR

Experiments were made by nine railways with this running gear. Six railways were supplied by the Nürnburger Maschinen-Bauanstalt, and the others by Hermann Böcker and the Herbrand Company. On four of these lines the experiments have not yet been concluded, four others express satisfaction, and only one complains about the insufficient braking resulting with this system.

This type of running gear doubtless has many advantages as the wheel base can be greatly increased, but where the hand brake only is used, too much strain is placed upon the braking levers. Another disadvantage as compared with rigid axle trucks is that the car weight is greatly increased. The system probably is advantageous only for cars with more than twenty seats, and where the ordinary double trucks are not desirable on account of heavy grades.

TRUCK SPRINGS

Double spring suspension is used on practically all of the motor cars; seventy-two companies use this form, and only eighteen confining themselves to single springs. For trail cars, however, double springs have not been widely adopted. Fifty-six railways are still using single springs for their trailers. It is recommended that double springs should be used on all rolling stock. Recently elliptic springs have been given the preference over spiral springs. The failures of springs are usually due to defective material as apparent from the reports of railways, on some of which no breakages occur, while on others they are very frequent.

GEARING

The life of gear wheels is extraordinarily variable and ranges from 10,000 km to 300,000 km (6200 miles to 186,000 miles) for the gears, and 10,000 km (6200 miles) for pinions. It may be of interest to give the various modules of pitch used. Twenty-two railways use a module of 6.5 mm (.255 in.), thirty-eight of 8 mm to 8.5 mm (.31 in. to .33 in.), eleven of 9 mm to 10 mm (.354 in. to .393 in.), and only two have a module of less than 6 mm (.236 in.). It will be seen therefore, that the largest number of systems use a module of 8.5 (.33 in.), which is probably the right one for railways with unfavorable grade and track conditions. However, a smaller module could be used for city railways where the operating conditions are not so unfavorable. It has also been found that a shorter tooth has resulted in a considerable reduction of noise, hence it is recommended that under favorable conditions a module of 6 to 7 be used instead of 8.5. In general the life of the pinion is about one-third that of the gear.

The usual gear ratio varies from 1:3.5 to 1:5.6, and none of the companies is thinking of changing the ratios it has in use. Involute teeth are used by sixty-five railways, and cycloid teeth by twenty-five railways. Naturally the increasing work put upon the gearing by the use of heavier cars and short-circuiting brakes demanded the adoption of better material. It is some time since cast-iron gears were replaced by cast steel, and the former material is now used by only one company. Siemens-Martin steel is generally used for pinions, but five railways are using mild steel also. Case hardening of the pinions has been employed with such success that their life has been doubled, and even tripled. Thirty-six railways are favorably disposed toward this process, but fourteen complain that it results in a greater and unequal wear of the gears.

The life of the gearing may be noted from the following table:

Life of Gears in		Number of Railways.	Life of Pinions in		Number of Railways.
1000 Km.	1000 Miles.		1000 Km.	1000 Miles.	
1- 10	.62- 6.2	3	1- 10	.62- 6.2	13
10- 20	6.2 - 12.4	2	10- 20	6.2 -12.4	14
20- 30	12.4 - 18.6	2	20- 30	12.4 -18.6	11
30- 40	18.6 - 24.8	6	30- 40	18.6 -24 8	7
40- 50	24.8 - 31	3	40- 50	24.8 -31.	5
50- 60	31. - 37.2	2	50- 60	31. -37.2	6
60- 70	37.2 - 43.4	5	60- 70	37.2 -43.4	3
70- 80	43.4 - 49 6	3	70- 80	43.4 -49.6	3
80- 90	49.6 - 55.8	5	80- 90	49.6 -55.8	1
90-100	55.8 - 62.	2	90-100	55.8 -62.	3
100-110	62. - 68.2	1	Over 100	Over 62.	7
110-120	68.2 - 74.4	3			
120-130	74.4 - 80.6	1			
130-140	80.6 - 86.8	3			
140-150	86.8 - 93.	8			
150-200	93. -124.	5			
200-300	124. -186.	5			
Over 300	Over 186.	2			

It is surprising to learn from the foregoing table that the life of the gearing is so short on many lines, and it would seem that this important point does not receive the attention it deserves. Aside from the material and the even wear of the gear and pinion, the length of the armature bearings and the condition in which they are kept must also exercise considerable influence on the gear life. It may be asserted with confidence that the armature bearing on the gear wheel side should not be less than 120 mm (4.72 ins.) in length, and better still, as much as 150 mm (5.89 ins.), while the motor bearings should not be less than 220 mm (8.66 ins.) and, if possible, 250 mm (9.84 ins.). The great wear of most of the gear wheels reported is ascribed to the causes mentioned, and also to the fact that many railways do not use the same quality of material constantly so that they rarely receive exactly the same shapes even though one model is followed. Some systems have found that the life of the gears can be lengthened by recutting the teeth on the gear where the rims are of sufficient depth.

Fifteen railways have been using gear wheels with inter-

changeable rims, but the experiments with them are not looked upon as conclusive. It is believed, however, that this type of gear may find a wider field if the first cost and renewal cost can be reduced. The general impression is that the manufacturer places too great a value on his patent.

MOTOR LUBRICATION

Although lubrication by oil is recognized as superior to grease, most of the railways are still using the latter, as the old motor bearings are not adapted for oil. The conditions in this respect are shown in the following table giving number of companies:

	Grease.	Oil.	Oil and Grease.
Motor bearings	51	18	26
Armature bearings	48	26	21
Journal bearings	8	87	
Gearing	85	10	

MOTOR BEARINGS

The next table gives a résumé of the life of motor and armature bearings, and from this will be seen the close connection between the life of the bearings and the wear of the gearing. In general the life of motor bearings varies between 10,000 and 140,000 km (6200 and 86,800 miles), and of the armature bearings between 1000 and 50,000 km (620 and 31,000 miles).

Life of Motor Bearings in		Number of Railways.	Life of Armature Bearings in		Number of Railways.
1000 Km.	1000 Miles.		1000 Km.	1000 Miles.	
20– 30	12.4–18.6	22	1– 5	.62– 3.1	8
30– 40	18.6–24.8	6	5–10	3.1 – 6.2	15
40– 50	24.8–31.	7	10–20	6.2 –12 4	24
50– 60	31. –37.2	4	20–30	12.4 –18.6	19
60– 70	37.2–43.4	3	30–40	18.6 –24.8	9
70– 80	43.4–49.6	1	40–50	24.8 –31.	5
80– 90	49.6–55.8	2			
90–100	55.8–62.	4			
100–140	62. –86.8	4			

BRAKE-SHOES

The reports on brake-shoes show that gray iron is used on eighty-two railways, cast steel on five railways, an equal mixture of steel and gray iron on two railways, and chilled iron on only one railway. Three systems are using a patent mixture, but do not give results. One company reports that it uses wood and another a combination of gray iron and cast iron with a different amount of combined carbon. Two railways prefer hard, instead of soft, gray iron. Sixty-eight lines are using combined brake-shoes and heads, and twenty-seven employ shoes with interchangeable brake heads. The latter arrangement appears preferable. The life of brake-shoes varies between 400 and 16,000 km (248 and 9920 miles), as shown in the table herewith.

Wear of Brake Shoes.		Number of Railways.
Km.	Miles.	
400– 2000	248–1240	19
2000– 4000	1240–2480	21
4000– 6000	2480–3720	11
6000– 8000	3720–4960	9
8000–10000	4960–6200	6
10000–12000	6200–7440	4
12000–14000	7440–8680	3
14000–16000	8680–9920	4

VIENNA TRAMWAY FIGURES

The management of the Vienna municipal street railway system has just published its annual report for 1906 in a volume comprising eighty-four pages with full details of every department. Included are two maps, one in colors showing the track plan of the system and the other a bird's-eye view of Vienna. From the report it appears that the management is to give an auto-bus service to a suburban point called Kaiser-Ebersdorf as soon as the vehicles arrive. Plans are under way also for transportation of beer from the municipal brewery at Rennersdorf to distributing centers in Vienna.

The system includes 189 km. (117.2 miles) of route and 397 km. (246.1 miles) of track. Part of the system in the center of Vienna, amounting to 29.8 km. (18.5 miles), is of the conduit type. During the year the management constructed 35 km. (21.7 miles) of new track. Of this about 21 km. (13 miles) were furnished with Melaun mitred joints, 9 km. (5.4 miles) with Scheinig & Hoffman bridge joints and the rest angle-plate joints. A considerable portion of the old joints were repaired according to the Melaun method.

White tin tablets bearing instructions to throw the electric brake in circuit have been posted at the tops of all grades of 4 per cent and over to decrease accidents.

The total number of cars was 3928; the average weight per car increased from 12.4 tons to 12.8 tons; the seating capacity from 38.1 to 39.4 and the standing room from 30.3 to 32.

The total number of employees on the Vienna municipal system is 6857. As on many other Continental railway systems, a great deal of attention is given to employees' pensions, as well as sick and death benefits. The time served by the employees of the old private companies is counted toward the retirement period whether or not any money was paid by such individuals into the pension fund during their former period of employment. If anyone has been a member of the pension fund for ten years and is discharged for no fault of his own he is entitled to partake of the benefits as though he had been retired for old age. The office employees are also pensioned. The minimum annual pension for widows has been increased from 400 K ($97) to 800 K ($194), and the maximum pension from 1,800 K ($436.50) to 2,700 K ($654.75).

All apprentices and mechanics in the shops receive a daily bonus of .6 K (14.5 cents) to .8 K (19.4 cents) for night work, and the night employees of the overhead system a bonus of from 1 K (24.25 cents) to 1.6 K (38.75 cents). The instructors in the employees school receive 2 K (48.5 cents) extra a day, and for instructing men in practical operation the conductors and motormen receive 6 K (14.5 cents) additional. The student employees receive 2 K (48.5 cents) a day while learning.

During the year the salaries of petty officers, such as inspectors, were increased 35 to 40 per cent and the schedule arranged so all would have one day off in every seven instead of one-half day as heretofore. The period during which officers of the company receive full salary in case of illness was increased from six months to one year, and for petty officers from two months to four months. All persons who are members of the pension association receive sickness expenses up to 75 per cent of their usual wages from the fifteenth day of their illness and continuing sixty days if necessary. Employees obliged to attend army

manoeuvers received 21,818 K ($5,290.86) in 1906, and 21,761 K ($5,277.04) for other leaves of absence. In premiums 29,060 K ($7,047.05) was given to motormen, 1,896 K ($459.78) to conductors, and 695 K ($168.54) to other employees. For welfare work 1,052,845 K ($255,215) was spent.

The pension institute had 108 men and 128 women. The sick benefit fund averaged a membership of 6472 during the year, or practically all of the regular employees. During the year 51,632 K ($12,520) was paid for employees' accident insurance.

Key numbers and letters are now used instead of the usual car destination signs and are illuminated at night. The schedule speed of the cars has been increased from 10.3 km. (6.4 miles) to 11.8 km. (7.4 miles) an hour, or about 13 per cent. Owing to the greater strain thus put upon the motormen, the number of hours of actual service for them was reduced on most of the lines, and hence the decrease in wages has not been in proportion to the increase in speed. During the year 58,578,379 car-km. (36,315,595 car-miles) were operated, an increase of 11.4 per cent over the preceding year. The increase in motor car-km. operated was 3.5 per cent, and of trailers 25.9 per cent. In all 199,436,291 passengers were carried, making an increase of 9.7 per cent over the preceding year, as compared with 11.4 per cent increase in mileage. During the same year the Vienna City Railway carried 31,147,771, the United Omnibus Company 13,872,118, and the Vienna steam tramways 3,856,381 passengers. The average number of passenger per car-km. was 3.4 (5.4 passengers per car-mile). The receipts from passengers were 28,454,577 K ($6,900,235) or an increase of 9.6 per cent, which is practically the same as the increase in passengers already noted. The average receipts was 48.6 heller per car-km. (19.4 cents per car-mile). The average receipts per passenger was 14.41 heller (3.5 cents). During the year there were 1261 accidents involving personal injuries; 1178 were slight, 83 severe, and 20 fatal. The majority of these accidents was due to passengers jumping on and off cars in motion, resulting in the death of three, and twenty-two severely injured. There were 340 accidents due to crossing tracks. The increase in accidents over the preceding year was between 20 and 25 per cent, and is ascribed partly to the increase in speed, but mainly to the exceptionally bad weather during the year. A large number of cars is equipped with wheel guards, and others are now being furnished with basket-type fenders.

The total income from passengers was 28,454,577 K ($6,900,235), against 25,970,941 K ($6,297,953) in 1905. The operating expense per car-km., excluding the amounts paid for the different branches of welfare work, was 28.3 heller (11.3 cents per car-mile) in 1906, and 29.8 heller (11.9 cents) in 1905. The total operating expenses in 1906 were 59.3 per cent of the income, and 60.3 per cent in 1905, but adding the welfare expenses these figures rise to 63 per cent and 63.1 per cent respectively.

The United Railroads of San Francisco has started the work of placing its feed wires underground, an improvement that will extend to the entire system as soon as the condition of the streets will permit. The underground conduits are laid along a portion of Mission Street, and are now being installed along the east end of Market Street, the part that is being regraded. A trench is excavated along the south track, outside the rails, and the conduit laid in concrete is inserted. A manhole is placed on every block.

HIGH-VOLTAGE DIRECT-CURRENT AND ALTERNATING-CURRENT SYSTEMS FOR INTERURBAN RAILWAYS*

BY W. J. DAVIS, JR.

The magnitude and direction of engineering development in apparatus for the electrical equipment of high-speed interurban railways is well illustrated by a study of the systems adopted by some of the more important lines recently built or now under construction. These systems may be divided into three classes, namely:

1. 600-volt direct current using either overhead trolley or third rail.

2. 1200-volt direct current, overhead trolley.

3. Single-phase alternating current, 3300- or 6600-volt overhead trolley.

As apparatus for the operation of the 1200-volt direct-current system is being manufactured in this country only by one company, the list of roads given below comprises only those using this kind of equipment, and is limited to sales to new roads made during the past year.

The largest installation undertaken during the past year was that of the West Jersey & Seashore Railroad, comprising equipment for 145 miles of single track and 35,600 hp in railway motors. On account of the limited time required for the completion of this installation (six months from date of selecting power house site) it was impossible to furnish apparatus of special type, making the selection of the 600-volt direct-current system obligatory. For this reason the equipment of this road is not included in the following statistics.

	Length of Track.	No. of Cars.	Size Motors.	Total Motor H.P
600 VOLTS DIRECT CURRENT				
Texas Traction Co.	63 miles	15	4 x 75 hp.	4,500
Elmira, Corning & Waverly	15 "	7	4 x 60 "	1,680
Buffalo, Lockport & Rochester	70 "	19	4 x 75 "	5,700
Oregon Railway	40 "	8	4 x 75 "	2,400
	188 miles	49		14,280
1200 VOLTS DIRECT CURRENT				
Central California Traction Co.	16 miles	6	4 x 75 hp.	1,800
Pittsburg, Harmony, New Castle & Butler	63 "	12	4 x 75 "	3,600
Indianapolis & Louisville	41 "	10	4 x 75 "	3,000
Indianapolis, Columbus & Southern	..	3	4 x 75 "	900
San Jose & Santa Clara	9 "	8	4 x 75 "	2,400
	129 miles	39		11,700
SINGLE-PHASE 3300 OR 6600 VOLTS				
Washington, Baltimore & Annapolis	52 miles	25	4 x 125 hp. / 2 x 125 "	11,500
Central Illinois Construction Co.	40 "	10	4 x 75 "	3,000
Anderson (S. C.) Railway	35 "	3	4 x 75 "	900
Richmond & Chesapeake Bay	15 "	4	4 x 125 "	2,000
	142 miles	42		17,400

Total horse power in motors sold, 43,380 of which
600 volt direct current has 33 per cent.
1200 volt direct current has 27 per cent.
Single-phase alternating current has 40 per cent.

It is most interesting to note that two-thirds of the total motor capacity sold consists of 1200-volt direct-current and single-phase alternating-current motors, indicating the eagerness of electric railway builders to take advantage of the reduced cost of construction and equipment, and economies in operation resulting from the use of higher secondary distributing voltages. The magnitude of the possible savings will depend upon the local and service conditions and will vary over a wide range.

Generally speaking, increased voltage at the trolley will be attended with reduction in cost of copper and sub-station apparatus, and by increased cost of car equipments due

* Paper presented at a meeting of the Chicago section of the American Institute of Electrical Engineers, March 26, 1907. For a report of the discussion on this paper, see page 950 of the STREET RAILWAY JOURNAL for June 1.

to the inherently heavier and more expensive character of the motors and control systems. Where the car movement is especially frequent, as in case of rapid transit suburban service in the vicinity of the larger cities, requiring from two to four tracks, the 600-volt direct-current systems will generally prove the cheaper, a result largely due to the lower cost of the motors.

On account of the variable character of the conditions encountered, each problem requires a special investigation before the relative merits of the three systems can be reliably determined, but the following general limitations will be found to hold true.

1. Street railways and elevated roads in cities should unquestionably be equipped with standard 600-volt direct-current apparatus.

2. Suburban lines 10 to 15 miles in length operating cars on frequent headway should be equipped with 600-volt direct-current system.

3. For high-speed interurban railways operating cars 50 ft. or more over all at speeds of 40 m. p. h. or more:

a. The 600-volt direct-current system is the most reliable on account of being most fully developed.

b. The 1200-volt direct-current system is somewhat cheaper in cost than the 600-volt system, but is as yet an untried system.

c. The single-phase alternating-current system will in most cases show material saving in cost over the direct-current systems, and has been developed to a point where it may be considered commercially successful and capable of giving satisfaction in operation, if properly proportioned for the service to be performed.

There are certain conditions which render the alternating-current motor system unduly expensive or impracticable, namely, the enforced use of a frequency greater than 30 cycles, the presence of grades greater than 8 per cent or the necessity of obtaining perfectly balanced three-phase load under all conditions. In such cases, the 1200-volt or the 600-volt direct-current system will prove the most economical, preference being given to the latter, although the cost of installation will be greater.

The single-phase alternating-current and 1200-volt direct-current equipments may both be made to operate satisfactorily on standard 600-volt direct-current systems, and assuming equal reliability, the question becomes one of first cost and economy in operation. The following table will show approximately the relative cost of a typical suburban road with the several systems.

Comparative Cost Per Mile, Single Track.

	Direct Current 600 Volts.	Direct Current 1200 Volts.	Alternating Current 6600 Volts.
Road bed complete, including grading, ballasting, etc	$15,000	$15,000	$15,000
Trolley and feeder installed	3,800	3,000	2,100
Track bonding	600	530	480
Transmission line, installed	1,500	1,500	1,300
Sub-stations, installed	2,200	1,600	600
Power station, installed	2,450	2,450	2,570
Cars and equipment	1,800	1,970	2,300
Telephone	120	120	120
Total	$27,470	$26,170	$24,470
Saving over 600 volts, direct current	.....	1,300	3,000

It is of interest to compare the operating economy of the three systems, eliminating those items which are of equal value in each. The comparison given below is based on coal at $3 per ton; coal consumption, 3.5 lbs. per kw-hour; sub-station attendance, $1,750 per annum; maintenance of car equipments, 0.4 cent per car-mile for 600-volt direct current; 0.5 cent for 1200-volt direct current, and 0.6 cent for alternating current, and fixed charges at 10.5 per cent.

Relative Operating Cost Per Mile Single Track Per Annum

Per Mile of Track, One-Hour Headway.	Direct Current 600 Volts.	Direct Current 1200 Volts.	Alternating Current 6600 Volts.
Car-miles per day	64	64	64
Kilowatt-hours per day at power-house	275	275	245
Cost of coal per annum	470	470	419
Cost of sub-station attendance	175	79	46
Maintenance of motors and control	94	117	140
Total	$739	$366	$605
Saving over 600 volts direct current exclusive of fixed charges	....	73	134
Saving in fixed charges	....	137	315
Total annual saving	....	$210	$449

Another method of comparison is to capitalize the annual saving exclusive of fixed charges. Assuming fifteen years as the average life of equipment and construction work, the present value of the annual saving in operating expenses per mile of track at 5 per cent interest will be:

For the 1200-volt direct-current system..... $756
To which add saving in first cost..... 1,300

Making the total capital value of..... $2,056 = 7.5%
And for the 6600-volt single-phase system..... $1,390
To which add saving in first cost..... 3,000

Making the total capital value of..... $4,390 = 16%

The above comparison is based on service and construction conditions applying to the typical high-speed interurban electric railway, the fundamental assumptions and principal data being as follows:

Length of road, 50 miles or more.

Cars 52 ft. over all, weighing 21 tons without equipment or load, and seating fifty-six passengers.

Car equipment, four 75-hp motors.

Maximum speed on tangent level track, 45 m. p. h.

Schedule speed 24 m. p. h., including stops and slow running through towns.

Headway, maximum service, 0.5 hour.

Frequency of stops, one in 2 miles, interurban.

Average car energy, 85 watt-hours per ton-mile at car.

	Direct Current 600 Volts.	Direct Current 1200 Volts.	Alternating Current 6600 Volts.
Cost of cars equipped	$10,800	$11,800	$13,800
Spacing of sub-stations	10 miles	22 miles	32 miles
Maximum voltage drop, trolley line	25%	25%	10%
Efficiency of system, generator bus-bars to cars	71%	71%	84%
Average efficiency of car equipment	75%	75%	73%
Average power-factor of system	96%	96%	85%

As the 1200-volt direct-current system is still in process of development, a brief description may prove of interest.

The roads which are now being equipped may be divided into three classes: 1. Those which are required to operate on 600-volt direct current at full maximum speed as on the 1200-volt sections; 2, those which are required to operate on 600-volt direct current, but at approximately half maximum speed; and 3, those which operate only on 1200-volt trolley.

The first class requires motors wound for 600-volts, but designed to stand 1200 volts without danger of flashing or injury to the insulation. The motors are connected in four-multiple when run on 600 volts and in two parallel groups of two motors in series when run on the 1200-volt sections.

In the second and third classes the motors may be wound for either 600 or 1200 volts, preference being given to the latter on account of improvement in tractive power at slipping point of the wheels. In order to obtain satisfactory commutation qualities and to prevent tendency to flashing

at the commutator at the high voltages encountered, all motors for the 1200-volt system are provided with a compensating winding in the shape of series-wound auxiliary poles located midway between the magnetizing poles, and so proportioned as to neutralize the armature reaction under all loads. The additional insulation required causes the motors to weigh 15 per cent to 20 per cent more for a given output than 600-volt motors. This additional weight is not due to the inter-pole construction, as on the basis of equal voltages the inter-pole motor will weigh about the same or a little less than the standard railway motor.

The control system is substantially the same as that used on the 600-volt system, with the exception of some slight changes in the insulation of the primary circuits. The secondary circuits are all energized at 600 volts, as are also the car heaters and lights, and for this purpose a small dynamotor is furnished for use when run on 1200 volts, the function being to change the voltage to 600. The capacity of this dynamotor as furnished with quadruple 75-hp equipment is 38 amps., which provides for the lighting, heating, and air-pump circuits for one car, and secondary control-circuit for a train of six cars.

NEW TYPES OF OIL SWITCHES AND CIRCUIT-BREAKERS

The development of the oil switch and circuit breaker has produced what is probably the most valuable addition to high-potential line apparatus made during the last ten years. It is indeed likely that the development of high-tension transmission of power would have been very seriously hampered but for the invention of the oil switch. This use of oil has made it possible to rupture easily and safely circuits carrying heavy currents at high voltage, and, further, to open these circuits under conditions of short circuit. The possibility of opening high-tension circuits under conditions of heavy overload has made possible the development and application of the present system of relays. By means of these relays, used in connection with oil circuit breakers, perfect protection can be secured for the apparatus to which they are applied. The term "switch" is given to those pieces of apparatus in which the contacts are similar to the ordinary switch, and are opened and closed by hand. Apparatus in which the contacts tend to separate and are only held in a closed position by means of triggers and toggles are called "circuit breakers."

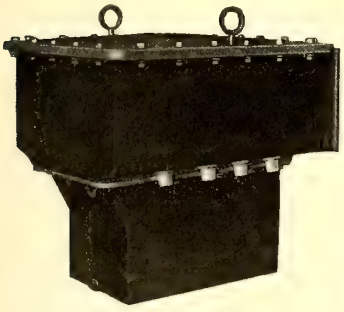


FIG. 1.—EXTERIOR SUBWAY CIRCUIT BREAKER

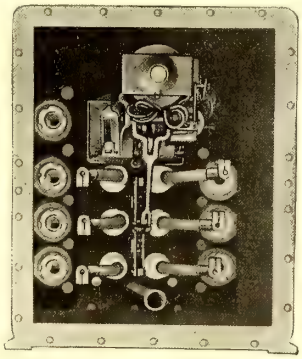


FIG. 2.—TOP OF SUBWAY CIRCUIT BREAKER WITH COVER REMOVED

The accompanying views illustrate several new types brought out recently by the Westinghouse Electric & Manufacturing Company. Fig. 1 and 2 show type F oil circuit breaker for potentials of 1100 to 6600 volts and currents of 200 to 300 amps. It is a single-throw circuit breaker and is adapted for mounting in manholes, the case being of cast iron with water-tight, wiped joints. All parts of the circuit breaker are enclosed within the case, yet are convenient of access. The operating mechanism, line connections, calibration, etc., may be exposed to view by removing the top of the case. The leads connecting to the stationary terminals are shown, also the opening through which the outside connections pass, with an extra one on one side for the leads to the solenoids by which the circuit breaker is electrically operated.

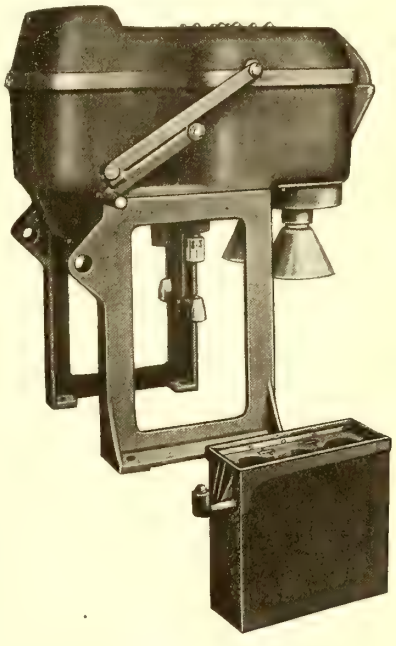


FIG. 3.—EXTERIOR OF BRIDGE CIRCUIT BREAKER

The oil tank of this breaker is bolted to the upper part of the case and can be readily removed to allow an inspection of the contacts. The tank is lined with wood and the contacts have wooden barriers between them. Fresh oil can be poured into the tank, without opening the case, through the tube shown, which extends through the top of the case and is closed by a screw plug.

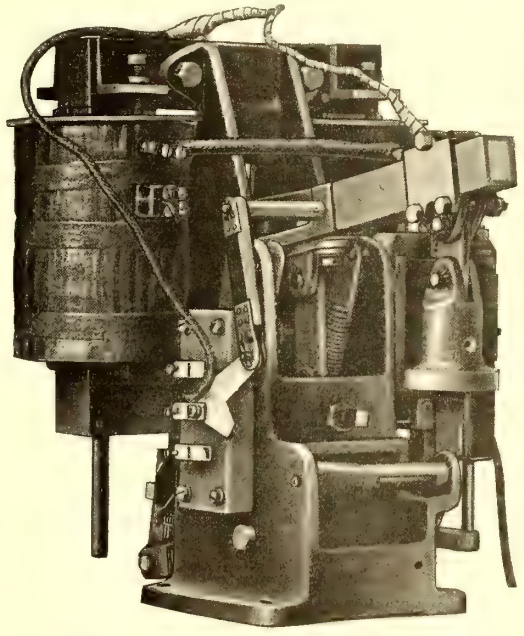


FIG. 4.—INTERIOR OF BRIDGE CIRCUIT BREAKER

Figs. 3 and 4 show a modified type B, which is intended for potentials from 3300 to 22,000 volts and currents from 300 to 1200 amps. This breaker was designed specially for the electrification of the New York, New Haven & Hartford Railway. It is mounted on the bridges which support the catenary line construction, and is therefore entirely enclosed

in a weatherproof case. The upper part of this case contains the tripping and release coils, the current-regulating device and toggle mechanism, and is made of cast iron. The outside leads pass out through the bottom of this part of the case through heavy insulators. The lower part of the case consists of a wood-lined, sheet-metal oil tank, similar to the type B circuit breaker just described.

The bridge type circuit breaker is single-pole, single-throw, and has an automatic overload release mechanism. There are two tripping coils, each energized by a special type of series transformer whose secondary consists of a coil mounted in the case (seen in Fig. 4, just above the line insulator), and whose primary consists of that portion of the outside lead encircled by the secondary coil. This type of circuit breaker is fitted with disconnecting switches, mounted on the cover within the case in such a way that when the cover is raised the breaker is disconnected from the line. The same movement of the cover trips the breaker before the switches are opened, thus preventing arcing on the switch terminals.

CATENARY CONSTRUCTION ON WASHINGTON, BALTIMORE & ANNAPOLIS RAILWAY

Several articles in this paper have described the preliminary work on the Washington, Baltimore & Annapolis single-phase railway now being constructed between those two cities. The work is now far enough advanced to give some details of the overhead line construction, which is of the catenary type. The road is double tracked from Washington to Baltimore, and a pole line is being erected on each side of the right of way carrying side brackets for suspending the trolley wires. The poles are spaced 150 feet apart. The type of bracket used on this section of the line is shown in Fig. 1. These brackets are of T-bar construction 10 ft. 6 ins. in length with 5/8 in. support rod. At the outer end of each bracket is a guide casting, through which is threaded a cable extending across the track between each pair of poles. This cable is extended from each pole obliquely to the ground and there anchored with Miller guy anchors. This gives ample stiffening against lateral vibration. On the single-track branch line extending from Academy Junction to Annapolis a single pole line is used with the type of bracket shown in Fig. 2. These brackets are likewise of T-bar construction and are 11 ft. in length.

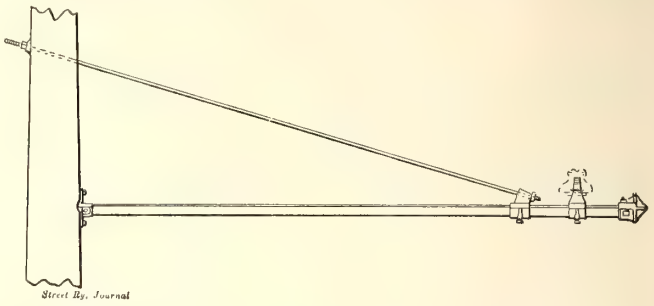


FIG. 2.—BRACKET USED ON SINGLE-TRACK LINE FROM ACADEMY JUNCTION TO ANNAPOLIS

All pole lines are grounded in the following manner: A ground line of 5/16 in. galvanized steel strand is strung along the tops of the poles, and this line is grounded at every fifth pole. On each pole at the back of the pole casting, and in electrical contact with the latter, is mounted a ground plate which is connected by a wire with the ground line carried along the tops of the poles. By this arrangement each bracket is thoroughly grounded. The messenger wire for supporting the trolley is carried on porcelain insulators mounted on malleable-iron pins with Portland cement, the pins being adjustable on the bracket arms.

On curves the poles are spaced closer, as conditions demand. Here the messenger and trolley are guyed to con-

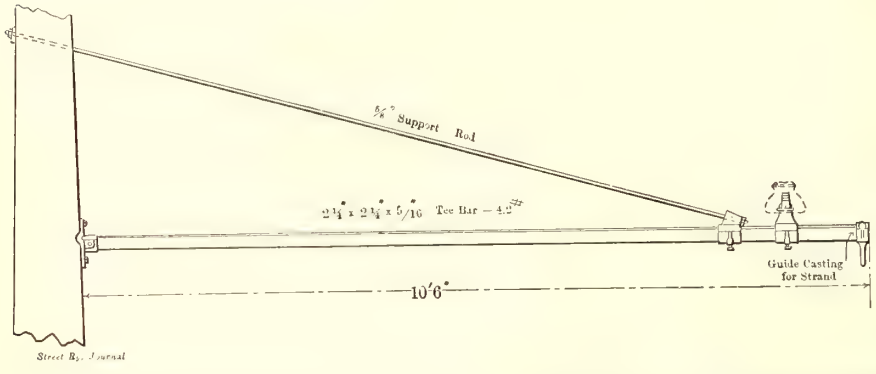


FIG. 1.—BRACKET USED ON DOUBLE-TRACK LINE FROM WASHINGTON TO BALTIMORE

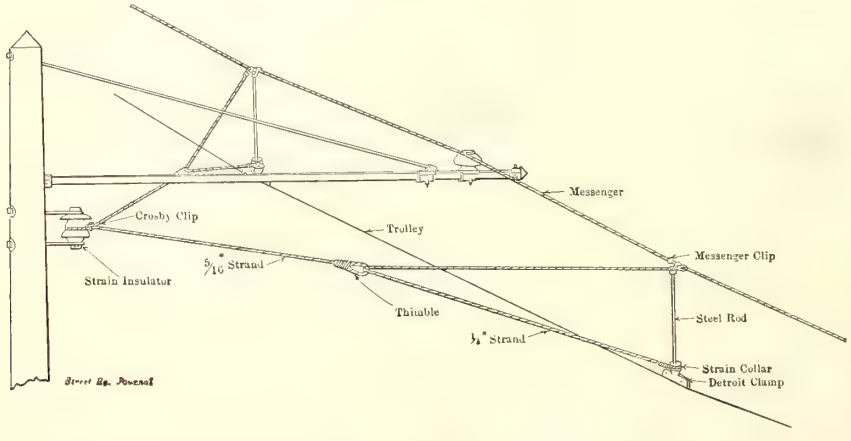


FIG. 3.—SHOWING BRIDLE CONSTRUCTION FOR GUYING TROLLEY WIRE AND MESSENGER ON CURVES

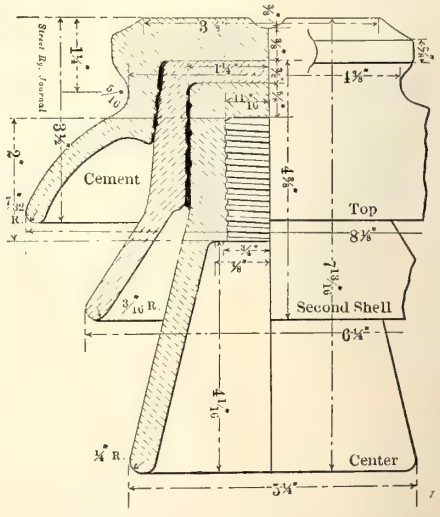


FIG. 5.—33,000-VOLT HIGH-TENSION INSULATOR

form to the curve by wires extending from a porcelain strain insulator, mounted on the pole out to the nearest suspension rod and on each side of the bracket shown in Fig 3. Fig. 4 shows the strain insulator used.

The 33,000-volt insulators for the transmission line, the low-tension insulator for the trolley feeders and the telephone insulators are all mounted on the pole lines supporting the trolley wire. Fig. 5 shows the type of 33,000-volt insulator used. This insulator is of triple petticoat construction, the three members being cemented together. The maximum diameter is 9⅜ ins., and the height over all 7 13/16 ins. The insulators are supported on 9-in. oak pins.

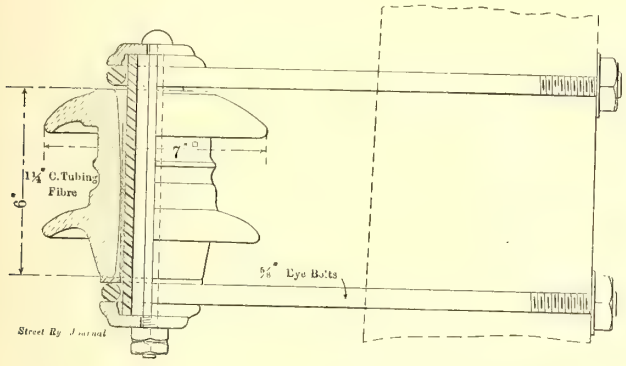


FIG. 4.—STRAIN INSULATOR USED ON CURVES RADIAL GEAR

The material described including the Detroit trolley wire clamps, the Miller guy anchors and other accessories was furnished by the Ohio Brass Foundry.

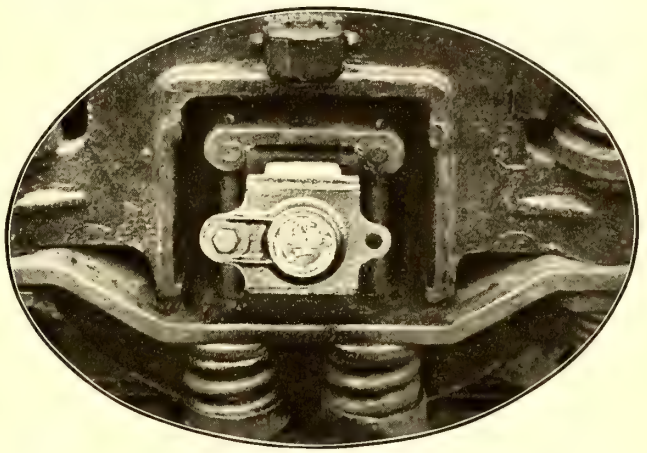
RADIAL OR STEERING AXLE

The accompanying illustration shows a car of the Metropolitan Electric Tramways, of London, equipped with a novel type of radial axles termed a "steering control," owned by the Warner Engineering Company, of London. The explanation given of the action of this steering control on straight track is that a rigid four-wheel truck, with the gage clearance necessary in practice, however equal the wheels or dead parallel the axles, will generally set on the track so that in a few yards it will run hard against the flanges to one side, and when the flange pressure has reached a certain maximum or when a slight kink in the track is encountered, the front wheels of the car are skidded right over to the other side, and in a very short distance the reverse sway occurs. This action can be easily felt when riding in a car, particularly a single-truck car, and is said by some to be a prolific cause of rail corrugation.



CAR OF MIDDLESEX TRAMWAYS EQUIPPED WITH RADIAL GEAR

The second engraving shows the gear for connecting the journal boxes to the main frame of the truck. The links shown on either side of the journal boxes swing at an angle to the main frame, passing through radial slots in the yoke bridge, which is the bar passing under the axle boxes, and connect to knuckle joints concealed inside the journal-box springs. The pins passing through the lower ends of these links are set radially to the king-pin in the center of the car.



RADIAL GEAR

To produce a movement which is the mechanical equivalent of this at the upper end of the links, where the space does not permit of the pins being set radially to the king-pin, pins parallel to the axle are employed, passing through a bridge piece which rocks transversely on the axle box, while at the same time the axle box itself tilts or rotates to and fro upon its journal.

When the car is standing still it can be swayed horizontally several inches by hand, when the peculiar tilting action of these boxes can be distinctly seen.

A NEW AUTOMATIC STOKER

The Sarco Fuel Saving & Engineering Company, of New York, has recently put on the market an automatic stoker for power stations, although the principle used is so different from that of most stokers that the manufacturers prefer to term it a mechanical shovel. In the device a reciprocating ram deposits a measured amount of coal in front of a pendulous shovel 14 ins. wide, the edge of which swings close to the bottom of a curved pan. The shovel is drawn back by a cam and tappet against a strong "spiral" spring to a point of release, at which point it is swung swiftly forward by the spring. This action projects the coal lengthwise of the furnace to a predetermined point on the grate. By simple mechanism a stronger degree of tension is imparted to the spring at each throw, and the coal is thrown to a correspondingly further distance upon the grate. After the maximum throw is reached, the mechan-

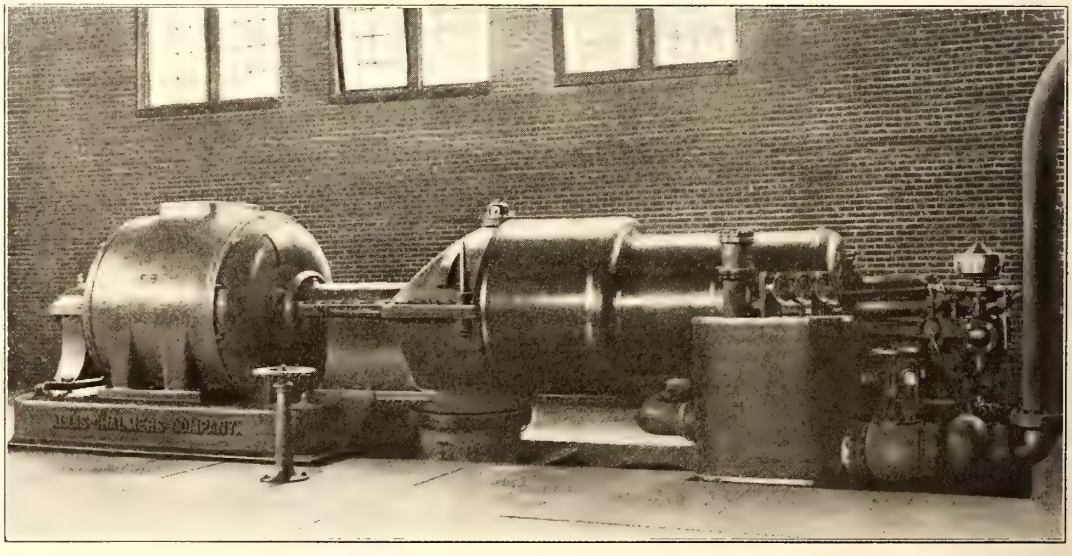
ism returns to the low tension. The change from one to the other is made automatically and with precision. With an allowance of one shovel to about each 3 ft. width of furnace, the result is said to be a very uniform distribution of the coal to all parts of the grate regardless of its length or width. In the device described, the grate and stoker are separate and distinct from each other, so much so that the grates may be supplied by anyone. No change in grates affects the shovel, and the grates may be changed to suit the coal, while the shovel can remain undisturbed.

Among the claims made for the stoker are better distribution of fuel, possibility of using cheap grates and grates of any size, even temperature on grates, flexibility of supply, possibility of using any kind of coal, and of changing at any time to hand firing. Stokers or shovels of this kind are in use by the International Paper Company at its plants at Palmer's Falls, and at Glens Falls, N. Y., and by the Oxford Paper Company, at Rumford Falls, Maine.

TEST OF A 1000-KW. TURBINE AND ALTERNATOR AT THE KOKOMO STATION OF THE KOKOMO, MARION & WESTERN TRACTION COMPANY

An interesting test was recently made of the turbo-generator installed at Kokomo, Ind., in the power house of the Kokomo, Marion & Western Traction Company for the purpose of determining the steam consumption of the turbine when operated under normal load. Through an arrangement with the officers of the Traction Company, Paul Diserens, of Purdue University, working in consultation with Philip H. Palmer, superintendent, represented the Traction Company's interests, and F. C. Purcell represented Allis-Chalmers Company.

The steam turbine is an Allis-Chalmers Parsons standard horizontal turbine. The generator is a standard Allis-Chalmers turbo-alternator, direct-coupled to the steam turbine. The condensing apparatus is of the Allis-Chalmers standard turbo-jet type. The characteristics of the unit are as follows: Rated capacity, 1000 kw; speed, 1300 r. p. m.; frequency, 60-cycle; winding, two-phase; e. m. f., 2300-volt; current per phase (normal), 218 amps. The turbine was built to operate normally with steam pressure of 140 lbs. per square inch gage pressure at turbine throttle, dry saturated, and a vacuum of 23 ins. of mercury, referred to 30 ins. barometer at the exhaust nozzle. The unit is calculated to carry an overload of 50 per cent when operating under the above steam conditions and at 100 per cent power factor. The auxiliary machinery provided consists of a motor-driven exciter, a steam-driven exciter, the jet condenser and pump mentioned above and two small circulating pumps. There are five boilers supplying steam to a loop header. The turbine, two Russell engines and an auxiliary header are supplied from this main header.



1000-KW TURBO-ALTERNATOR THAT WAS TESTED

During the test boilers 3, 4 and 5 were made to supply steam to the turbine being tested. Both sets of boilers were operated at as nearly the same steam pressure as possible. The water delivered to boilers Nos. 3, 4 and 5 was weighed in calibrated barrels. The drip from the steam header and from separators at the Russell engines and at the throttle of the turbine was collected and weighed. At the conclusion boilers 33, 4 and 5 were cut out of service and the entire load of the station was thrown on boilers 1 and 2. With the plant thus operated, enough fire was allowed to remain under boilers Nos. 3, 4 and 5 to maintain a steam pressure equal to that carried by boilers Nos. 1 and 2. The weight of water fed to boilers Nos. 3, 4 and 5 during the test was assumed to establish a rate of leakage and radiation from boilers and piping which would apply to the efficiency test.

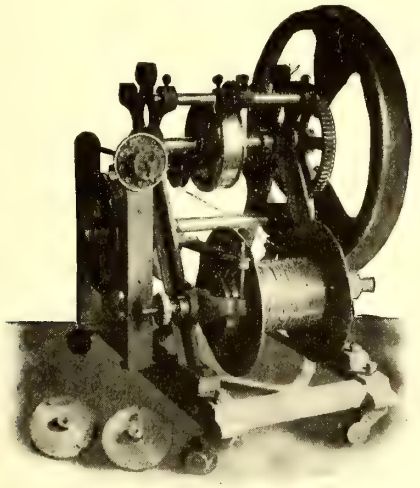
In determining the steam consumed by the turbine, the drip caught at the Russell engines, at the trap in the steam header at the separator at the turbine throttle, and the amount due to leakage and radiation in the boiler, as shown by the leakage test, were subtracted from the water fed to the boilers. This result corrected for the quality of the steam was assumed to equal dry steam supplied to the turbine. The electrical output was measured by carefully calibrated instruments. All the load possible given to the turbine aggregated only a little over half its normal capacity.

Following are the results of the test: Average load, 556.3 kw; per cent of rated load, 55.33 per cent; duration of test, 4 hours; steam pressure at turbine throttle, 136.4 gage; steam pressure at turbine inlet, 61.9 gage; vacuum turbine exhaust, 26.59 ins.; barometer, 28.98; vacuum at turbine referred to 30 ins. barometer, 27.66; revolutions per minute, 1800; total water used, 55,662 lbs.; total drip, 450.6; boiler leakage, 5,344.6 lbs.; moisture in steam by calorimeter, 2.82 per cent; dry steam supplied to turbine per hour 12,115 lbs.; actual consumption of dry steam for kw-hour, 21.90 lbs.

The guaranteed steam consumption for one-half load 28 ins. vacuum was 24 lbs. per kw-hour, and the result of the test showed that the actual steam consumption was 2.1 lbs. less than the guarantee.

A COMBINED TENSION AND BANDING MACHINE

A machine that combines all of the excellent features of the company's tension and banding machines is being offered by the Device Improvement Company, of Hanover, Pa. While the machine, as shown in the accompanying illustration, forms practically a unit, the tension machine may be instantly removed, and the magnet wire tension drum applied and placed in the most suitable position for field and armature coil winding. The machines in this position are always ready for use without any adjustment whatever, and practically no more floor space is occupied than with one machine. The band wire after leaving the tension machine passes under and through the banding machine to the traveling grooved pulley on the front, and thence to the guide pulley for feeding to the armature. The front of the banding machine in this case is entirely unobstructed by the wire, giving the operator perfect freedom. As the machines in this position form a unit, all strain on the lag bolts holding the machine to the floor is eliminated, and there is no jumping or giving of wire under the greatest tension. On the whole, these machines are said to constitute a reliable banding outfit, easy to operate and very fast.



COMBINED TENSION AND BANDING MACHINE

The Lake Shore Electric Railway has begun operating one through car each way between Sandusky and Toledo on a 2-hour schedule. The car leaves Toledo at 7:30 in the morning. Heretofore passengers making the trip through between these cities have been compelled to change cars at Fremont.

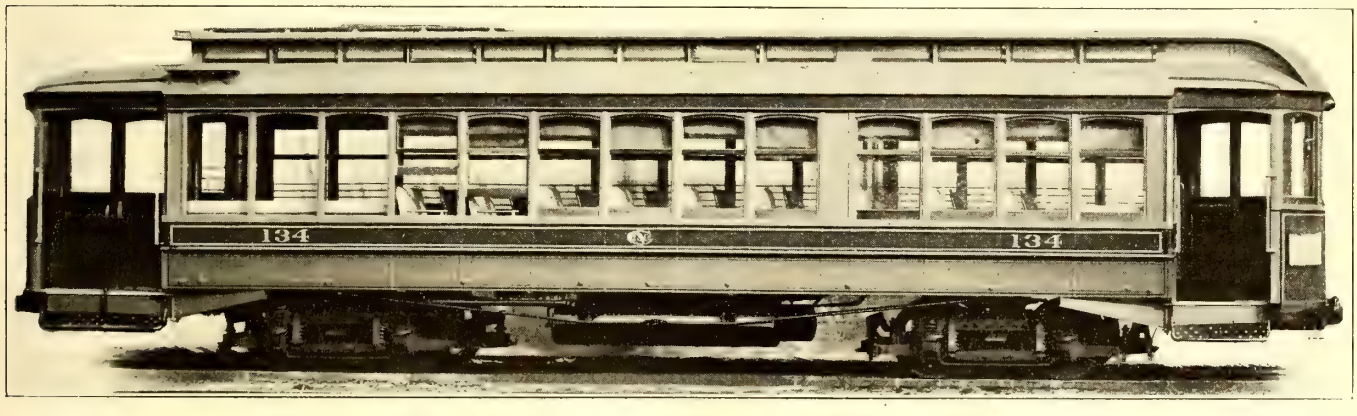
CIRCULAR ON THE OPEN TANK METHOD FOR LUMBER TREATMENT ISSUED BY AGRICULTURAL DEPARTMENT

The United States Department of Agriculture is distributing a circular in which all users of wood will be interested. It is entitled "The Open-Tank Method for the Treatment of Timber," and contains beside the general test, illustrations showing a diagram of an experimental tank used for treating fence posts, diagram of an experimental tank used for treating telephone poles, experimental tank used for treating mine timbers, diagram of a small commercial plant for treating mine timbers, cross-ties, cross-arms, etc. The history of the open-tank method is reviewed, what the method is is explained, the theory of the process is outlined, and the methods employed are all considered. The circular closes with a few words on the application and limitations of the open-tank method and apparatus necessary to apply it successfully.

CHICAGO & SOUTHERN TRACTION COMPANY'S NEW ROLLING STOCK

Extensions on the Chicago & Southern Traction Company have been progressing rapidly. When completed, the system will connect Chicago with Hammond, Chicago Heights, Joliet and Kankakee. There is much pleasure traffic on the lines and the bulk of it is distributed at Calumet Grove, and the parks at Blue Island, Chicago Heights and Kankakee. Fifteen semi-convertible cars supplied by the G. C. Kuhlman Car Company have tended to relieve congestion.

The new cars are of the combination passenger and smoking type and are operated in the one direction only; therefore the entrances are on one side only and steam-coach roof at the front end only. The motorman's compartment is formed by the conjunction of two folding doors, the compartment occupying about one-half the width of the platform. The rear platform is of the familiar "Detroit" type, best calculated to regulate ingress and egress of passengers, and provide extra standing space. A hardwood partition with a swinging door divides the compartments, both of which are equipped with Brill seats with stationary backs and upholstered in spring rattan. Following are the chief dimensions: Length over end panels, 35 ft.; over crown pieces, 8 ft. 6 ins.; over posts at belt, 8 ft. 9½ ins.; size of side sills, 4 ins. x 7¾ ins.; end sills, 5¼ ins. x 6⅞ ins. The trucks are of the Brill No. 27-FE1 type with solid forged side frames; the wheel base is 4 ft. 6 ins.; four motors of 40-hp capacity each are used per car.



COMBINATION CAR FOR CHICAGO & SOUTHERN COMPANY

LEGAL DEPARTMENT*

EMPLOYEES AS PASSENGERS

The recent decision of the Supreme Court of Rhode Island in Enos vs. Rhode Island Suburban Railway Company (67 Atl., 5), takes the sounder and juster view of a question as to which the courts are not in harmony. It was held that a railroad flagman, who received as compensation for services a weekly sum of money and transportation tickets on the railroad to convey him to and from his work, was a passenger while riding home on one of the tickets after his day's work had been completed, and, therefore, was entitled to recover against the company for damages for personal injuries sustained through the negligence of servants of the company who would have been fellow servants of the plaintiff if the latter had been on duty at the time and place of the accident.

This case is clearly distinguishable from such a case as Russell vs. Hudson River Railroad Company (17 N. Y., 134), in which it was decided by the New York Court of Appeals, that a laborer employed by a railroad company to work in connection with a train of cars under an arrangement to be conveyed to his home every night in such cars free of charge, cannot maintain an action against the company for an injury sustained, while thus riding home, in consequence of the negligence of the engineer. This case was correctly decided, and would doubtless be followed by all jurisdictions in which the fellow-servant doctrine is in force, because the laborer was to be conveyed home by the same train on which he worked, and it even appeared that he might be called upon at any time to render services as a brakeman. So, also, some cases and some text-writers have stated the rule broadly, that whenever an employee has been granted and is availing himself of gratuitous carriage, his status as a servant still attaches, precluding his recovery for injuries occasioned by the fault of another employee.

The decision of the Supreme Court of Pennsylvania in O'Donnell vs. Railroad Company (59 Penn., 239), however, is in accord with that of the Supreme Court of Rhode Island (supra). The Pennsylvania Court said in part: "The work of the plaintiff was wholly at the bridge. * * * At the time of the accident he had finished his day's work and was 10 or 12 miles from the bridge on his way home. Under these circumstances the court below instructed the jury that the plaintiff was traveling as a passenger, and not in the capacity of a servant. * * * He was not hired to pursue his business on the train, but was carried in consideration of a reduction in the price of his wages. When his day's work was performed, he was no longer in the service of the company, but was free to go or stay, and when he traveled in effect paid his fare out of his wages." This case was followed by the later one of McNulty vs. Pennsylvania Railroad Company (182 Penn., 479), to the same effect, clearly establishing its principle as the Pennsylvania doctrine. Such doctrine was disapproved by the New York Court of Appeals in Vick vs. N. Y. C. & H. R. R. Co. (95 N. Y., 267).

As above intimated, we consider the position taken by the courts of Pennsylvania and Rhode Island the more logical as well as the more equitable one. Provided some reference be made to the carriage of an employee on cars on which he is not to work, as one of the inducements and elements of the contract of employment, it, of course, would make no difference whether or not he be given and required to use passenger tickets. In either case he may be regarded as having "paid his fare out of his wages." Nor should the courts hesitate to imply from circumstances an engagement for free transportation to and from work as an integral part of the contract of employment. It has been laid down by one court that "the weight of authority and of sound policy, we think, is that where a servant performs all his work at a fixed place, and the master, either by custom or as a gratuity, carries him to and from his work, the servant doing no service for the master on the train, he is to be treated as a passenger." (Transit Company vs. Venable, 105 Tenn., 460, and cases cited), and see also Dickinson vs. West End Railway (177 Mass., 365.).

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CHARTERS, ORDINANCES, FRANCHISES.

CONNECTICUT. — Eminent Domain — Condemnation of Land for Street Railway—Conditions Precedent—Corporations—Meetings of Directors—Validity—Attempted Agreement with Landowner—Evidence—Presumptions—Continuance of Fact—Negotiations for Purchase—Necessity—Evidence—Admissibility—Best and Secondary—Condemnation Proceedings.

1. Gen. St. 1902, Sec. 3681, providing that every railroad company before applying to the commissioners for their approval of the location of its road shall deposit with the State Treasurer a specified sum for each mile of its proposed road, when considered in connection with the facts that it was enacted in 1882 when street railways were operated by horses, and that it was placed in the Revisal of 1892, in the chapter relating to steam railroads, and not referred to in the subsequent chapter relating to street railways, and when considered in connection with sections 3680, 3687 and 3844, authorizing railroad companies to acquire land necessary for the construction of their roads, and authorizing every street railway company to purchase land for its road, and regulating the conditions and methods of exercising the power of eminent domain given to steam railroads, does not apply to a street railway company authorized by its charter to take land in the manner provided for taking land for steam railroads, and it need not deposit with the Treasurer of the State any sum for each mile of its proposed road before it can maintain proceedings to condemn land for its road.

2. Four of the seven directors of a corporation held a meeting pursuant to a call made by the secretary of the board by telephonic communication with them. The other three could not be reached before the meeting, and had no notice of it, but after its close they with the other four signed a waiver of notice. Held, that the action taken at the meeting was valid.

3. In proceedings by a street railway to condemn land for its road, it appeared that the approval of the location of the road by the Commissioners was first asked and given in January, 1907, and that the only attempts made by the company to agree with the owners of the land sought to be taken took place in 1906. Held, that it was immaterial that negotiations with the owners for the purchase of the land were not renewed after the approval of the location of the road.

4. Proof that several years before the trial a person was the treasurer of a domestic corporation which failed to thereafter file any annual statement giving the names of its officers as required by law authorized the inference that he was its treasurer up to the time of the trial.

5. Under Gen. St. 1902, Sec. 3687, providing that, when a railroad company cannot obtain real estate for railroad purposes by agreement with the parties interested, it may apply to any judge for the appointment of appraisers to estimate damages that may arise from the taking of the land, etc., and application by a street railway company to condemn land for its right of way cannot be sustained without proof that the company could not obtain the land by agreement with the owner, and it was not enough to prove that it had negotiated, though in the best of faith, with some one not in fact owning the land or representing the owner.

6. In proceedings by a street railway to condemn land for its right of way, evidence that its agent entered into negotiations with a third person who claimed to represent the corporation owning the land sought to be taken, and had in his possession deeds of the land executed to it and named a price for the land which the company declined to pay, and that the agent received several letters in regard to the matter from a third person, one of which was subscribed by the name of the corporation, followed by the name of the third person, was admissible to show

negotiations with one representing the owner, essential to the maintenance of the proceedings.

7. In proceedings by a street railway to condemn land for its right of way, the court did not err in permitting its agent, who testified that he took a draft contract for the sale of the land sought to be taken, and owned by a foreign realty company, to an individual shown by a statement previously filed by the corporation to be its treasurer, to state that the contract, not produced nor its absence accounted for, was drawn in terms as a contract by the foreign company, though the evidence was not the best evidence, the rule requiring the exclusion of secondary evidence not being inflexibly applied in such proceedings.

8. Where, in proceedings by a street railway to condemn land for a right of way, the evidence showed that its agent had entered into negotiations with a third person who claimed to represent the company owning the land sought to be taken, with a view of purchasing the same, evidence of the tax collector of the town where the land was located that the year before he received from the third person a list of the property owned by the corporation which was liable to taxation was admissible to show that the third person acted for the company. —(Stafford Springs Street Railway Company vs. Middle River Manufacturing Company; Same vs. Eastern Connecticut Realty Company, 66 Atl. Rep., 775.)

IOWA.—Courts—Jurisdiction of Federal Courts—Federal Question—Constitutional Law—Impairment of Contracts—Law of State—Street Railways—Grant of Franchise—Construction of Ordinance.

1. A suit by a street railway company claiming in good faith to have a contract with a city giving it a perpetual right to operate its cars in the streets of the city to enjoin the city from impairing such contract by enforcing an enactment of its Council treating the company as a tresspasser and requiring the removal of its tracks from the streets is a suit arising under the Constitution of the United States of which a Federal Court has jurisdiction regardless of the citizenship of the parties.

2. A resolution of a City Council directing the removal from the streets of the tracks of a street railway company is a law of the State, within the meaning of the contract clause of the Federal Constitution, where under the State law the resolution is as effective for the intended purpose as an ordinance would be.

3. That a State Constitution contains a provision prohibiting the passage of any law impairing the obligation of contracts does not deprive the litigant of the right to invoke the similar provision of the Federal Constitution in a suit which involves the question of its violation.

4. In 1866 the city of Des Moines passed an ordinance granting to a street railway company and its successors and assigns the right to lay tracks in any of the streets of the city, and to "operate thereon cars in the manner and for the time and upon the conditions hereinafter mentioned and prescribed." A subsequent section provided that the right granted "shall be exclusive for the term of thirty years," and that the city should not, "until after the expiration of said term, grant to or confer upon any person or corporation any privileges which will impair or destroy the rights and privileges herein granted to said company." At that time there was no statute of the State of Iowa specifically conferring on cities the power to grant franchises to street railroad companies, but such grants were afterward legalized by the Legislature, and there is no statute limiting the term for which such grants may be made. At all times until the year 1905, the city in many ways recognized the franchise as in force, and after the expiration of the thirty-year term required complainant, which had succeeded to the property and franchise of the original company, to pave streets, and construct new lines at large expense. In 1905 the city Council passed a resolution treating complainant as a trespasser, and ordering all of its 70 miles of tracks removed from the streets. Held, that the ordinance granted a franchise in perpetuity, its exclusive character only being terminated at the end of the thirty years, and created a contract which the city could not impair; that complainant was entitled to an injunction restraining the enforcement of the resolution on that ground, and also on the further ground that the city was estopped by its acts from insisting upon a different construction of the contract.—(Des Moines City Ry. Co. vs. City of Des Moines, 151 Federal Rep., 854.)

MICHIGAN.—Street Railways—Sales of Property—Construction of Contract—Property Covered.

An interurban electric road sold to defendant electric railway all its property, privileges, and assets and all the property, equipment, and material of a construction company used in the construction of the railway and then on the railway or in its vicinity. Plaintiff's assignor had sold to the construction company previous to the sale by the interurban certain electric rotary motors, reserving title until the price was paid, but which contract of sale was not recorded as required by Comp. laws 1897, Sec. 6336, providing that no contract for the sale of railroad equipment should be valid as against bona fide purchasers unless filed for record in the office of the Secretary of State. These rotaries were installed by the construction company after the sale by the interurban under its contract to construct and equip the interurban, and were never fully paid for. Held, in trover upon defendant's refusal to surrender the rotaries or to pay the unpaid balance of the price, that one of the rights of the interurban being the contract right to have these rotaries installed, that right passed to defendant under the clause providing that the interurban sold all its property, rights, and assets, and that plaintiff was not entitled to recover.—(Hogan vs. Detroit United Ry., 111 N. W. Rep., 765.)

MICHIGAN. — Municipal Corporations — Streets — Improvement—Street Railways—Same—Works of Internal Improvement—Parks—Sewers—Waterworks.

1. Neither Detroit city charter, Sec. 169, authorizing the city to establish, pave, repair, and otherwise improve its highways, streets, and avenues, nor Comp. laws, Sec. 3443, requiring the city to keep its streets "reasonably safe and convenient for public travel," authorized the city to own and lay street car tracks in streets to be leased and used by private street railway corporations for hire.

2. The construction and maintenance of parks, waterworks, sewers, and a public lighting system are not works of "internal improvement," within Const. article 14, Sec. 9, providing that the city shall not be a party to or interested in any work of internal improvement, nor engage in carrying on any such work, etc., such undertakings being mere contributions to the public health, safety, and welfare.

3. The construction and ownership of street railway tracks by a city in its streets to be leased for revenue to a street railway company furnishing the equipment, power, etc., constituted a work of internal improvement, in which the city was prohibited from engaging by Const. article 14, Sec. 9, declaring that the State shall not be a party to or interested in any work of internal improvement, etc.—(Bird, Atty. Gen., vs. Common Council of city of Detroit et al., 111 N. W. Rep., 860.)

MINNESOTA. — Street Railways — Liabilities — Purchase of Franchises and Property—Rights of Creditors—Same.

1. Where a street railway company paid the stockholders of another street railway company an agreed price per share, and received from the latter company a conveyance of all its franchises and property without further consideration, the equitable doctrine that the capital stock and property of a corporation is to be deemed a trust fund for the payment of debts, and that when such property has been divided among the stockholders leaving debts unpaid, the stockholders are bound to refund, does not apply to the property and franchises transferred, but to the consideration paid to the stockholders.

2. Under Rev. St. 1899, p. 393, Sec. 1187, pars. 7, 8, giving street railroad companies power to purchase from or sell to other corporations their franchises and other property, a street railway company which purchased the franchises and property of another street railway company paying the consideration to the stockholders of the latter is not liable for debts of the latter company which were not liens at the time of the transfer.—(Hagemann vs. Southern Electric R. Co. et al., 100 S. W. Rep., 1081.)

NEW HAMPSHIRE. — Corporations — Directors — Qualifications—Relation to Another Corporation—By-laws—Powers of Directors—Sale of Assets—Officers Appointed to Execute Contract—Agency—Directors—Change in Directors—Effect—Contract—Sufficiency of Execution—Appeal—Questions Reviewable—Contracts—Separate Agreement—Indivisibility—Appepal—Issues Determined in Lower Court—Trial—Motion to Dismiss Bill—Time for Making—Appeal—Review—Basis for Decree—Corporations—Common Stockholders—Trust Relation to Preferred Stockholders—Evidence—Value of Property—Evidence—Contracts—Sealed Instructions—Alteration by Writing or Lesser Degree.

1. A contract dated December 28 provided for the sale by a construction company of securities, etc., to a trust company for

cash, debentures, stock, etc., and that the trust company should furnish funds to complete work to be done in the construction company's name, and control that company for that purpose. Officers of the construction company were to be selected by the trust company. The contract should not bind the trust company until the other company's property was examined, and the report found satisfactory. Plaintiffs were preferred stockholders in the construction company without voting power, L. holding all the common stock. December 31 the directors of the construction company, L. being one of them, authorized officers to execute the contract, and immediately thereafter three of the five directors resigned, and were succeeded by nominees of the trust company. January 3 the trust company wrote L., president of the construction company, that the examination of the property was satisfactory, and that the trust company would accept the contract if the construction company would pay certain construction expenses, and L. as president wrote the trust company that day that the company would do so. Plaintiffs sued the trust company for an accounting for the assets received, alleging actual and constructive fraud in the contract. Held, that the fact that the construction company's new directors were selected by the trust company did not as a matter of law disqualify them to act as directors upon matters pending between the company between their election and the acceptance of the contract, even if they would be so disqualified afterwards, the presumption being that they would act as directors in good faith and according to law, and that presumption was not weakened by the fact that they were lawyers.

2. The construction company's by-laws providing that the affairs of the corporation should be managed by the directors who might exercise all such powers as were not by law required to be otherwise exercised, subject to the control of the common stockholders, but that no action of the common stockholders would invalidate any prior act of the directors, are in harmony with the law as to the power of the directors.

3. The construction company's certificate of incorporation recited that it was organized to construct railroads, etc., to hold, sell, or otherwise dispose of stocks, bonds, etc., of corporations and to cause the legal estate and interest in any property acquired to be vested in the name of any company to be formed, and either upon trust for or as agents or nominees of the corporation, or upon any other terms considered by the directors for the benefit of the corporation, and to carry out the objects as principals or agents or for the joint account of the corporation, and any company, etc. Held, that their powers were sufficiently comprehensive to include the making of the contract involved.

4. The officers appointed by the directors to execute the contract became agents of the corporation, and not agents of the directors.

5. The omission of the directors to take steps to reconsider the voting of authority to make the contract did not tend to prove bad faith on their part, or control of them by the trust company.

6. A change in directors did not as a matter of law abrogate the authority and direction to the officers to execute the contract.

7. Execution of the contract by the officers bound the construction company and rendered any other acceptance unnecessary.

8. Though the contract was delivered January 3, at the same time the letters between L. and the trust company were exchanged, whether they form a single, indivisible contract is a question of law, depending upon the intention of the parties, the decision of which is reviewable in the supreme court.

9. The contract dated December 28, and that formed by the letters exchanged January 3, do not constitute a single, indivisible contract, but two separate agreements.

10. Where the trial court has decreed for plaintiffs on the theory of constructive fraud, and has not passed upon the issue of intentional fraud, the Supreme Court on reversing the decree will not determine the question of intentional fraud, but will leave it for the superior court to decide.

11. Defendant's motion to dismiss the bill for want of sufficient evidence to support it should have been made at the close of plaintiff's evidence, and before the issues were submitted upon their merits.

12. The trial court having stated the facts found upon which the decree was based, and it appearing therefrom that the question of fraud in fact which was tried and submitted has not been decided, on appeal the Supreme Court will determine the question whether the facts stated authorized the decree, being unable to assume from the general decree that facts sufficient to authorize it were found, since the contrary appears.

13. The common stockholders having entire control of the corporation, the relation of trust between them and the preferred stockholders more clearly appears than in relation of majority to minority stockholders.

14. If required to account, a trust company being chargeable with the value of the property when taken, subsequent developments would be evidence, but not the only evidence of its value.

15. All stipulations by parol anterior to or contemporaneous with a written agreement are merged in the writing, which is conclusively presumed, in the absence of fraud or mistake, to contain the matter as to which the minds of the parties met, and where the final expression and purpose of the parties is by a writing under seal, all other matter in writing is parol and merged in the sealed instrument, which cannot be contradicted or altered by any anterior or contemporaneous writing of less degree.—(Kidd et al. vs. New Hampshire Traction Company et al. 66 Atl. Rep., 127.)
Atl., Rep., 127.)

NEW YORK.—Municipal Corporations—Grant of Right to Use Street for Purposes Other Than Highway—Power to Grant Franchise—Street Railroads—Acquisition of Rights in Streets—License or Consent of Municipality—Prohibition—Nature and Grounds—Same—Motion to Dismiss—Alternative Writ.

1. The local authorities of a village or town may grant a franchise for the building and operating of a street surface railway to two or more rival companies, provided the routes are not the same.

2. The granting of the State railroad commissioner's certificate of convenience and necessity to a railroad corporation is not a prerequisite to the granting to it of a local franchise, but it may obtain the certificate after it has received the local franchise.

3. A railroad corporation, which owns no property, is not a taxpayer or resident of a village, has no vested rights therein, no village consent or franchise, and has applied for none over the route proposed by the defendant company, and has no certificate of convenience and necessity for that route, is not entitled to a writ of prohibition to prevent the village authorities from granting a franchise to defendant to construct a line of trolley railroad through the village.

4. Code Civ. Proc. Sec. 2097, provides that an objection to the legal sufficiency of the papers upon which a writ of prohibition was granted may be taken in the return, and that a motion to set aside the alternative writ for any matter not involving the merits must be made at a term where the writ might have been granted. Held, that an objection to the sufficiency of the papers upon which a writ was granted may be taken in the return or presented at a special term of the court before the return day.—(People ex rel. West Shore Traction Company vs. Bauer et al., 103 N. Y. Sup., 1081.)

NEW YORK.—Street Railroads—Lease of Subway—Rights of Tenant.

The city of New York leased a subway to a railroad company, without restriction as to the right of the lessee to maintain in its stations weighing and vending machines. Held, that the lessee had the right to maintain such machines as is the custom of railroads, where they were purposely placed so that their obstructing or interfering with the public was absolutely impossible.—(City of New York vs. Interborough Rapid Transit Company, 104, N. Y. Sup., 157.)

NEW YORK.—Street Railroads—Extension—Necessity—Evidence—Municipal Corporations—Parks—Streets.

1. On a hearing as to the necessity of an extension of a street railroad before commissioners, evidence that, from the point where the proposed extension ends, petitioner owns a right of way along the street for a long distance, and that it is proposed in time to extend the road along such right of way to and beyond the city limits, is proper to be considered as one of the circumstances bearing on the necessity for such extension.

2. Where a street formerly used as a plank road was conveyed to park commissioners, as authorized by laws 1876, p. 477, c. 445, whereupon the commissioners improved the road as an approach to the park, a part of such road nearly a mile distant from the park did not thereby become part of the park, but was subject to the highway law of the city.—(In re United 104 N. Y. Sup., 157.)

NEW YORK.—Carriers—Street Railways—Transfers—Change of Direction.

Railroad law, laws 1892, p. 1406, c. 676, Sec. 104, requires every street railway company to carry, between any two points on the roads over which it has the right to run cars, any passenger desiring to make one continuous trip between such points for one single fare and without extra charge, and to give the passenger a transfer entitling him to a continuous trip to any point on such road, for the promotion of public convenience. Held, that such section did not prevent a street railway company from adopting a regulation requiring passengers making use of transfers to use the same only in the same general direction of their initial trip.—(Kelly vs. New York City Ry. Co., 104 N. Y. Sup., 561.)

NEW YORK.—Street Railways—Construction of Tracks Across Railroad Bridge—Statutes.

A street railway company cannot lay its tracks on an overhead railroad bridge built by a steam railroad company across its tracks in a street, without either agreeing with the steam railroad company on the amount of compensation to be paid and on the question of the location of the tracks, or having the same determined by Commissioners in accordance with railroad law, laws 1890, p. 1087, c. 565, Sec. 12, notwithstanding laws 1897, p. 794, c. 754, vesting the determination of the matter in which crossings shall be made, whether above, below, or at grade, in the State Board of Railroad Commissioners.—(Lake Shore & M. S. Ry. Co. vs. Chautauqua Traction Co., 104 N. Y. Sup., 550.)

NEW YORK.—Carriers—Street Railways—Passengers—Transfers—Reasonableness of Rule.

A street railway company's rule requiring a passenger to demand a transfer when he pays his fare is reasonable and enforceable.—(Fischer vs. New York City Railway Company, 104, N. Y. Sup., 400.)

NEW YORK.—Carriers—Street Railways—Passengers—Transfers—Sufficiency of Request.

A street railway company is not liable for refusal of a transfer, where a passenger, though desiring to transfer to a westbound car on C. Street, merely asked for a transfer to that street, and was given one to an east-bound car.—(Thistle vs. New York City Railway Company, 104, N. Y. Sup., 401.)

NEW YORK.—Street Railways—Repair of Streets.

Under railroad law, laws 1890, p. 1112, c. 565, Sec. 98, requiring a railroad company to keep in repair that portion of the street "between its tracks, the rails of its tracks and two feet in width outside of its tracks," it is required to keep in repair a space two feet outside of each rail.—(City of Amsterdam vs. Fonda, J. & G. R. Company, 104, N. Y. Sup., 411.)

NEW YORK.—Municipal Corporations—Grant of Right to Use Street—Forfeiture—Waiver—Injunction—Action—Burden of Proof.

1. Where the authorities of a town consented to the building of a railroad upon the streets thereof, on condition that the consent should not be operative until the road should give a bond indemnifying the town against all damages arising from the construction of the road, and on condition that one track should be in operation within two years and that an acceptance of the consent should be filed within a specified time, and there was due acceptance, but the road failed to begin construction work or to give the bond within the required two years, but upon application the authorities waived the defaults and extended the time, and the road was not in default under the amended consent, the owner of property abutting on one of the streets involved could not enjoin the construction of the road on the ground that the default could not be waived.

2. Plaintiff having claimed that the consent should have been on condition that the provisions of Railroad Law, Laws 1890, p. 1109, c. 565, Sec. 92, should be complied with, the burden was upon him to point out those provisions of the law claimed to have been omitted.—(Manton vs. South Shore Traction Company, 104 N. Y. Sup., 612.)

PENNSYLVANIA.—Municipal Corporations—Bridges—Contract with Railway Company—Contract—Construction.

1. A street railway company agreed with a borough to build a bridge, with approaches, so that they would be a part of a municipal street, paved and curbed. A sufficient surface could be obtained only by extending the base of the embankment beyond the limits of the street, so as to encroach on private property, or, if the base was restricted to the street limits, by the building of a retaining wall. The city had not acquired any land for any extension of the width of the street; but the railroad company constructed retaining walls only a part of the distance, and for the remainder widened the base so as to encroach upon private land. On refusal of the railroad company to construct the retaining walls any further, the city finished the work. Held, that the railway company was bound to build such retaining walls, and the borough was entitled to recover the cost of constructing the same from the railway company.

2. Where a railway company and borough agreed to build a bridge and the necessary approaches, the question whether the company was to construct a sewer drop on the bridge approaches under the contract was a question of the intent of the parties, and was for the jury, in an action by the city to recover the cost of completing the unfinished work.—(North Braddock Borough vs. Monongahela Street Railway Company, 66, Atl. Rep., 152.)

PENNSYLVANIA.—Street Railroads—Change of Street—Relaying Tracks—Injunction—Relaying Street Car Tracks—Relaying Tracks—Consent of Borough.

1. A contract between a street railway company and a borough provided that the company should not remove its tracks without the consent of the borough. Thereafter the county reconstructed a bridge on which the tracks were laid, so that they did not align with those on the road. The street railway company secretly and at night took up its tracks to readjust them, without any attempt to obtain the consent of the borough. Held, that an injunction at the suit of the railway company to enjoin the borough from preventing the railway company from taking up the tracks before such consent was obtained would not lie.

2. Where a county changes a bridge so that a street railway company is compelled to move its tracks to align them with a track on the bridge, the borough whose consent is necessary to such change cannot arbitrarily withhold consent or burden its consent with conditions imposing further pecuniary obligations on the company.—(Chester D. & P. Railway Company et al. vs. Darby Borough, 66 Atl. Rep., 357.)

PENNSYLVANIA.—Injunctions—Contracts—Specific Performance—Street Railroads—Location of Tracks—Contract.

1. A contract between a street railway company and a turnpike company will be specifically enforced by a mandatory injunction so as to compel the railway company to lay its tracks at the height and in the location specified in the contract.

2. A contract between a street railway company and a turnpike company provided that the external portion of the track should be placed 20 ft. from and parallel with the center line of a portion of the road, except in running over or under bridges, or where it must from necessity be less than 20 ft. The tracks were laid at one place in the center of the road, and in many places the outside rail was laid 18 ft. from the center with the knowledge of the turnpike company. Held, that the court, at the suit of the turnpike company, would only compel the removal of the tracks at the point where they were placed in the center of the road.—(Chester & Darby Telford Road Company vs. Chester, D. & P. Railway Company et al., 66 Atl. Rep., 358.)

PENNSYLVANIA.—Municipal Corporations—Legislative Control—Street Railroads—Use of Streets—Grant by City—Rights Acquired—Obstruction in Street—Liabilities—Evidence—Opinion Evidence.

1. The Legislature can authorize an electric railway company to lay its tracks and operate its lines on the streets of a city or any other municipality, and may empower the municipality to grant such authority, and to accompany the grant with such restrictions as may seem proper to protect the public in the use of the highways.

2. Where an electric company was authorized by ordinance to operate its railway on a certain street, no inference can be drawn that by the grant of the use of such street it was authorized to exclude the public from it or to operate its railway in a manner to render the street unnecessarily dangerous.

3. A street railway, having authority to use a street, planted a trolley pole in the middle thereof; the pole being about 10 ins. in diameter and standing on a base about 2½ ft. in diameter at the street level and about 18 ins. in height. There was no artificial light on the pole. Held, that the city was liable for the death of a man whose wagon was upset on a dark night by striking the base of the pole.

4. Where a witness described a pole obstructing a street, its size, its location, and all the conditions existing, it was not

error to exclude his opinion as to the danger caused thereby.—(McKim vs. City of Philadelphia, 66 Atl. Rep., 340.)

TENNESSEE.—Carriers—Rules—Power to Make—Fares—Reasonableness of Rules—Questions for Court—Payment of Fare—Making Change—Ejection of Passenger.

1. Carriers may make regulations necessary for the proper control of the cars operated by them, and may within legal limits fix the fare to be charged and the time, place, and manner of payment.

2. Whether a rule of a street railway company requiring conductors to be provided with currency or fractional coins to the amount of $5, and to change bills or coins of that denomination or less when tendered in payment of a 5-cent fare, etc., is a reasonable one, is a question of law.

3. A street railway company, though not having the right to require the exact fare charged to be tendered by its passengers, may fix the limit on the amount of change it will undertake to furnish passengers.

4. A rule of a street railway company requiring conductors to be provided with currency or fractional coins to the amount of $5, and to change money of that denomination or less when tendered in payment of a 5-cent fare, and, on failure of a passenger to tender money of that denomination or less, to put him off the car, is a reasonable rule; and a conductor may refuse to change a $10 bill tendered by a passenger for the payment of the fares of himself and wife, and may, on a failure to otherwise pay the fare, require them to leave the car, though the passenger had no knowledge of the rule.—(Knoxville Traction Company vs. Wilkerson (two cases), 99 S. W. Rep., 992.)

LIABILITY FOR NEGLIGENCE.

ALABAMA.—Carriers—Injuries to Passengers—Action—Complaint—Sufficiency—Evidence—Declarations—Physical Condition—Carriers—Injuries to Passengers—Evidence—Trial—Instructions—Assumption of Facts—Pleading—Admissions by Pleading—Trial—Instructions—Appeal and Error—Review—Conflicting Evidence.

1. In an action against a carrier for injuries to a passenger, the complaint alleged that plaintiff notified the conductor of her intention to alight at a certain street intersection, that the car came to a full stop, and before plaintiff had time to alight the car suddenly started, and as a direct and proximate result thereof plaintiff was thrown to the ground and injured in certain respects, and it was alleged that the damage was caused by defendant's negligence in so starting the car. Demurrers were interposed on the ground that the complaint joined an action of trespass with one in case, on the ground that the cause of action was improperly set forth and that the averments of the complaint were not alleged as facts, and on the ground that the averments were vague, uncertain, and indefinite, and that no facts were alleged putting defendant on notice as to what negligence was relied on by plaintiff. Held, that the demurrers were properly overruled.

2. In an action for injuries, there was no error in overruling an objection to a question propounded by plaintiff to a physician as to what plaintiff complained of when he was called to see her.

3. In an action for injuries to a passenger on a street car, it was proper to refuse to permit the motorman to answer a question as to whether he remembered whether he "had on another white lady," as if he had answered it in the affirmative it would have corroborated the plaintiff, and if he had answered it in the negative the answer would have amounted to nothing, and there was no duty on plaintiff's part to introduce such white woman as a witness.

4. In an action for injuries to a passenger on a street car, owing to the car having suddenly started when plaintiff was about to alight, a requested instruction that, if the car was in motion when plaintiff alighted or attempted to alight, the verdict should be for defendant, was properly refused, as assuming that plaintiff alighted, which might have been taken by the jury as an intimation that plaintiff was not thrown from the car as she alleged.

5. In an action for injuries by the next friend of the injured person, a plea of the general issue admits the character in which plaintiff sues.

6. Where, in an action for injuries, there was no contest as to age and discretion of plaintiff, a requested instruction that plaintiff was of sufficient judgment and discretion to be guilty of contributory negligence was properly refused.

7. A verdict based on conflicting evidence will not be disturbed on appeal, unless the record discloses a decided preponderance of the evidence against the verdict.—(Birmingham Railway, Light & Power Company vs. Moore, 43 S. Rep., 841.)

ALABAMA.—Carriers—Injury to Passenger—Actions—Complaint—Allegation as to Place of Injury—Continuance—Grounds—Loss of Pleadings—Appeal—Review—Showing Error—Record—Negligence—Presumptions—Damages—Amount—Question for Jury—Evidence—Competency of Experts—Damages—Medical Books—Witnesses—Proper Cross-Examination—Appeal—Review—Harmless Error—Pleading—Issues on Proof—Unnecessary Allegations—Instruction—Trial—Reasonable Doubt—Doubt of Individual Juror—Excessive—Injuries to Person—Deliberations of Jury—Quotient Verdict—New Trial—Affidavit of Jurors to Impeach Verdict—Affidavit of Jurors to Sustain Verdict.

1. Where a complaint alleged that plaintiff was a passenger on defendant's car when she received the injury complained of, the duty of the defendant toward her was thus shown, and the averment of a failure to perform this duty was sufficient.

2. The allegation in a complaint that plaintiff was injured while on a car of defendant, which operated its cars in the city of Birmingham, was a sufficient allegation as to the place where the injury occurred.

3. A motion to continue a case on the ground that the original pleadings were lost was properly denied, where the court ordered that the record of the original papers might be used upon the trial in all respects as the original, as expressly provided by Code 1896, Sec. 2644, 2645.

4. Where the original answers to interrogatories are lost, and a certified copy of the same is offered for filing, no error can be predicated on the action of the court in overruling an objection to such copy where there is nothing in the record to show that it was substituted.

5. Where a passenger on defendant's street car was injured by the car colliding with another, and there is no evidence explanatory of the collision, the negligence of defendant is presumed.

6. In a personal injury action, where the evidence varies as to the extent of the injuries received, it becomes a question for the jury.

7. Where a complaint in an action for injuries avers that plaintiff was put to great expense for medical attention, it was proper to ask her on the trial what amount she had paid or was to pay her doctors.

8. Where there is evidence to show the facts substantially as they are embraced in a hypothetical question asked, and the witness was competent to give evidence as an expert, it was not error to allow him to answer the hypothetical question.

9. In an action for injuries, it was proper for plaintiff to show that all and any means known to medical skill were resorted to in the proper treatment of the plaintiff to relieve her from danger.

10. Where, in an action for injuries, there was evidence that plaintiff had appendicitis, superinduced by her injury, it was competent to show the results that followed the disease.

11. Where a person received injuries which she claimed produced appendicitis, it was competent to introduce as evidence parts of standard medical books which related to the disease.

12. Where, in an action for injuries received in defendant's car, the conductor on the car manifested lack of recollection of the incidents of the accident, it was proper cross-examination to ask him: "Is it not a fact that the Godkin baby was very badly injured?" "Did you know the names of anybody on the car?"

13. Where a question objected to is not answered, it is not error to fail to rule it out.

14. In an action for injuries to a passenger, an allegation of negligence on the part of the carrier is sufficient to embrace the negligence of the carrier's servants.

15. In an action for injuries to a passenger, it is not fatal to fail to support with evidence an allegation that the car was wrecked, where no negligence is alleged with respect to the wreck, nor any of plaintiff's injuries attributed to the wreck.

16. Where the complaint alleged other injuries than one claimed to have caused appendicitis, it was not error to refuse to charge that the burden of proof is on the plaintiff to show that the injuries alleged were the proximate cause of the appendicitis.

17. It is error to refuse to charge that plaintiff cannot recover if, after a fair consideration of all the evidence, any indi-

vidual juror is reasonably satisfied by any material part of the evidence that she ought not to recover.

18. Where the evidence in an action for injuries, showed that plaintiff received injuries, one of which superinduced appendicitis, on account of which she had to undergo an operation, which resulted in great injury to her health a verdict for $3,725 was not excessive.

19. To have a verdict vacated on the ground that it was a quotient verdict, it must be shown by competent evidence that the jurors in advance agreed to be bound by a particular mode adopted of arriving at the verdict.

20. The affidavit of a juror is not admissible, on motion for new trial, to impeach the verdict.

21. It is error for a court to refuse to consider the affidavits of jurors on motion for new trial as evidence supporting the verdict.—(Birmingham Railway, Light & Power Company vs. Moore, 42 S. Rep., 1024.)

ALABAMA.—Master and Servant—Injuries to Third Persons—Willful or Wanton Injury—Pleading—Damages—Personal Injuries.

1. Willful or wanton injury is not sufficiently pleaded by a count alleging that, while plaintiff was engaged in leaving defendant's car at a station to which he had been carried therein, defendant's servant in charge or control of the car, acting in the line and scope of his authority as such, wantonly or intentionally caused the car to start or jerk, and thereby wantonly or intentionally caused plaintiff to suffer the injuries set out in the first count; there being no averment or showing of a purpose to inflict the injury.

2. A complaint alleging that plaintiff was thrown down, his ankle broken, his foot, leg, and other parts of his body cut, bruised, mashed, and otherwise injured, and he was shocked, crippled, and disfigured is sufficient to allow proof of a rupture, and also of a broken leg above the ankle.—(Birmingham Railway, Light & Power Company vs. Brown, 43 S. Rep., 342.)

ALABAMA.—Master and Servant—Negligence of Servant—Responsibility of Master—Willfulness—Willful Act of Servant—Evidence—Expert—Subjects of Expert Testimony—Conclusions—Street Railways—Injuries to Pedestrians—Action—Opinion—Insanity—Nonexperts.

1. While an allegation of negligence of a master may be sustained by proof of negligence of his servant, evidence that the master participated in the negligent act of the servant by directing the latter to do or perform the act would operate to change the master's act from negligence to intention or willfulness.

2. Where, in an action for death of plaintiff's intestate by being struck by a street car, there was no evidence that defendant corporation participated in any manner in the willful act of its employee which caused the injury, and did not thereafter ratify such act, a count charging defendant with willfulness or wantonness was not sustained.

3. Where, in an action for death of a pedestrian by being struck by a street car, a witness was qualified to testify as an expert concerning the operation of cars, he was properly allowed to testify to the distance at which a car could be stopped, running at the speed of the car in question.

4. In an action for death of plaintiff's intestate by being struck by a street car, a witness was not entitled to testify that the motorman "seemed to try to stop the car as quick as he could," but should have been required to state the facts as to what the motorman did to stop the car.

5. In an action for death of plaintiff's intestate by being struck by a street car, defendant's motorman, after having testified that when he first saw deceased he was walking in a path two or three feet from the side of the track, was entitled to state whether the car would have struck deceased in passing him at that distance from the track.

6. In an action for death in a collision with a street car, the motorman was not entitled to testify whether he stopped the car as soon as he could, but was required to state what he did to stop the car, and whether that was all that could have been done to stop the car as soon as possible.

7. A nonexpert is required to state the facts on which he bases his opinion in testifying on an issue of insanity.—(Birmingham Railway, Light & Power Company vs. Randle, 43 S. Rep., 355.)

CALIFORNIA.—Street Railways—Bicyclists—Care Required—Collision — Contributory Negligence — Appeal — Review — Harmless Error—Instruction—Burden of Showing Prejudice—Trial—Instructions—Matter Covered by Other Instructions—Hypothetical Instruction—Refusal to Instruct—Inapplicability.

1. Though a bicyclist riding along a street railway track is bound to exercise such care to protect himself from injury as is appropriate to the case, a failure to maintain a constant watch and to listen for cars approaching in either direction is not negligence as a matter of law; he being required to use reasonable care in the exercise of his faculties, and whether he did so being a question of fact.

2. Where in daytime a bicyclist rode about a block and a half along a straight street car line, though there was amply room for him in the roadway, and was struck by a car, he was guilty of contributory negligence barring recovery, it appearing his failure to see or hear the car resulted from absolute inattention to his situation and surroundings, and through his failure to exercise any care whatever.

3. In an action for injury to a bicyclist struck by a street car, error in instructing as to the degree of care required of bicyclists riding along tracks was harmless, where the undisputed evidence showed he was guilty of contributory negligence, barring his right to recover.

4. It is incumbent upon appellant to show, not only abstract error, but prejudicial error on the facts in evidence, and to avail himself of the point that an instruction was erroneous he must bring sufficient evidence to show that upon a proper instruction there might have been a finding for him.

5. In an action for injury to a bicyclist struck by a street car, an instruction on the degree of care required of bicyclists riding along tracks was not erroneous for failing to instruct on the last clear doctrine, where it was covered in another part of the charge.

6. It was not error in an action for injury to a bicyclist to instruct that if the motorman when about a block away saw the plaintiff riding between two tracks and far enough away from the track on which the car was running so that the car could have passed him safely, and that the motorman gave warning of the car's approach, and the front of the car did pass him and plaintiff then, either through excitement or otherwise, lost his balance, veered towards the car, and the rear step of the car struck him, and that the car was running on a straight track, the jury should find for defendant; there being evidence to sustain the hypothesis.

7. An instruction inapplicable to the facts presented is properly refused.—(Hamlin vs. Pacific Electric Railway Company (L. A. 1781), 89 Pac. Rep., 1109.)

CALIFORNIA.—Street Railways—Injuries to Travelers—Instructions — Care Required — Trial — Duty to Request — Collision—Ordinary Care—Refusal of Request—Duty to Request.

1. An instruction, in an action for injuries in a collision with a street car, that it was the duty of the operator of the railway to exercise "ordinary care" and caution in the management and operation of the car to avoid inflicting injury on a person traveling on or using a street on which the car was operated, was not objectionable for failure to require the use of "great care."

2. Plaintiff cannot object that an instruction correctly announcing the law was too general, where he presented no requests for an instruction making it more definite and specific.

3. In an action for injuries to a traveler in a collision with a street car, the court charged that a person operating a street car was bound to anticipate the presence of vehicles and pedestrians on the highway; that he should be watchful to see that the way was clear and to regulate his speed accordingly; that a speed of 8 miles an hour would be negligence, unless it was a safe rate under all the circumstances; and that the motorman was bound to run his car consistent with proper care for the safety of persons using the street, and for the safety of plaintiff. Held, that such instruction sufficiently charged what was required of defendant in order to exercise ordinary care.

4. Where, in an action for injuries to plaintiff in a collision with a street car, an instruction given properly submitted to the jury the question of plaintiff's negligence in not leaving the wagon in which he was seated, before the collision, it was not error for the court to refuse an instruction on such issue in the language of the request.

5. Where plaintiff's requested charge did not require that plaintiff's negligence should be found to have been the proximate cause of his injury in order to preclude his recovery, plaintiff could not object on appeal that the court's modification of such instruction did not contain such requirement.

6. Where, in an action for injuries in a street car collision, none of the instructions requested or given remotely suggested a submission of the last clear chance doctrine, plaintiff could not object on appeal that a modification of a requested charge, submitting plaintiff's contributory negligence, was erroneous, as in effect withdrawing such doctrine from the jury.—(Henderson vs. Los Angeles Traction Company, 89 Pac. Rep., 976.)

GEORGIA.—Trial—Instructions—Carriers — Injury to Passenger.

The plaintiff based his right of action against the defendant upon the negligence of the latter's employees in suddenly and violently starting a car, which had been stopped upon a signal given by the plaintiff, who was attempting to board the car, without giving him reasonable opportunity to do so in safety, in consequence of which negligent act upon the part of defendant's employees he was thrown to the ground and injured; and it was error for the court, after having properly charged upon this (which was the sole theory of the plaintiff, as appears from the petition), to so charge the jury as in effect to authorize them to find for the plaintiff, upon a state of facts entirely different from those upon which the plaintiff by his pleading and evidence rested his right to a recovery.—(Savannah Electric Company vs. McClelland, 57 S. E. Rep., 91.)

ILLINOIS.—Carriers—Carriage of Passengers—Degree of Care Required—Action for Injuries—Instructions—Trial—Misleading Instructions—Cure by Subsequent Instruction—Appeal—Motions for New Trial—Points Relied on—Waiver of Errors—Evidence—Documentary Evidence—X-Ray Photographs—Preliminary Proof—Sufficiency—Witnesses—Cross-Examination.

1. In an action against a railroad company and a street railway company for injuries to a passenger on a street car caused by collision with the railroad train, an instruction that, so far as consistent with the practical operation of its road, it is the duty of a railroad company to exercise the highest degree of care and caution for the safety and security of passengers, while being transported, was not erroneous as requiring a degree of care more or less than was "reasonably" consistent with the practical operation of the road.

2. In an action against a railroad company and a street railway company for injuries to a passenger on a street car caused by a collision with a railroad train, instructions relating to the degree of care required by a carrier of passengers were not erroneous because inapplicable to the railroad company, since a jury could not have understood the instructions as having any relation to the case against the railroad company.

3. In an action for injuries to a passenger on a street car caused by a collision with a railroad train, an instruction that common carriers are required to do all that human care, vigilance, nd foresight can reasonably do, consistent with the character and mode of conveyance adopted and the practical prosecution of the business, to prevent accidents to passengers riding upon their trains, is not objectionable because it uses the words "practical prosecution of its business," instead of "practical operation of its road."

4. In an action against a railroad company and a street railway company for injuries to a passenger on a street car caused by collision with a railroad train, an instruction charging the jury to consider to what extent plaintiff was injured or marred in his personal appearance, and to what extent he may have endured physical and mental suffering as a natural and inevitable result of such injury, was not erroneous as allowing for loss of time, where an instruction given at defendant's request told the jury that plaintiff was not entitled to recover for any loss of business.

5. Where a party filed a written motion for a new trial, in which the grounds and points relied upon were specified, all questions not embraced in the points so filed were waived, and could not be urged on appeal.

6. In an action for injuries to a passenger on a street car caused by the collision with a railroad train, testimony of a witness for defendant, that he was a post-graduate physician and surgeon, and had 12 years' experience in the practice of his profession, and was experienced in the matter of making X-ray views, and that he made the original negatives and prints therefrom, and that the same was correct representations of what they purported to be, was sufficient preliminary proof to authorize the reception of such X-ray photographs in evidence.

7. A physician, testifying for plaintiff in a personal injury suit against a railroad company and a street railway company in regard to the injuries sustained, cannot be asked on cross-examination if the principal part of his professional industry did not consist of consultation with attorneys to secure claims, such as the one in suit, and in consultation to have an arrangement with them for contingent fees.—(Chicago City Railway Company vs. Smith; Chicago & Grand Trunk Railway Company vs. Same, 80 N. E. Rep., 716.)

ILLINOIS.—Pleading—Aider by Verdict—Judgment—Arrest—Defective Pleading—Motion—Carriers—Injuries to Passenger—Action—Question for Jury—Duty of Carrier—Trial—Instructions — Construction as a Whole — Evidence—Opinion—Physical Condition.

1. In an action against a street railway company for injuries to a passenger, allegations that defendant, through its servants in charge of the operation and management of the car, so carelessly and improperly ran, managed, and operated it that as a result the car thereby ran into and collided with a wagon on the track, though general, were sufficient after verdict, to support a judgment for plaintiff.

2. In an action against a street railway company for injury to a passenger, caused by a collision of the car with a wagon driven through an opening in a wall extending parallel with the track, a count of a declaration averred the existence of the opening in the wall, that it connected with a plank roadway laid from the street through the opening, and that "long prior to and at the time and place in question said opening and roadway were used by teams and wagons." Held, that though the extent of the use of the passageway through the opening is not averred, and upon demurrer the averment might have been held insufficient, it was sufficient, on motion in arrest of judgment, to support a judgment for plaintiff.

3. On a verdict for plaintiff, the court will regard every material fact, upon the motion in arrest of judgment, alleged in the declaration or fairly or reasonably inferable from what is alleged, as proved on the trial.

4. In an action against a street railway company for injuries to a passenger, caused by the car colliding with a wagon which was driven through an opening in a wall extending parallel with the track, held, under the evidence, a question for the jury whether the company was quilty of actionable negligence in approaching the opening with its car in the manner in which it did, or whether it had taken such reasonable precaution to warn its servants of the approach of teams through such opening as would reasonably guard its passengers from being injured by cars colliding with such teams.

5. It is a carrier's duty to use a very high degree of care to safely transport its passengers, doing all that human care, vigilance, and foresight can reasonably do, in view of the character and mode of conveyance adopted, consistent with the practical operation of its cars.

6. In an action against a street railway company for injuries to a passenger, caused by collision with a wagon, an instruction that it is the duty of carriers to do all that human care, vigilance, and foresight can reasonably do, under the circumstances and in view of the character and the mode of conveyance adopted, reasonably to guard against accidents, etc., was not erroneous for not limiting the degree of care required to such care as is consistent with the practical operation of the road, where, when considered with other instructions, the instruction could not have misled the jury as to the degree of care required.

7. In an action against a street railway company for injuries to plaintiff while a passenger, the admission of testimony of expert witnesses, who talked with her and made experiments by sticking pins in her flesh and manipulating her limbs, to determine whether or not she was feigning paralysis, and their opinions as to her condition, was not error; the court having repeatedly informed the witnesses that they were to base their opinions only upon what they had seen, and not upon any statements made to them by plaintiff, or upon any physical manifestations of the plaintiff within her control, and having excluded specifically all evidences from the consideration of the jury which could by any possibility be regarded an infringement of the rule against the consideration by them of any subjective condition in the plaintiff brought out during the examination of the witnesses.—(Chicago City Railway Company vs. Shreve, 80 N. E. Rep., 1049.)

ILLINOIS.—Master and Servant—Injuries to Servant—Contributory Negligence—Question for Jury—Trial—Instructions—Construction as a Whole.

1. In an action for injuries caused by a defective step on a

car, where there was no evidence that plaintiff had worked with the car before the day he was injured, or that he had any occasion to see or observe it on the day of his injury before attempting to use it, he cannot be held guilty of negligence, as a matter of law, in failing to see the defective condition of the step.

2. Where an instruction fails to state all the law on the subject, it is not reversible error if what it omits is supplied by other instructions.—(Peoria & P. Terminal Railway vs. Schantz, 80 N. E. Rep., 1041.)

ILLINOIS.—Street Railways—Action for Injuries—Evidence—Sufficiency—Pleadings—General Issue—Matters Denied—Matter of Inducement.

1. Evidence examined, and held sufficient to show that defendant, and not another street railway company, was in the possession and operation of the street car line whose car jumped the track and collided with plaintiff's wagon, thereby injuring him.

2. An averment, in an action for injuries sustained, that defendant owned and operated a street railway, is not denied a plea of the general issue, but such averment can only be reached by a special plea denying that defendant owned or operated the same.—(Chicago Union Traction Company vs. Jerka, 81 N. E. Rep., 7.)

ILLINOIS.—Evidence—Opinion Evidence—Expert Testimony—Bodily Condition—Trial—Objections to Evidence—Carriers—Injuries to Passengers—Action—Issues and Proof—Instructions—Reference to Declaration—Interragatories to Jury—Appeal—Harmless Error.

1. In an action for injuries, a physician who had examined plaintiff, testified that she was suffering from traumatic neurosis, and, after stating that her condition resulted from injury to the bone, was asked "what might cause such an injury as that to the spine," to which he replied, "Transmission." Held, that defendant was not prejudiced by such question and answer, as it would have been competent for plaintiff to have asked and obtained an answer as to whether the injuries plaintiff was suffering from might have resulted from the fall she had described.

2. An objection "no proper foundation laid, and incompetent," to the testimony of a medical expert was a general objection, insufficient to preserve for review a specific objection to the testimony.

3. Where a declaration in an action for injuries to a passenger alleged that the car on which she was a passenger stopped at a certain street, evidence that the car stopped on the south side of such street instead of on the north side, which was the usual stopping place, was not insufficient to sustain the declaration.

4. An instruction to the effect that plaintiff was entitled to recover, if she had proved her case as alleged in the declaration, was not erroneous, though there was no evidence to sustain some of the counts of the declaration.

5. In an action for injuries to a passenger alleged to have been sustained by her owing to the starting of the car while she was alighting, it was proper to refuse to submit an interrogation as to whether plaintiff had proved by a preponderance of all the evidence in the case that the car was standing still when she attempted to alight.

6. In an action for injuries to a passenger alleged to have been sustained owing to the sudden starting of the car while she was attempting to alight, defendant requested the submission of an interrogatory as to whether plaintiff has proved by a preponderance of the evidence that the car was standing still when she attempted to alight, which interrogatory was refused, but one was submitted as to whether plaintiff could by the exercise of ordinary care have avoided the injury, which was answered in the negative. Held, that such interrogatory covered in substance the one refused, so that defendant was not prejudiced by the refusal.—(Chicago City Railway Company vs. Foster, 80 N. E. Rep., 762.)

INDIANA.—Carriers—Injuries to Passengers—Negligence—Evidence—Sufficiency—Contributory Negligence—Question for Jury—Death—Actions for Death—Damages—Trial—Errors in Instructions Cured by Other Instructions—Applicability to Issues—Appeal—Harmless Error—Erroneous Instructions.

1. In an action against a street railway for the death of an infant passenger thrown from an open car, evidence examined, and held to sustain a finding of negligence in running the car at an excessive speed around an abrupt curve, thereby throwing the child from the car.

2. A mother with three children boarded an open street car, and permitted a child 7 years of age to set at the end of a seat next to a wire screen designed to protect passengers. The screen did not reach to the floor of the car, and, while it was going around an abrupt curve, the child was thrown from the seat under the wire screen to the ground, and killed. Held, that the mother was not guilty of contributory negligence of precluding a recovery for the child's death.

3. In an action by a father for the death of a child about 7 years old, a verdict for $1,000 is not excessive.

4. The error in an instruction in an action by a parent for the death of a child that the measure of damages is that sum which under the evidence and the common experience of the jurors would have been the value, etc., arising from the fact that it authorizes the assessment of damages on facts not shown by the evidence, is cured by other instructions informing the jury that everything done by them must be done under the evidence.

5. Where, in an action by a parent for the negligent death of an infant child, no issue as to the child being non sui juris was tendered by the pleadings, instructions leaving to the jury the question whether the child was non sui juris were erroneous.

6. Where, in an action by a parent for the death of a child, there was nothing to show that the child at the time of the accident did not exercise such prudence as was ordinarily possessed by one of his age, nor anything to show negligence judged by the standard of care required of an adult, the error in submitting to the jury the question whether the child was non sui juris, though no such issue was raised by the pleadings, was not reversible.—(Indianapolis Traction & Terminal Company vs. Beckman, 81 N. E. Rep., 82.)

INDIANA.—Appeal—Assignment of Error—Review—Master and Servant—Injuries to Servant—Actions—Complaint—Liability of Employer—Statutes—Construction—Sufficiency—Assumption of Risk—Trial—Special Findings—Damages—Personal Injuries—Excessive Damages—Instructions.

1. An assignment that the court erred in overruling a demurrer to the complaint which does not designate the court which made the ruling is reviewable, where the record shows that the appeal is from a judgment of the circuit court, and that the ruling on demurrer was made by a superior court.

2. A complaint, in an action for injuries to an employee of a street railway, which alleges that plaintiff was injured by the negligence of a third person in defendant's service, to whose order he was at the time of the injury bound to conform, and was conforming, and which shows that third person's authority to give orders to plaintiff and plaintiff's duty to obey, and the giving of an order and the injury to plaintiff while conforming thereto, states a cause of action under Employer's Liability Act, Burns' Ann. St. 1901, Sec. 7083, subd. 2, making a corporation liable for injuries to its employee caused by the negligence of a person in its service to whose order or direction the injured employee was bound to and did conform.

3. The words "order or direction," as used in the statute, apply to special orders, as distinguished from general orders and the protection of the statute does not extend to an employee injured from the negligence of his foreman while working under general directions.

4. A complaint, in an action under such act for injuries to an employee of a street railway, which alleged that plaintiff was in the employ of defendant as a trackman, that on the day of the accident he was ordered by defendant's roadmaster to repair a broken bridge; that at the time the roadmaster had authority from defendant to order plaintiff where to work, and what to do; that the roadmaster ordered plaintiff to clear away debris at the bridge and prepare a footing at a designated spot, to which order plaintiff was bound to conform; and that while conforming thereto he was injured by the negligence of the roadmaster—alleged that plaintiff was injured while obeying a special order, as distinguished from a general order.

5. Under Employer's Liability Act, Burns' Ann. St. 1901, Sec. 7083, subd. 2, making a railroad liable for injuries to an employee caused by the negligence of a person in its service, to whose order the injured employee was bound to and did conform, a railroad cannot defeat an action for personal injuries sustained by an employee in consequence of the negligence of such person by proof of assumption of risk.

6. In an action for injuries to an employee of a street railway, while obeying a special order of a superior, because of the negligence of the latter, the jury in a special verdict found that the superior ordered the employee to do certain work,

and that at the time of the injury the employee was working under "the general order" of the superior. The jury rendered a verdict for plaintiff. Held, that, though the special findings designated the order which the employee was obeying at the time of his injury as a general order, it must be presumed in support of the general verdict that the findings showed that the employee was in fact obeying a special order, thereby removing any inconsistency between the special finding and the general verdict.

7. An employee, 35 years old, sustained an injury necessitating the removal of a portion of his skull. His sight and hearing were impaired, and his nervous system injured, and he was permanently incapacitated from pursuing his vocation. Held, that a verdict for $10,000 would not be set aside as excessive

8. Since one employed to do repair work may rely on the master not negligently or maliciously investing the place where the work is done with unexpected dangers, an instruction that, when one hires out to a railroad to do repair work, he assumes those risks which are incidental to the work, and he cannot rely "wholly" on his employer to make the working place safe, is erroneous.—(Indianapolis Street Railway Company vs. Kane, 80 N. E. Rep., 841.)

INDIANA.—Carriers—Injury to Passengers—Actions—Complaint—Sufficiency—Appeal—Correction of Record—Prejudicial Error—Street Railways—Regulations—Lookouts—Ordinances—Validity—Harmless Error—Admission of Evidence—Evidence—Examination of Experts—Hypothetical Questions—Failure to Submit Issues—Instructions.

1. A complaint in an action for injuries to a passenger on a street car in a collision with a train on a railroad crossing which alleges that "defendant by and through its servants" in charge of the car negligently ran it on the railroad track and collided with a freight car thereon, causing injury to the passenger, shows that defendant's servants had charge of the car and were acting in the line of their employment at the time of the injury.

2. After the close of the evidence on the first trial of an action, defendant obtained leave to amend its answer to correspond with the proof. The amendment did not change the issues. The record recited that the court granted the amendment, and that the same was filed. After judgment plaintiff filed a motion to correct the entry by making it show that the amendment to the answer was by interlineation and not by filing an amended answer. Held, that the action of the court in sustaining the motion and making the correction, if erroneous, was not prejudicial.

3. A municipal ordinance requiring street car conductors to go across steam railroad tracks in advance of their cars, and prohibiting the motorman from moving the cars across the tracks until signaled so to do by the conductors from the opposite side of the tracks, is not unreasonable.

4. Where, in an action by a street car passenger for injuries in a collision between a car and a freight car at a railroad crossing, the uncontradicted evidence showed that at the time of the accident it was cloudy and misting rain, that there was an electric light at the crossing, and that the street car had an electric head-light illuminating the surroundings, the error, if any, in permitting the record of the signal service to be admitted in evidence, was harmless.

5. Where, in a personal injury action, plaintiff had introduced evidence from which the jury might infer that her physical condition as described in a hypothetical question propounded to an expert was produced alone by the injury she had received in the accident complained of, the hypothetical question was not erroneous.

6. Where, in an action for personal injuries, defendant relied on plaintiff's execution of a release of her claim for damages, and the evidence showed that the amount paid in consideration of the release was tendered back to defendant within a day or two after the execution of the release, and that the tender was kept good by bringing the money into court when the suit was brought, the omission of the court to state in its instructions that it was necessary, to justify a verdict for plaintiff, that a tender of the money received by her on executing the release should be proved, was harmless.

7. Where, in a personal injury action, defendant relied on a release executed by plaintiff, and the evidence warranted a finding that plaintiff was at the time of its execution mentally incompetent, and that it was procured by fraud of defendant, the error, if any, in an instruction that if defendant without the knowledge of plaintiff altered the release by inserting therein that if it agreed to pay plaintiff's doctor bills the release was void, was not reversible.—(Indianapolis Traction & Terminal Company vs. Formes, 80 N. E. Rep., 872.)

INDIANA.—Carriers—Street Railways—Injury to Passenger—Evidence—Damages—Excessiveness—Personal Injury.

1. In an action for injury to a passenger as she was attempting to alight from a street car, evidence held sufficient to warrant a finding that defendant was negligent in prematurely starting the car.

2. Plaintiff, while endeavoring to alight from a street car, was injured by the premature starting of the car. She suffered a severe and painful sprain of her ankle, and was confined to her bed eight or ten days from the effects of the injury; her ankle joint being weakened and sore for a much longer time. Held, that a verdict allowing plaintiff $300 damages was not excessive.—(Evansville Electric Railway Company vs. Lerch, 81 N. E. Rep., 225.)

INDIANA.—Street Railways—Actions for Injuries—Questions for Jury—Complaint—Sufficiency.

1. In an action for injuries sustained in being thrown from a wagon by a sudden lunge of the team which was frightened by a street car, held, under the evidence, that the question whether the motorman saw the peril in which plaintiff was placed on account of the fright of her team was for the jury.

2. Where, in an action for injuries sustained in being thrown from a wagon by a sudden lunge of the team which was frightened by a street car, the complaint did not show, except by way of recital, that the motorman saw or heard the signals calling his attention to plaintiff's peril, nor aver that the car was being operated in an unusual manner, nor that plaintiff's mules showed any disposition to go upon the defendant's track, nor that the failure to stop or check the speed of the car was the proximate cause of the injury, and did not aver facts from which it could be inferred that the accident would not have occurred if the car had been checked after the signal to stop had been given, it did not state a cause of action against defendant.—(Folz vs. Evansville Electric Railway, 80 N. E. Rep., 868.)

INDIANA.—Negligence—Questions for Jury—Contributory Negligence—Street Railways—Operation — Injuries — Persons Crossing Track—Evidence—Instructions—Care by Defendant.

1. The question of contributory negligence is for the jury, on a consideration of all the evidence relating thereto.

2. Evidence, in an action to recover for damages from being struck by defendant's car while crossing its track, held, sufficient to sustain a verdict for plaintiff.

3. Where there is a conflict of evidence as to defendant's negligence, the question is for the jury.

4. In an action against a street railway company for damages for being struck by defendant's car while crossing its track, an instruction that it was defendant's duty to exercise care and diligence to prevent injuries to persons lawfully traveling the streets occupied by its tracks, and that it would be liable for a failure to do so, is unobjectionable.—(Indianapolis Street Railway Company vs. Demaree, 80 N. E. Rep., 687.)

IOWA.—Carriers—Injury to Passengers—Negligence—Contributory Negligence—Assumption of Risk—Duty of Carrier — Trial — Instructions — Issues Submitted — Injury to Passengers—Evidence—Husband and Wife—Personal Injuries to Wife — Recovery — Appeal—Harmless Error—Opinion Evidence.

1. Though an interurban railroad, operating cars which for the accommodation of passengers stopped at highway crossings, was not required to provide a passenger platform at such crossings, it was required to exercise reasonable care to enable passengers to alight with as little danger as practicable, and where a car was stopped at a highway crossing, and a passenger invited to alight at a place more hazardous than that at which the car might conveniently have been stopped, the railroad was negligent.

2. A passenger on an interurban car, which stops for him to alight at a highway crossing, may assume that the car has been stopped in a portion of the highway where he is invited to alight, unless warned of danger, and is not conclusively negligent in accepting the invitation to alight at a place which is in fact unsafe, but the question of his negligence is for the jury.

3. A passenger on an interurban car stopping at highway crossings does not assume the risk involved in stopping the car for him to alight at a more dangerous place than the usual

place for alighting, where he had no knowledge of the added danger.

4. An interurban railway company owes a public duty to a passenger to furnish him a safe place to alight at his destination, and is not relieved of that duty by knowledge on the part of the passenger that it had not previously been discharging that duty.

5. Where, in an action for injuries to a passenger while alighting from an interurban car, the same facts which would constitute contributory negligence would also constitute assumption of risk, there was no occasion to charge on assumption of risk after instructions as to contributory negligence.

6. Where, in an action by a passenger on an interurban car for injuries received while alighting at a highway crossing, the court, after instructing the jury to consider only the negligence alleged in the petition, stated categorically the grounds of negligence, without including the alleged negligence in carrying plaintiff beyond the platform at the crossing, the question whether the company was negligent in carrying plaintiff beyond the platform was not submitted.

7. Where the evidence showed that the company did not maintain platforms at a highway crossing, but that approaches to the rails on either side had been planked by it, and the highway had been graded up to the planks, and that it was usual to stop cars for passengers to alight by stepping onto the approach, and that the company did not stop the car until after it had passed the approach, an instruction that if the company stopped the car to allow passengers to alight, and notified a passenger to alight at an unsuitable place, and failed to furnish a reasonably safe place, the jury might find that the company was negligent, was proper.

8. The action of the court in calling the attention of the jury to facts shown in evidence in determining whether the employees of the company should have assisted the passenger to alight, and leaving it for the jury to say whether there was negligence in not giving the passenger assistance, was proper, as the duty to assist passengers to alight might arise under special circumstances.

9. A married woman may recover in her own right for physical pain, suffering, and mental anguish resulting from the negligence of another.

10. Where, in an action by a married woman for a personal injury, there was no evidence of the loss of earning capacity, the refusal to charge that she could not recover damages on that account was proper.

11. Where, in an action for personal injuries, the jury properly found a verdict for $3,000, an instruction on the measure of damages, stating that plaintiff in no event could recover more than $15,000, the amount claimed in the petition, was not prejudicial.

12. Where the questions asked medical witnesses and their answers, taken together, showed that they only testified that plaintiff's injuries were due to some external violence such as that which plaintiff without contradiction sustained, the overruling of objections to the questions as calling for statements as to the cause of the injury and usurping the functions of the jury was not prejudicial.—(McGovern vs. Interurban Ry. Co., 111 N. W. Rep., 412.)

MASSACHUSETTS.—Evidence—Opinion Evidence—Negligence—Injuries to Passenger at Station—Precautions Against Recurrence of Injury—Appeal and Error—Objection Not Made Below—Trial—Questions for Jury—Instructions.

1. Where, in an action against an elevated street railway for injuries received through being crowded off a station platform, the alleged negligence consisting in failing to maintain a large enough platform and in allowing too many passengers to congregate thereon at a time, a witness was properly allowed to answer the question whether, if three cars unloaded thirty-three passengers each on the platform, it would make a fair-sized crowd thereon.

2. Plaintiff was also properly permitted to ask defendant's inspector of surface cars whether the crowd on the platform of the station could be controlled by the number of incoming surface cars allowed to go into the station, by the number of persons admitted into the station through the turnstiles, and if, by controlling them there, the size of the crowd in the station could be controlled.

3. Evidence that subsequent to the action defendant had extended its platform, while also admissible for the purpose of showing that it was practically possible for defendant so to do, having regard to the conduct of its business, was not admissible for the purpose of showing negligence on defendant's part at the time of the accident.

4. Where, in an action for injuries through negligence, no objection was made at the trial that the negligence alleged in the declaration did not cover a certain question, the objection was not open on appeal.

5. In an action against an elevated street railway for injuries, received through being crowded off defendant's station platform by reason of defendant's failing to provide proper platform facilities, a question, asked one of defendant's witnesses, whether or not, in determining the plan of operating a street railway, it was proper to consider the desires of the traveling public, where they can be taken into consideration without interfering with safety in the operation of the road, was properly excluded.

6. In an action against a street railway for injuries received through being pushed off a station platform, which defendant was alleged to have permitted to become overcrowded, plaintiff had a right to go to the jury on the grounds that the platform in question was too small to take care of the passengers who landed on it, and that the guard who should have been on the platform was not there.

7. In an action against a street railway for injuries received through being pushed off a station platform, which defendant was alleged to have permitted to become overcrowded, a requested ruling that defendant was not responsible for accidents happening solely through the ordinary rushing and crowding occurring on the road during rush hours was properly refused.—(Beverley et al. vs. Boston Elevated Railway Company (two cases), 80 N. E. Rep., 507.)

14. Where the answers to certain interrogatories objected to in so far as they could be made more certain from the evidence were fully covered by answers to other interrogatories returned with the verdict, the court did not err in refusing to require the jury to make the answers objected to more specific.

15. Where, in an action for injuries in a collision with a street car, it appeared without dispute that at the time a passenger made a remark to the conductor that there was a man under the car plaintiff's body was being dragged under the fender of the car, the admission of such declaration in evidence, though erroneous, was harmless.

16. Where, in an action for injuries in a collision with a street car, there was no substantial dispute that plaintiff was dragged a certain distance, the admission of evidence of the appearance of the track the next morning for the purpose of showing the same fact was harmless to defendant.

17. Where, in an action for injuries to plaintiff in a collision with a street car, he testified that he had lost his sense of taste and smell, defendant was not prejudiced by the admission of the opinion of plaintiff's wife that such was the fact.—(Indianapolis Street Railway Company vs. Taylor (No. 5,807), 80 N. E. Rep., 435.)

KENTUCKY.—Damages—Excessive Damages—Injuries to Person—Permanent Injuries—Carriers—Injury to Passenger—Action—Sufficiency of Evidence.

1. In an action for personal injuries, where plaintiff was seriously bruised, lost control of her bowels and urine, was subject to hemorrhages, and her physician thought her injuries would be permanent, a verdict of $3,500 is not excessive.

2. In an action for injuries sustained in getting off a street car, evidence examined, and held sufficient to sustain a verdict for plaintiff.—(Louisville Ry. Co. vs. Worley, 101 S. W. Rep., 926.)

NEBRASKA.—Street Railways—Use of Street—Reciprocal Duties—Same—Injury to Horse.

1. The right to use the streets of a city by the driver of a horse and the manager of a street car are equal, and each must use it with reasonable regard for the safety and convenience of the other.

2. Where the motorman in charge of a car sees, or by the use of reasonable care may see, that a horse is unduly frightened by his car, he must do what he reasonably can to prevent danger and damage; but, if the horse shows no signs of fright which are observable to him until too late to stop, he is not negligent in running into a horse which rears and alights immediately in front of the car.—(Olney vs. Omaha & C. B. St. Ry. Co., 111 N. W. Rep., 784.)

KENTUCKY.—Carriers—Street Railway—Injury to Passenger—Damages—Excessive—Personal Injuries.

1. Where one is boarding a street car that has stopped to permit him to board, and the car is suddenly started before he gets safely on it, the company is negligent and liable for any injury he may sustain; it being the company's duty to know that he is safely aboard before starting the car.

2. A $1,250 verdict for personal injuries is not excessive, where before the injury plaintiff was in good health, able to perform the labor necessary to obtain her livelihood, and afterwards was unfit, by reason of pain and suffering caused by it, to follow any occupation requiring physical effort, and a serious, painful, and dangerous operation will be necessary to effect a cure, if one can be effected.—(Louisville Ry. Co. vs. Pulliam, 101 S. W. Rep., 295.)

MASSACHUSETTS.—Carriers—Passengers—Injury in Passing From One Car to Another—Carrier's Liability.

It is not negligence for an elevated railway company to permit passengers to pass from one car to another while the train is at a standstill, nor in such circumstances is it its duty to warn passengers of the existence of a space between the cars.—(Hogan vs. Boston Elevated Ry. Co., 81 N. E. Rep., 198.)

MASSACHUSETTS.—Carriers—Injury to Passenger—Equipment—Inspection.

In an action by a street car passenger for injuries caused by the derailment of the car, owing to a wheel on one of the trucks being loose, instructions that the company was required to exercise reasonable care commensurate with the danger to ascertain the fitness of the equipment before using the same, and that it was for the jury to determine what tests were reasonably required and would have revealed the defect, etc., the court sufficiently stated the law that it was the duty of the company, before using the equipment, to apply every reasonable test to discover if the same was in suitable condition for service, though a paragraph of the instructions, standing alone, might lead the jury to believe that, if the company bought its equipment from a reputable manufacturer, it performed its duty.—(Marshall vs. Boston & W. St. Ry. Co., 81 N. E. Rep., 195.)

MASSACHUSETTS.—Carriers—Injury to Passengers—Negligence—Care Required—Contributory Negligence.

1. It is the duty of a brakeman employed on an elevated railroad to know whether passengers are attempting to leave a car when he closes the gate thereof, and to act accordingly.

2. A passenger on an elevated railroad, who moves rapidly to alight from a car and is injured by running into the gate thereof without observing it or the brakeman closing it, is not, as a matter of law, guilty of contributory negligence, precluding a recovery.—(McGarry vs. Boston Elevated Ry. Co., 81 N. E. Rep., 194.)

MASSACHUSETTS. — Carriers — Who Are Passengers — Master and Servant—Fellow Servants—Who Are.

1. Men engaged in constructing railroad tracks were taken to and from the place of work in a special car furnished by the company for the mutual accommodation of the men and the company. The men paid no fare. Held, that the men were not passengers.

2. Men engaged in constructing railroad tracks, who are taken to and from the place of work in a special car, are fellow servants of the motorman, relieving the company from liability for injuries sustained in a collision between the car and the wagon.—(Kilduff vs. Boston Elevated Ry. Co., 81 N. E. Rep., 191.)

MASSACHUSETTS. — Appeal — Exceptions — Waiver — Failure to Argue—Master and Servant—Death of Employee—Contributory Negligence—Question for Jury—Trial—Instructions—Consideration of Instructions as a Whole.

1. Exceptions not argued must be deemed waived.

2. Where, in an action for the death of a motorman by collision with another car, the evidence showed that when the motorman started he was given a clear right of way by the starter having authority to order the movement of the car, that acting under the order the motorman went forward, that before the collision his car passed around a curve, and that he did not see the other car until a collision was inevitable, the question of the motorman's negligence was for the jury.

3. In an action for the death of a motorman by collision with another car, the evidence showed that when the car was ready to proceed, the dispatcher gave the order for the movement of the car, though he either knew, or in the exercise of reasonable care would have known, that the other car had not passed. Held, that the question of the negligence of the dispatcher, within Rev. Laws, c. 106, Sec. 71, cl. 2, making a master liable for the negligence of an employee exercising superintendence, was for the jury.

4. In an action for the death of a motorman by a collision with another car, the evidence showed that a dispatcher exercising superintendence ordered the car to proceed. The conductor examined the register kept for the purpose, which showed that only two cars had gone in the other direction, when three should have been recorded. The rules provided that under such conditions a car should not leave without a written order until the third car had passed. When the dispatcher gave the order he knew that the third car had not passed. Held that, though the collision would not have occurred if the conductor had observed the rules, the negligence of the dispatcher, arising from his failure to take reasonable precaution to ascertain whether three cars had passed, was the efficient cause of the accident, rendering the employer liable.

5. Where it is claimed that the jury were misled by erroneous statements of the judge in his instructions, the instructions as a whole must be examined, and, if it appears that the jury were not misled, the erroneous statements are not ground for reversal.—(Doe vs. Boston & W. St. Ry. Co., 80 N. E. Rep., 814.)

MASSACHUSETTS.—Carriers—Street Railroads—Contributory Negligence—Negligence—Prima Facie Case—Care Required.

1. Where plaintiff, on boarding a street car, found that it was so crowded that passengers were standing on the platform and runningboard, he was not negligent as a matter of law in himself taking a position on the runningboard.

2. Plaintiff, while riding on the runningboard of a crowded street car, was violently thrown against a passing wagon, and injured, by the rear trucks of the car turning onto a switch as they passed over it, bringing the rear part of the car into collision with the wagon. The entire management of the track and equipment was in the control of defendant, and it offered no evidence either of its supervision and care of the track or of the cause of the derailment. Held, that the facts were sufficient to warrant an inference of defendant's negligence.

3. A street railway company is bound to exercise such reasonable diligence for the safety of passengers as the nature of its business demands.—(Egan vs. Old Colony St. Ry. Co., 80 N. E. Rep., 696.)

MISSOURI.—Carriers—Street Railways—Negligence—Carrying Passengers Beyond Destination—Instructions—Pleadings—Allegations—Materiality.

1. In an action against a street railway for carrying a passenger beyond her destination, evidence held to warrant the submission to the jury of the question whether or not plaintiff was negligently carried to defendant's car house.

2. Where, in an action against a street railway for carrying plaintiff, a passenger, beyond her destination, one allegation of the petition was that defendant failed to put plaintiff off at Nineteenth and F Streets, while another allegation named Nineteenth and V Streets, and one of defendant's own instructions was that, if plaintiff was put off at Nineteenth and V Streets, defendant was not liable, an instruction directing a verdict for failure to put plaintiff off at the latter corner was not misleading; all the testimony showing that plaintiff was to be put off at Nineteenth and F Streets.

3. Where, in an action against a street railway for carrying plaintiff, a passenger, beyond her destination, the petition alleged that plaintiff was carried to defendant's car house, an instruction authorized a recovery, if plaintiff was carried beyond her destination to another and distant part of the city, was not erroneous.

4. Plaintiff's evidence being that she was carried to defendant's car house, which was ten blocks distant, and defendant's evidence being that plaintiff was put off only one block from her destination, the instruction was not subject to the rule that an instruction, which of itself covers the whole case and authorizes a finding for either party, must not exclude from the consideration of the jury any material issue supported by substantial evidence on either side.

5. In an action against a street railway for carrying plaintiff, a passenger, beyond her destination, an allegation in the petition that plaintiff was a stranger in the city was not material to her right of recovery.—(Henderson vs. Metropolitan St. Ry. Co., 100 S. W. Rep., 1111.)

LONDON LETTER

The London County Council has now definitely committed itself to the installation of the G. B. surface contact system in the East end of London as the method of electrification of the tramways from the existing conduit tramways near Aldgate by way of High Street, Whitechapel, Mile End Road and Bow Road to the country boundary at Bow Bridge. As stated last month, the Tramways Committee recommended this system, and though there was some opposition at the subsequent meeting of the Council, the recommendation of the highways committee has been carried. The expenditure will amount to a little more than £72,000. There will be no suspension in the efforts of the Council to extend the electrification of the tramways in London next year, it having been decided by the highways committee to recommend the Council to seek sanction in the next session of Parliament for quite a comprehensive syystem of new tramways. Powers are to be sought for the construction of seven new lines, some of which are short connections, though one or two are important new routes, among them two to make the Crystal Palace more accessible than at present. The overhead trolley will be recommended for these routes and will be adopted if the opposition is not too severe. The total cost of the proposed schemes of the London County Council for next year amounts to £229,000, with an additional £122,000 for street widenings. The tramways will be charged with one-third of this latter amount, the local authorities through whose territory the tramways will run with another third, and the improvement's account with the remaining third.

It was reported some months ago that the district of Lee had been connected with the Southern system of electric tramways, which seemed to give general satisfaction at the time. The speed limit was fixed at 16 m. p. h., however, by the Board of Trade, and the inhabitants of Lee now consider this speed is excessive In consequence a petition to the London County Council has been started to have the speed reduced from 16 miles to 12 m. h. p., and the Lewisham Borough Council has also decided to make a further appeal to the Board of Trade for a like reduction.

In connection with the tramways of London, it is interesting to note that John Burns, M. P., who is president of the Local Government Board, and a Member of the Cabinet, in an address before the International Congress on Housing, spoke very warmly in favor of London's tramways. He stated that the taking of the tramways over Westminster and Vauxhall Bridges had done more to revolutionize the minds of the industrial people of London than twenty-five years of previous housing agitation. Mr. Burns is of the opinion that the system should be developed till London owns 1000 miles of tramways, and favors a penny maximum universal fare and half-penny stages.

With the rapid extension of the tramways system in London and the congested state of London traffic, it would appear that the drivers of tramway cars would have to be men in as nearly perfect physical condition as possible, and Mr. Fell, the chief officer of the tramways, recently arranged that all the drivers should undergo a rigid physical examination by medical officers to see that none of them were suffering from any complaint which would work against them in performing their duties efficiently. The drivers look upon this, however, as an effort by the Council to get rid of a number of the older members of the force, in view of the new Employers' Liability Act. Mr. Fell has publicly stated that there is not the slightest foundation for any such fear. His action has solely to do with the safety of the public, and he considers that it is imperative that every driver should be examined so that there may be no chance of drivers being affected, for instance, with a weak heart, who would be liable to sudden seizure at a critical moment. For the moment the subject has been dropped, but it will doubtless be revived before long.

While on the subject of London traffic, it is interesting to note that as the result of continued agitation for the appointment of a Traffic Board for London, which was recommended by the Royal Commission on London Traffic a year or so ago, such a Board has now been decided upon, and the Board of Trade has announced that it is going to establish a branch of its department for this purpose. Colonel Sir Herbert Jekyell, K. C. M. G., now assistant secretary in the railway department, will have charge of this branch. This is, of course, not exactly what has been desired, being merely a department of the Board of Trade and possessing no further powers than that department possesses, but it will doubtless fulfil its purposes, and will at least be able to give serious consideration to the existing traffic problems and to make preparation of schemes for the regulation of the traffic which would have to be authorized by Parliament later. The Moderate Party of the London County Council, now in authority, is strongly in favor of this Board, though it does not meet with the approval of the Progressives. Sir John Benn, one of the late chairmen of the tramways committee, stated that it would cost the rates at least £33,000 a year, and other Progressives stated that the proper Board to have complete control of the traffic of London was the London County Council itself.

It will be remembered that the starting up of the London County Council power house at Greenwich gave rise to a serious controversy between that body and the authorities of the Greenwich Observatory, owing to vibration and emission of fumes, both of which were inclined to upset the delicate calculations of that invaluable institution. In providing for extension therefore, it was decided some time ago not to make use of any further reciprocating engines, and a contract has just been awarded to Williams & Robinson, of Rugby, for two 5000-kw, three-phase turbo-generators, consisting of their well-known type of turbine coupled to Dick Kerr generators. Though Williams & Robinson were not the lowest bidders, the committee recommended the acceptance of their proposal, giving various reasons why they believed the equipment offered to be the best available. Stiffer bearings, lower peripheral speed, less time necessary in starting and less energy required for excitation than in those of other makes were some of the reasons given by the Council for its action.

The tramcar which was so constructed that it could run on the Leeds and Bradford lines, which are of different gage, has given excellent results during its month's trial imposed by the Board of Trade. The tramways committees of the two Corporations are in negotiation with a view to arranging for a permanent through service. The results of the trials have been formally submitted to the Board of Trade, whose approval seems to be all that is necessary before the regular through service of cars becomes an accomplished fact.

The House of Lords recently gave judgment in one of those tramway cases where a corporation acquires the undertaking from a company, and a question arises as to the basis on which the purchase is to be effected. The tramway in question was situated in the borough of Dudley, and the Corporation contended that the basis of valuation should be "structural basis," while the Stourbridge & District Electric Traction Company maintained that the valuation ought to be the going concern basis.

Mr. Justice Swinfen Eady adopted the former view, and so did the Court of Appeal, and the House of Lords has now upheld the judgment of Justice Swinfen Eady. Lord Collins, who was the dissentient, thought the valuation should proceed on the going concern basis. The difference between the two methods of valuation was as between £16,548 and £32,576.

The natural sequence of the Dundee and Monifieth tramways is, in the opinion of most people, the extension of the system to Carnoustie. This development, it is understood, is likely to be accomplished at no very distant date. A survey of the proposed route has been made, and other arrangements made for forwarding the project.

The Municipal Tramway Association will hold its annual meeting at Manchester from Sept. 25 to 27. Several questions to be discussed deal with matters of urgency, and the debates should prove of exceptional interest. J. M. McElroy, president, and A. R. Fearnley, secretary, are making the usual careful preparations for the meeting, which promises to be as successful as in former years, both from a business and social point of view.

It is understood that a contract has been definitely arranged between the Fife Electric Power Company and the Dunfermline & District Tramways Company for a supply of electricity for the tramways. The tramways, which are intended to serve the district east of Dunfermline as far as Lochgelly and north as far as Kelty, will cover a distance of 15 miles.

Sir Francis Cory-Wright, chairman of the light railways committee of the Middlesex County Council, recently opened the new electric tramway from Palmer's Green to Winchmore Hill by personally driving the first car over the route in the presence of a number of influential people, including Board of Trade, County Council, and tramway officials. This extension will ultimately be carried to Enfield.

After years of negotiation and debate the Town Council of Luton has decided definitely to accept the offer of J. G. White & Company to work a system of electric tramways for Luton. The agreement gives the Council the option of taking over the scheme after five or fifteen years.

An important arrangement has just been concluded between the Hampstead Tube and the Central London Railway for the issue of through tickets between their respective systems. This is the first time in the history of the Central London Railway that through tickets have been issued with any other company, and the new arrangement will tend to bring the Hampstead and Highgate districts into closer touch with the city and West End.

The question of a general revision of passenger fares in London was recently considered at a meeting of officials of the various underground and tube railways and the principal 'bus companies. The meeting was held in private, but at its close it was officially announced that the following resolutions had been passed:

1. That a conference be formed to be called the "London Passenger Traffic Conference."

2. That the object of the conference is to create an organization for mutual conference in regard to fares, routes, and other matters of common interest, and generally to take such action as may from time to time be deemed expedient to promote the general interests of the members thereof.

3. That each company represented on the conference shall be entitled to one vote.

4. That the chairman and deputy chairman of the conference shall be elected by the members at the first meeting held in January in each year, and shall hold office for one year.

5. That any company represented on the conference may at any time record a dissent from any resolution of the conference, and such resolution shall thereupon have no binding effect on the dissenting company.

Norman A. Thompson, consulting electrical engineer, initiator of the scheme for the electrification of the Edinburgh tramways, says he has come to the conclusion that, despite the heavy outlay on the existing tramways, it is a commercially sound proposition to convert the whole undertaking at once to electric working, assuming that reasonable terms would be granted by the Corporation and the present Tramway Company on behalf of any new capital involved, and, further, that the overhead system be adopted practically throughout the town. A financial firm of high standing has been considering the problem in conjunction with himself, and all that has been done is to ascertain that the company is willing to consider being bought out if the terms are agreeable, and the Town Council has been asked how much cash down it would want to sell the present tramways to a new company and grant a concession for working them for sixty years.

Sir Henry Oakley, presiding at the half-yearly meeting of the Central London Railway Company, said that in connection with the Anglo-French Exhibition at Shepherd's Bush, the company proposed to put a small station on a loop line so as to take passengers to and from the entrance of the show. During the six months under review there had been a steadily growing diminution in the number of passengers, the diminution being two millions, or 10 per cent, whilst the cash loss was £16,000. The diminution was altogether due to the intense and increased competition. The ratio of the "Tube's" loss in traffic was now diminishing, and it looked as if the bottom had been reached. Regarding the negotiations for a conference between the railways and the 'bus companies, nothing definite had yet been accomplished, but he looked forward to a successful outcome to the various meetings. As to the revision of their own fares, this was turning out successfully, and the extra penny on the long journey meant an addition to their revenue, without extra cost, of £60 to £70 per day. The dividend at the rate of 1 per cent less than in the corresponding period represented £15,000 less to divide, but there was carried forward £25,000 instead of the £14,000 brought in.

Another serious tramway accident occurred last month, and this time Bradford, a city with many grades, is the sufferer. An electric car with a covered top descending Church Bank, a steep decline into Forster Square in the center of the city, failed to turn the corner, and left the rails, running into a warehouse. The top compartment was smashed away from the body, and the latter, after recoiling from the building, fell over on its side. Including the driver and conductor there were twelve persons on the car, all of whom were more or less injured, while a pedestrian who could not escape the car had his leg broken. After the accident Mr. Spencer, the manager of the tramways, made an inspection of the car and states that he found that the three brakes, the hand brake, the slipper brake, and the electric brake were all in working order, and the condition of the wheels showed that they had not skidded. The cause of the accident is therefore at present not explained.

A. C. S.

SERIOUS ACCIDENT ON AN ILLINOIS SYSTEM

Thirteen persons were killed and seventy-six injured in a head-on collision between a train, consisting of a motor car and trailer, and an empty express car on the Charleston and Mattoon line of the Mattoon City Railway Company at 10:30 o'clock Aug. 30, one mile west of Charleston. Both cars were running at high speed and met as they were rounding a sharp curve. The train was telescoped by the express car and both were reduced to a mass of wood and iron. A confusion of orders received over the telephone is said to have been responsible for the accident.

THE ILLINOIS TRACTION SYSTEM IN ST. LOUIS

The Illinois Traction System has concluded all arrangements to enter St. Louis in the manner contemplated in its original plans. As a result of the action of the Venice City Council the company is enabled to form an adequate independent terminal system in connection with its new bridge across the Mississippi River from Venice to the foot of Salisbury Street in St. Louis. The company has ground for yards, terminals and depots at Salisbury Street in St. Louis, and adjacent to the stock yards at Venice. The land on both sides of the river is situated at the approaches of the proposed bridge. The Venice Council has granted the company rights of way over a mile of city streets and over a mile of private property. The private right of way is for a separate bridge approach. Preparations are being made to begin the construction of the bridge piers as soon as possible. By the time that this work is done, the steel superstructure will be on hand, ready to be placed in position. The intention is to have the line in St. Louis finished when the bridge will be completed.

ARRESTS IN ROCHESTER IN CONNECTION WITH FALSE STATEMENTS IN SECURITY EMPLOYMENT

Judge Chadsey at Rochester has made an example of Harry Hill and Harry Stuckey, who, as announced in the issue of the Street Railway Journal for Aug. 24, were arrested and charged with making false statements to secure employment. The judge imposed a straight sentence of thirty days each in the penitentiary upon the defendants, and added another penalty of $25 fine or an additional twenty-five days in the penitentiary. When arraigned Hill and Stuckey pleaded guilty, admitting that statements they swore to when they took jobs with the company were false. The judge said: "I can readily see how such men make such statements to get positions, but when there is wrongdoing it reflects upon the good names of other employees. They have violated this section of the code. There must be some punishment meted out to them. They will spend thirty days each in the penitentiary and an additional fine of $25 or twenty-five days in the penitentiary."

The section of the code under which Hill and Stuckey were arrested is 570. Stuckey, it was stated in court, is the son of a minister in Altoona, while Hill hails from a city near Altoona. W. C. Callaghan, superintendent of transportation of the Rochester company, and S. S. Crane, of Altoona, manager of the Altoona & Logan Valley Electric Railway, were both in court. Mr. Crane identified Hill and Stuckey as former employees of his company.

The Rochester Railway Company has been after conductors who they think have been "knocking down" recently, and the arrest of Hill and Stuckey was due to some hard work on the part of Mr. Callaghan.

PARK AMUSEMENT ORGANIZATION PROPOSED

An organization of the owners of all of the open-air amusement interests in North America is being proposed by C. H. Oberheide, of New York City and Chicago, who originated and is now acting as vice-president and general manager of the Trenton (N. J.) White City Company. The purpose is to advance mutual interests in securing information for the use of its members regarding construction of various devices, the booking of the best European and American attractions, and the discussion of best business methods in management. It is reported that fifty park owners have already given full consent to the scheme.

It is estimated that there are in the United States about 300 park owners, and that at least $10,000,000 is invested in amusement park enterprises in the United States, Canada and Mexico. Up to the present time no organization has existed to represent these interests. Mr. Oberheide is now in communication with every amusement park owner upon the North American continent, and has formulated a working plan for the purpose of organization.

THE SITUATION IN CHICAGO

Bion J. Arnold, president of the board of supervising engineers in traction matters, has given more fully his ideas on the loop and subway question. He reiterates his former opinion, it would be better if the loop could be abandoned and the cars now run on elevated roads put under ground, but taking into consideration the legal difficulties in the way of taking down the loop, he says the most feasible present plan is to use the structure for through train service and relegate the loop feature to the subways.

"It is probable," Mr. Arnold is quoted as saying, "owing to the geographical conditions which naturally restrict Chicago's business district, that not only the surface and subsurface of the streets but also the supersurface will be required to take care of transportation needs in the future. These facts, combined with the fact that the removal of the elevated structure would be extremely difficult for legal reasons, make it probable that it will have to be utilized in place.

"Whatever is done with it, however, should tend toward through routeing and the increasing of the business district. I am opposed to using the structure for shuttle trains or any other scheme tending to perpetuate this loop feature, but it can be used for through trains from north to south."

Mr. Arnold and the other members of the board of supervising engineers have completed their figures showing the credits due the Chicago City railway for the improvements made in its property between June 30, 1906, and Feb. 1, 1907, the dates when the appraisement of its property was made and the ordinance under which it is now operating went into effect. The total is $1,816,853. According to the ordinance, this must be added to the original appraisement, $21,000,000, making a total of $22,816,853 which the city would have to pay if it bought the property now.

L. C. Krauthoff and George W. Wickersham, of New York, and John C. Hately, Seymour Morris and W. T. Fenton, of Chicago, constituting the committee of reorganization and readjustment of the Union Traction properties, have sent out a statement to all interested stock and bondholders, especially the latter, explaining in detail what they are asked to do in order to perfect the reorganization plan and allow the Chicago Railways Company to accept the ordinances and operate the present Union Traction properties. The arguments addressed to the bondholders, who are the main persons to be considered, is that the entire mortgage indebtedness of the Chicago Railways Company is limited to the amount payable by the city in event of purchase. Under this plan every bondholder is offered dollar for dollar in a new bond, intrinsically worth its face value, and his only contribution to the readjustment is the difference now payable on his bond and 4 per cent for five years and 4½ per cent thereafter.

Justice Brewer, of the United States Supreme Court, has telegraphed that he will be in Chicago Sept. 5 to sit with the Court of Appeals in the hearing of the Union Traction troubles then to be had.

P. S. C. MAKES RECOMENDATIONS FOR IMPROVING SERVICE

The Public Service Commission, of the first district of New York, has adopted five orders providing for changes in the operation of the elevated, surface and subway lines in Manhattan and the Bronx, and ordering the Brooklyn Rapid Transit to show cause why it should not discontinue its ash and garbage trains. In compliance with provisions of the public service act, each common carrier corporation affected has a day on which to appear and present evidence and examine witnesses in regard to the matter contained in the orders. The hearings on the orders will be held from Sept. 16 to 20, inclusive. After the corporations have their "day in court" the orders will formally be issued to them.

The five orders provide for more cars on the surface lines and more trains in the subway and on the elevated. Besides these orders, the Commission issued an order to the Interborough-Metropolitan Company directing it to give Marvyn Scudder, an expert accountant for the Commission, access to all its books, papers and records.

One of the orders directs the New York City Railway Company to increase service on its Madison and Fourth Avenue line by the addition of a total of 180 cars. Another directs that the service in the subway and on all elevated lines be increased 20 per cent for an hour and a half both before and after the rush hours, and to furnish adequate transportation facilities on holidays.

The New York City Railway Company is also ordered to increase the service on its Broadway lines and the lines run in connection with those lines, and in continuation of them over Columbus and Lenox Avenues, Seventh and Lexington Avenues, and also to make other changes in the running of cars.

The fourth operative order directs that numerous through trains shall be run to West Farms over the Second and Third Avenues lines, under certain conditions. This and the order to the Brooklyn Rapid Transit Company comprise the operative orders issued yesterday.

The first order is:

It is hereby ordered that a hearing be had on the 16th day of September, 1907, at 2 o'clock in the afternoon, and at any time or times to which the same may be adjourned, at the rooms of the Commission, borough of Manhattan, city and State of New York, to inquire whether the service and equipment of the New York City Railway Company in respect to the transportation of persons in the First District is unjust, unreasonable, improper or inadequate, and if so found to be to determine whether the following increase in the service and change in the equipment would be just, reasonable, adequate and proper to be put in force, observed and used in the transportation of persons in the said First District, namely:

(1) To increase the present service on the Madison and Fourth Avenue line from 116th Street to Astor Place and Broadway by running thirty additional cars south from 116th Street to Astor Place and Broadway between the hours of 6 o'clock and 9 o'clock a. m. daily except Sundays.

(2) To increase the present service on the Madison and Fourth Avenue line from 135th Street to Astor Place and Broadway by running twenty additional cars south from 135th Street to Astor Place and Broadway between the hours of 6 o'clock and 9 o'clock a. m. daily except Sundays.

(3) To increase the present service on the Madison and Fourth Avenue line from the Brooklyn Bridge by running twenty additional cars north from the Brooklyn Bridge between the hours of 6 and 8 o'clock a. m. daily except Sundays.

(4) To increase the present service on the Madison and Fourth Avenue line from Astor Place and Broadway by running forty additional cars north from Astor Place and Broadway between the hours of half past 4 and 7 o'clock p. m. daily except Sundays.

(5) To increase the present service on the Madison and Fourth Avenue line from Astor Place and Broadway by running thirty additional cars north from Astor Place and Broadway between the hours of 7 o'clock and 12 o'clock daily, except Sundays.

(6) To increase the present Sunday service on the Madison and Fourth Avenue line by running forty additional cars over said line during the day.

(7) To require that destination signs showing the route and all points of destination of the cars should be provided and conspicuously displayed upon each car run over the Madison and Fourth Avenue line.

(8) To require that signs giving the "run number of the cars should be provided and conspicuously displayed upon each car run over the Madison and Fourth Avenue line.

All to the end that the Commission may make such order or orders in the premises as shall be just and reasonable.

Further ordered: That the New York City Railway Company be given at least ten days' notice of such hearing by service upon it either personally or by mail of a certified copy of this order, and that at such hearing the said street railroad corporation be afforded all reasonable opportunity of presenting evidence and examining and cross-examining witnesses as to the matters hereinabove set forth.

STEAM VS. ELECTRICITY THE SUBJECT AT THE NEW YORK R. R. CLUB

The next regular meeting of the New York Railroad Club will be held at the building of the United Engineering Societies on Friday evening, Sept. 20. Max Toltz, of St. Paul, Minn., vice-president and general manager of the Manistee & Grand Rapids Railroad, will present a paper on "Steam Locomotive versus Electric Locomotive." Invitations to formally discuss the same have been accepted by Samuel Vauclain, Baldwin Locomotive Works, Philadelphia, Pa.; C. A. Seley, Chicago, Rock Island & Pacific Railroad, Chicago, Ill.; George Gibbs, chief engineer Pennsylvania Tunnel & Terminal Railroad, New York City; J. E. Muhlfeld, superintendent motive power Baltimore & Ohio Railroad, Baltimore, Md.; H. H. Vaughan, assistant to the vice-president, Canadian Pacific Railroad, Montreal, Quebec.

OHIO ELECTRIC RAILWAY PURPOSES ANNOUNCED

Official announcements have been made regarding the Ohio Electric Railway Company, which set at rest the rumors regarding the purpose of the company. As stated in the last issue of the Street Railway Journal, the company on Aug. 27 increased its capital stock from $100,000 to $25,000,000, half of which is preferred. It was this announcement that caused the circulation of the rumors. The official announcements are as follows:

THE OHIO ELECTRIC RAILWAY COMPANY.

CINCINNATI, OHIO, Aug. 31, 1907.

GENERAL ORDER.

To Officers and Employees The Indiana, Columbus & Eastern Traction Company, The Lima & Toledo Traction Company:

You are hereby notified that the property formerly owned and operated by the Lima & Toledo Traction Company and the Indiana, Columbus & Eastern Traction Company has been acquired by the Ohio Electric Railway Company, and beginning on midnight on this date, will be operated by said company.

Until further notice all officers and employees will be retained in their present positions.

The property will be operated under the following districts:

Western District: Consisting of the lines between Dayton and Richmond and between Dayton and Union City.

Central District: Consisting of the lines between Dayton and Columbus and between Springfield and Lima.

Eastern District: Consisting of the lines between Columbus and Zanesville and between Columbus and Morgans, and that portion of the lines in the City of Columbus as far west as the Big Four crossing.

Northern District: Consisting of the lines between Lima and Fort Wayne and between Lima and Defiance and between Lima and Toledo.

HERBERT MCNULTA, President.

THE INDIANA, COLUMBUS & EASTERN TRACTION COMPANY.
THE LIMA AND TOLEDO TRACTION COMPANY.

CINCINNATI, OHIO, Aug. 31, 1907.

GENERAL ORDER.

To Officers and Employees The Indiana, Columbus & Eastern Traction Company, The Lima & Toledo Traction Company:

You are hereby notified that the property formerly owned and operated by the Lima & Toledo Traction Company and the Indiana, Columbus & Eastern Traction Company has been acquired by the Ohio Electric Railway Company, and beginning at midnight on this date will be operated by said company.

W. KESLEY, President.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED AUG. 20, 1907

863,580. Underframe for Cars; Enton Becker, Columbus, Ohio. App. filed May 10, 1907. Provides means whereby the underframe can be adapted to trucks of more than the usual height so that the coupling devices will be made to properly align with the coupling devices on cars having trucks of standard height.

863,587. Rail Supporting Device; John W. Carraway, St. James City, Fla. App. filed April 13, 1907. Stringers having rail seats therein are mortised to the cross-ties.

863,609. Electrically Signaling from Moving Trains; Alva D. Jones, Louisville, Ky. App. filed Dec. 3, 1906. An apparatus actuated by the steam or smoke issuing from a locomotive for completing an electrical circuit to operate signals, etc., by chemical means, as the train passes.

863,615. Metallic Car; Joseph L. Levy, New York, N. Y. App. filed May 18, 1903. Details of construction of a hopper car.

863,667. Relay; Jacob B. Struble, Wilkinsburg, Pa. App. filed Feb. 18, 1907. A relay for use in railway signaling in which sectional track rails are charged by an alternating current and connected by inductive bonds are used.

863682. Railway Tie; Samuel H. Warren, Hurricane, Tenn. App. filed May 6, 1907. A metallic rail having adjustable rail-chairs thereon.

863,690. Trolley Device; Samuel E. Belcher, Los Angeles, Cal. App. filed Jan. 10, 1906. Pneumatic means to aid in repositioning the trolley wheel on the wire when it has left the same.

863,694. Car Mover; George Bolinger, Neodesha, Kan. App. filed Dec. 31, 1906. Details.

863,699. Extension Car Step; James H. Cameron, Paris, Texas. App. filed April 29, 1907. A temporary extension step for the car which may be readily folded and pushed back to a position beneath the platform or lower step.

863,744. Air Brake Coupling; Edward D. Nelson and William L. Brown, Altoona, Pa. App. filed Feb. 20, 1906. In an air brake system, an air pipe connection including a coupling hose having metallic end couplings and a flexible body, said body having an inner rubber tube surrounded by an outer fabric tube permeable to air through the interstices of the fabric and entirely disconnected with, but supporting the inner tube, and of sufficient strength to prevent a serious deformation and rupture of the inner tube on the formation of an initial leak therein, thereby preventing said leak from causing an emergency application of the air brakes.

863,746. Air Brake Apparatus; Edward D. Nelson and William L. Brown, Altoona, Pa. App. filed May 21, 1907. A special construction of hose designed for the train pipe and line connections of air brake systems.

863,755. Controlling Apparatus for Railroad Signaling; Petrus J. Portman, Amsterdam, Netherlands. App. filed June 8, 1906. Signal system operated by magnetic induction by which the engineer is kept informed of the condition of the trolley conductor both ahead and behind his train.

863,785. Automatic Air Brake System and Engineer's Valve; Fred B. Corey, Schenectady, N. Y. App. filed May 25, 1904. Means controlled by the engineer's valve for breaking the connection between the train-pipe and the triple valve on the locomotive when said engineer's valve is moved to connect the train pipe for releasing the brakes.

863,788. Rail Joint; Robert A. Dinsmore, New Athens, Ohio. App. filed March 29, 1907. The fish-plates have hook-shaped lugs which pass through the webs of the rails and engage one another.

863,318. Rail Bond; Ben Willard, New Orleans, La. App. filed March 31, 1899. The bond consists of a single strand conductor provided at its ends with a plurality of contacts flexibly connected to each other.

863,823. Combined Automatic and Straight Air Brake; Edward A. Wright, Edgewood Park, Pa. App. filed Dec. 19, 1904. An independent brake valve adapted to control a supply of air from the main reservoir to the driver brake auxiliary reservoir, whereby the brakes on the locomotive may be controlled independently of the automatic train brakes.

863,835. Rail Joint; George R. Clifford, Chicago, Ill. App. filed April 9, 1906. The fish-plates and bolts are of heavy construction and the object of the invention is to provide rigidity of the joint.

863,849. Load Brake Apparatus; Herbert T. Herr, Denver, Col. App. filed Dec. 1, 1904. Provides for the application of an increased braking force by fluid under pressure from a supplemental reservoir acting on the piston of a supplemental brake cylinder, when an increased or additional braking force is required.

863,865. Railroad Signal Device; William Michel, Columbus, Ohio. App. filed April 8, 1907. A lever or stop located adjacent to the rail to operate a valve located on the locomotive whereby a signal is actuated.

863,866. Rail Joint; William B. Michel, Buffalo, N. Y. App. filed April 27, 1907. The abutting rail-sections have reinforced webs to form shoulders, and the fish-plates have reinforced ends

forming shoulders which engage with the shoulders on the webs.

863,871. Car Underframe; Harry M. Pflager, St. Louis, Mo. App. filed March 9, 1907. Details of construction.

863,904. Railway Car; Harry Cohen, Philadelphia, Pa. App. filed May 13, 1907. A car having seats arranged crosswise thereof and doors at both ends of each seat adapted to be raised and lowered. Station indicating apparatus.

863,912. Detector Bar; Walter E. Foster, Chicago, Ill. App. filed June 8, 1906. A detector bar mounted adjacent to the rail and movable upwardly and laterally to engage a face of a wheel on the rail

863,913. Block Signaling Apparatus; Walter E. Foster, Chicago, Ill. App. filed April 25, 1907. A signal locking device arranged to be operated by a reversal of the line polarity, and means whereby the passage of a train into and out a block automatically reverses the line polarity and thereby operates the lock.

863,935. Hanger Strap or Handhold for Cars; John F. Newton, Jr., Boston, Mass. The handhold of the strap is provided with a non-absorbent material.

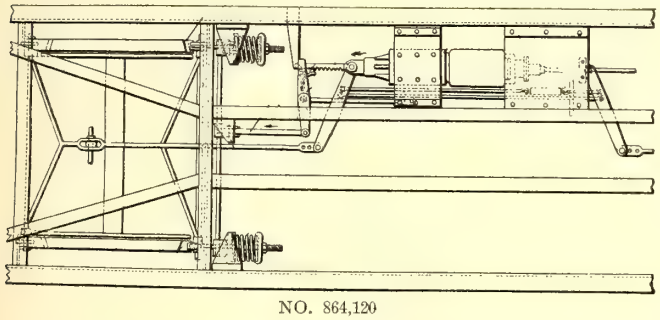
863,954. Snow Plow; William C. Vague, Brooks, Minn. App. filed April 11, 1907. Embodies a longitudinal conveyor for initially removing the snow from the track and a transverse conveyor for receiving the snow from the longitudinal conveyor and throwing it to one side of the track.

863,984. Trolley; Nelson J. Greenison, New York, N. Y. App. filed Jan. 28, 1907. The trolley wheel is swiveled on a vertical axis on the end of the trolley pole and is constrained to move within a limited arc of angular movement by cars or lugs thereon.

863,987. Railway Tie; Thomas G. Hamilton, Pittsburg, Pa. App. filed Feb. 18, 1907. A trough-shaped open top tie composed of plate metal bent to provide a supporting base, upwardly and inwardly sloping sides and outwardly extending flanges, with stiffening abutments and recesses pressed in the sides, bottom and top portions, and having its ends cut off at an angle backwardly and upwardly from the lower terminals of the tie.

864,000. Rail Joint; Michael Kalina, Braddock, Pa. App. filed Jan. 30, 1907. A base and integral fish-plates adapted to engage the rail ends and be secured thereto by a pin and key.

864,108. Automatic Coupling; James C. Sands, Dover, N. J. App. filed Dec. 4, 1906. Relates to the automatic coupling of



NO. 864,120

train pipe systems, including the steam, air and water mains.

864,120. Brake Mechanism for Railway and Other Vehicles; Harvey E. Brown, Norbury, Eng. App. filed July 24, 1905. Utilizes the tangential pull of the brake blocks for counteracting the direct pressure incidental to the application of the brake and thereby reduces the amount of pressure between the brake blocks and the wheels.

864,121. Brake Mechanism for Railway and Other Vehicles; Harvey E. Brown, Norbury, Eng. App. filed April 20, 1907. In railway brake mechanism, means co-operative with and actuated by the tangential pull on the blocks for definitely and positively arresting the application of the brakes, whereby the brake blocks are caused to move towards or away from the wheels and thereby produce a variation of pressure thereon.

864,137. Tie Plate; Willis McKee, Elyria, Ohio. App. filed June 2, 1905. A rolled tie plate bar having a transverse abutment and longitudinal ribs and having a straight flat upper surface.

PERSONAL MENTION

MR. J. T. PORTER, having resigned from the Shreveport Traction Company, of Shreveport, La., to engage in the electrical construction business, Mr. H. H. Lunsford has been appointed superintendent and Mr. D. G. Rushing, master mechanic.

MR. A. F. SCHOEPF, superintendent of the Columbus and Springfield and Grove City divisions of the Indiana, Columbus & Eastern Traction Company, who has been on an extended leave of absence to recuperate his health, is expected to take up his work again in a few days. He is much improved in health.

MR. WILLIS C. CONRAD has been appointed claim agent for the New Orleans Railway & Light Company, to succeed Mr. William H. Renaud, recently appointed private secretary to President Foster. Mr. Conrad has been in the service of the company as assistant claim agent since the consolidation of the various railroad companies in New Orleans, having served prior to that time as claim agent for the New Orleans & Carrollton Railroad, Light & Power Company.

MR. C. T. CONVERSE, who has been connected with the Woonsocket Street Railway Company since last February, has been appointed traveling auditor for the New England Investment & Security Company, with headquarters at Boston. Mr. Converse, previous to coming to Woonsocket, was in Millbury, Mass., for a period of seven years. When the Woonsocket line went under new management he was made the personal representative of the New England Investment & Security Company.

MR. WILLIAM H. RENAUD, claim agent of the New Orleans Railway & Light Company, has been appointed as private secretary to President Foster of the company, and specially assigned to the duty of car-service improvements. Mr. Renaud is one of the best informed men in the service of the company, having long been identified with the company and its constituents. He served the New Orleans Traction Company under the administration of Mr. H. M. Littell and also under that of Mr. C. D. Wyman.

MR. E. R. COFFIN, vice-president of the Electric Bond & Securities Corporation of New York, which controls a number of electric light and railway properties throughout the United States, died suddenly Sept. 2 at the Omaha General Hospital, where he was taken a week ago while traveling from San Francisco to New York. Mr. Coffin was born in Lynn, Mass., July 28, 1873. After being graduated at Harvard University, where he took the degree of A. B., he entered the Harvard Law School, from which he was graduated in 1896. He was admitted to the bar of Massachusetts, and later practiced in New York City until November, 1904, when he became vice-president of the Electric Securities Corporation. His father was Mr. C. A. Coffin, president of the General Electric Company.

MR. GEO. STANLEY has resigned as purchasing agent of the Cleveland Electric Railway Company to come East and manage his interests in the New York & North Shore Railroad, which proposes to build an important system to connect Mineola, Port Washington and a number of towns along the sound side of Long Island. This is the second company that Mr. Stanley, together with Cleveland interests, has been connected with on Long Island. The other was the New York & Long Island Traction Company, operating between Mineola, Hempstead and Freeport, which was sold to the Belmont interests, controlling the Long Island City lines and the traction properties in New York. Mr. Geo. Stanley is a brother of John J. Stanley, vice-president and general manager of the Cleveland Electric Railway Company, who is a member of the Andrews-Stanley-Vanderbilt syndicate.

MR. R. W. BAILEY, of the Alton division of the East St. Louis & Suburban Railway Company, has resigned and will go to Peoria to become general superintendent of the Peoria Railway system, owned by the McKinley syndicate. Mr. Bailey has been connected with the syndicate owning the East St. Louis & Suburban for many years. He was the receiver of the line from St. Louis to St. Charles, and before going to Alton had a responsible position in the operating department of the East St. Louis Railway system. The office of superintendent of the Alton division is subordinate to that of the general superintendent, held by Mr. G. C. Pierce, and that of general manager, held by Mr. L. C. Haynes. No superintendent will be appointed to succeed Mr. Bailey. The Alton business will be handled from the East St. Louis offices of the company, and Mr. T. W. Gregory, auditor of the company, will spend half his time in Alton. Mr. R. C. Hardy, chief clerk, will have his authority extended over the Alton division. Mr. Bailey has been presented with two handsome testimonials by the employees of the company at Alton as a token of esteem. The members of the street railway employees union, conductors and motormen, gave Mr. Bailey a beautiful gold emblem of the Order of Elks, the neck being studded with diamonds, while the office force gave him a handsome watch fob.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement, "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. ‡ Including Rapid Railway system, Sandwich, Windsor & Amherstburg Railway, and Detroit, Monroe & Toledo Short Line Railway.

Company.	Period.	Total Gross Earnings.	Operating Expenses.	Net Earnings.	Deductions From Income.	Net Income, Amount Available for Dividends.
AKRON, O. Northern Ohio Tr. & Light Co.	1 m., July, '07	209,040	110,149	98,891	43,624	55,267
	1 " " '06	183,744	100,937	82,807	40,660	42,147
	7 " " '07	1,058,297	623,554	434,743	296,359	138,384
	7 " " '06	935,685	581,025	354,660	280,413	74,247
CHAMPAIGN, ILL. Illinois Traction Co.	1 m., July, '07	329,601	*183,318	146,283	.....	.....
	1 " " '06	262,725	*136,708	126,017	.....	.....
	7 " " '07	2,035,918	*1,158,200	877,718	.....	.....
	7 " " '06	1,625,595	*913,151	712,444	.....	.....
CHARLESTON, S. C. Charleston Consolidated Ry., Gas & Elec. Co.	1 m., July, '07	67,298	38,619	28,679	13,517	15,162
	1 " " '06	61,727	34,564	27,163	13,017	14,147
	5 " " '07	302,942	185,667	117,274	67,583	49,691
	5 " " '06	272,214	162,708	109,506	64,933	44,573
CHICAGO, ILL. Aurora Elgin & Chicago Ry. Co.	1 m., June, '07	136,909	70,455	66,454	27,650	38,804
	1 " " '06	113,155	60,043	53,112	24,939	28,173
	12 " " '07	1,332,597	722,776	609,820	319,100	290,720
	12 " " '06	1,175,821	645,392	530,428	294,018	236,410
Chicago & Milwaukee Elec. R.R. Co.	1 m., July, '07	117,096	42,559	74,537	.....	.....
	1 " " '06	97,425	33,485	63,939	.....	.....
	7 " " '07	551,604	236,914	314,691	.....	.....
	7 " " '06	429,298	177,279	252,019	.....	.....
CLEVELAND, O. Cleveland, Painesville & Eastern R.R. Co.	1 m., July, '07	34,401	*15,893	18,508	6,796	11,712
	1 " " '06	32,631	*15,774	16,856	7,108	9,748
	7 " " '07	157,587	*84,225	73,362	50,072	23,290
	7 " " '06	146,518	*81,876	64,642	48,314	16,328
Cleveland, Southwestern & Columbus Ry. Co. (Incl. Ohio Central)	1 m., June, '07	67,965	40,265	27,701	.....	.....
	1 " " '06	59,058	31,777	27,281	.....	.....
	6 " " '07	338,687	205,182	133,505	.....	.....
	6 " " '06	289,277	173,160	116,117	.....	.....
COLUMBUS, GA. Columbus Elec. Co.	1 m., June, '07	30,334	*18,794	11,540	10,100	1,440
	1 " " '06	24,979	*13,657	11,322	8,762	2,560
	12 " " '07	334,704	*187,979	146,725	112,507	34,218
DALLAS, TEX. Dallas Elec. Corp'n.	1 m., June, '07	91,926	*65,514	26,412	18,731	7,681
	1 " " '06	88,821	*54,842	33,979	15,292	18,688
	12 " " '07	1,062,056	*780,345	281,711	198,472	83,239
	12 " " '06	1,008,363	*623,627	384,736	183,387	201,349
DETROIT, MICH Detroit, Jackson & Chicago Ry.	1 m., July, '07	38,586	*29,688	8,898	15,012	†6,114
	6 " " '07	203,212	*161,285	41,927	90,075	†48,148
‡Detroit United Ry. Co.	1 m., July, '07	668,551	*383,624	284,927	117,009	167,918
	1 " " '06	603,182	*337,576	265,606	105,463	160,143
	7 " " '07	3,791,254	*2,329,767	1,461,487	796,012	665,475
	7 " " '06	3,381,061	*2,015,646	1,365,415	710,206	655,209
DULUTH, MINN. Duluth St. Ry. Co.	1 m., June, '07	72,816	34,712	38,104	17,925	20,179
	1 " " '06	66,999	29,266	37,734	17,534	20,200
	6 " " '07	386,121	201,052	185,068	105,932	79,137
	6 " " '06	356,238	191,475	164,762	105,053	59,709
EAST ST. LOUIS, ILL. East St. Louis & Suburban Co.	1 m., June, '07	183,067	93,754	89,313	.....	.....
	1 " " '06	163,019	81,583	81,436	.....	.....
	6 " " '07	997,817	542,952	454,865	.....	.....
	6 " " '06	896,157	457,451	438,706	.....	.....
EL PASO TEX. El Paso Cos.	1 m., June, '07	41,030	*30,002	11,028	5,214	5,815
	1 " " '06	32,183	*20,334	11,848	3,797	8,052
	12 " " '07	444,507	*339,129	105,378	58,268	52,110
	12 " " '06	332,572	*221,608	110,964	45,347	65,617
FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co.	1 m., June, '07	107,307	64,237	43,070	.....	.....
	1 " " '06	93,648	57,285	36,363	.....	.....
	6 " " '07	569,277	348,995	220,282	.....	.....
	6 " " '06	491,886	307,090	184,796	.....	.....
FT. WORTH, TEX. Northern Texas Tr. Co.	1 m., June, '07	92,588	*53,683	38,905	10,624	28,281
	1 " " '06	73,032	*45,398	27,634	9,942	17,692
	12 " " '07	967,105	*607,526	359,579	122,020	237,559
	12 " " '06	735,736	*454,365	281,371	119,275	162,096
GALVESTON, TEX. Galveston Elec. Co.	1 m., June, '07	36,521	*19,501	17,020	4,167	12,853
	1 " " '06	32,165	*16,411	15,754	4,167	11,587
	12 " " '07	345,980	*206,049	139,931	50,000	89,931
	12 " " '06	286,613	*179,595	107,018	50,000	57,018
HOUGHTON, MICH. Houghton County St. Ry. Co.	1 m., June, '07	22,438	*12,063	10,375	3,945	6,430
	1 " " '06	20,152	*11,752	8,400	3,918	4,482
	12 " " '07	243,320	*151,121	92,199	47,168	45,031
	12 " " '06	211,196	*144,624	66,572	45,945	20,627
HOUSTON, TEX. Houston Electric Co.	1 m., June, '07	59,076	*39,167	19,909	8,417	11,492
	1 " " '06	51,158	*30,138	21,021	7,692	13,329
	12 " " '07	634,522	*413,231	221,291	95,910	125,380
	12 " " '06	558,301	*346,646	211,655	100,366	111,289
KANSAS CITY, MO. Kansas City Ry. & Lt. Co.	1 m., June, '07	515,816	281,275	234,541	153,228	81,312
	1 " " '06	457,788	245,102	212,686	142,026	70,660
LEXINGTON, KY. Lexington & Interurban Rys. Co.	1 m., June, '07	45,475	30,964	14,511	.....	.....
	1 " " '06	47,508	30,114	17,394	.....	.....
	6 " " '07	249,695	169,529	80,166	.....	.....
	6 " " '06	231,641	163,451	68,190	.....	.....
MILWAUKEE, WIS. Milwaukee Elec. Ry. & Lt. Co.	1 m., July, '07	337,649	166,125	171,524	103,158	68,366
	1 " " '06	305,681	146,817	158,864	90,191	68,673
	7 " " '07	2,199,576	1,102,428	1,097,148	671,851	425,297
	7 " " '06	1,977,341	987,029	990,312	604,596	385,716
Milwaukee Lt. Ht. & Tr. Co.	1 m., July, '07	97,179	35,488	61,692	60,020	1,672
	1 " " '06	81,679	26,784	54,895	30,709	24,186
	7 " " '07	441,715	194,199	247,516	269,942	†22,425
	7 " " '06	374,920	149,830	225,090	176,671	48,419
MINNEAPOLIS, MINN. Twin City R. T. Co.	1 m., June, '07	530,741	248,769	281,972	115,142	166,830
	1 " " '06	484,590	215,544	269,046	110,592	158,455
	6 " " '07	2,848,614	1,397,142	1,451,472	691,317	760,156
	6 " " '06	2,554,609	1,214,382	1,340,226	660,017	680,210
MONTREAL, CAN. Montreal St. Ry. Co.	1 m., July, '07	339,756	175,947	163,810	67,733	96,077
	1 " " '06	300,885	161,161	139,723	55,802	83,922
	10 " " '07	2,834,644	1,761,545	1,073,099	457,347	615,752
	10 " " '06	2,494,670	1,528,354	966,316	374,810	591,505
NEW ORLEANS, LA. New Orleans Ry. & Lt. Co.	1 m., June, '07	492,653	279,676	212,977	167,044	45,933
	1 " " '06	446,278	261,319	184,959	155,124	29,835
	6 " " '07	3,066,155	1,577,171	1,488,984	1,000,562	488,422
	6 " " '06	2,899,088	1,540,468	1,358,620	916,286	442,334
NORFOLK, VA. Norfolk & Portsmouth Tr. Co.	1 m., June, '07	254,247	149,235	105,012	.....	.....
	1 " " '06	150,750	102,872	47,978	.....	.....
	6 " " '07	1,100,180	700,482	399,698	.....	.....
	6 " " '06	788,214	520,048	268,166	.....	.....
PEEKSKILL, N. Y. Peekskill Lt. & R. R. Co	1 m., June, '07	16,513	7,990	8,523	.....	.....
	1 " " '06	15,219	7,065	8,154	.....	.....
	6 " " '07	75,824	43,714	32,110	.....	.....
	6 " " '06	65,976	35,984	29,992	.....	.....
PHILADELPHIA, PA. American Rys. Co.	1 m., July, '07	302,034	.....	.....	.....	.....
	1 " " '06	276,275	.....	.....	.....	.....
PLYMOUTH, MASS. Brockton & Plymouth St. Ry. Co.	1 m., June, '07	12,360	*8,456	3,903	1,800	2,104
	1 " " '06	10,808	*6,477	4,331	1,832	2,499
	12 " " '07	116,420	*75,033	41,387	21,640	19,747
	12 " " '06	104,040	*70,884	33,156	21,540	11,616
ROCHESTER, N. Y. Rochester Ry. Co.	3 m., June, '07	642,997	385,554	257,443	146,431	111,012
	3 " " '06	551,639	332,152	219,487	99,761	119,726
	12 " " '07	2,451,698	1,540,928	910,770	461,593	449,177
	12 " " '06	2,093,383	1,204,904	888,479	381,559	506,920
ST. LOUIS, MO. United Railways Co. of St. Louis	1 m., July, '07	941,878	*573,936	367,942	232,511	135,431
	1 " " '06	901,554	*565,578	335,976	231,850	104,126
	7 " " '07	6,229,490	*4,099,972	2,129,518	1,618,820	510,698
	7 " " '06	5,851,186	*3,686,358	2,164,828	1,622,614	542,214
SAVANNAH, GA. Savannah Electric Co.	1 m., June, '07	51,836	*33,399	18,437	11,948	6,489
	1 " " '06	58,224	*30,165	28,059	11,263	16,797
	12 " " '07	590,843	*384,984	205,859	139,035	66,823
	12 " " '06	614,780	*369,689	245,091	130,343	114,749
TACOMA, WASH. Puget Sound El. Ry. Co.	1 m., June, '07	147,199	*88,263	58,936	31,977	26,959
	1 " " '06	116,794	*78,629	38,165	24,763	13,402

Street Railway Journal

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Commencing with this issue the address of the main office of The Street Railway Journal is

239 West Thirty-Ninth Street, New York City

Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1907 *to date* 303,850 *copies, an average of* 8214 *copies per week.*

Our New Home

An article elsewhere in this issue describes the new home of the STREET RAILWAY JOURNAL at 239 West Thirty-Ninth Street, New York. The previous office of this paper and of the McGraw Publishing Company, at 114 Liberty Street, has been too small for the purpose for some time and the decision to find new headquarters was reached about two years ago, after the question of location had long been under advisement and the other considerations connected with the change had received attention commensurate with their importance. Finally it was concluded to build a structure of the size necessary for the press rooms, composing rooms, offices, etc., required in a publishing business, in the neighborhood of the new Grand Central station, the new Pennsylvania Railroad station and the United Engineering Societies Building. The present site was therefore selected and the erection of the "Thirty-Ninth Street Building" was completed. We believe the location a convenient one for visitors from out of town, who, with those from New York, will be welcomed at our new offices.

Voltage Regulation for Car Lights

The generally acknowledged inefficient lighting of interurban cars has resulted within the last few years in frequent attempts to devise voltage regulators. These devices are intended to maintain a constant voltage on the lamps with a variation of line voltage of about 50 per cent, to require practically no attention on the part of the car inspectors and to be so designed that they can be put on the market at a comparatively small cost. The Patent Office records show the issuance of patents for various devices intended to fulfil these conditions. In several instances they contain a solenoid which is connected across the line and whose armature cuts in and out resistance in series with the lamps. In others a motor generator of small size is used. Still a third method is to use a storage battery or storage battery booster when the voltage gets too low. Devices of this type have been tried on cars, but for some reason or other they have not been generally adopted. Their fault evidently lies either in their inability to maintain the voltage constant or in their liability to get out of order. The subject does not possess the same importance on city roads, because owing to the shorter distances of transmission the voltage is more constant.

We believe the value of properly illuminating interurban cars, and city cars as well, where there are variations in voltage, has been underestimated by both inventors and railway men, otherwise there would have been more improvement in this respect. If necessary, the quality of cheapness in installation and maintenance can be subordinated to that of efficiency. The longer the ride at night the greater the necessity for good lighting and no lighting is really good unless it permits the passenger in any part of the car to read his newspaper with ease. During the last six years the interurban car has been improved in so many other respects, so far as comfort in traveling is concerned, that proper illumination is worthy of attention, even if it costs slightly more than the usual arrangement of lamps.

Dispatching and Curves

Every electric railway operator should think long and seriously about a wreck such as that reported as happening recently on an interurban line in the Middle West. From the newspaper descriptions several causes contributed to bring about the collision. A misunderstanding of signals only most probably would have resulted in no more than the cars meeting between switches and one car being compelled to back to the nearest siding had there not been a sharp curve at the critical point. The newspaper accounts may be in error regarding the details of the disaster, but there are systems with lax dispatching rules, and many have curves where it is impossible to see the track a sufficient distance ahead to avoid an accident should the usual methods of dispatching permit cars to meet on these curves. The managements of the larger interurban systems, and we feel safe in saying the majority of those of the smaller roads, appreciate the importance of systematic dispatching. This should be universal. But if there is carelessness or lack of discipline in the office regarding dispatching, it is safe to say there will be greater carelessness among the men. A railway system may be run with lax methods for years without serious accident, and during this time the cars may be gotten over the road with fewer delays and at less cost than would otherwise be the case. But sooner or later the inevitable will happen, and the road will be far worse off both financially and with regard to its reputation for safety than it would have been if system had been observed. The only road that can be operated without careful dispatching is one operating one car only.

In the construction of roads the increased liability to accident due to curves is not usually given the consideration it deserves. Money is not always plentiful when a road is being built, and there is often great temptation to save a few hundred dollars here and there by putting in sharp curves and going round hills rather than through them. Where blind curves cannot be avoided on a single track line it is sometimes possible to double track the curve.

Unfortunately those operators and managers of interurban properties who appreciate least the importance of building their line straight are often the ones who are likely in the operation of their road to appreciate least the value of adopting careful methods of operation.

Adjustment of Accident Claims

Electric railway companies have different ideas as to the proper conduct of their claim departments. Some manifest a tendency to carry all contestable claims to the courts; some make an effort to settle promptly all such claims, while stoutly opposing all suits where the company is clearly not at fault. Still others are ready to pay out a small amount for almost any injury caused by the operation of the cars, whether the company is strictly liable under the law or not, provided there is no suspicion that a fraudulent demand is being made against the company. The argument advanced in favor of this policy is that if the case should come to court the true state of facts might be misunderstood by the jury, or at any rate by the public at large, and thus the company would create an antagonistic feeling against it, even if it was not mulcted for a large sum as damages. There are of course also all gradations of policy between those already outlined, but in the main it may be said that each claim department, tacitly or otherwise, adopts one of these general principles of procedure in the conduct of its business.

We think all will agree that local conditions have a large bearing upon the proper plan to pursue. For instance, if the community in which the road is located is an intelligent one and the rights of a corporation under the law of negligence are usually construed in a fair way, a different policy can be followed than where every man's hand, figuratively speaking, is raised against the company. Again, in a small city it is often much more easy to investigate the standing of the plaintiff and keep track of the witnesses in an accident case. All will assent also to the general doctrine that "every case should rest upon its merits." It is impossible, or rather highly undesirable from an economical standpoint, to adopt any hard-and-fast rule in the conduct of the claim department, probably more so than in any other branch of street railway work, because the field in which the energies of the department are engaged is that of human nature. Nevertheless it is worth while to consider briefly the three main lines of policy mentioned, and draw from experience such lessons as it may suggest.

A case occurred not many months ago upon the line of an interurban railway company in the Middle West where an accident, due to no fault of the company, resulted in injury to several and one fatality. It was shown to the satisfaction of the management that the derailment of the car was due to some spikes placed maliciously on the rail. At any rate there was no defect in the track, and the trucks of the wrecked car, without being repaired in any way, were put in service under another car immediately after the accident. In the face of all these circumstances the company settled practically all of the claims without contesting them in the courts. One reason was the avoidance of publicity, and another was the general attitude of the public toward public corporations. Had the claims been contested it is probable that many would have been allowed, even if no negligence was shown, because of the general antagonistic feeling of the community to public corporations. No doubt also the final expenses to the company would have been at least as large as they were by pursuing the settlement policy. While the chances are that the company may hereafter be regarded as "easy" and will be subjected to a number of unfair suits, it has benefited in other ways by following the settlement policy mentioned, and the feeling toward the company is now distinctly friendly. This sentiment, while perhaps expensive in the way it was secured, is clearly an asset which is worth having.

In another case, that of a city road, the company had for some time pursued the policy of following up each accident and securing the best release possible in the shortest available time. At the end of the fiscal year, three years ago, the point was raised in the directors' meeting that perhaps this procedure was breeding claims which would not have been made if the company had not shown itself so ready to pay money out of its treasury. At the earnest solicitation of one of the directors, a large stockholder in the company, a waiting policy was then tried, and nothing

was done in the settlement of damages until legal claims had actually been filed. The results of the two policies are instructive and valuable. For the last year during which all cases were looked up quickly and carefully, the average cost per settlement was $93. For the following year, under the holding back policy, the number of claims was reduced about 10 per cent, but the average cost per settlement increased to $150, although there were no serious accidents during the year and nothing in the operating records to indicate any reason to expect an increase. In other words, the result showed that although the number of claims fell off, the aggregate cost of making each settlement increased about 45 per cent. It was also found that there were numerous other objections to the waiting policy, not the least of which was the difficulty of keeping in touch with the company's witnesses. In that particular instance the statistics show that about 20 per cent of the company's witnesses disappear from one cause and another between the time of the accident and the trial.

It is quite probable that the first instance cited is somewhat unusual, and possibly neither of them should be considered as precedents in the case of other companies differently situated. Yet they indicate that there are more ways than one of treating this question, and that the plan of contesting every doubtful claim is not always the cheapest in the long run.

A Plan for the Instruction of Trainmen

It is generally conceded that trainmen are deficient in their knowledge of car apparatus; in fact, their knowledge can often be compared to that of an engineer who knows only enough to open the throttle and to blow the whistle. While we cannot expect to make electrical engineers of trainmen, none will deny that if they had a little theoretical knowledge, a general idea of the equipment and a specific idea of how to take care of emergencies, the cost of maintenance of equipment would be greatly decreased and the delays to traffic would be less frequent. Attempts by individual roads to educate the trainmen are usually too expensive to be adopted, except by the largest roads. In most cases the energies of those who try to organize a course of instruction are absorbed by the time the proper apparatus has been gotten in shape. To conduct an instruction department successfully one man should devote his whole time to it, not so much because all his energies would be required in the actual work of instruction, but if other duties are crowded upon him he cannot keep in the proper frame of mind to make the course interesting for the men. Even if they had a suitable man, very few railways could afford to let one man devote all of his time to instructing men. But suitable men are very scarce, for they must have both practical experience and technical training in addition to natural ability as a teacher.

At present interurban roads from Lafayette, Ind., on the west to Erie, Pa., on the east are interconnected, and soon Pennsylvania will be connected by interurban and city lines to Missouri. This interconnection suggests a new method of carrying out instruction work in the Middle West interurban region in an effective manner, and it could be conducted in the same way in other districts as well. It would cost some money, it is true, but this expense would be distributed so as not to fall heavily on any one road The idea might be carried out by a private organization that would take contracts to instruct men and arouse their interest in the equipment or it could be undertaken by a group of railways or by a railway association. It is even possible that some one of the technical universities might take it up. The plan contemplates an instruction car or probably a train of them in charge of an instruction crew, consisting of both technical and practical men. Part of the car should be fitted up after the manner of those test cars which have been built for technical universities, so that all of the apparatus could be gotten at and so that measuring instruments could be placed in all of the circuits. In addition, the working parts of the most common electrical apparatus could be shown in sections. The brake equipment should be given almost as much attention as the electrical equipment.

In combination with the work a text-book particularly adapted to men handling the cars should be prepared. This book would deal very lightly with theory and only so far as would be required to give the practical man the basic ideas of the apparatus he was studying. The text-books would be purchased in quantities by companies and supplied to the men. The instruction or school train would make periodic visits to each system and the test apparatus would be used to demonstrate the statements in the book. The instructor would, of course, amplify on the statements in the book and explain them fully. He would also conduct examinations, either oral or written, at each visit, on certain portions of the book. By having the instructor grade the men according to the manner in which they passed the examinations and having the companies reward them in some manner for high standing, without doubt an incentive to study would be produced.

All of the work would have to be conducted in such a manner as to prove not only beneficial, but interesting to the men. The practical demonstration of statements in the instruction book would doubtless conduct to this end. For instance, the statement that to throw off the power with a drum type controller slowly creates a long arc and risks burning the controller might be demonstrated by having a controller with a mica cover so as to show the relative arcs produced when the handle was thrown around quickly and slowly. Again, the excessive current put through the motors by throwing the power on too rapidly could be shown by instruments. A watt-meter could be used in connection to show the waste of power with too rapid starting. Experiments showing that rolling friction is greater than sliding friction would interest almost any man, and after he understood this fact no doubt the number of flattened wheels would be decreased greatly.

One great advantage of such a system of instruction as outlined would be that the expense to each road, if it were inaugurated by a combination of systems, would be so small that costly and elaborate apparatus could be installed in the car. And, too, as the instructor would be occupied practically all of his time in teaching men, he would become very proficient in his work and would soon discover methods of instructing the men and of making the work interesting that could not be put into use by a man who did not specialize in such work.

CONCRETE SHOPS AND CAR HOUSES AT NASHVILLE

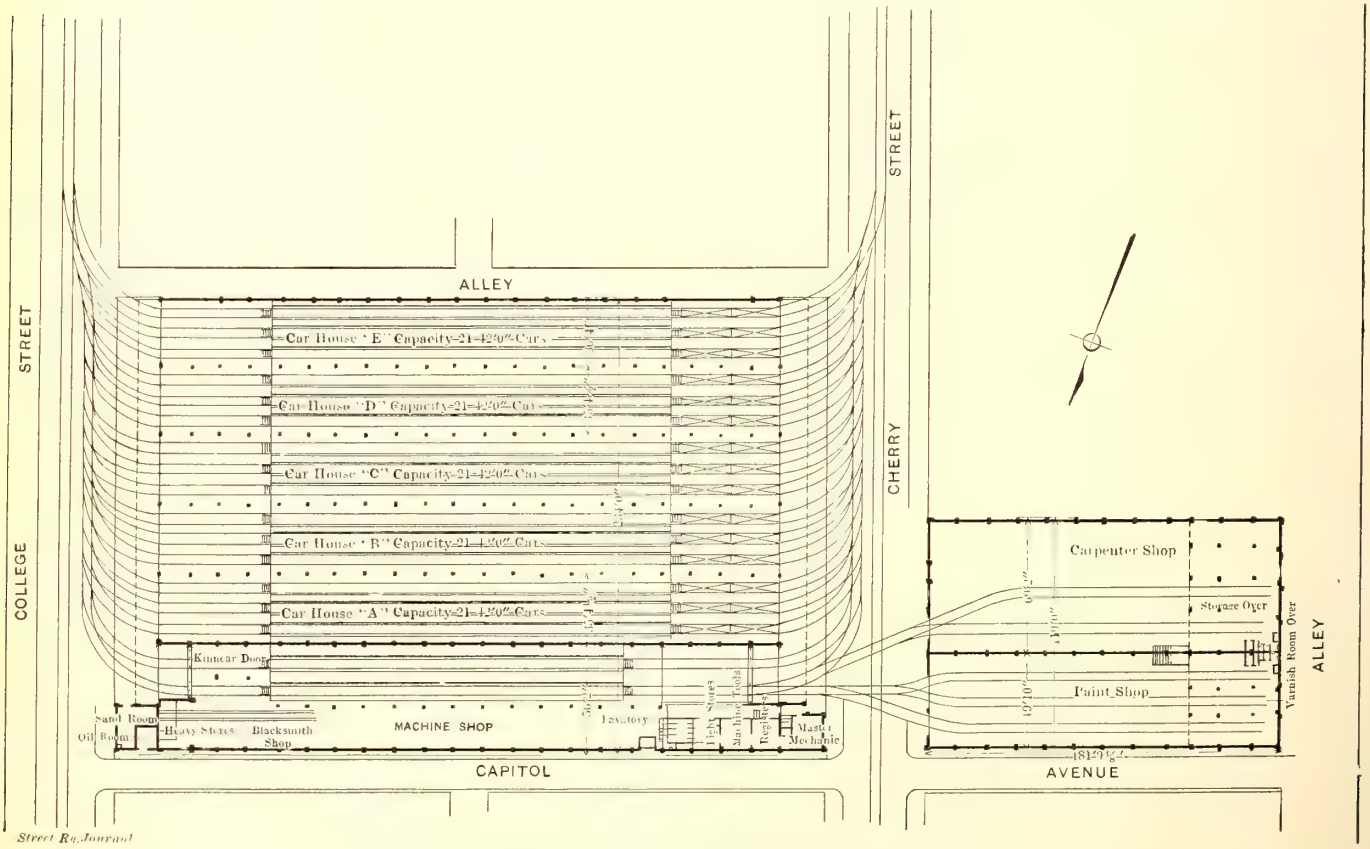
In deciding on the location of its new shops and car houses the Nashville Railway & Light Company determined that the expense of the dead mileage with the car houses located at a point distant from the center of the city would be greater than the increased investment in property near the center, and accordingly the new structures were located only about one block from the transfer station, the downtown terminus of all of the car lines.



FOURTH AVENUE FRONT OF CAR HOUSE AND SHOPS

The shops, as built, represent the most advanced ideas in fireproof construction and in arrangement for facilitating car repairs. They occupy two buildings facing each other and on opposite sides of Fourth Avenue. Both buildings are of practically the same construction. Concrete foundations support reinforced concrete columns, which carry the loads and between which brick curtain walls are built in. The floors are of concrete and the roofs are of 6-in. concrete slabs covered with five-ply tar paper and gravel. The slabs are supported by reinforced concrete girders. Track openings are closed by Kinnear rolling steel doors, and smaller openings are provided with automatic fire doors. The wiring is in conduit, that for power being embedded in the concrete floors and brought out at the bases of the machines. All of the stairways in the buildings are of iron and the buildings are well lighted by both windows and skylight, and artificial illumination is furnished by enclosed arc lights.

The main building, the greater portion of the floor space of which is taken up by the storage tracks, measures 361 ft. by 232 ft. wide. The northern portion, used as a repair shop, is two stories high. This contains on the ground floor two repair tracks with machine and blacksmith shops alongside them. The office



PLAN OF NASHVILLE REPAIR SHOPS AND CAR HOUSE

of the master mechanic, rooms for the repair of registers, for machine tools, for light stores and wash room are located near the front of the building, and a sand room and room for the storage of oils are in the rear.

The hot water heating apparatus for both buildings is

installed in the basement. A motorr-driven centrifugal pump forces the water through the radiating pipes, which in most instances are located just under the ceilings. A separate heater is installed in the basement for heating water used in the wash rooms and in washing cars.

The second floor of the repair shop section contains the storeroom and storeroom offices in the frward portion and the winding room in the rear. A 3-ton Otis elevator carries materials to and from the storeroom. The elevator is so located that wagons standing in Capitol Avenue may be unloaded directly onto it.

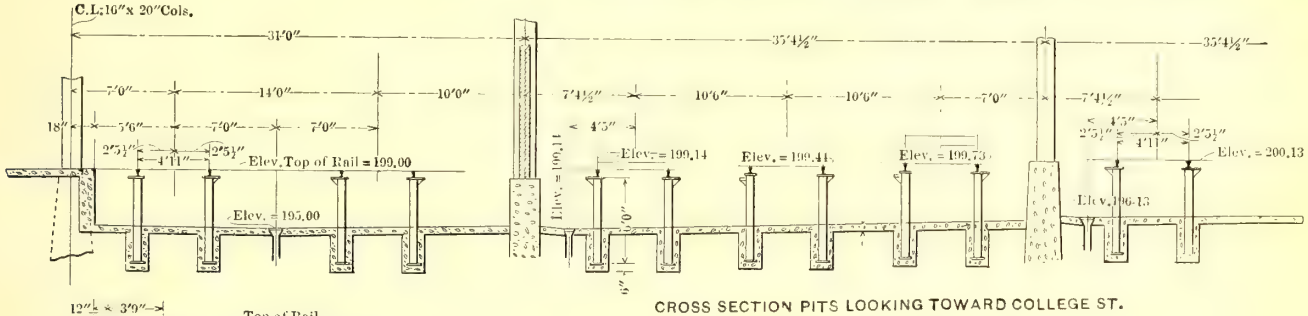
THE MACHINE SHOP

To minimize injury to parts being handled, the concrete floor of the machine shop is covered with a 2-in. wood flooring. The larger machines are all motor-driven by individual 500-volt direct-current or 220-volt alternating current motors. The equipment consists of:

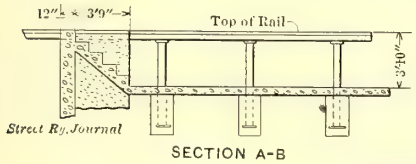
Bolt cutter and shaper	5-hp motor, a.c.
24-inch drill press	3-hp motor, a.c.
24-inch Le Blond lathe, direct-connected to a	7½-hp motor, d.c.
16-inch Le Blond lathe, direct-connected to a	5-hp motor, d.c.
36-inch drill press belted to a	5-hp motor, a.c.
24-inch back geared shaper	5-hp motor, a.c.
200-ton hydraulic wheel press direct-connected to a	7½-hp motor, a.c.
36-inch wheel-boring machine direct-connected to a	5-hp motor, a.c.
Drill grinder, back saw, emery wheel, small lathe, grind stone, belted to a	5-hp motor, 1



ROOF OF NASHVILLE CAR HOUSE, SHOWING SKYLIGHTS

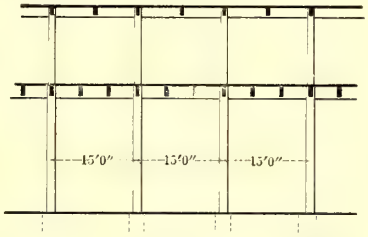


CROSS SECTION PITS LOOKING TOWARD COLLEGE ST.

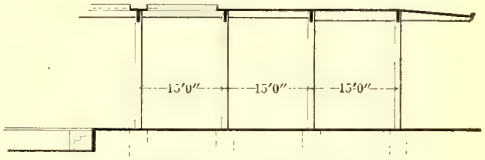


SECTION A-B

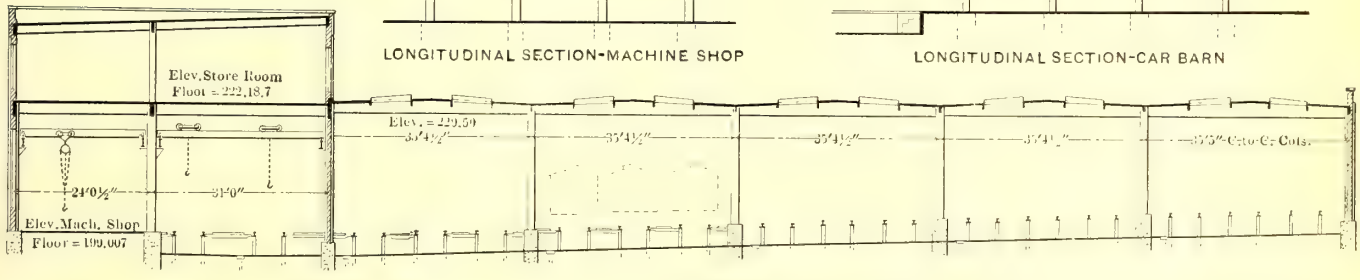
PIT DETAILS OF NASHVILLE SHOPS



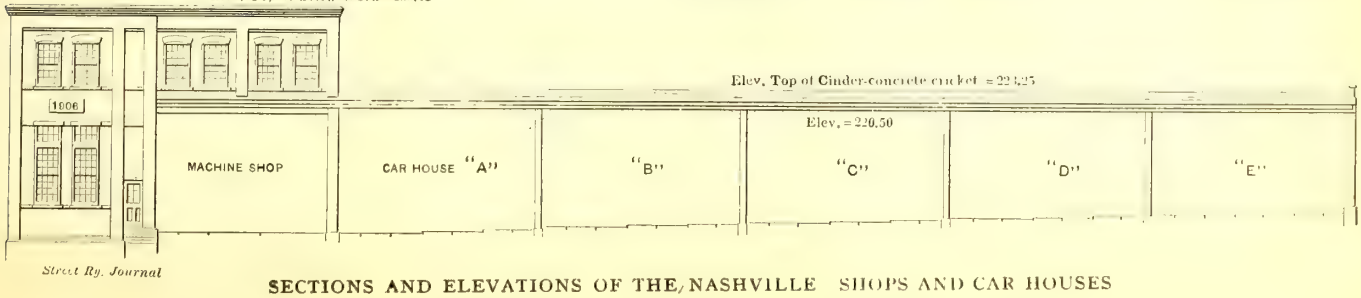
LONGITUDINAL SECTION-MACHINE SHOP



LONGITUDINAL SECTION-CAR BARN



CROSS SECTION-LINES 16 & 17



SECTIONS AND ELEVATIONS OF THE NASHVILLE SHOPS AND CAR HOUSES

For bench work ten benches are located along the north wall just underneath the windows, and each is supplied with a 6-in. vice. In the blacksmith shop, which comprises a section of the general repair shop in the rear of the machine tools, are installed two Buffalo down-draft forges. The blower and the 24-in. suction fan for the forges are driven by a 5-hp motor.

The rear of the room is used for the storage of wheels and axles and other heavy materials. A staggered double track extending from the rear to the wheel press facilitates the handling and storage of wheels. The oil room in the rear contains seven 65-gal., self-measuring Bowser oil tanks in which are kept oils and paint materials.



NASHVILLE MACHINE SHOP, WITH INDIVIDUAL DRIVE OF MACHINES

The winding room immediately over the central portion of the machine shop is provided with a 16-in. lathe for banding armatures, and an old 100-ton wheel press is being fitted up for pressing on commutators and armature cores. Armatures are handled by means of a 2-ton electrically-operated Sprague hoist, which runs on an overhead I-beam. This beam extends over an opening in the floor, and the hoist is used to raise and lower armatures from and to the floor below.

For almost their entire length the two repair tracks are supported 3 ft. 10 ins. above a concrete pit on cast-iron posts placed about 6 ft. apart. The posts, which are 6 ins. in diameter, are set in solid concrete approximately 2½ ft. below the pit floor.

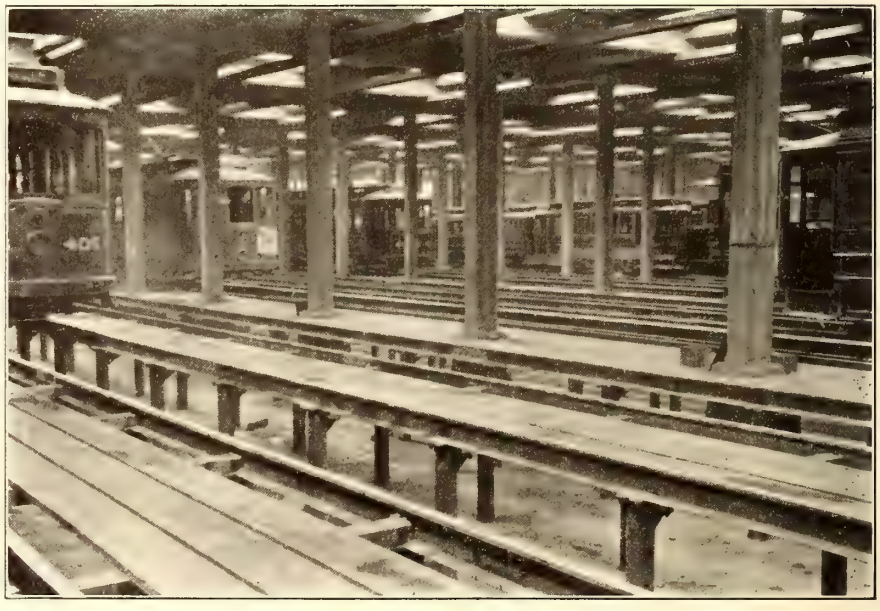
The rails are 80-lb. Lorain Steel Company section No. 335, and rest on, and are bolted to, cast-iron heads. The pit extends the full width between the two tracks and several feet beyond the outside rail of each. To get at the sides of the cars provision has been made for the support of a platform between the tracks, but this has not been erected. The floor space at each end of the pit is used in repairing trucks after they have been pulled from underneath the car.

The repair pits are served by two electrically-operated cranes of 8-ton capacity each, built by the Northern Engineering Works. In addition to carrying trucks and heavy pails about the shop, these are used as car hoists, as is shown in one of the accompanying views.

THE CAR HOUSE

The car house or storage shed is separated from the repair shops proper by a brick curtain wall. As the climate is comparatively mild in Nashville, the storage tracks were not closed in at the ends, and, as may be seen from an accompanying cut, the building presents an unusually attractive appearance, which is heightened considerably by the extended roof which overhangs the supporting columns about 15 ft.

The car shed contains fifteen tracks, each with a capacity for seven 42-ft. cars, or the whole car house will shelter 105 cars. All of the tracks are provided with pits, or rather, one pit about 300 ft. long extends under all of them. The pit and track construction in the car house is similar to that in the repair shop. However, the platforms between the tracks have been installed, as is shown in an accompanying reproduction. Cars are washed at the west end of the building, where the concrete floor slopes to drains. Hose outlets flush with the floor are located between each track. The storage shed is fireproof in the strictest sense of the word, as the only combustible materials in it are in the platforms between the tracks and the wood trolley troughs.



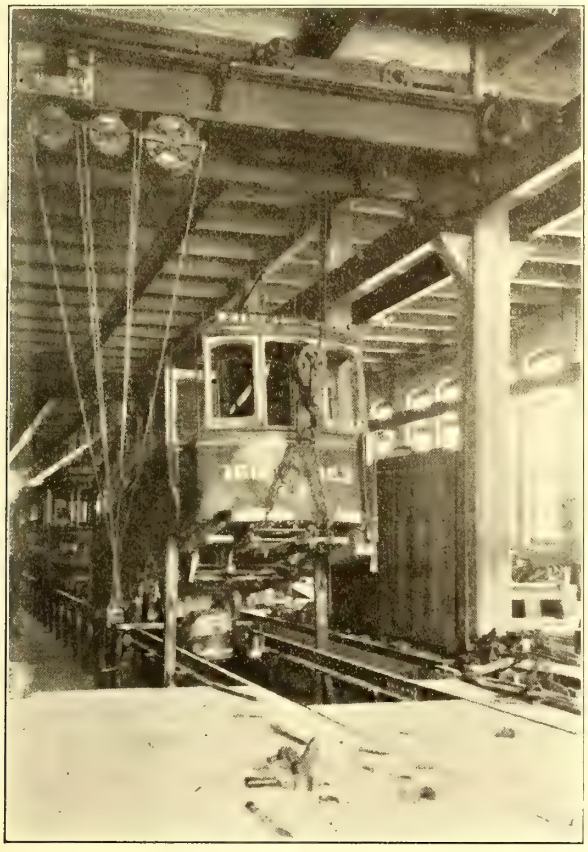
VIEW SHOWING THE OPEN-PIT CONSTRUCTION IN THE NASHVILLE CAR HOUSE

THE CARPENTER AND PAINT SHOP

The building containing the carpenter and paint shop measures 181 ft. 9 ins deep by 119 ft. wide. The two shops are divided by a brick curtain wall. In the rear portion of each is a gallery of concrete construction extending approximately one-fourth of the depth of the building. The

paint shop, which contains three tracks, has a capacity for fifteen cars. All of the tracks are provided with drains, so that the cars may be washed and painted without moving them after they have once been set in the shop. The gallery in the rear is used as a varnish and furnishing room.

The carpenter shop contains two tracks which enter the building through one opening. This opening, as well as the two of the paint shop, is provided with Kinnear rolling



CRANE USED AS CAR HOIST IN THE NASHVILLE SHOPS

steel doors. All of the wood-working tools, which in most instances are driven by individual motors, are located in the south half of the building.

The machine equipment is rather complete, as is shown by the accompanying list:

Improved resaw	20-hp motor.
Improved planer	15-hp motor.
10-inch molder	15-hp motor.
Universal woodworker	10-hp motor.
Cut-off saw	5-hp motor.
Rip saw	7½-hp motor.
Tenon machine	5-hp motor.
Mortising machine	7½-hp motor
Molding machine	5-hp motor.
Band saw	5-hp motor.
Double spindle shaper	7½-hp motor.
Sand paper machine	3-hp motor.
Gang saw	10-hp motor.
Drill press, grind stone, emery wheel	5-hp motor.

All of the motors are a. c.

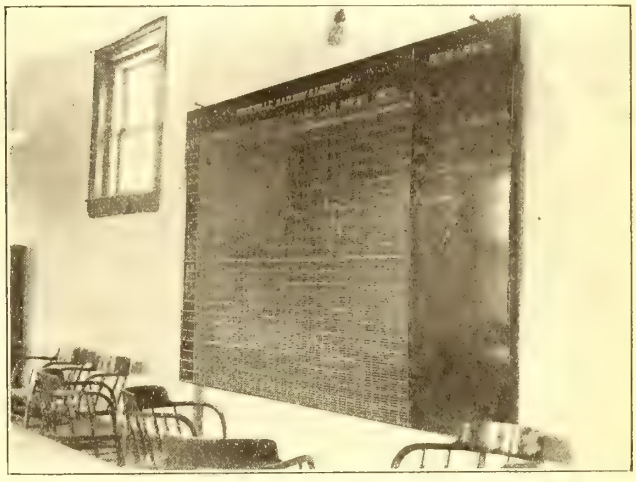
All the wood-working machines were furnished by the J. A. Fay & Egan Company. Along the south wall are located seven workmen's benches. The gallery in the rear is utilized as storage space for lumber.

The master mechanic's office is in the westernmost extension of the two-story section. A stairway from it leads directly to the drafting room immediately above.

The shops were designed and constructed by Ford, Bacon & Davis.

HANDLING TRAINMEN AT KNOXVILLE

The Knoxville Railway & Light Company has adopted several out-of-the-ordinary methods for educating trainmen and encouraging them in their work. T. C. Kelly, superintendent of the railways, has inaugurated the prac-



BOARD IN INSTRUCTION ROOM ON WHICH ARE PLOTTED CURRENT CONSUMPTION AND CAR-MILE CURVES

tice of giving men instructions with regard to the use of current with the aid of a large blackboard chart. This board is erected in the trainmen's rooms at the shop. On

TRAIN ORDER No.

190

Train No. will pass Train No. on siding No. and Train No. on siding No. and Train No. on siding No.

Dispatcher

KNOXVILLE RAILWAY & LIGHT COMPANY'S TRAIN ORDER

it tracings are made each month showing the total current in kw-hours used per day, and also the car-miles. A comparison of the two curves and the general instruction given

EMPLOYES WHO SHOULD BE COMMENDED OR DISCIPLINED

KNOXVILLE RAILWAY & LIGHT CO.
INSPECTOR'S DAILY REPORT

Date 190 Line
On Duty On Duty
Off Duty Off Duty
Weather—A. M P. M
Inspector

DEFECTIVE CARS, TRACK AND LINE NOT REPAIRED

DELAYS AND SUGGESTIONS

ACCIDENTS

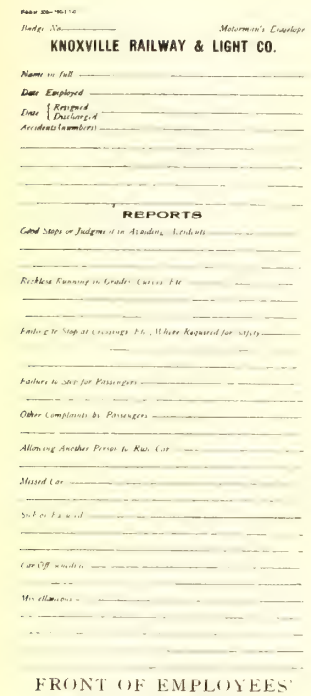
CAR | MOT. No. | CONDITION | PARTICULARS

OUTSIDE OF INSPECTOR'S DAILY REPORT

has resulted in the motormen appreciating the possibility of wasting current and they have handled the controller more carefully. At any rate, the current per car-mile has decreased considerably since the instruction was begun. Each month Mr. Kelley has a personal talk with all of his

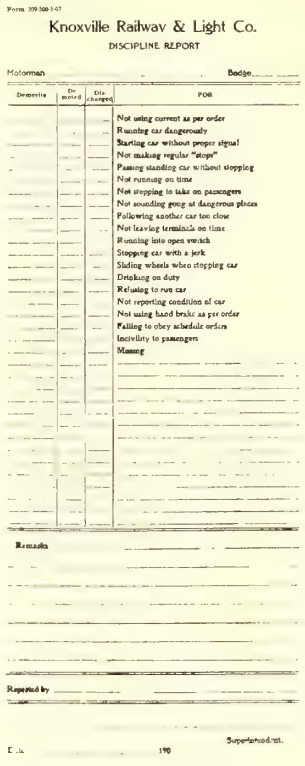
men. These are not for the purpose of criticising, but largely to get better acquainted and to instruct wherein the service can be made better.

The demerit system without the merits is used in promoting trainmen. The runs are classed according to importance, and the oldest men with the cleanest records are given the best runs. One run which is regarded as the best, extends out of the city about 6 miles and has the best roadbed and best equipment. It is considered by both the men and the company as an honor to be assigned to this run. The result is that the men in trying to get the best runs render the best service that is possible to be had from them.


KNOXVILLE RAILWAY & LIGHT CO.

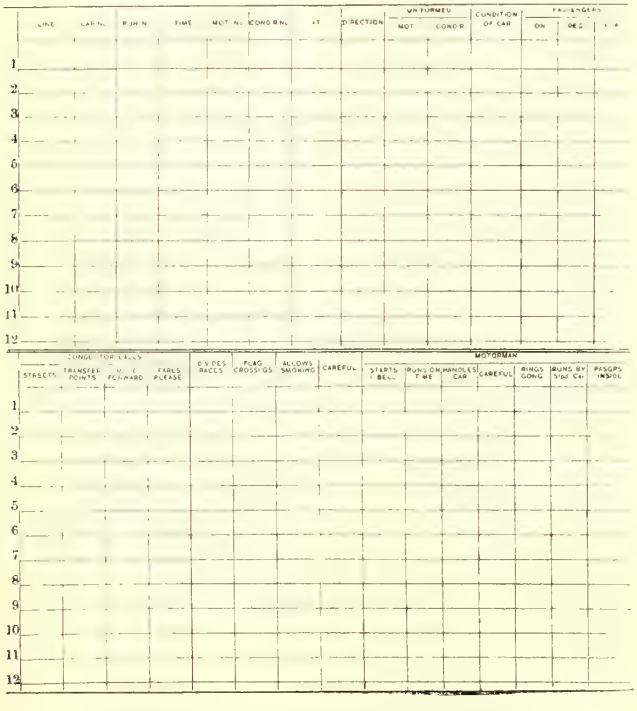
REPORTS

FRONT OF EMPLOYEES' RECORD ENVELOPE


Knoxville Railway & Light Co.

DISCIPLINE REPORT

DISCIPLINE REPORT


INSIDE OF INSPECTOR'S DAILY REPORT

The ratings of the men are changed weekly, the list showing the relative positions being posted on the bulletin board.

Men losing their positions in the list are dropped from their class to the next class below, or to the extra list, depending on what class they belong. Four demerits in thirty days sets a man back.

Delinquencies of men are usually reported by the two inspectors kept on the lines, who report daily to the superintendent on special forms. The reports concerning each man are copied off onto individual discipline reports. This latter report, together with all other papers concerning the man, is filed in a large manila envelope. The face of the envelope is covered with blanks for keeping a general summary of the reports concerning the man.

The company has recently changed its downtown offices and in its new quarters special provisions have been made for the conveniences of trainmen. One room has been fitted up for a general reading room. All of the employees have a club, for which 25 cents per month is charged for membership. The club rooms in the new quarters are provided with a library and facilities for stereopticon lectures.

QUARTERLY MEETING OF THE NEW YORK STATE STREET RAILWAY ASSOCIATION

A quarterly meeting of the New York State Street Railway Association, the first since the annual meeting, is announced to be held at Kingston, N. Y., at 10 a. m., Sept. 21, 1907. It will be convened either at Kingston Point Pavilion or on the "Central Hudson," a large steamboat, as may seem desirable at the time. The programme is as follows:

Morning Session, 10 a. m.

Subject: Interurban Rules.

Report of Committee.

John E. Duffy, Supt., Syracuse Rapid Transit Co.

Discussion.

J. R. Harrigan, Asst. Gen. Mgr., Buffalo & Lake Erie Traction Co.

W. H. Collins, Gen. Supt., F. J. & G. R. R. Co.

F. J. Gerdon, Supt., Utica & Mohawk Valley Ry. Co.

W. R. W. Griffin, Supt., Rochester & Eastern Rapid Ry. Co.

J. H. Cain, Div. Supt., Hudson Valley R. R. Co.

Afternoon Session, 1:30 p. m.

Subject: Collection and Registration of Interurban Fares.

Paper.

B. A. Frankel, Chief Treas. Dept., Utica & Mohawk Valley Ry. Co.

Discussion.

Jno. G. Phillips, Asst. Gen. Mgr., Hudson Valley Railroad Co.

H. M. Beardsley, Sec. and Treas., Elmira Water, Light & Railroad Co.

N. P. Baker, Div. Supt., International Railway Co.

Subject: Express Rates and Service.

Paper.

Frank Walsh, Gen. Mgr., Electric Express Co., Schenectady.

Discussion.

C. H. Armatage, Traffic Mgr., United Traction Co.

B. E. Wilson, G. P. & F. A., Rochester Ry. Co.

F. C. Nugent, Gen. Supt., Oneonta & Mohawk Valley R. R. Co.

The employees of the United Railways Company, of St. Louis, and their families recently enjoyed a three-days outing at Creve Cœur Lake, a resort near St. Louis. The company paid all expenses, including transportation and a barbecue dinner each day. Badges were issued to each employee for every member of his family.

CONTACT RESISTANCE IN CONNECTION WITH RAIL BONDING

Some very interesting experimental work was done on this subject by P. M. Hall, P. C. Smith and C. B. Starbird, members of the class of 1907 at the Worcester Polytechnic Institute, under the direction of Albert S. Richey, professor of electric railway engineering. In connection with the important subject of rail bonding, accurate data are desirable with reference to contact resistance with the effect of time and temperature on the same, the strength and flexibility of different forms of connection, and so forth. To obtain accurate data on all of these conditions affecting the efficiency of the rail-bond would require much more time than was available, and consequently but one phase of the subject was taken up, with the effort to cover that phase as thoroughly and accurately as possible.

To this end, a study of contact resistance was made with special reference to compression bonds. Data were obtained on the contact resistance between steel and copper under different pressures, also on the relation of resistance to the area of contact, and the effect of oxides, oils, etc., between the contact surfaces.

Under the pressures used in compressing the bond terminal into the rail, the copper flows to such an extent that the contact resistance between the steel and copper is very low, and consequently great care must be exercised in its measurement. If the drop of potential method of measurement be employed, quite small currents must be used lest the thermo-electric and heating effects completely destroy the reliability of the tests. This was the method adopted in these tests, using very small currents, measuring the drop of potential across the contact with a sensitive galvanometer.

The apparatus used is shown in the photograph, Fig. 1, and diagram of connections, Fig. 2. The former consisted of steel cylinders 1 in. long, accurately faced on one end, and of copper discs .25 in. thick, accurately faced upon both end surfaces, both discs and cylinders being of the same diameter. These were placed, one copper disc between two steel cylinders and compressive force was applied upon the extremities of the steel cylinders, thus compressing the copper against the steel and forming two areas of contact. Current was sent across the contact areas by a circuit connecting to the extremities of the steel cylinders and pressure was applied by means of an Emory hydraulic testing machine of 100,000 pounds capacity.

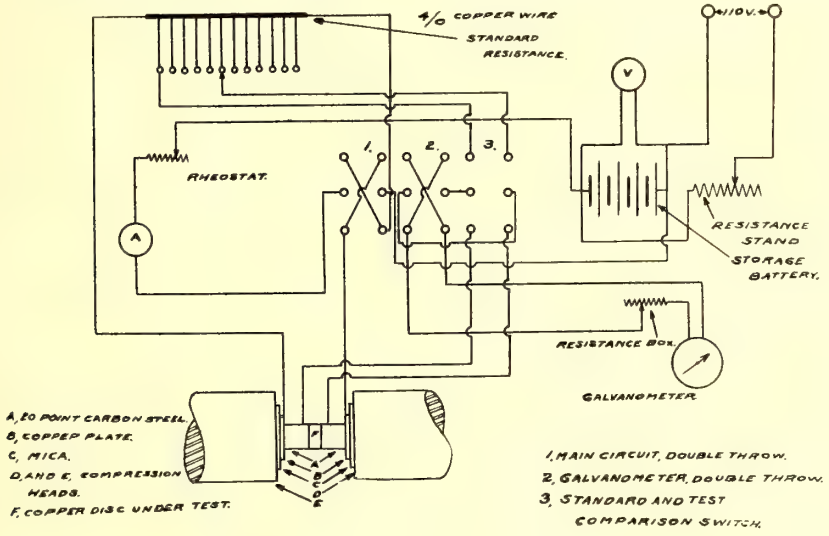


FIG. 2.—DIAGRAM OF CONNECTIONS

The leads to the galvanometer switch were taken from the test piece as near to the center of the cylinders and the contact area as possible. The galvanometer leads bridged .5 in. of steel, .25 in. of copper and two contact areas on each test piece. To maintain the condition found in practice, that the copper shall not flow freely, a steel band .375 in. thick was placed over the copper disc, covering .0625 in. of the steel on either side of the disc. This band was insulated from the copper and the steel contact pieces.

As it was quite important that the current flowing in the test circuit should be kept constant, the 110-volt supply circuit was cut down to about 10 volts by means of a resistance stand, and a small storage battery of four cells was floated on the 10-volt line. The battery took up the fluctuations on the line, and for further regulation a rheostat of an infinite number of steps was placed in the testing circuit. Then by means of an ammeter the current in the testing circuit was kept exactly constant.

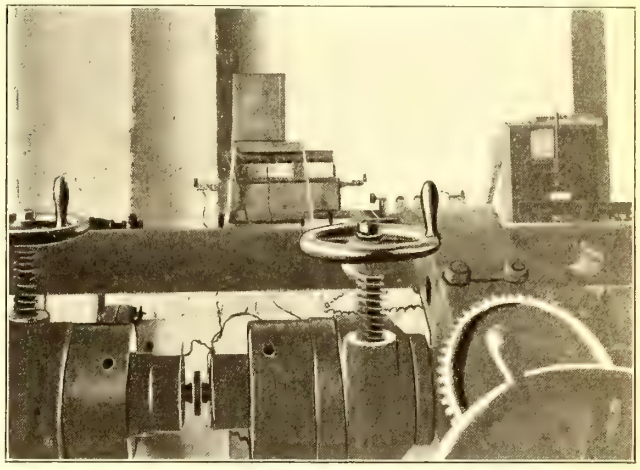


FIG. 1.—TESTING MACHINE

To eliminate errors from thermal effects a small current of 4 amps. was used, and the current was reversed to reverse thermal effects.

The resistance as measured consists of the sum of two contact resistances, the resistance of two pieces of steel and of one of copper. To obtain the contact resistance the resistance of the steel and copper was subtracted. These resistances were measured and calculated, allowances being made for the shortening in length and lessening of resistances under the heavy pressures employed. Curves in Fig. 3 show the compression of the copper with various pressures, increasing and decreasing.

Tests were made on five sizes of discs, varying in cross-section from one to two square inches, the materials being soft-drawn or forged copper, cast copper, and hard-drawn copper. The contact resistance was obtained for each specimen at pressure, increasing gradually from 2000 to 60,000 lbs. per square inch, then being reduced gradually to 2000 lbs. per square inch.

The curves shown in Figs. 4 to 7, inclusive, show in part the results obtained. The dotted line in Fig. 6 was drawn through the points on each curve corresponding to 10,000 lbs. pressure per square inch and shows that the contact resistance varies in a definite ratio with the area of contact.

Figs. 4 and 5 are specimen curves of individual tests on soft-drawn and cast copper respectively. An interesting feature brought out in all of these individual tests is the difference in resistance values between increasing and decreasing pressure. This is clearly exhibited in these two curves.

Tests were made with oil, soap suds and soda water between the contact surfaces, these substances being those usually employed in drilling the rail to receive the bond terminals. Averaging the values obtained in the tests with oil, the resistance of contact for bright surfaces is .00000052 ohms, and for surfaces coated with oil .0000009 ohms. This shows a slight increase of resistance when oil is used. With soda water the average resistance for bright surfaces is .00000104 ohms, and for surfaces coated with soda water .00000113. This also indicates a slight increase of resistance. With soap suds the average resistance for bright surfaces is .00000068 ohms, and for coated surfaces .000000505 ohms, a decreased resistance.

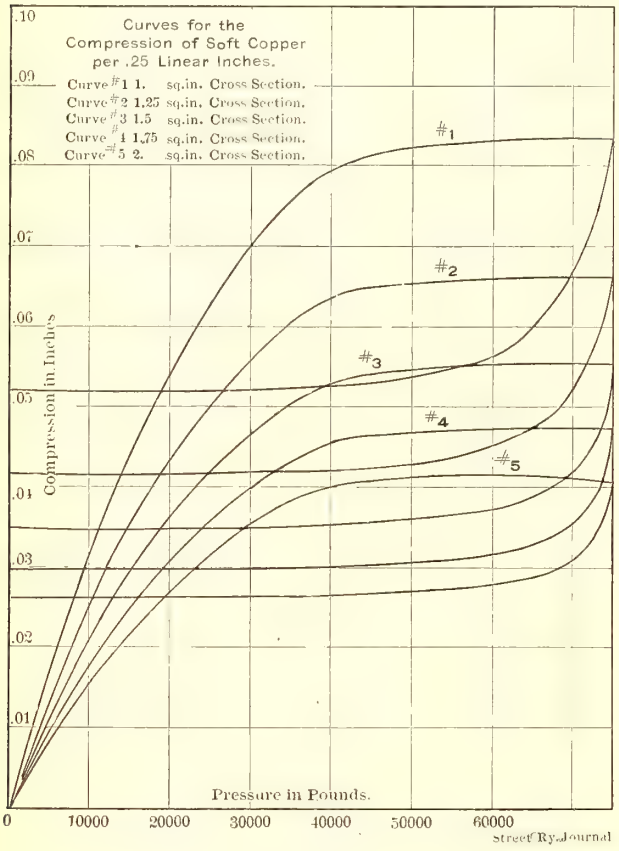


FIG. 3

A large number of these individual tests was made, and it is by a comparison of the complete set of curves that conclusions can best be drawn. The general shape of the contact resistance pressure curve is the same for all classes of copper used.

One of the objects of this series of tests was to determine the pressure of the rail-bond against the steel rail which gives the best resistance value. This pressure was found to be from 25,000 to 30,00 lbs. per square inch of contact surface. This pressure is within the elastic limit of steel, and consequently the steel does not take a permanent set when it is applied. It would be inadvisable to exceed this pressure very much because the elastic limit of the steel would then be exceeded and the value of the bond-joint destroyed. This pressure of 25,000 to 30,000 pounds is from 6000 to 10,000 lbs. lower than the pressure which must be applied to the ends of the bond terminal. The 25,000 to 30,000 lbs. is the pressure which must be exerted along the diameter of the bond terminal, the extra pressure applied to the ends of the terminal being necessary to keep the copper in a flowing state.

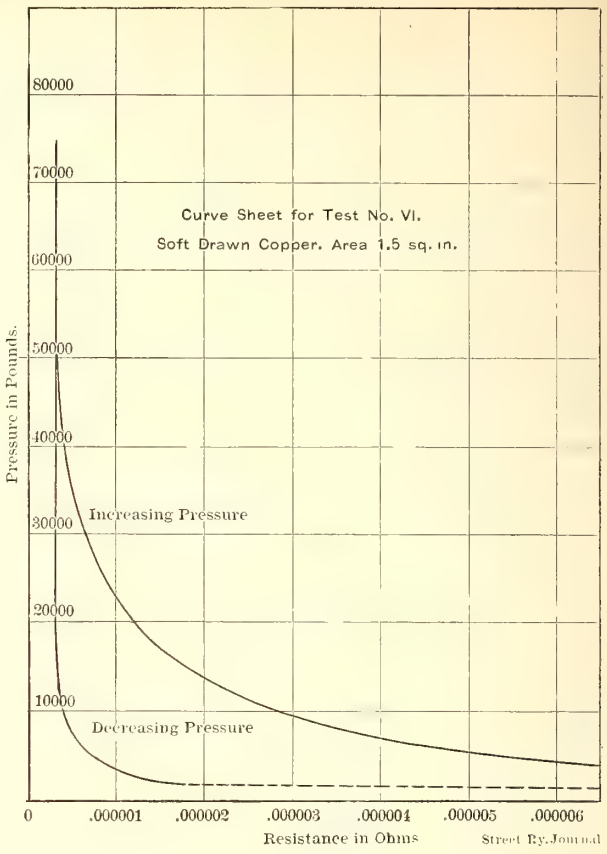


FIG. 4

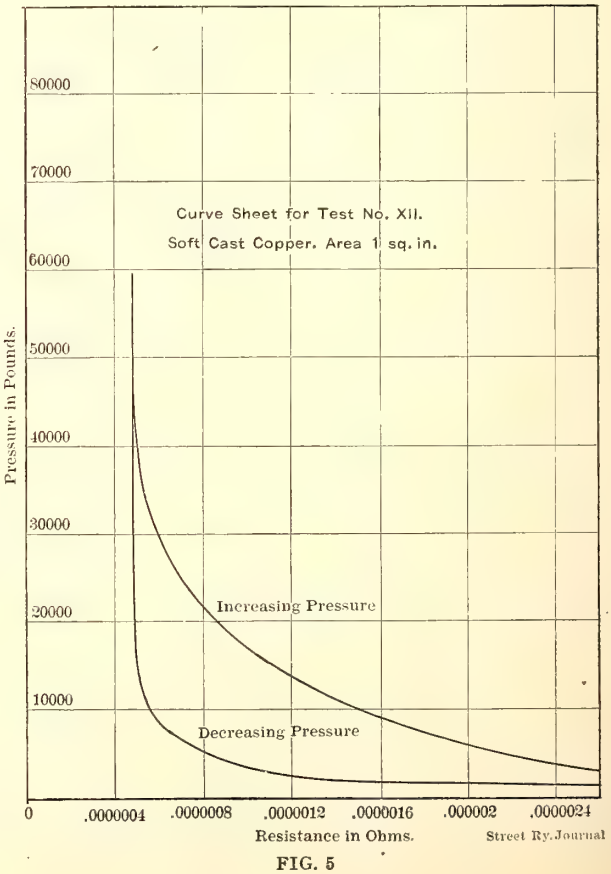


FIG. 5

From the series of tests made it may be said that it does not pay to increase the area of the bond terminal unless the pressure applied to the bond terminal is correspondingly increased.. That is, if the contact surface of the bond terminal is doubled, it is necessary to double the pressure applied to the bond before any appreciable difference of contact resistance is obtained.

Another point determined from the results obtained was, that the contact resistance between annealed cast copper and steel was from 30 to 60 per cent higher than the resistance between annealed rolled copper and steel. It is believed that the porosity of the cast copper is largely responsible for this wide difference in contact resistance. It might be well to state that the cast copper specimens used in these tests were made from stock cast at the institute foundry where very little cast copper work is done. Probably if specimens of cast copper had been obtained from some company which makes a specialty in this class of work, the large increase in contact resistance would have been somewhat lowered.

The tests made in the hard-rolled copper are not of very great importance because in practice the copper should be annealed in order that it will flow more easily.

The data secured with the surfaces coated with liquids, which are generally employed when drilling the rails, show

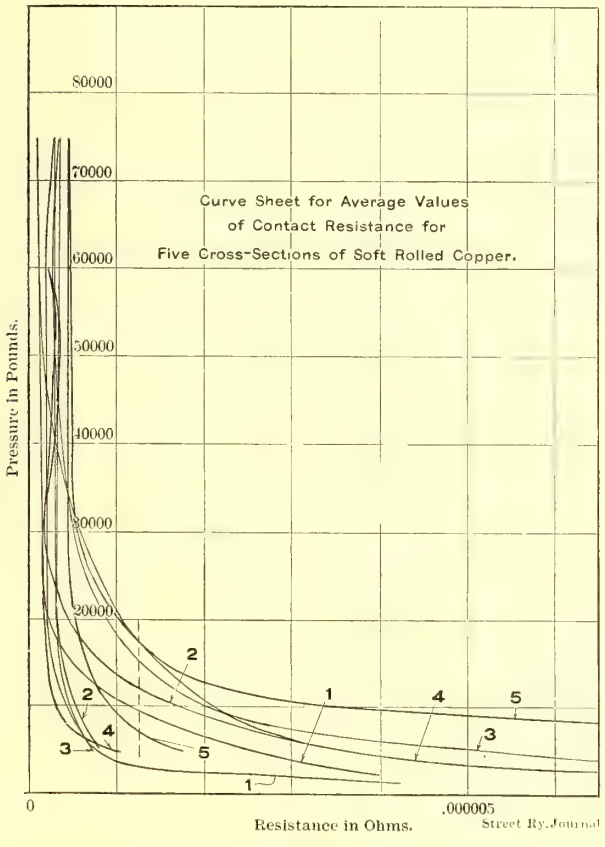


FIG. 6

that there is an appreciable increase of resistance with oil, while with soda water and soap suds the change of resistance is very slight. These results would tend to show that it is better to use soap suds or soda water when drilling rather than oil, but opinion has been expressed to the contrary, for the following reason: After the joint has been made, there will be some liquid left on the contact surface. If the liquid is soda water or soap suds there is a possibility of corrosion if the air should come in contact with the moisture, while if the liquid is oil, the corrosion could not take place. According to this opinion, it is advisable, therefore, to use a little oil in the joint, so that the oil will fill the small cells in the steel which the copper fails to

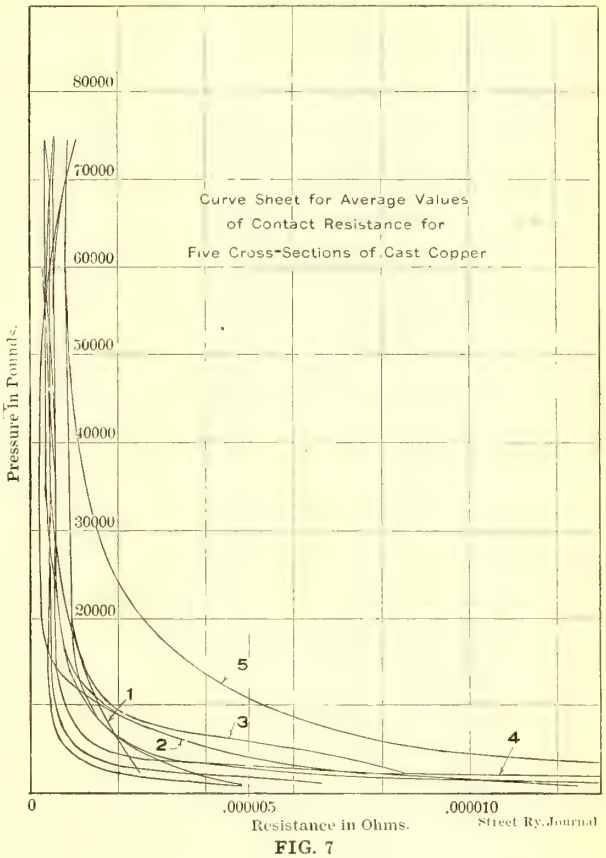


FIG. 7

fill and thereby prevent the entrance of air and moisture to these cells after the joint has been made for some time.

GERMAN ENGINEERS ON TOUR OF INSPECTION

The decision of the Prussian Government to electrify the Berlin Stadt- und Ringbahn has led to the appointment by that government of a commission to study the applications of electricity to heavy electric traction conditions in this country. This commission reached this country Aug. 27 and has already inspected the New York Central, New Haven and Long Island installations in New York, the Boston subway and elevated systems, the General Electric Works at Schenectady, and the Erie electrification at Rochester. The party has also visited Niagara Falls and Pittsburg. It was to leave that city on Sept. 11, for Indianapolis, Fort Wayne, Chicago, Toledo, Helena, where it was to investigate the high tension distribution system in operation there, and Spokane. After leaving the Pacific Coast the party expects to go to Mexico to inspect the Necaxa and other high-tension transmission lines.

The chairman of the commission is Herr Geheimer Baurat Wittfeld, of the Ministry of Railways, Highways and Bridges (Offentlichen Arbeiten). Associated with Mr. Wittfeld and accompanying him on the trip are: Dr. Ing. Walter Reichel, professor at the Berlin Polytechnic School and formerly chief engineer of the railway department of the Siemens & Halske Company; Frederick Jordan, general manager of the Felton Guillaume-Lahmeyer Works of Frankfort; Emmerich Frischmuth, engineering director of the Siemens-Schuckert Works of Berlin, and Baumeister Phillip Pforr, manager and chief engineer of the railway

department of Allgemeine Elektricitaets Gesellschaft, of Berlin.

The cost of equipping and operating the Berlin Stadtbahn electrically, estimated by Dr. Reichel, was published in the Street Railway Journal for Aug. 3. According to the Berlin papers, Minister Breitenbach, of the railway department, has made public the plan decided upon, which is to divide the system of 366 miles into two sections, one to be electrified by 1913, the other by 1920. The single-phase system, with 10,000 volts on the trolley wire, will be used.

SUPERHEATING STEAM

BY W. H. BOOTH.

In superheating, there is, per se, nothing mysterious. The chief trouble is that efficient superheating can only be obtained where the gases will from time to time be hotter than the superheater tubes can endure for very long at a time. The superheater must, in brief, be exposed to temperatures it is not fit to bear for an indefinite period. Engineers must put up with the conditions and must choose between the means offered them for circumventing the more virulent. And so they must learn to combine the factors of first cost, the probability of average reasonable gas temperatures and the amount of temperature control they can get with the conditions of the case.

The actual steam economy due to the use of superheated steam will not vary much with the method and apparatus of superheating. Given a superheat of 100 degrees, it matters little how it is obtained, so far as regards the economy of steam. The fuel economy is altogether a different matter, and it may very well be taken that more is paid for an economy than it is worth commercially. But there can be no doubt of the steam economy with superheat. In the case of a recent test by Albert C. Wood, of a Foster superheater heated by blast furnace gas, the steam economy was found to be 16.82 per cent. Here there was no special question of fuel economy, owing to the fuel being a waste product not yet fully utilized.

The plant consisted of four 19 ins. and 31 ins. x 22 ins. cross compound vertical condensing engines, three De Laval steam turbines, two 14 ins. and 24 ins. x 14 ins. Westinghouse single acting compound engines, non-condensing, and six B. & W. boilers 14 ft. wide x 9 ft. high. Two tests were made with steam superheated 8 degrees and 119.6 degrees respectively, the first test, of course, representing fully dry steam.

The steam pressures were 100 pounds and 101.6 pounds, or practically identical at the boilers and 99.9 pounds and 100.8 pounds at the engines.

In each case the vacuum was 22.1 inches, and under these practically equal conditions the economy was 16.82 per cent in favor of the higher superheat. Probably if the comparison had been made with merely saturated steam the economy would have been 20 per cent. The numerous engines and turbines using the steam suffice to show that the result is a good average commercial figure, and one that can be regularly anticipated.

There is, however, a distinction which should be made between economy of steam used by engines and economy of fuel. If an engine shows an economy of heat used, one would expect an equal economy of fuel. We say economy of *heat* advisedly, because it is far too common to speak as we have done already of the economy of steam by weight, whereas superheated steam may contain several per cent more heat per pound than does saturated steam. Let us suppose it contains 8 per cent more heat acquired from the fuel and that an economy by weight is shown of 20 per cent. What is the heat economy? About 13.6 per cent only, and this is the economy that should be expected of the fuel. Now, the fuel economy may be more or less than this figure, according to whether the heat arrangements of the steam generating plant are good or otherwise.

The coal economy may usually be expected to be something less than the economy of weight of steam, but it is with heat units that the engineer should deal if he is not to confuse his comparisons.

The importance of being able correctly to define the economy derived from superheating is sufficient justification for all the experiments now being made, or that have been made for determining the specific heat of superheated steam or its total heat at different pressures and temperatures. The subject appears to be surrounded with difficulties, and very contradictory figures are being found. It is not really possible as yet correctly to state the heat economy for the use of superheated steam, because nobody seems to be sure of any figure beyond Regorault's value of 0.48. There is, however, some reason to think that a value of 0.55 to 0.65 is not far wrong for modern temperatures and pressures, and the coefficient 0.6 will be a fair approximation pending some really authoritative or unanimous conclusion as to the true values.

ELECTRIFICATION OF THE SOUTHERN PACIFIC SUBURBAN LINES IN OAKLAND, CAL.

Contracts for the electrical equipment of the suburban lines in Oakland, Cal., and vicinity belonging to the Southern Pacific Railroad Company were let last week at the New York office of the company. The equipment of these lines with electric cars has been under consideration by the company for a long time. The service given is distinctly of a suburban rapid transit character, as the lines serve to connect San Francisco with the large residential communities of Oakland, Berkeley and other important places lying opposite San Francisco across the bay. The commuter traffic is confined largely within a radius of about seven miles, and the different roads conducting this service converge at Alameda Mole, where they connect with a line of ferryboats which carry the passengers across the bay to San Francisco. The stations on the suburban lines are located on an average of .4 of a mile apart, and the system, as a whole, is said to do a larger suburban business in number of passengers carried than any other in the country, the Illinois Central suburban lines out of Chicago alone excepted.

The electrical equipment now decided upon will consist of multiple unit trains with from three to twelve cars per train, made up in the usual combination of motor and trail cars. The cars seat eighty passengers each. Eighty motor cars have been ordered and each will be equipped with four General Electric 125-hp motors. Direct current will be employed and overhead catenary construction will be installed. The power station will be equipped with two 5000-kw, 25-cycle, 13,200-volt, three-phase units, the contract for which has been awarded the Westinghouse Machine Company. Parker boilers have been ordered with Worthington condensers and auxiliaries.

The Utah Railway, Light & Power Company has completely remodelled the Tribune Building in Salt Lake City at a cost of more than $30,000 and is now using it as a general office structure. The company has under consideration the erection of a passenger station to the rear of the office building.

MONTREAL TRUCK AND WHEEL PRACTICE

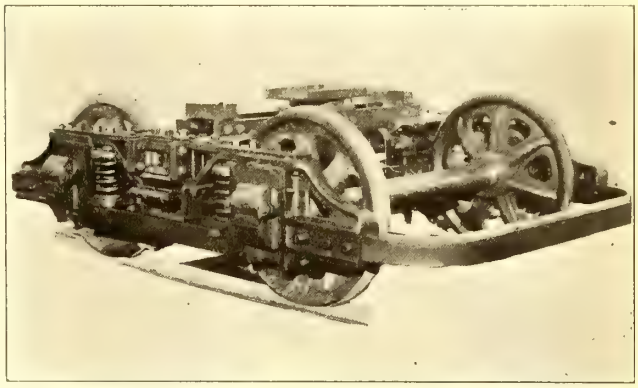
The Montreal Street Railway Company has installed during the last eighteen months 100 passenger-car trucks, known as the Class 60 bogie. The truck is notable for the simplicity of its construction and is said to have demonstrated its ability to meet the severe conditions under which the road has to operate during the winter months. These trucks were built by the Montreal Steel Works, Ltd., who also furnished the railway's freight trucks, which are known as Class 100. Both types have the wearing parts interchangeable, thus reducing the number of spare parts stocked to a minimum. They are all designed for outside-hung motors.

The following table gives the principal data of the Class 60 and Class 100 trucks used:

	Class 60	Class 100
Length of wheel base	4 ft. 8 ins.	4 ft. 8 ins.
Length of spring base	3 ft. 1 in.	.....
Frame center	6 ft. 0 ins.	6 ft. 0 ins.
Top of rail to top of center bearing	2 ft. 7 ins.	2 ft. 7 ins.
Width of bolster	12 ins.	12 ins.
Diameter of wheels	33 ins.	33 ins.
Type of wheels	Steel tired with steel centers.	Cast iron.
Diameter of axle	5 ins.	5 ins.
Diameter of journals	4 ins.	4 ins.
Length of journals	8 ins.	8 ins.
Wheel gage	4 ft. 8⅜ ins.	4 ft. 8⅜ ins.
Weight without motors	8,700 lbs.	.....

The Class 60 truck is made throughout of cast steel and standard merchant sizes of rolled steel. The pedestal casting is particularly designed to stand the severe strain to which it is subjected, the front end being extended to support the end brace, which is made of extra heavy angle-iron to prevent the truck from getting out of square. The rear end is extended to act as a spring seat for the equalizer springs.

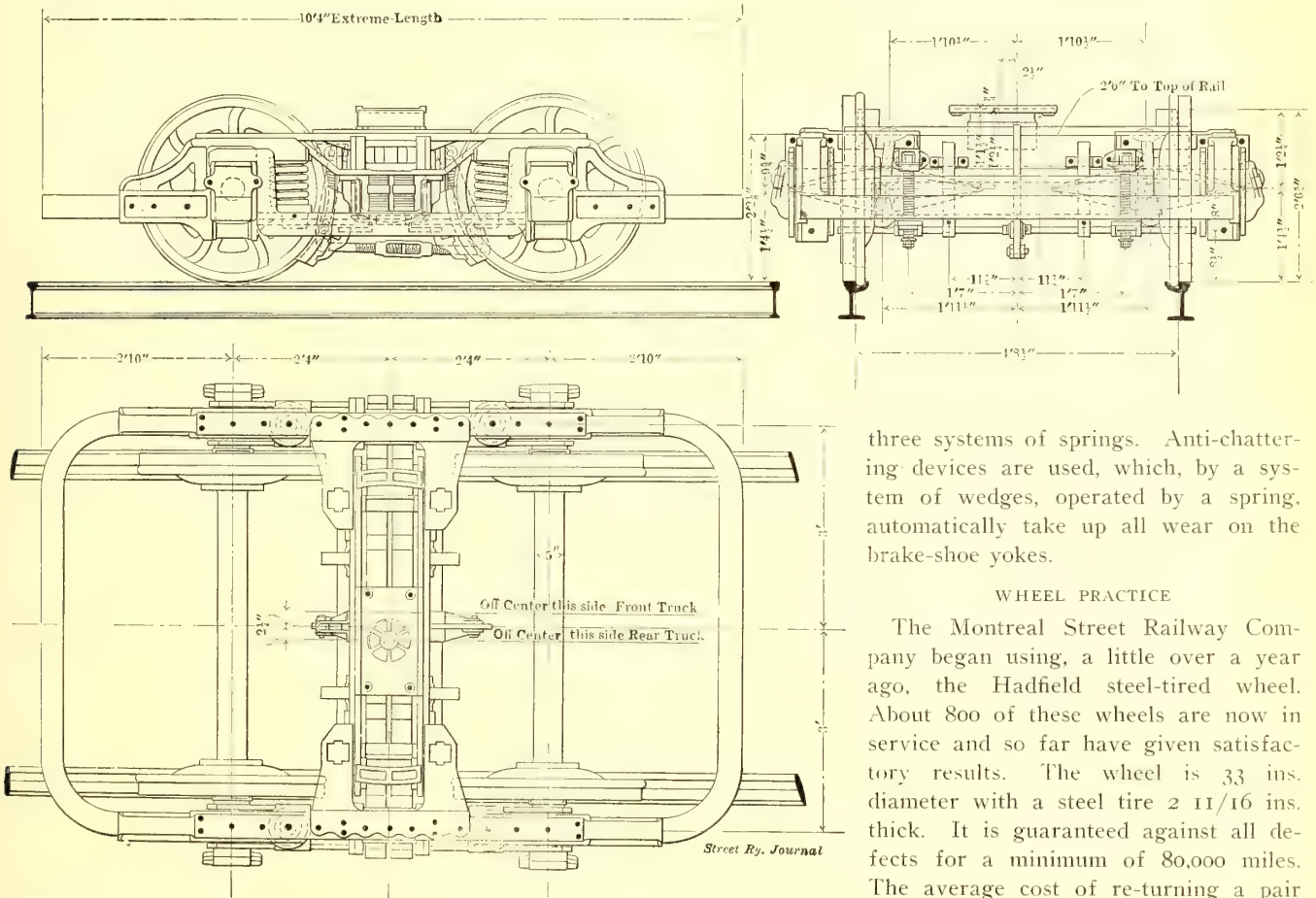
The axles are 5 ins. diameter, of hammered steel, with 4-in. x 8-in. bearings. The journals are of the M. C. B. type, 4 ins. x 8 ins., with bronze bearings and steel wedges.



MONTREAL PASSENGER TRUCK SHOWING THE SIMPLE FRAMING

The bolster is made up of two pieces of mild steel 7 ins x 1 ins. on edge, bolted and braced together throughout.

The spring arrangement is remarkable for the size of springs used, and consists of four spirals 8 ins. diameter, and two elliptic couplets 36-in. centers, with six plates of 4-in. x 7/16-in. steel. These springs have been found to give the car a softer motion than is obtained by the use of three systems of springs. Anti-chattering devices are used, which, by a system of wedges, operated by a spring, automatically take up all wear on the brake-shoe yokes.



PLAN, ELEVATION AND SECTION OF THE MONTREAL PASSENGER CAR TRUCK

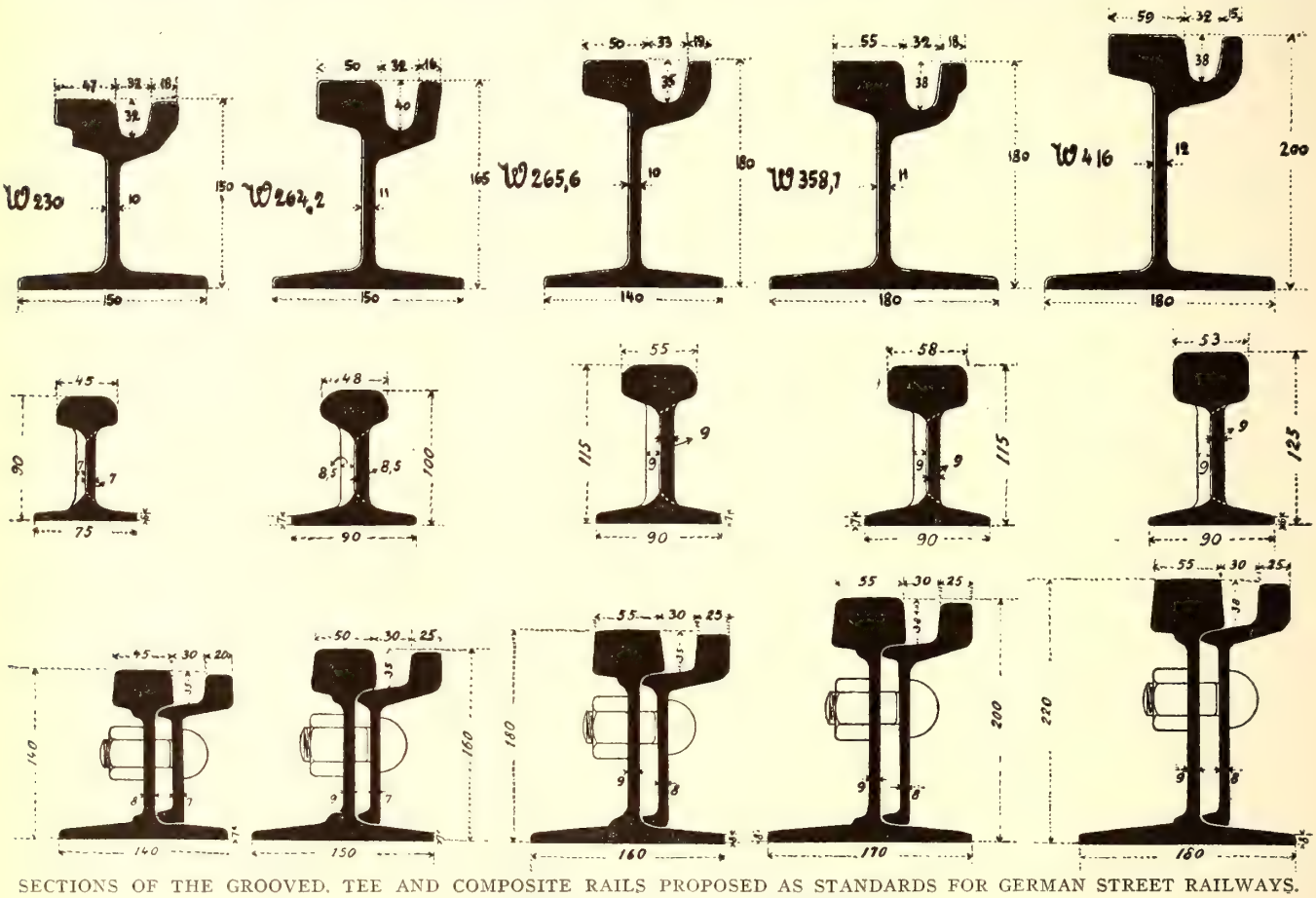
WHEEL PRACTICE

The Montreal Street Railway Company began using, a little over a year ago, the Hadfield steel-tired wheel. About 800 of these wheels are now in service and so far have given satisfactory results. The wheel is 33 ins. diameter with a steel tire 2 11/16 ins. thick. It is guaranteed against all defects for a minimum of 80,000 miles. The average cost of re-turning a pair is about 75 cents, and three re-turnings are figured on before the wheel is scrapped. At present all of the original wheels are still in use, but as the company is watching their behavior with great care the life records, when available, should prove of interest.

STANDARDIZATION OF RAIL SECTIONS OF THE GERMAN STREET & INTERURBAN RAILWAY ASSOCIATION

One of the important features of the eleventh annual meeting of the German Street & Interurban Railway Association (Verein Deutscher Strassenbahn-und-Kleinbahn Verwaltungen) held at Mannheim, Germany, Sept. 4, 5 and 6, was the presentation of reports on the standardization of rail sections, rail specifications and parts of rolling stock. The report on rail specifications was printed in the Street Railway Journal for Jan. 5, 1907, and that on rolling stock in the issue of Sept. 7. The report on rail sections follows:

Fifteen sections are proposed for standardization, these consisting of five each for grooved, composite and T-rails respectively and for wheel pressures from two to five tons graded as per table I.



SECTIONS OF THE GROOVED, TEE AND COMPOSITE RAILS PROPOSED AS STANDARDS FOR GERMAN STREET RAILWAYS. ALL DIMENSIONS ARE IN MILLIMETERS.

TABLE I

Section No.	Wheel Pressure in Metric Tons.	
I.	From 2 to 3	Average 2.5
II.	" 2.5 " 3.5	" 3
III.	" 3 " 4	" 3.5
IV.	" 3.5 " 4.5	" 4
V.	" 4 " 5	" 4.5

The committee on standardization assumes that the choice of any particular section will be governed by the density of traffic as well as by the wheel pressure.

The grooved rail sections suggested by the standardization committee have been selected with the idea of avoiding shapes that would require radical changes in rolling-mill equipment. In fact, an attempt has been made to select standards from sections now in use. This choice can be made in two ways, either by finding which of the present sections best answers service requirements or specifying beforehand the features a standard rail should embody. The first method is undesirable, as it might introduce a great variety of sections. The second method, therefore, is recommended, for no matter what sections are chosen, no great harm will be done, since the rolls for such sections will wear out eventually and then new shapes can be rolled to meet the conditions imposed by additional experience. Besides, in revising such standard sections from time to time it will then be easier to specify minimum weights and profiles for any given load than has been the case heretofore.

The principal points governing the choice of a standard rail are the shape of the head (groove, height of head and guard rail), the height of the rail, width of the base, moment of inertia and moment of resistance.

The depths of the grooves of the suggested sections, as given in the illustrations, are sufficient for normal traffic density. A groove up to 42 mm (1.6 ins.) in depth is recommended for very heavy traffic.

Experience has shown that grooved rails should not be less than 150 mm (5.85 ins.) high, but on account of manufacturing difficulties the extreme height is limited to little over 200 mm (7.8 ins.).

If the wheel pressure be expressed by G, the height of the rail h may be expressed by the empirical equation

$$h = \sqrt{8.75\,G + m}$$

In which $m = -3750$ mm (146.25 ins.) for light traffic.
$m = 625$ mm (24.37 ins.) for medium traffic.
$m = 5000$ mm (195 ins.) for heavy traffic.

From the foregoing values are secured the following rail heights for average traffic: 150 mm (5.85 ins.) for section I; 164 mm (6.4 ins.) for II; 177 mm (6.9 ins.) for III; 189 mm (7.37 ins.) for IV, and 200 mm (7.8 ins.) for V.

The base of the rail should be so wide that the pressure on the foundation does not exceed a certain limit, but on the other hand, paving conditions limit the base width of the lowest section. Hence it is recommended that a 130 mm (5.07 ins.) base should be used for this lightest section. Another limit is presented by rolling-mill conditions, which preclude a base greater than 180 mm (7.02 ins.) in width.

The higher the rail, the wider the base may be without offering obstruction to the pavement. The width b may be measured by the equation

$$b = .025\,G + n$$

In which $n = 55$ mm (2.14 ins.) for light traffic.

$n = 67.5$ mm (2.63 ins.) for medium traffic.

$n = 80$ mm (3.12 ins.) for heavy traffic.

From the foregoing the following base widths for average traffic are derived: 130 mm (5.07 ins.) for section I; 143 mm (5.58 ins.) for II; 155 mm (6.04 ins.) for III; 168 mm (6.55 ins.) for IV, and 180 mm (7.02 ins.) for V.

The moment of inertia must be so chosen that the specific surface pressure on the roadbed does not exceed a given figure. The assumption that this pressure is uniform throughout is not warranted by experience, for the pressure resultants are not normal to the rail base, but more or less oblique according to conditions. Now the less suited the cross-connections between the rails (such as ties) are to take up these horizontal forces, the more unequal must be the influence of the wheel pressure on the roadbed. Nevertheless, a uniform distribution of pressure may be assumed if care be taken that the average surface pressure remain small.

The surface pressure is also dependent on the rigidity of the roadbed and the moment of inertia of the rails. The first usually is expressed by the so-called foundation coefficient C, which on street railways should be taken as less than 20.

Now it has been found that the average pressure p on street railway foundations with a fairly rigid track where $C = 20$ does not exceed .7 kg per sq. cm. (9.95 lbs. per sq. in.) and further that the rails will remain in place with pressures up to 1.2 kg per sq. cm. (17.06 lbs. per sq. in.). The pressure p can be increased in proportion to the increase in the height of the rail and the width of its base, for the pressure distribution approaches uniformity in the same degree and because the greater the wheel pressure the greater the care usually taken to prepare the roadbed.

The committee considered it advisable to give p the following values: for light traffic, 1.5 kg per sq. cm. (21.33 lbs. per sq. in.); for medium traffic, 1.2 kg per sq. cm. (17.06 lbs. per sq. in.), and for heavy traffic, .9 kg per sq. cm. (12.8 lbs. per sq. in.).

It is now possible to find the moment of inertia to satisfy the following equation.

$$T = \frac{G^4\,C}{64\,E\,b^8\,p^4}$$

in which E. the modulus of elasticity, is taken at 2,000,000. Then for section I, $T = 1340$ cm^4 ($1340 \times .3937^4$ ins.); for II, 2087 cm^4 ($2087 \times .3937^4$ ins.); for III, 3036 cm^4 ($3036 \times .3937^4$ ins.); for IV, 4068 cm^4 ($4068 \times .3937^4$ ins.); and for V, 5298 cm^4 ($5298 \times .3937^4$ ins.).

Under the conditions assumed in the foregoing, the moments of resistance become so great that the normal tension remains far below the allowable limit and therefore requires special consideration. If all the minimum values previously derived are assembled, the following table II is secured. To these, the weights of corresponding rails are added for the sake of comparison.

TABLE II

Section	G Average Wheel Pressure in Metric Tons	h mm.	h ins.	b mm.	b ins.	P Kg.	P lbs.	T cm^4 (.3937^4 ins.)	Weight of Rail Kg. per m.	Weight of Rail Lbs. per Yd.
I.	2.5	150	5.85	130	5.07	1.2	2 64	1340	40	80.
II.	3	164	6.39	143	5.57	1.2	2,64	2087	43.8	87.6
III.	3.5	177	6.9	155	6.04	1.2	2.64	3036	48.6	97.2
IV.	4	189	7.37	168	6.55	1.2	2.64	4068	53.8	107.6
V.	4.5	200	7.8	180	7.02	1.2	2.64	5298	60	120

Table II is a sure and convenient criterion for testing the present grooved rail sections with reference to their availability for particular cases. The sections proposed are given in table III.

TABLE III—Grooved Rails, Class A

Section	Phoenix Section	Height mm.	Height ins.	Width of Base. mm.	Width of Base. ins.	Resistance Moment cm^3 (.3937^3 ins.)	Weight of Rail Kg. per m.	Weight of Rail Lbs. per Yd.
A I.	14b	150	5.85	150	5.85	230	42 4	84.8
A II.	18c	165	6.43	150	5.85	264.2	49.5	99
A III.	25d	180	7.02	140	5.46	265.6	46	92
A IV.	23e	180	7.02	180	7.02	358.7	57	114
A V.	38	180	7.02	180	7.02	416	60	120

COMPOUND RAILS

In general, the points taken up in considering grooved rails apply also to compound rails. The rail heights, however, are derived from the formula $h = .04\,G + m$, and the base from $b = .02\,G + n$, where m and n are constants for which values are given as follows: For heavy traffic $m = 60$ and $n = 100$; for medium traffic $m = 40$ and $n = 90$, and for very light traffic $m = 20$ and $n = 80$.

The highest pressure per sq. cm. under average load may be derived for the five sections up to 1.2 kg from the formula

$$p = G : 2bL \text{ when } L = \sqrt[4]{\frac{4\,E\,T}{b\,C}} \text{ and } C = 20.$$

In studying the carrying power and stability of compound rails, it is unnecessary to consider the guard rail since the running rail can be used without it. From this, the following table IV is secured.

TABLE IV—Compound Rails, Class B

Proposed Standard Sections.	Wheel Pressure in Metric Tons.	Section No.	Height. mm.	Height. ins.	Width of Base. mm.	Width of Base. ins.	Weight of Rail. Kg. per m.	Weight of Rail. Lbs. per Yd.
B I.	2 to 3	140	140	5.46	140	5.46	44.8	89.6
B II.	2.5 " 3.5	160	160	6.24	150	5.85	56.1	112.2
B III.	3 " 4	180	180	7.02	160	6.24	62.2	124.4
B IV.	3.5 " 4.5	200	200	7.8	170	6.63	67.5	135.0
B V.	4 " 5	220	220	8.58	180	7.02	71.3	142.6

T-RAILS

The following sections are proposed for standard T-rails as given in table V.

TABLE V—T Rails, Class C

Section.	Wheel Pressure in Metric Tons.	Height. mm.	Height. ins.	Width of Base. mm.	Width of Base. ins.	Weight of Rail. Kg. per m.	Weight of Rail. Lbs. per Yd.
C I.	2 to 3	90	3.51	75	2.92	15.8	31.6
C II.	2.5 " 3.5	100	3.93	90	3.51	20	40.
C III.	3 " 4	105	4.09	96	3.74	25	50
C IV.	3.5 " 4.5	115	4.48	90	3.51	27.2	54.4
C V.	4 " 5	125	4.87	90	3.51	28.5	57

It is understood that for these sections, the ties would be spaced 955 mm (37.24 ins.), 965 mm (37.63 ins.) and 970 mm (37.83 ins.), corresponding respectively to rail lengths of 15 m (49 ft.), 18 m (59 ft.) and 21 m (69 ft.).

PROGRAMS OF THE ATLANTIC CITY CONVENTIONS

The programs for the Atlantic City conventions of the American Street & Interurban Railway Association and its three affiliated associations have been announced by the secretary and are as presented below. The meetings of the parent association and of the engineering associations will be held in the Sun Parlor near the end of the Steel Pier. The Accountants' Association will convene in the Chalfonte Hotel, and the Claim Agents will hold their meeting in the St. Charles Hotel. The programs follow:

AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION.

(Steel Pier.)

Wednesday, Oct. 16, 1907—9.30 A. M. to 1 P. M.

Convention called to order.
Address of Welcome.
President's Address.
Report of Executive Committee.
Report of Secretary and Treasurer.
Addresses by presidents of affiliated and allied associations.
Announcements.
New Business.
Reports of Committees:
(a) Membership.
(b) Compensation for Carrying Mail.
(c) Subjects.
(d) Car Wiring.
(e) Standardization of Equipment.
Paper—"The Technically Trained Man and the Electric Railway Profession," by Prof. H. H. Morris, Cornell University, Ithaca, N. Y.
Paper—"The National Fire Protection Association and Its Work in the Street and Interurban Railway Field," by Ralph Sweetland, Boston, Mass.
Paper—"The Influence of the Design of Railway Structures on Economy of Operation," by H. J. Campion and William McClellan, Consulting Engineers, New York, N. Y.

Thursday, Oct. 17, 1907—9.30 A. M. to 1 P. M.

Appointment of Nominating Committee.
Reports of Committees:
Promotion of Traffic.
Rules.
Heavy Electric Traction.
Paper—"Package Express Business," by P. P. Crafts, General Manager Iowa & Illinois Railway Company, Clinton, Iowa.
Paper—"Freight Interchange with Steam Railroads," by H. H. Polk, President Interurban Railway Company, Des Moines, Iowa.
Paper—"A Department of Publicity," by J. Harvey White, Advertising Manager Boston Elevated Railway Company, Boston, Mass.
Paper—"Advertising from the Street Railway Standpoint," by A. W. Warnock, General Passenger Agent, Twin City Rapid Transit Company, Minneapolis, Minn.
Paper—"The Problems of a Small Road," by H. S. Cooper, Manager Galveston Electric Company, Galveston, Tex.
Paper—"The Use of Tee Rails in Cities," by C. Gordon Reel, Vice-President Kingston Consolidated Railway Company, Kingston, N. Y.

Friday, Oct. 18, 1907—9.30 A. M. to 1.00 P. M.

Reports of Committees:
(a) Insurance.
(b) Rules for the Construction of Modern Car Houses.
(c) Municipal Ownership.
(d) Public Relations.
Paper—"Public Policies of the Past and Future," by C. Loomis Allen, Vice-President Utica & Mohawk Valley Railway Company, Utica, N. Y.
Paper—"Interurban Railway Fares," by Theodore Stebbins, J. G. White & Company, New York, N. Y.
Discussion—"Reduced Fare Agitation."
Discussion—"Depreciation from the Financial and Managerial Standpoints."
Report of Nominating Committee.
Election of Officers.
Resolutions.
Unfinished Business.
Adjournment.

AMERICAN STREET & INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION.

(Chalfonte Hotel.)

Tuesday, Oct. 15, 1907—10.00 A. M. to 1.30 P. M.

Convention called to order.
Address—John I. Beggs, President American Street & Interurban Railway Association.
Annual Address of President.
Annual Report of Executive Committee.
Annual Report of Secretary-Treasurer.
Paper—"Park Accounting," by Frank J. Pryor, Jr., Comptroller the American Railways Company, Philadelphia, Pa.
Question Box, edited by Frank R. Henry, Auditor United Railways Company of St. Louis, St. Louis, Mo.
Appointment of Convention Committees
New Business.

Tuesday, Oct. 15, 1907—2.00 P. M. to 5.00 P. M.

Luncheon and Social Afternoon.

Wednesday, Oct. 16, 1907—9.30 A. M. to 1.00 P. M.

Joint Meeting with "American" Association (on Steel Pier).

Wednesday, Oct. 16, 1907—3. P. M. to 6.00 P. M.

Paper—"Mechanical Devices for Office Use," by F. E. Smith, Auditor Chicago Union Traction Company, Chicago, Ill.
Report of Committee on "Standard Classification of Accounts and Form of Report."
Report of Committee on "International Standard Form of Report."

Thursday, Oct. 17, 1907—10.00 A. M. to 2.00 P. M.

Paper—"Where Maintenance Ends and Depreciation Begins," by J. H. Neal, Auditor of Disbursements Boston Elevated Railway Company, Boston, Mass.
Reports of Convention Committees.
Election of Officers.
Installation of Officers.

AMERICAN STREET & INTERURBAN RAILWAY ENGINEERING ASSOCIATION.

(Steel Pier.)

Monday, Oct. 14, 1907—9.30 A. M. to 12.30 P. M.

Registration at Steel Pier.

Monday, Oct. 14, 1907—2.00 P. M. to 5.00 P. M.

Convention called to order.
Address—John I. Beggs, President American Street & Interurban Railway Association.
Reading of the Minutes of last meeting.
Address of the President.
Annual Report of the Executive Committee.
Annual Report of the Secretary-Treasurer.
Appointment of Convention Committees.
Reports of Special Committees.
Report of Committee on Control Apparatus.
Report of Committee on Maintenance and Inspection of Electrical Equipment.

Tuesday, Oct. 15, 1907—9.30 A. M. to 12.30 P. M.

Report of Committee on Way Matters.
Paper—"Care of Electric Railway Tracks," by George L. Wilson, Engineer Twin City Rapid Transit Company, Minneapolis, Minn.
Paper—"Rails and Joints as Affected by Traffic in New York City," by W. Boardman Reed, Engineer, New York City.
Report of Way Committee on "Rails Corrugation Investigation."
Report of Committee on "Concrete Tie Investigation."
Report of Sub-committee on "Rail and Rail Matters."

Tuesday, Oct. 15, 1907—2.00 P. M. to 5.00 P. M.

Report of "Committee on Standardization."
Report of "Committee on Open vs. Closed Terminals for Car Storage."

Report of Committee on "Operating and Storage Car House Designs."
Question Box.

Wednesday, Oct. 16, 1907—9.30 A. M. to 1.00 P. M.

Joint Meeting of American Association and Allied Associations.

Wednesday, Oct. 16, 1907—2.30 P. M. to 5.30 P. M.

Paper—"Gas Engines," by Paul Winsor, Chief Engineer Motive Power and Rolling Stock, Boston Elevated Railway Company, Boston, Mass.
Paper—"Gas-Engine Operation," by W. W. Cole, General Manager Elmira Water, Light & Railway Company, Elmira, N. Y.
Paper—"Steam Turbines," by St. John Chilton, Engineer, Allis-Chalmers Company, Milwaukee, Wis.
Paper—"Steam Turbines," by August H. Kreusi, Engineer, General Electric Company, Schenectady, N. Y.
Paper—"Double-Flow Turbine," by J. R. Bibbins, Engineer, Westinghouse Machine Company, East Pittsburg, Pa.
General Business.
Election of Officers.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION
(St. Charles Hotel)

MONDAY, OCT. 14, 1907—10.00 A. M. TO 12.30 P. M.

Registration and Badges (at Steel Pier).
Secretary Davis at St. Charles Hotel.

MONDAY, OCT. 14, 1907—2.00 P. M. TO 4.30 P. M.

Convention called to order.
Address—John I. Beggs, President, American Street and Interurban Railway Asociation.
Minutes of last meeting.
Address of Acting-President.
Annual Report of Executive Committee.
Annual Report of Secretary-Treasurer.
Appointment of Convention Committees.

TUESDAY, OCT. 15, 1907—10.00 A. M. TO 12.30 P. M.

Paper—"The Policy of the Claim Department to the Injured Employee," by R. H. Schoenen, Claim Agent, Lehigh Valley Transit Co., Allentown, Pa.
Paper—"The Claim Agent of To-day and His Work," by H. H. Bennett, Claim Agent, Fitchburg & Leominster Street Railway Co., Fitchburg, Mass.
Paper—"How I Manage Bad Cases," by Harry P. Vories, Claim Attorney, Pueblo & Suburban Traction & Lighting Company, Pueblo, Col.

TUESDAY, OCT. 15, 1907—2.00 P. M. TO 4.30 P. M.

Paper—"Selecting and Training of Investigators and Adjusters for the Claim Department," by Ellis C. Carpenter, Claim Adjuster, Indiana Union Traction Company, Anderson, Ind.
Question Box.
(Three Minutes alowed to each member to discuss a question.)

WEDNESDAY, OCT. 16, 1907—9.30 A. M. TO 1.00 P. M.

Joint Meeting with "American" Association (at Steel Pier).

WEDNESDAY, OCT. 16, 1907—2.30 P. M. TO 5.30 P. M.

Paper—"The Claim Department and What Should Be Done to Make It Effective," by C. B. Hardin, Claim Agent, United Railways Company of St. Louis, St. Louis, Mo.
Paper—"Instructions of Employees in the Work of preventing Accidents," by F. W. Johnson, Asst. Claim Agent, Philadelphia Rapid Transit Company, Philadelphia, Pa.
General Business.
Election of Officers.

As a kind of trade-mark, President Franklin of the Toledo & Western Railroad Company has decided to call his route "The Modern Way," following the lead of some of the steam lines which have adopted such phrases as "The Only Way," "The Comfortable Way," "The Banner Route," "The Educational Route," etc. Three new passenger coaches have recently been received from the Niles Car & Manufacturing Company and put into the limited service between Toledo and Adrian, Mich., and they are proving very popular.

OUR NEW OFFICE BUILDING

As briefly announced in the last issue of this paper, the STREET RAILWAY JOURNAL has moved to its new home in the Thirty-Ninth Street Building, the facade of which is shown in the accompanying illustration. Situated about a half block east of Broadway on Thirty-Ninth Street, the building is within a few blocks of the Times Square subway station and the Sixth and Ninth Avenue elevated stations, and is convenient to Broadway, crosstown and avenue surface lines. Its advantage of easy accessibility will be further increased upon the completion, several blocks south, of the Pennsylvania and McAdoo North River terminals and of the East River Belmont Tunnel, which latter will land passengers at Times Square, three blocks north. An incidental advantage of the location is the neighborhood of the Engineering Societies Building, a block east, with its fine technical library at the disposition of the editorial staff. While the new location is somewhat removed from



THE NEW HOME OF THE STREET RAILWAY JOURNAL

that part of the city where the offices of the STREET RAILWAY JOURNAL have been located ever since the paper was established, the change of location is in accordance with the recent tendency still further to extend the business section to the north in order to profit by the transit improvements under way as already briefly noted.

The building has a frontage of 126 ft. on the north side of Thirty-Ninth Street, with a depth of 98 ft., and consists of eleven floors and a basement. The front is flanked by pavilions which provide for the elevators, stairways and toilets, thus leaving unobstructed the main floors. There are recess courts in the rear of the pavilions, the interior of the building thus being lighted from all sides.

The building is entirely of reinforced concrete and probably the most advanced example of its type in the world. The steel reinforcement of the columns is sufficient in itself to carry the load of the building. The floors, which are formed of reinforced concrete slabs, are carried by reinforced concrete girders of large size and wide span.

These girders and their molded connection with the columns give to the ceilings a symmetrical and attractive appearance which recalls the beamed interiors of European mediæval structures. The external walls are finished entirely in concrete, the front facade having its surface carefully floated. To those who have had doubt as to the appearance of a large facade entirely in concrete it will be an agreeable surprise to know that it is possible to produce an effect with a carefully worked concrete surface as handsome as with the use of the most attractive stone or brick. All the engineering details connected with the construction of the building were in the hands of Prof. William H. Burr, of Columbia University.

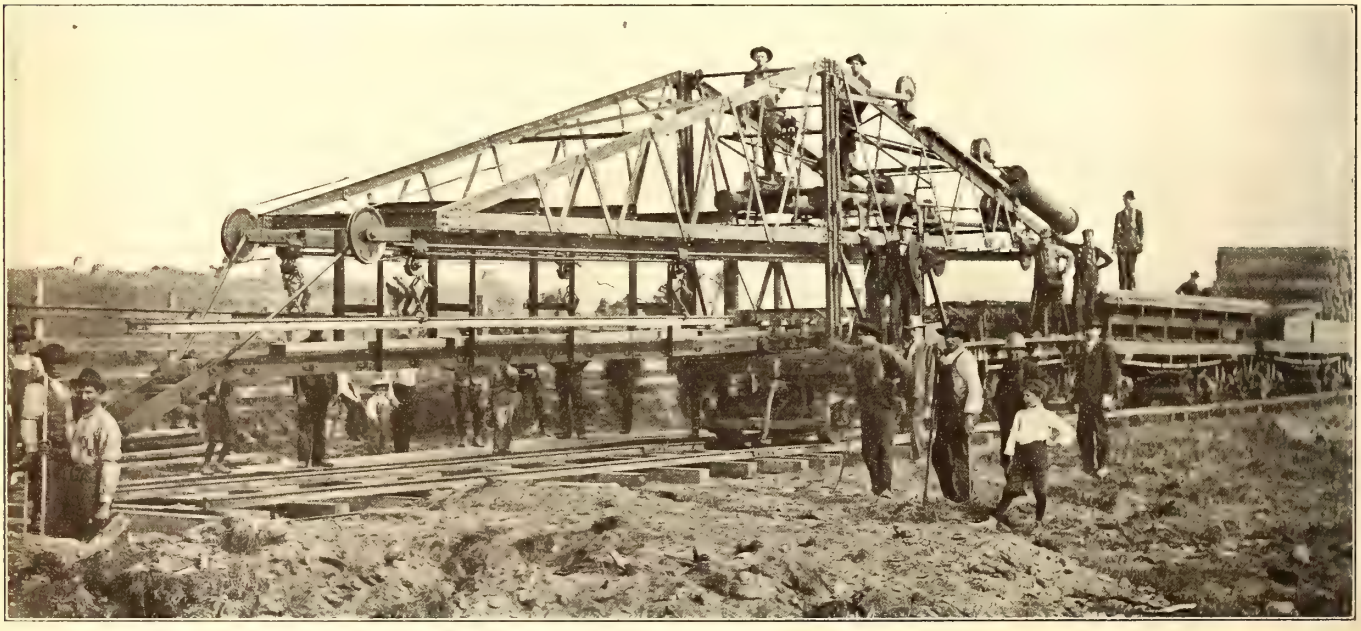
Two high-speed electric elevators for passenger service are installed in the east pavilion and one passenger and one freight elevator in the west pavilion. Current for all purposes, lighting and power is taken from the street main. The boiler equipment for heating has a sufficient capacity to furnish steam for power should it become desirable at any time in the future to generate electric current on the premises. At the present, however, there does not seem to be any probability that an individual generating plant will have at any time to be installed.

It is of interest to note that approximately ten thousand barrels of concrete and fifteen hundred tons of steel were used in the construction of the building. Each of the floors of the building has an area of ten thousand five hundred square feet. The offices of this journal are on the eleventh or top floor, where every modern office convenience has been provided. A large printing plant is now in course of installation in the building for the service of the several journals published by the McGraw Publishing Company, and will occupy three entire floors, viz.: The second, third and fourth floors.

A PACIFIC COAST TRACK-LAYING MACHINE

In connection with the article in the Sept. 7 issue of the Street Railway Journal, on the Pacific Coast Traction Company, it may be of interest to add a note on the track-laying machine used during the construction period.

The machine was of local design, built by the Westcott Track-Layer & Manufacturing Company, of Tacoma. As can be readily seen from the accompanying illustration the machine consists essentially of a steel truss mounted on a flat car and provided with the necessary pneumatic hoists and conveyors. The machine handles both the rails and ties; the ties are distributed by hand, but the rails are laid on the ties in position for spiking, by the machine without rehandling. On the Pacific Traction Company's system the machine laid from two to two and a half miles per day with the following crew: Four men to operate the machine and feed ties and rails, four strappers, eight spikers, four nippers, six tiemen to distribute and space ties, one pedler and one foreman. The distinction between this and other so-called track-laying machines is that the handling of rails is totally avoided and the handling of ties reduced to their distribution over one rail length of grade.



TRACK-LAYING MACHINE IN SERVICE ON THE PACIFIC COAST TRACTION COMPANY'S LINES

CAR CLEANING SANITARY SPRAY

The New York City Railway Company has adopted a new method of cleaning and disinfecting its cars. The compound which is used is called the Gillette Sanitary Spray and is manufactured by the Gillette Chemical Company, New York, of which Col. Giles S. Allison is president. The compound is furnished in any quantity desired and is applied by an atomizer to the floor, woodwork, metal parts, windows, seats and any part of the inside or outside of the car which requires cleaning. The spray lays the dust, disinfects and deodorizes the car, kills all germs and insures good sanitary condition. As a window cleaner the spray is convenient and thorough, a dry cloth being all that is necessary to clean the window thoroughly after the spray has been applied. The spray does not injure the most delicate varnish on either wood or metal.

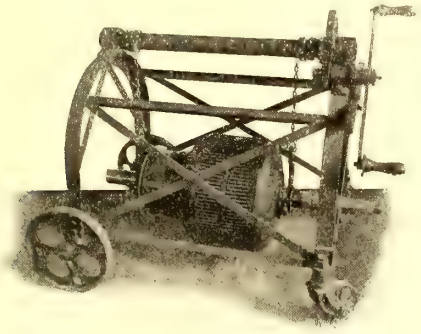
TRAIN TESTING APPARATUS

Prof. Sydney W. Ashe, of the Brooklyn Polytechnic Institute, has written this paper that through an oversight the connecton of Mr. Keiley with the train testing apparatus described by Prof. Ashe in an article in the Street Railway Journal for Aug. 24 was not given. The testing set described was based upon one invented some four

years ago by J. D. Keiley, now electrical engineer of the New York Central & Hudson River Railroad Company, but has been changed by Prof. Ashe by the introduction of the various devices described by him in the STREET RAILWAY JOURNAL for Sept. 8 and Dec. 1, 1906, and Sept. 7, 1907.

A SPECIALLY DESIGNED ARMATURE TRUCK

Progress in handling an armature in the shop after it has been removed from the motor for repairs or rewinding is to the repair shop, thence to the banding machine and finally to the armature rack for storage or to the car itself. Thus the armature must cover a good deal of ground and the problem presents itself of how to transport it on account of its weight and delicate construction. The danger of rolling an armature on the floor is fully appreciated and so a truck becomes imperative. The ideal truck should insure the safe transport of the armature without necessitating the services of several men, planks, blocks, etc., for both placing and unloading, as is frequently the

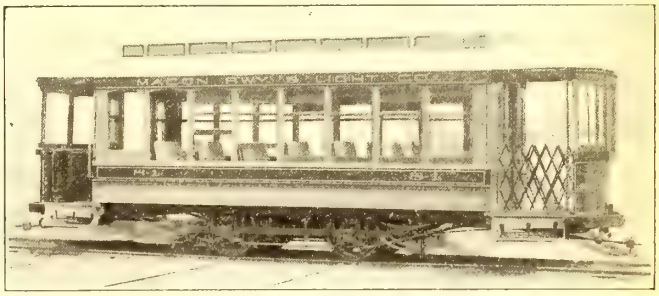


ARMATURE TRUCK

case. A truck designed to move armatures with greatest ease, speed and with no possibility of injury to the armature in any way has been designed by the Device Improvement Company, of Hanover, Pa. It consists of two semicircular angle steel frames joined by suitable braces. The forward end is provided with twelve-inch cast iron wheels with steel axles joined rigidly to the frame. The rear end has large casters which swing in any direction by means of which the truck is easily steered. A large double thick pipe on the top of the frame revolves on suitable bearings, and forms the hoisting drum around which the chain revolves. The gear wheel is pinned to this drum and meshes with a pinion, which is revolved by the crank. On this shaft is the ratchet and when the armature is elevated to the proper height, four or five inches above the floor, the dog is engaged holding the armature in position. The braces at the forward end run only part way down so that the largest armatures have clearance. On each chain is a forged hook of ample size to take in the largest shafts with boxes. As the armature rests on the floor the truck is pushed over it, the hooks placed on the shaft and elevated, the handles again grasped and the suspended armature wheeled to the desired position.

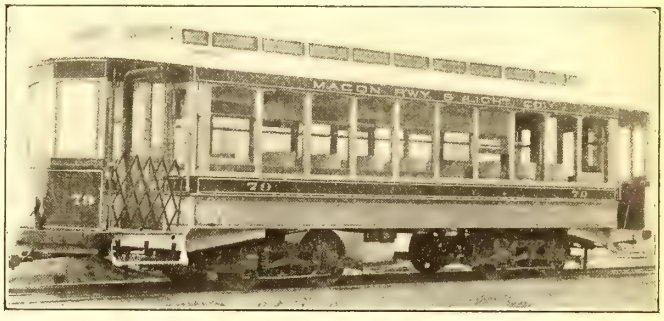
MACON RAILWAY & LIGHT COMPANY BUYS NEW ROLLING STOCK

Travel on the Macon Railway & Light Company has been unusually brisk this summer, with the result that new equipment had to be purchased. Since its arrival, however, a marked improvement has been noticeable in the service, especially on the lines reaching Crumps, North Highland and Ocmulgee Park. The new equipment, numbering ten cars in all, is composed of both double and single-truck Brill semi-convertibles, and the larger cars have proved especially valuable in handling the crowds going to and coming from the amusement parks mentioned, while the window



EXTERIOR SINGLE TRUCK CAR FOR MACON

system employed on these cars is particularly well adapted to this class of travel. The Macon Railway & Light Company is a consolidation of all the railway and light companies in Macon, and the new equipment swells the total number of cars operated to sixty-seven. Both types of cars are equipped with the Brill portable vestibule; in fact, the



EXTERIOR DOUBLE TRUCK CAR FOR MACON

cars throughout have specialties made by this builder, including radial draw-bars, ratchet brake handles, etc. Some of the dimensions of the larger cars follow: Length over end panels, 28 ft.; over crown pieces, 37 ft. 5 ins.; width



INTERIOR MACON CAR

over sills, including panels, 7 ft. 10½ ins.; height from floor to window sill, 23 ins.; size of side sills, 4 ins. x 7¾ ins.; end sills, 5¼ ins. x 6⅞ ins. The trucks are the No. 27-G1 with 4-ft. 6-in. wheel base. The smaller cars are 20 ft. 8 ins. in length with correspondingly similar dimensions and are mounted on the No. 21-E single truck.

NOTES ON THE PORTLAND (ORE.) SYSTEM

As now organized the combined lines of the Portland Railway, Light & Power Company, of Portland, Ore., namely, the Portland Railway Company and the Oregon Water Power & Railway Company, make Portland the radiating point for a widely divergent system of railways which is playing a prominent part in the building of a greater Portland. There are seven trains daily between Portland and the suburban communities of Gresham, Anderson, Boring, Barton, Eagle Creek, Currinsville, Estacada and Cazadero, and between Portland and Oregon City there is a 35-minute service. Freight trains are run daily and milk and cream shipments are given passenger-train service. The electric trains of the Oregon Water Power lines have brought a rich agricultural section of Clackamas County into direct connection with Portland at a passenger rate of only two cents a mile with a correspondingly low freight rate.

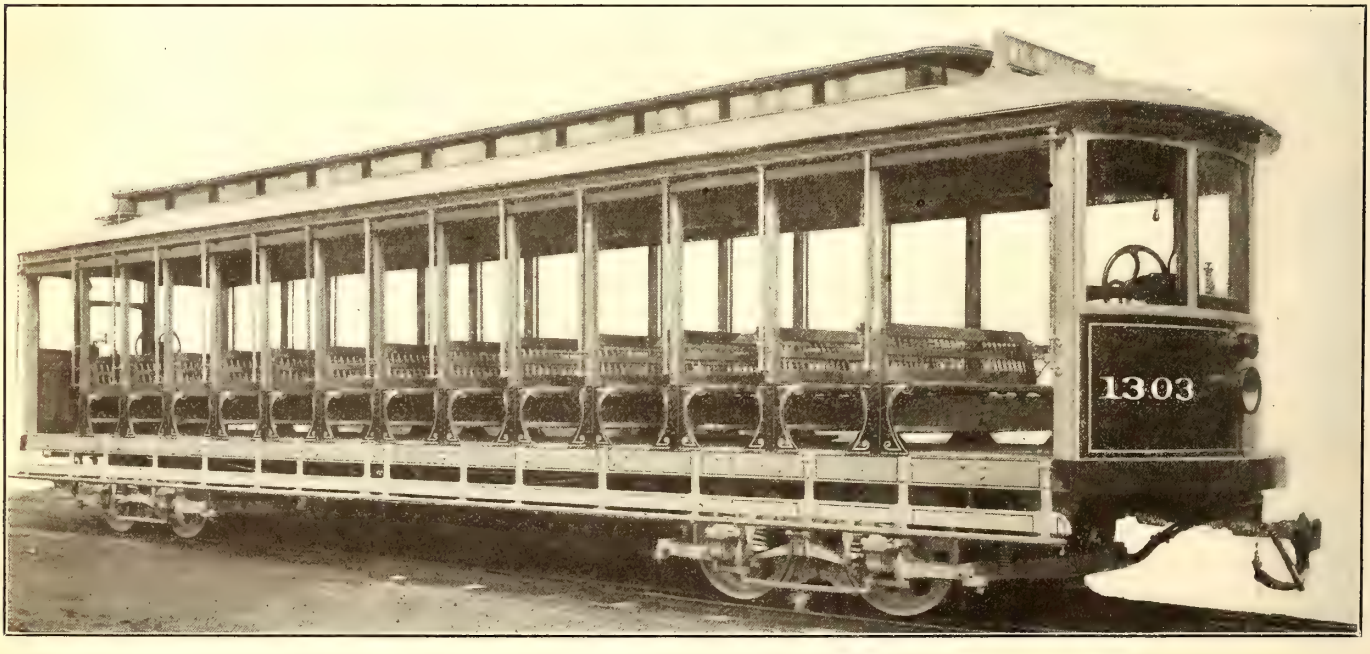
The company has in the neighborhood of 375 cars, a large number of which have been supplied by the American Car Company, and during the present year will add to its passenger equipment 100 cars. The freight equipment will be increased by the addition of three new electric locomotives and about 50 box and flat cars. Arrangements will also be completed whereby the freight service will be handled entirely by electricity instead of partially by steam as formerly. Additional side tracks and switching facilities are also to be provided. Twenty new passenger cars recently constructed in the shops of the company are now in operation.

With the completion of the Cazadero power plant described in detail in the Street Railway Journal for May 18, 1907, and the installation of new converting machinery at the various sub-stations, which are now almost completed, the power available will be sufficient adequately to handle the business for several years to come. Among other improvements are a new steel bridge at the Clackamas River and substantial additions to the car barns. About 10 miles of track will probably be constructed and with it will be laid hard-surface permanent pavement in the various business streets on both sides of the river. There will be expended on the standard and narrow-gauge railway systems combined, this year, in extensions and betterments, about $1,250,000.

Another interesting fact is that something like 7300 cars of freight in carload lots were handled over the lines last year. In this work, the telephone plays a very important part, the dispatching of trains being done entirely by telephone. In all, about 95 miles of telephone line are operated. There is now under construction a new dispatching line from Portland to Cazadero, a distance of some 38 miles. Extensions under way comprise about 2¼ miles on the Sandy Road line and 8½ miles on the Troutdale division. The country opened up by the latter extensions has been cleared, and the new line should make it an object for the land owners to render it productive.

Extensive improvements under way at Oregon City, about 15 miles from Portland, will improve the service between these points to the extent of making a 30-minute schedule possible instead of the present 35-minute service. One of the most beneficial improvements is the double tracking of The Oaks Line, extending from the south end of what is known as the yacht siding some 8700 feet south of The Oaks, Portland's popular amusement resort, located about 5 miles up the Willamette. This work, requiring a fill of 90,000 yards, was commenced on March 8, and on May 15 was completed with the exception of surfacing a small portion of the track. With the extension and double tracking of the yacht siding from the north end to the Inman Poulson Mill passengers have the benefit of a double-track line from Portland to The Oaks and a superior service than heretofore.

The new cars, 15 of which, of the 13-bench open type, have just been shipped by the American Car Company, are of the closed-end type eliminating the usual bulkhead and permitting all the seats to face in the one direction.

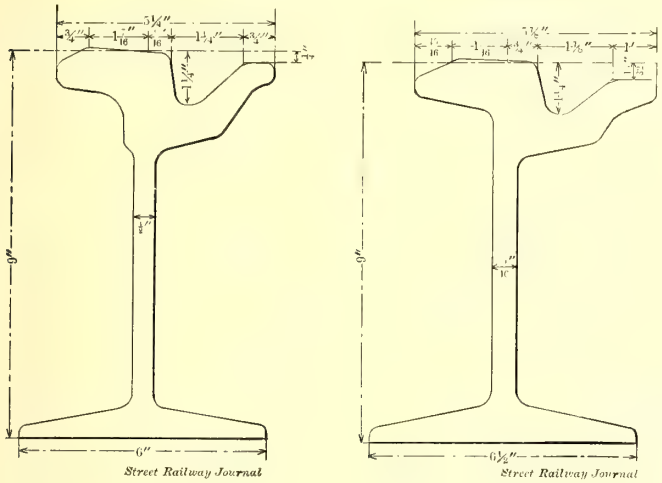


TYPE OF OPEN CAR ADOPTED FOR USE IN PORTLAND

The cars will be operated by the multiple-unit control system. They are finished in ash with ceilings of maple. Following are the principal dimensions of the cars: Length over bumpers, 42 ft. 10 13-16 ins.; width over sills, 7 ft. 6 15-16 ins.; height from floor to ceiling, 8 ft. 1 3-8 ins.; from track to under side of sills, 31 5-16 ins.; the side sills measure 4 1-2 ins. x 7 ins., rabbited to receive 4 ins. x 6 ins. angle; end sills, 4 ins. x 6 ins. plated with 3 ins. x 4 ins. x 1-2 in. angle; sill plates, 7 ins. x 5-8 in.

TWO TYPES OF RAIL APPROVED FOR USE IN COLUMBUS

The board of public service of Columbus, Ohio, has approved two styles of grooved rails, either one of which may be used by the Columbus Railway Company or the interurban lines entering the city over improved streets. Pattern A, as shown in the accompanying engraving, was described in the STREET RAILWAY JOURNAL on Aug. 24. Pattern B was selected by the board since the publication of that issue, and both were approved by the board Aug. 28. Pattern A, which is known as the Chicago type of rail, must have a weight of not less than 129 pounds to the yard, and pattern B, the Philadelphia type, must have a weight of not less than 141 pounds per yard.



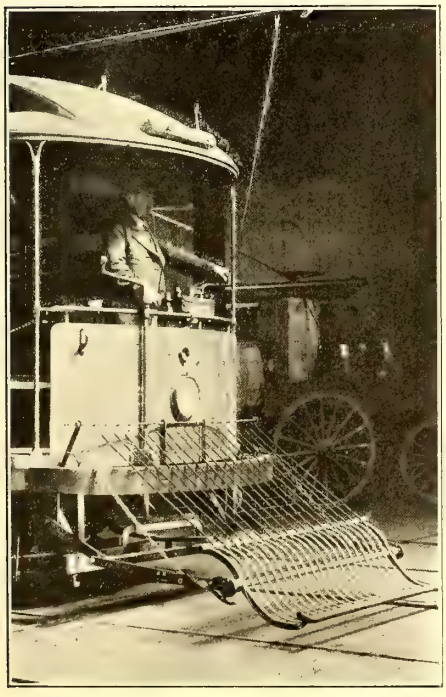
COLUMBUS RAILS PATTERNS A AND B

The selection and approval of these rails by the service board is in accordance with an ordinance passed by the City Council of Columbus, June 10, 1907, providing that only grooved rails shall be laid on improved streets in the city of Columbus, and requiring the service board to approve the weight and pattern of all such rails. Neither the members of the service board nor the city engineer will admit that other types of rail will be approved, but it is understood that upon the advice of City Solicitor Marshall other types are being considered. Mr. Marshall fears that if the electric railways are restricted to one or even two types of rail, they will have ground on which to contest the action of Council and the service board. As matters stand at present, however, the electric lines are required to use one or the other of the rails approved, and official notices to the companies to this effect are being prepared.

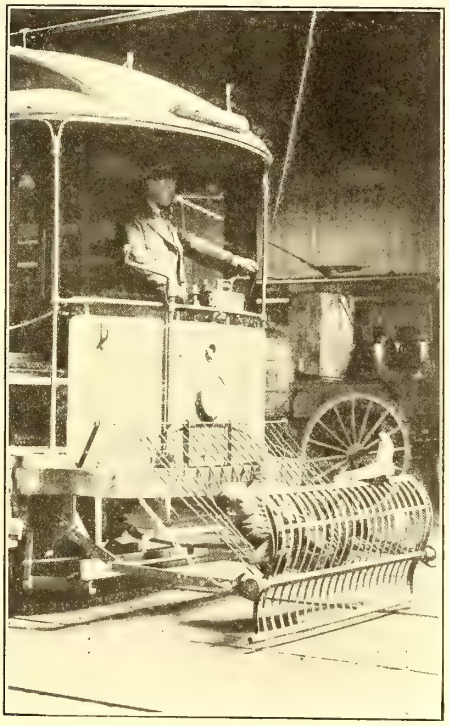
The Ohio Electric Railway Company, it is expected, will contest the order. The company has a precedent in Columbus on which it will probably lay some stress in its fight. The board of public service preceding the present one approved plans for laying T-rail with the special Hayden block paving on the West Town Street line and the work of putting this in is still going on. The city, although it is improving West Town and the laying of the T-rail is in violation of the recent ordinance, has shown no inclination to interfere with that work.

THE WORCESTER FENDER

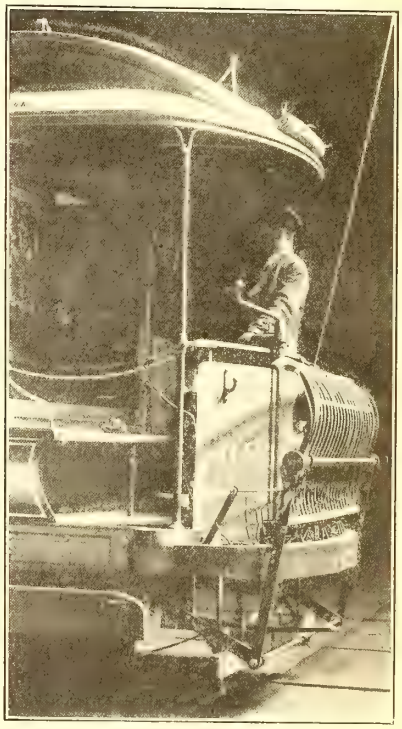
The Worcester Consolidated Street Railway Company is now trying a new double-acting fender invented by J. M. Smith, one of its employees. This fender was one of the many lately tested in Worcester by the Massachusetts Railroad Commission, and made so good a showing that the Worcester Railway Supply Company determined to place it on the market.



FENDER READY FOR ACTION



FENDER IN ACTION



FENDER NOT IN USE

The general construction and operation of the fender may be clearly seen from the accompanying illustrations. The lower portion is a curved steel grid carried on a shaft which on striking an object turns up immediately to form a protective basket by coming in contact with the upper portion of the fender which is made of chain. The edge of the lower section of the fender is furnished with a rubber hose to soften the shock of collisions. The fender may be easily regulated for any desired rail clearance.

FINANCIAL INTELLIGENCE

Wall Street, Sept. 11, 1907.

The Money Market

The past week has witnessed a further decided improvement in the monetary situation, both here and in Europe. In the local market the demand for money for stock and corporate purposes has fallen off considerably and has resulted in a decided lowering of rates for practically all classes of accommodation. Time money has been extremely easy, asking charges for all maturities up to six months ruling ½@1 per cent lower than those recently quoted. Sixty-day money, which commanded 6 per cent a short time ago, was obtainable at 5¼ per cent, while money maturing in from four to six months could be had at 6 per cent, as against 7@7½ per cent reported a few weeks ago. Money on call during the early part of the week was in abundant supply at rates ranging from 2½ to 3½ per cent, but at the close of the week there was a general marking up in the rates to 7 per cent, due to the preparations making for taking up the $40,000,000 4½ per cent 50-year bonds of the City of New York, the payment of a considerable amount due to the Pennsylvania Railroad Company on account of the Union Pacific purchases of Baltimore & Ohio stock last fall, and to the redemption of about $6,000,000 Japanese Government 6 per cent bonds. These payments called for an aggregate of more than $80,000,000, but it is generally believed that the tying up of this vast amount of money will be only temporary, as it is expected that the money paid for the new New York City bonds will be redeposited in the banks in the near future. The success of the New York City bond issue was unparalleled in the history of the city and indicates the willingness of investors, both large and small, to put their funds into attractive issues whether they be offered by corporations or by municipalities. More than 950 bids were received for the issue, aggregating $207,159,420, at prices ranging from 100 to 110, the latter offer being for a small amount.

The demand for money at the principal European centers has been considerably smaller, and has been reflected in a decided easing off in the private discount rates at both London and Paris. The official discount rates, however, remain unchanged. The foreign exchange market developed pronounced weakness, prime demand bills declining nearly a cent a pound to 4.86, a rate which precludes any possibility of gold exports to Europe.

The bank statement published last Saturday was rather disappointing. Loans increased $611,800, cash has decreased $1,426,800. Deposits increased $170,800, which, deducted from the decrease in cash, shows a reduction in the surplus reserve of $1,384,100. The surplus now stands at $7,372,350, as against $6,577,925 in the corresponding week of last year, $4,831,350 in 1905, $38,438,250 in 1904, $15,372,200 in 1903, $715,075 in 1902, $6,915,875 in 1901, and $26,056,250 in 1900.

The Stock Market

Largely to the exclusion of everything else, Wall Street's interest has recently centered in the $40,000,000 bond issue of the City of New York, bids for which were opened on Tuesday last. Nearly 1000 bids were received for the issue, aggregating more than $207,000,000. The fact that prior to the opening of the bonds there was active trading in the bonds on the local curb market "when issued" at substantial premiums over par was very naturally accepted as in the light of a foregone conclusion that the issue, unlike the most recent emissions by the City of New York, would prove an unqualified success. Of course, the extremely favorable terms on which these bonds were offered to investors had very much to do with this condition of affairs, as opportunities to secure a 50-year 4½ per cent obligation of any such municipality as the City of New York are extremely rare, a fact thoroughly appreciated by investors of large and small means, and especially managers of estates, trusts, etc., not only throughout the United States, but in Europe as well. In consideration of this situation it was perfectly natural that the stock market should have reflected a decidedly improved tone, as it was appreciated that the success of the New York City loan would undoubtedly lead up to a much broader and better bond market generally, which in turn would sooner or later culminate in a stronger market for stocks. As contributing in no small degree to the better tone to the stock market was a considerable falling off in the rates for time money and a slight hardening in quotations for call loans was not regarded as an altogether unmixed blessing, as it was accepted as being due to withdrawals of funds by intending subscribers to the New York City bonds and therefore only a temporary affair. Besides this, a decline in foreign exchange rates here and a betterment of monetary conditions abroad were taken as strong indications that this country will be able to draw gold in large quantities from Europe this fall and that, consequently, we would experience no difficulty in handling our crops, particularly in view of the attitude of the Treasury in coming to the aid of the banks by making liberal deposits with them during all the crop moving periods. Evidences that both Federal and State authorities will from now on pursue safer policies with reference to the large corporate interests in different parts of the United States were also accepted in a very favorable light, and about the only development that might be construed at all unfavorably was the fact that in practically all lines of commerce and trade a relaxation is now apparent. However, this was likewise looked upon as another blessing in disguise, as it is thoroughly appreciated that this movement on the part of merchants and manufacturers is merely in the nature of getting their houses in order. A further reduction in prices for refined copper was viewed as in the best interests of those chiefly concerned, as it was felt that it would eventuate in a large increase in the demand from consumers; at any rate the stocks of most of the large copper producing concerns recorded greater or less advances in the market during the week, a fact which applies to the shares of pretty much all industrial and railway corporations.

Developments in connection with the local traction companies have been highly interesting, values of these securities shrinking to the lowest prices ever touched in the market. The chief event of the past week, from a stock market viewpoint, was, of course, the suspension of dividends on Interborough-Metropolitan preferred, a step which had been pretty thoroughly discounted in all the recent fall in the securities of that company. In refreshing contrast to the foregoing was the declaration of the regular quarterly guaranteed dividend of 1¾ per cent by the Manhattan Railway Company.

Philadelphia

The dulness prevailing in the general securities market during the past week was reflected to a great extent in the local traction shares. Trading in the group included a very small number of issues, only a few of which developed any degree of activity. Philadelphia Rapid Transit was again the leader of the list, upwards of 8000 shares changing hands. From 15½ the price ran off to 14⅜, under moderate pressure, but at the close the stock ($42.50 paid) was sold from 22½ to 19½. Union Traction was fairly animated and weak, about 2200 shares selling at 54¾@52. Otherwise the market was absolutely featureless. Philadelphia Traction brought 91@90½, and United Companies of New Jersey sold at 245½@241. Other transactions included United Traction of Pittsburg at 46, Consolidated Traction at 69, and Philadelphia Company common at 41.

Chicago

The decision of the United States Court of Appeals, in which it was held that Judge Grosscup had no power to turn over to the Chicago Railways Company the properties of the Chicago Union Traction Company and its subsidiary companies without consent of the bond and stockholders of the underlying companies, was received with some satisfaction on the part of the Eastern interests in Chicago traction affairs. A new plan will now be formulated by new interests which, it is said, will more fully represent the holders of the underlying securities than did the old plan, and it is thought that the new plan will receive the approval and support of the holders of the underlying security holders. It is believed that application will be made for an extension of time given the Chicago Railways Company for accepting the new city ordinance. Trading in the local traction issues during the week were unimportant. South Side Elevated sold at 81@80; Chicago City Railway at 150; Metropolitan Elevated preferred at 65¾; Northern Elevated preferred at 60.

Other Traction Securities

The feature of the Baltimore traction shares was the pronounced strength exhibited by the United Railway issues, prices for all classes of bonds and the stock advancing sharply on moderate purchases. The 4 per cent bonds, after selling at 84½, rose to 86, while the incomes advanced nearly a point to

52⅞. The refunding 5s moved up a point to 78¼, while the stock gained 1½ points to 13, on the purchase of a few hundred shares. Trading in the other issues was practically at a standstill. Norfolk Railway & Light 5s brought 95. The Boston market was extremely quiet, and while prices moved with some irregularity, the general tone was firm. Boston Elevated sold at 130, and West End common and preferred sold at 85½ and 101@100, respectively. Boston & Worcester common advanced ⅜ to 20, and the preferred stock brought 65. Boston & Suburban sold at 14. Massachusetts Electric issues were quiet, but steady, the preferred selling at 51@51½ and the common at 13@12½.

Quite a little trading has been done in traction securities on the Cleveland Stock Exchange within the past week. Cleveland Electric has shown strength by a gain of six points, the last sale being at 52. The announcement of $1,000,000 new stock to be sold at $20 a share by the Northern Ohio Traction & Light caused the market to drop away from that issue somewhat, the decline being several points. The closing quotations were 20 bid and 21¼ asked, while the figures had formerly stood around 24. Aurora, Elgin & Chicago preferred was quoted at 72 bid and 75¼ asked, while Toledo Railway & Light stood at 21 bid. Forest City closed at 96 bid and 98¼ asked.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Sept. 4	Sept. 11
American Railways	48	46½
Boston Elevated	130	129
Brooklyn Rapid Transit	48¼	45⅜
Chicago City	150	150
Chicago Union Traction (common) certificates	—	2⅞
Chicago Union Traction (preferred) certificates	—	a52
Cleveland Electric	—	50
Consolidated Traction of New Jersey	67	67
Detroit United	64	64
Interboroug-Metropolitan	9¾	8¾
Interborough-Metropolitan (preferred)	28	256
International Traction (common)	—	—
International Traction (preferred), 4s	—	—
Manhattan Railway	120	117
Massachusetts Elec. Cos. (common)	13	12
Massachusetts Elec. Cos. (preferred)	51	50
Metropolitan Elevated, Chicago (common)	21½	21
Metropolitan Elevated, Chicago (preferred)	63	—
Metropolitan Street	38	37
North American	62½	60
North Jersey Street Railway	40	40
Philadelphia Company (common)	39	38½
Philadelphia Rapid Transit	14⅜	19¾
Philadelphia Traction	91	91
Public Service Corporation certificates	62	65
Public Service Corporation 5 per cent. notes	92	92
South Side Elevated (Chicago)	80	80
Third Avenue	56	50
Twin City, Minneapolis (common)	90¼	91
Union Traction (Philadelphia)	54¼	51

a Asked.

According to the "Iron Age" there is a more cheerful feeling in the Eastern pig iron trade, due to the fact that there has been increased activity, some good concerns having bought not only for the last quarter, but also during the first quarter of next year. It is estimated that the purchases in the Eastern markets aggregate about 50,000 tons. In the West and South buyer and seller are still apart. The copper market is utterly demoralized. The effort to induce buyers by naming 18 cents for electrolytic has been a flat failure, and the conviction is gaining in the trade that there will be no halt until 15 cents is reached. Electrolytic has been sold for shipment abroad at the equivalent of 16⅝ cents, and is now being offered at 16½ cents without takers.

NORTHERN OHIO SECURING FUNDS FOR IMPROVEMENTS

The directors of the Northern Ohio Traction & Light Company have decided to issue $1,000,000 stock to be sold at $20 a share, for the purpose of securing funds to cover the improvements that are being made this year. Owing to the unsatisfactory condition of the bond market, it was felt that bonds could not be disposed of to good advantage. To secure the funds it had become necessary either to issue stock or suspend the payment of dividends. Of the two methods, it was decided to call upon the stockholders. The company has sold $8,000,000 of its authorized $10,000,000 capital stock and an additional $1,500,000 has been issued and held in the treasury. The stock to be put out will come from this issue. It will be sold to the stockholders to the extent of one-eighth of their present holdings, one-fourth to be paid on Sept. 20 and one-fourth on the 20th of each of the following months of the year. No fractional shares will be sold. The improvements for the year will entail an expense of about $375,000, of which about $100,000 has been required for new rights of way. The equipment purchased also amounts to quite an item. The sale of stock will provide $200,000, and the remainder will be paid from the surplus above the amount paid to stockholders in dividends. The gross earnings for the year are estimated at about $1,900,000, and a surplus of nearly 4 per cent will probably be earned on the stock. Next year, it is thought, $100,000 will cover the cost of improvements. The gain in earnings so far this year demonstrates the advantage the improvements have been to the road, and when they are all completed the showing will be still better.

NEW ENGLAND STREET RAILWAY CLUB AT PROVIDENCE

The fifth annual outing of the New England Street Railway Club was held at the Pomham Club Thursday, Sept. 5. The members of the club, numbering 135, arrived in Providence at 11 o'clock and took a special car to the club house. A ball game was to have been played, but the weather precluded that diversion, and the time was given up to bowling and whist. The dinner was served at 1.30 o'clock and was entirely informal, the President, Henry C. Vage, being at the head of the table. The entertainment which was to have been given at Vanity Fair was also postponed. The club returned to Boston at 6 o'clock last evening. Among those present were Herbert W. Smith, Elliott O. Johnson, W. S. Fernald, G. W. Adams, E. W. Holst, L. H. Parker, C. B. Coundy, C. H. Larimer, Frederick A. Smith, Edwin Dey Sibley, Frank D. Masterson, W. L. Adams, F. A. Boss, W. S. Sisson, Frank Booth, W. F. Abeley, W. J. Keenan, J. F. Malloney, George C. Tewksbury, George C. Ewing, Joseph A. Fitzpatrick, A. C. Fairbanks, T. H. Plouff, Charles W. Chandler, J. Henry Blanchard, A. W. Chesterton, F. L. Fairbanks, R. W. Eaton, G. H. Gleason, George H. Martin, C. H. Andrews, Frederick D. Hall, C. E. Brint, J. M. Cox, G. T. Paraschos, Charles A. Record, J. M. Prendergast, J. Allison Smith, Philip A. Welsh, William W. Field, Jerry W. Hayes, James A. Montgomery, William C. Snow, D. Kennedy, George A. Ober, Robert Mathias, D. G. Trayers, J. Harry Seavey, J. Emil Johnson, Louis L. Drake, Melville B. Chase, Wright Webb, W. L. Ford, R. S. Brown, W. E. Case, Jr., H. M. Ballard, L. A. Crowell, John J. Lane, D. L. Prendergast, E. L. Janes and James F. Wattles, of Boston; J. E. Thielson, D. F. Sherman, Harry Daw, Railroad Commissioner Joseph P. Burlingame, William Rice, J. P. Thorndike, F. H. Brown, L. A. Shippee, Edward Fitzgerald, M. H. Bronsdon, W. C. Langford, Jesse Mills, William M. Peck, William E. Carr, F. H. Young, Alonzo R. Williams, J. E. Case, John McDonald, Frank McDonald, R. Roscoe Anderson, Superintendent of Transportation Rhode Island Company; Franklin A. Smith, Secretary Providence & Danielson Railway Company; H. F. Purrington, H. H. Botham, J. H. Hackett, A. L. Campbell, of Providence; James W. Sullivan, E. P. Shaw, Jr., G. M. Cox, S. K. Page, Newton, Mass.; J. E. Dozier, Leslie H. Brown, Lynn, Mass.; Deputy Railroad Commissioner David J. White, Pawtucket; H. C. Page, Springfield, Mass.; A. C. Ralph, George C. Moore, Taunton, Mass.; George S. Brush, Newtonville, Mass.; F. F. Munroe, Mt. Vernon, Mass.; E. C. Clark and E. C. Clark, Jr., Northampton, Mass.; George P. Dole, Wareham, Mass.; John R. Miller, Walter E. Gardner, Medfield, Mass.; Fred T. Stockwell, H. B. Smith, Cambridge, Mass.; L. S. Pierce, Laconia, N. H.; John W. Ogden, Maynard, Mass.; George H. Burgess, George R. Damon, C. H. Abbott, C. H. Howe, Leominster, Mass.; Reginald M. Campbell, J. E. Southwell, C. G. Corey, New York; W. A. Trubee, Bridgeport, Conn.; H. N. Ransom, Schenectady, N. Y.; M. P. McLaughlin, Wakefield, Mass.; C. V. Mills, Ayer, Mass., and A. E. Jackman, Narragansett.

MORE FREIGHT RIGHTS SOUGHT IN MASSACHUSETTS

A movement has just been started by the Boston & Northern Street Railway to secure freight and express rights from the local authorities in cities and towns north of Boston reached by the trunk lines and branches between that city and Lowell and Lawrence, the principal mill cities of the Merrimac river valley. This action has been impending for some time, but it appears to have been hastened by the success of the Old Colony Street Railway in developing freight and express business from Brockton, Taunton and other cities in southeastern Massachusetts to and from Providence.

There has been no trolley freight business whatever in the Boston & Northern territory up to the present time except a little between Newburyport and Plum Island by the Shaw interests. Within the last two weeks the Boston & Northern petitions have been filed in Lowell, Lawrence, Methuen, Andover, North Andover, Middleton, Danvers, Dracut, Tewksbury, Wilmington, North Reading, Reading, Wakefield and Melrose, and public hearings have been called on several petitions. After the local authorities have acted, it will be necessary to get the local grants approved by the Railroad Commissioners. The petitions now filed cover probably about a third of the Boston & Northern territory, especially the trunk line which leaves the Boston Elevated Railway Company's system of surface lines at Malden, and running north through Melrose, Wakefield and Reading, forks at Reading square, sending one branch to Lowell by way of Wilmington and Tewksbury, and the other branch to Lawrence by way of North Reading and Andover. Fast passenger service with half hourly cars alternating for Lowell and Lawrence out of the Boston Elevated Company's Sullivan square terminal is now operated over this route.

The petitions so far filed lack Malden. Aside from that city the entire through route has been covered sufficiently to foreshadow direct trolley express service from the heart of Boston out over the tracks of the city system to Malden, and thence to the northern districts. With this for a beginning, the Boston & Northern will eventually make similar applications in the rest of its territory, to cover such centers as Lynn, Salem, Beverly, Gloucester, Newburyport and Haverhill, with the towns lying between.

It is not denied that it is eventually planned for the Boston & Northern freight and express service to be developed north of Boston and the similar service already running pretty widely in the Old Colony territory south. In the event of such a connection express cars could be run through from the Merrimac valley cities to the mill cities in the southeastern part of the State. While General Bancroft, of the Boston Elevated Company, has stated that his company intends to develop a freight and express service sufficient to get the cars of outside companies in and out of the central business sections, there is a good deal of opposition to it, and the company's petition for local rights has been for several months awaiting a hearing before the Board of Aldermen.

It is doubtful if the Old Colony express service is brought any nearer Boston until the solution of the Boston Elevated's freight problem makes it possible to make actual entrance to that city. Only this summer the Old Colony secured its local rights in Quincy after a long deadlock, thus completing its chain of freight and express franchises up to the edge of the Boston system. But for the time being the freight cars will not be operated north of the Brockton district. The Old Colony's service at present covers Taunton, Brockton, Rockland, Whitman, Abington, Bridgewater, New Bedford, Lakeville, Middleboro, and, by arrangement with the Brockton & Plymouth Street Railway, Plymouth. Most of these places get two round trips a day to Providence, where the cars are handled at the Rhode Island Company's trolley freight house on the water front.

The other principal trolley freight developments in Massachusetts just at present are by the New York, New Haven & Hartford Railroad interests, represented by the New England Investment & Securities Company. This company, having started a trolley express service in the Springfield district, and applied for rights in the Worcester district, has now turned to Pittsfield, and is getting things in shape for a freight service both north and south of that city. Within the last week or ten days it has started a heavy double-truck combination passenger and express car over the Berkshire Street Railway, running five round trips a day to Great Barrington, a two-hour run to the southward. The car leaves Pittsfield at 6.05, 10.05 a. m. and 2.05, 6.05 and 10.05 p. m. President L. S. Storrs is authority for the statement that the company will replace the combination car with regular express cars whenever the business warrants it.

THE TRANSIT INQUIRY IN NEW YORK

At the continuation of the transit hearing in New York last week by the Public Service Commission the subject considered had mainly to do with the details of the agreement of lease between the different companies and the use made of a $13,000,000 fund authorized to be applied to the electrification of certain horse car lines. Briefly, the several agreements between the companies were discussed in detail, but nothing was elicited beyond what was already known as a result of the publication of the separate leases at the time the properties were transferred. As regards the charges for electrification, the difficulty was experienced of accurately fixing them because of the difference between the basis on which they had been worked out and the way in which the work was charged. The estimates for this work, made in 1902, were computed according to the franchises of the different roads, just as the reports are made to the Railroad Commissioners, whereas the figures presented by Vice-President and General Manager Root, of the New York City Railway Company, covered the routes as operated, which are quite different from the lines as originally laid down in the franchise grants.

In connection with the hearing, however, an interesting communication was received from Mr. Belmont relating to the construction accounts of the Interborough Rapid Transit Company, concerning which some misapprehension seems to have been created as a result of a recent hearing. Mr. Belmont says the question of items to be charged to the construction account of the subway was left entirely with Mr. Gaynor as accountant, and so he asked Mr. Gaynor now why he included in the construction charges, among other things, the salary of Mr. Bryan as vice-president, the salary of Mr. Belmont, the amounts paid to August Belmont & Company as fiscal managers, the discount on the $15,000,000 of notes which it has been alleged erroneously was charged against August Belmont & Company, the commission paid to Belmont & Company upon the issue of notes, the item for the publication of the souvenir book, the contribution of $500 to the National Civic Federation and one or two other matters.

Mr. Gaynor replied to the effect that the misunderstanding complained of was due to the fact that there was no general construction account in the subway other than the equipment account. So far as the salaries of Mr. Bryan and Mr. Belmont were concerned, Mr. Gaynor reported that they were charged to equipment in the earlier stages of the enterprise, according as their services were given to assembling the subway equipment. He distinguished between the salary of Mr. Belmont and a payment of $25,000 in 1906 to Belmont & Company on account of services as financial managers.

A large part of Mr. Gaynor's letter was devoted to the subject of discounts on bonds. These items, amounting to $450,000, did not, he said, represent payments to Belmont & Company, and the books of the subway did not show any such entries, but simply that the discounts on the bonds sold through Belmont & Company were charged to equipment account. The price was 97 and accrued interest.

The commissions paid Belmont & Company, said Mr. Gaynor, were three-quarters of 1 per cent on the sales of $15,000,000 notes, all told, which the banking firm split up with its associates in the handling of the issue, receiving itself $37,500. As to the publication of the souvenir book, Mr. Gaynor referred to the justification offered by President Bryan, which has already been printed.

The contribution of $500 to the National Civic Federation, which accompanied one of the same amount by Mr. Belmont personally, Mr. Gaynor declared to be on a par with contributions of other railroad corporations to Young Men's Christian Associations, reading rooms and other undertakings contributing to the welfare of employees. He called attention finally to the fact that the directors' fees were charged to equipment account only to a time two months after the operation of the subway was started.

William Barclay Parsons, chief engineer of the Interborough Rapid Transit Company, after making an examination of both tubes of the Battery tunnel to Brooklyn last week, said the tubes would be opened late next month or early in November

BOND ISSUE TO COAST COMPANY FOR REFUNDING AND IMPROVEMENTS

A trust deed for $20,000,000 has been executed by the Los Angeles-Pacific Railway Company, of Los Angeles, Cal., in favor of the Southern Trust Company, of that city, to secure the payment of an issue of new bonds to that amount, the security covering all of the extensive properties of the railway company. The Los Angeles-Pacific Railway Company has a bonded indebtedness of about $12,000,000. The new bond issue has been ordered for retiring or refunding the old bonds, and at the same time providing funds for the extensive improvements which are to be made to the system—improvements which amount practically to rebuilding, re-equipping, and extending several lines of the road. Holders of the present bonds will be given their option whether they will retain their present holdings or exchange them for the new bonds on the basis of dollar for dollar. The retirement of the old bonds will leave about $8,000,000 to be expended in improvements. The most costly work which the company has planned is the subway scheme, by which the shortest possible lines to Hollywood and Santa Monica will be obtained, and through which high-speed trains will be run at regular intervals. Attractive stations will be built, and the Los Angeles depot, which will be between Fourth and Fifth street on Hill, will have considerable track space. New power stations and substations will be built.

AFFAIRS IN CHICAGO

The order recently entered by Judge Grosscup in the United States Circuit Court, directing the receivers of the Union Traction Company, which operates the street car systems on the North and West sides of the city, to turn these properties over to a new corporation called the Chicago Railways Company, for twenty years, was on Sept. 7 reversed by the United States Court of Appeals. The decision of the higher court remands the case to the United States Circuit Court and leaves the traction situation where it was before the formation of the Chicago Railways Company. It was the opinion of the Court of Appeals that Judge Grosscup had no power to give the possession to Chicago Railways Company without the consent of the bondholders and stockholders of the underlying companies, and declared that the only manner in which the Railways Company can secure possession of the traction properties is through negotiations with the stockholders and the bondholders.

The City Council some time ago passed an ordinance granting to the Chicago Railways Company the right to operate the street car systems on the North and West sides of the city. This ordinance, in the opinion of Justice Brewer of the United States Supreme Court, who read the decision, was fair and should have been put in operation. The Court held, however, that the wisdom of such a decision, or even public necessity from a business point of view, could not be taken into consideration, as the interests of the private property holders were the paramount points at issue. The action taken by the Court of Appeals hinged entirely on the question of jurisdiction. The power of Judge Grosscup to issue the order in favor of the Chicago Railways Company was the only thing assailed. The opinion of Judge Brewer praised the wisdom of the order issued by Judge Grosscup, but declared that legally it was wrong. The ordinance passed by the City Council in favor of the Chicago Railways Company has never been formally accepted by that corporation, and as the time for its acceptance expires by limitation Sept. 14, it will be impossible for that company to obtain possession of the properties by negotiation with the stockholders and bondholders by that time. The entire traction situation, therefore, reverts to the period when the properties were held by receivers, and before the proposed unification of the North and West side lines was contemplated.

The question of widening the space between cars came up last week, but Mr. Arnold's plea was not heeded, Charles V. Weston and Mr. Fleming, both of whom represent the city, voting against Mr. Arnold's proposition to widen the space from 8½ ins. to 20 ins. The standard distance between track centers as previously fixed by the board was 9 ft. 8½ ins. Mr. Arnold proposed to effect the increase by reducing the width of the cars. Mr. Arnold, as chief engineer, brought the matter of space between cars before the board in a letter on Aug. 21. On the following day, as chairman of the board, he made a statement in which he held that a distance of 20 ins. ought to be established between cars, instead of 8½ ins.

"Since going into this subject," said Mr. Arnold, "I have taken the pains personally to measure the distance between cars, not only on many of Chicago's street, but also on many of the principal streets, both wide and narrow, in the city of New York. I find that the distance between track centers on many of the outlying roads of Chicago is 10 ft. 7 ins., and that in New York it is 10 ft. 2 ins.

"In New York, with this distance of 10 ft. 2 ins., there is a clearance space between cars of something over 2 ft., depending on the width of the cars used. While it is true that the cars operated in New York City are narrow, due to the use of longitudinal side seats, it is nevertheless not clear to me that we cannot get suitable cars for Chicago's needs within a space of approximately 8 ft. 6 ins., especially in view of the fact that the new cars ordered by the Union Traction Company are only 8 ft. 5 ins. wide, and that we may, and very likely will, adopt the 'pay-as-you-enter' type of car."

Engineer Weston's statement went into the subject at length, with this conclusion:

"Unless you can provide ample space between passing cars to make it entirely safe for all persons to stand between them we should contract the space sufficiently to make it prohibitive for anybody to attempt to stand between tracks at a point where two cars are passing."

Engineer Fleming's vote in favor of the narrow space was based on his expressed opinion that "it is desirable either to make the cars narrow enough or the spacing wide enough, so that a person could stand safely between cars passing each other in the street, or so plan the cars and the spacing between tracks that the distance between cars will be so small that the people will clearly understand that it is dangerous to attempt to stand between cars when they are passing on the street."

The board's action establishes 9 ft. 8½ inches as the standard distance between centers of tracks. With cars 9 ft. wide, such as the new Chicago City Railway cars, the clearance becomes 8½ ins. Between two cars, each 8 ft. 5 ins. wide, such as the Union Traction Company has ordered, the clearance is 15½ ins., and with a Chicago City and Union Traction car passing each other the clearance will be 12 ins.

The statement circulated in Chicago and the East to the effect that Mayor Busse would call the attention of the Council to the subject of electrifying the steam lines operating within the limits of Chicago proved to have foundation in fact, for the Mayor in his first message, presented last week, asked the Council to take up the subject and report on it. The Council instructed a committee accordingly. The Mayor, in addressing the Council on this subject, said: "Some little time ago my attention was called to the fact that the New York Central & Hudson River Railroad and other railroads entering New York City had substituted electric power for steam on their terminal lines, thereby doing away with the smoke that is produced in such volume by the common type of steam locomotive.

"It has occurred to me in this connection that, if electric motor power could be substituted for steam power on the terminals of the railroads entering Chicago and coming into the heart of the business district, a large part of the smoke nuisance problem would thereby be solved.

"Acting on this thought while the Council was on vacation, I invited a number of citizens of Chicago, including the chairman of the Council committee on local transportation and the city health commissioner, to accompany me to New York for the purpose of observing the results of the electrification of the railroad terminals there.

"In New York we were taken over the terminals of the New York Central & Hudson River Railroad by Mr. W. J. Wilgus, second vice-president and electrical engineer of that road, who has been in charge of the entire work of converting the motive power from steam to electricity. We found that the immense traffic of the New York Central road and of the other roads using its terminals in New York was being handled successfully and, in fact, with the highest degree of efficiency by means of electrical power, and that the smoke nuisance produced by the common type of steam locomotive had been entirely eliminated.

"Our observations, while satisfying us as to the advisability of substituting electrical motive power for steam power on railroad terminals in the city, have no definite bearing, of

course, upon the difficulties to be surmounted and the practical details involved in the working out of such a change. As Chicago is the greatest railroad center in the world, this problem of doing away with the common type of soft coal burning steam engines inside the city is, of course, a tremendous one, but it is a problem which I think the railroads realize must be faced some time in the near future, and it is one which the city must help to solve, to the end that the smoke nuisance may be eliminated.

"Therefore, I would recommend that this whole subject matter of the electrification of railway terminals in Chicago be taken up by the Council committee on local transportation with power to employ such assistance, make such investigations and prepare such reports as may be necessary to advise this Council fully as to the possibility of installing the necessary electrical equipment for use on the railway terminals of Chicago to do away with the steam engines and eliminate the smoke nuisance from that source."

THE CLEVELAND SITUATION

Judge Estep of the Common Pleas Court has denied the Cleveland Electric Railway Company a writ of mandamus in the injunction cases filed a few days ago to prevent the Forest City Railway Company from occupying Central Avenue under the so-called curative ordinance passed by the City Council some time ago. The ordinance was attacked on the ground that the company had not secured consents of property owners either for the original ordinances or the renewal, and that they are illegal. The court held that the control of the records of the Council could not be interfered with, and that that body had a right to correct ordinary mistakes or blunders. While this decision will have some effect on the suits pending, the attorneys for the old company feel that it will not be material. In all, three suits were filed—one by the Cleveland Electric as a taxpayer, one by the company as the proprietor of a street railway system, and one by Edward S. Isom. In addition Charles Fromson, a property owner on Central Avenue, filed an injunction suit, the allegations being much the same as in the other suits.

The investigation of the Forest City Railway Company's books by representatives of Charles S. Thrasher, a stockholder, has been continued through the week. The result of the examination of the stock certificates showed that out of the total of $2,000,000 stock of the company about $900,000 has been sold. The remainder is in the hands of Fred C. Alber, secretary, and is looked upon as watered stock. County Auditor Robert C. Wright is said to be heavily interested in the company, and an endeavor had been made to keep his connection a secret. The investigation has disclosed a number of other stockholders, but their names are kept secret. The accountants and attorneys are endeavoring to learn these names, but the officers will give no information except to refer them to the stock books. It seems that this stock is held in Mr. Alber's name and voted by him, according to the report of the investigators. Mr. Thrasher has threatened to bring suit to ascertain these names if they are not given by the officers.

In explanation of the manner in which Secretary H. J. Davies, of the Cleveland Electric, and A. B. Du Pont, of the Municipal Traction Company, had arrived at the city's share of the receipts from the Central Avenue and Quincy Street lines after the franchises had expired. Council was informed that the receipts from the Quincy line for the time were $163,961.09, and those of the Central Avenue line were $300,872.43, making a total of $464,833.52. From this the operating expenses, $302,141.79, were deducted, leaving a balance of $162,691.73. Upon an investment of $724,000, the entire physical value of the property, 6 per cent. interest was allowed. This, with allowances for depreciation being deducted, left $78,203.36 net earnings for the city. Mr. Du Pont stated that the valuation of the property was high, but that he had given up to it because the city had no power to collect anything and he felt that it was better to have this amount than nothing. Mr. Davies said the amounts were fair, but not excessive. CARTER.

Congressman Theodore Burton has been nominated for mayor by the Republicans to oppose Tom L. Johnson. In agreeing to accept the nomination, Mr. Burton stipulated that the settlement of the traction question be left to the administration, and that there be no alliances of any kind. As far as the traction question goes, the most important limitation in the platform adopted by the convention is that the fare shall not be greater than seven tickets for a quarter.

"We demand a prompt investigation of the expenses of operating a street railway system and an immediate settlement, without favor or partiality for any existing corporation, and with supreme regard for the interests of the people.

"Length of ride, liberality of transfers, modern high-class equipment, cleanliness of cars, frequency of service, are all matters in which citizens are interested, as well as in rate of fare."

Because of the fairness of Mr. Burton in all matters that he has handled in the past, it is believed that he will receive support regardless of political affiliation.

In the trial of the injunction suits brought by the Cleveland Electric to prevent the curative ordinance passed in August from being put into effect, several interesting facts have been brought out. From the evidence of Fred C. Alber, secretary and treasurer of the Forest City Railway Company, it seems that he secured from Mayor Johnson at various times from $60,000 to $80,000, for which stock was delivered for C. M. Bates, president of the New Jersey & Pennsylvania Traction Company, in which Mayor Johnson is interested, and M. T. Cable, of Rock Island, Ill. This stock was issued in the name of Fred C. Alber and indorsed in blank by him. That which went to Mr. Bates was delivered to Mayor Johnson, as was a portion of that which went to Mr. Cable. Mr. Alber stated that when he needed money, he sent over to Mayor Johnson for it and always got it. This money was deposited in his own name and afterward transferred to the company's account. It was received, he said, between 1903 and 1906. It was also brought out that Mayor Johnson has indorsed the company's note for $20,000 to the Cleveland Trust Company, and that the mayor had guaranteed a contract with the Lorain Steel Company. Mr. Alber could not remember just how the contract for cars had been made, whether they were purchased by Mr. Bates and turned over to the company or whether Mayor Johnson had secured them for the company.

The testimony of the registrar of the Forest City Railway Company showed that 900 shares of stock had been delivered to Mayor Johnson and a receipt had been given for them. This was about a year ago. The mayor explained that most of this stock reached C. M. Bates. Mr. Alber stated in his testimony that there were no outstanding notes indorsed by the mayor on Aug. 3, when the curative ordinance was passed.

Figures compiled by the Cleveland Electric Railway Company show that the receipts fell off $148,261 during the first three months of this year, while seven tickets for a quarter were being sold. During the following three months only $43,254.94 of the loss was recovered, leaving an actual loss for the six months of $105,006.48 over the preceding year. The loss in January was heaviest, $54,606.95, or 12.14 per cent. In February the loss was almost 12 per cent and in March 10 per cent. The following figures show the results for the six months, as compared with the same months the preceding year:

	1906.	1907.	Decrease.
January	$449,757	$395,150	$54,607
February	409,451	360,500	48,951
March	454,773	410,069	44,703
			Increase.
April	461,895	470,996	9,100
May	509,607	534,878	26,270
June	523,839	531,722	7,883
Total decrease			$105,006

An increased number of passengers was carried, but this did not make up for the loss. In fact, it is claimed that the loss was really greater because more cars were used, more current consumed and the depreciation was greater.

An amendment has been filed to an ordinance instituted some time ago by the Cleveland Electric Railway Company to prevent the Forest City Railway Company from using a portion of its track on Ontario Street. The allegation is made that the ordinance granting the new company joint use of the tracks is void, Mayor Johnson having been interested in the company at the time it was passed. A suit will also be brought within a short time, it is said, to enforcement of the ordinance fixing compensation for the use of the Superior Avenue tracks. The same allegations will be made in this case.

The investigation of the Forest City Railway Company, under the demand made by Charles S. Thrasher, has been continued, although the claim is made that some of the papers needed have not been produced for the use of the attorneys and experts.

NEW PUBLICATIONS

THE TECHNICAL YEAR BOOK, 1907; edited by A. C. Kelly and Charles Weeks. London, Percival Marshall & Company. 399 pages, illust. Price, cloth, 5 shillings; leather, 6½ shillings.

This handy annual presents an epitome of the technical progress of the year with, perhaps, especial attention to the electrical field. It is necessarily made up in large part from articles in the engineering periodicals and papers before engineering societies. But when the large number of such papers and societies is considered the work of the compilers of this book will be appreciated. Blank leaves are bound in for adding memoranda.

THE MARINE STEAM TURBINE, 2d edition, by J. W. Southern. New York, D. Van Nostrand & Company. 163 pages, illust. Price $2.50.

Turbines seem for many reasons well adapted for marine work; there are fewer working parts than with a steam engine, hence less danger of breakdown; steam is applied direct from the boiler to the shaft; the turbines weigh less than reciprocating engines and are placed well down in the vessel. On the other hand the turbine is most economical when running at a higher speed than is called for by a propeller shaft. The book mentioned discusses these points as well as others connected with marine turbine engineering and is well illustrated.

KAHN SYSTEM STANDARDS. 106 pages. Price, $1.50. Published by Engineering Department, Pressed Concrete Steel Company, Detroit, London, Toronto.

This is a handbook in limited edition of practical calculation and application of reinforced concrete, which represents a large amount of careful and exhaustive work on the part of the company's engineering department, and is a very valuable contribution on the subject of reinforced concrete. As stated in the preface, the object of the book is to present to the designer tables and information in such form as to be immediately available for use in actual designs, and at the same time to have these tables founded on scientific formulæ approved by the best engineering practice. While the work as presented deals mainly with the Kahn trussed bar, the Kahn system includes in its application two other types of reinforcement. Reinforced concrete bridges and culverts receive separate consideration.

OFFICIAL STATEMENT REGARDING OHIO ELECTRIC RAILWAY

J. B. Foraker, Jr., vice-president of the Indiana, Columbus & Eastern Company, is quoted as follows regarding the Ohio Electric Railway Company, which recently increased its capital stock to $25,000,000: "On the 1st of September the Ohio Electric Railway Company took over the Indiana, Columbus & Eastern Traction Company and the Lima & Toledo Traction Company, and for the present at least that is all that will be done. Whether the new company will absorb others or not is a matter which is in the future and is one which will be determined as these questions arise."

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED AUG. 27, 1907

864,187. Street Car Fender; George A. Parmenter, Cambridgeport, Mass. App. filed Dec. 1, 1906. Means for partially supporting the fender upon the car truck.

864,192. Car Truck; William G. Price, Butler, Pa. App. filed Jan. 3, 1906. A truck of the non-pivotal type provided with elongated side frames having eliptical springs at the ends thereof which support the ends of the car body.

864,228. Trolley Harp; Frank H. Brueggeman, Norwood, Ohio. App. filed April 23, 1906. The harp is provided with hollow journal boxes containing lubricating oil, the axles of the wheel being exposed at certain points and engaged by contact springs.

864,232. Railway Switch; James D. Downes, Detroit, Mich. App. filed April 1, 1907. The switch is operated through the medium of a cam wheel in the roadbed adapted to be engaged by an approaching car. Means for indicating the condition of the switch.

864,251. Catenary Suspension-Bracket for Curves; Elmer P. Morris, East Orange, N. J. App. filed Oct. 20, 1906. The trolley is supported from a single messenger cable, rigid bracket arms being provided at the curves to balance the radial strain between the conductor and the messenger wire.

864,252. Catenary Suspension Bracket; Elmer P. Morris, East Orange, N. J. App. filed Oct. 20, 1906. Relates to modifications of the above.

864,269. Brake for Car Wheels; John H. Shaw, New Haven, Conn. App. filed Dec. 14, 1906. A holder provided with a plurality of transverse recesses, a shoe provided with a plurality of corresponding transverse projections on the back thereof adapted to fit in the recesses in the holder, the shoe being adapted when broken to form a series of shoes each having one of said projections.

864,300. Rail Joint; Carl F. V. Hanzen, Buenos Ayres, Argentina. App. filed Nov. 26, 1906. Fish plates combined with a base plate or chair, both elements having downwardly inclined flanges which are secured to each other by bolts.

864,306. Electric Switch Operating Device; Frank A. Johnson and David A. Robbins, Danville, Ill. App. filed Oct. 22, 1906. Relates to the operation of track switches for trolley roads. Special plates or brushes depend from the trolley hangers, which engage special conductors on the trolley pole.

864,329. Brake-Rod Adjuster; William C. North, Durango, Mexico. App. filed Jan. 22, 1907. One portion of the rod consists of parallel legs, the other portion being adjustable keyed between the legs.

864,344. Fluid Pressure System; Samuel B. Stewart, Jr., Schenectady, N. Y. App. filed May 20, 1903. Control system for an electric motor for an air-pressure brake system. Includes among other features a power-driven rheostat having a worm gear connection with the motor.

864,422. Trolley Guard; Charles Harkness, Providence, R. I. App. filed March 8, 1906. In addition to the usual trolley wheel journaled on the harp, there are provided two disks with convex faces disposed toward the trolley conductor and which are yieldable downwardly and laterally.

864,477. Passenger Car; Arthur Lipschutz, St. Louis, Mo. App. filed July 17, 1906. Details of construction of a steel passenger car.

864,488. Signaling Apparatus for Tramways; Joseph M. H. Renson, Liege, Belgium. App. filed Nov. 14, 1906. Comprises two boxes placed upon the track slightly in advance of the junction with a single track section. Each box establishes a signal whenever a car passes from the double track to the single track and vice versa.

864,520. Trolley Wire Hanger or Ear; Harry G. Dyer, Gloucester City, N. J. App. filed Sept. 7, 1906. Has a groove in which the trolley wire is dropped laterally and in which it is sufficiently bent to preclude accidental displacement.

864,571. Trolley Harp; Thomas W. Small, Cleveland, Ohio. App. filed Dec. 5, 1906. The harp has a swivel connection with the pole, the wheel axle being connected with the pole by a flexible conductor.

864,653. Electric Railroading; Isidor Kitsee, Philadelphia, Pa. App. filed April 15, 1907. Trolleys are arranged between tracks, each train being equipped with trolley wheels on both sides so as to engage both adjacent conductors simultaneously. The circuits are so arranged with alternating trolley wires or conductors are of opposite electric potential.

864,669. Switch; Burleigh L. Murphy, Colorado Springs, Col. App. filed May 8, 1907. Provides a switch having the switch rails and switch points so constructed that a train in passing from the main track to the branch track rides upon elevated rails and passes over the rails of the main line track without coming in contact with the same.

864,681. Switch Locking Device and Operating Mechanism Therefor; Henry H. Nichols, Philadelphia, Pa. App. filed Feb. 9, 1907. Comprises a rocking shaft carrying a rack and having an eccentric connection with the switch-tongue, a balance shaft carrying a weight and a pinion meshing with said rack, an electric motor connected to the rocking shaft and circuit connections for the motor.

864,549. Time-Lock Mechanism; James C. Mock, Detroit, Mich. App. filed Feb. 19, 1907. A time lock adapted for use with outlying or non-interlocking railway switches. The object is to lock such a switch in normal position for a definite time after any signal which may be connected with it has been set to "stop."

CAUSE OF ILLINOIS WRECK

The Illinois State Board of Railroad Commissioners has investigated the collision of the Charleston & Malloon line of the Mattson City Railway Company near Charleston, resulting in the death of eighteen passengers, and says the accident was primarily due to the absence of a system of train dispatching. The board adopted a resolution instructing the secretary to notify all interurban roads in Illinois to at once furnish the commission with their rules and regulations for the operation of cars.

PERSONAL MENTION

MR. CHARLES W. CALKINS, of Cohoes, has been appointed superintendent of the Cohoes Railway Company, to succeed Mr. Thomas J. Mulcahey, resigned. Mr. Calkins has long been connected with the company, entering its service as a conductor.

MR. THOMAS J. MULCAHY has resigned as superintendent of the Cohoes Railway Company, of Cohoes, N. Y., to become superintendent of the Greenbush bridge. Mr. Mulcahy has been connected with the Cohoes Railway Company since it was leased by the United Traction Company, and has been in the street railway business for about 20 years, having served with the United Traction Company as conductor, inspector and division superintendent.

MR. CHARLES H. STANLEY has been appointed purchasing agent of the Cleveland Electric Railway Company of Cleveland, Ohio, to succeed his brother, Mr. Geo. A. Stanley, who, as noted in the Street Railway Journal for Sept. 7, has assumed the management of the New York & North Shore Railroad on Long Island, in which the same interests are identified that projected and built the New York & Long Island Traction Company's system, operating between Mineola, Hempstead, Freeport and other Long Island towns.

Mr. FRANKLIN H. SPIESE, of Tamaqua, Pa., a prominent business man is dead. Mr. Spiese was president of the Tamaqua National Bank, originator of the Edison Electric Illuminaing Company and the Tamaqua & Lansford Street Railway Company, now merged into the Eastern Pennsylvania Railway Company, and was a director in the Cumberland Valley Telephone, the American Subway and the Schuylkill Subway Telephone companies. He was vice-president of the United Haiti Improvement Company.

MR. C. L. ROGERS, superintendent of the Uxbridge & Blackstone Valley Street Railway, has been made superintendent of the Worcester & Blackstone Valley Railway by Vice-President L. S. Storrs, of the Worcester Consolidated Street Railway and the New England Securities & Investment Company. He will take charge of the line from Worcester as far as Millville, and will also operate that part of the Woonsocket Street Railway from Millville to Woonsocket, which is leased from the Rhode Island Company by the Uxbridge & Blackstone road, in order to bring all the roads in Massachusetts on the line from Worcester to Woonsocket under one management.

MR. J. A. EMERY has resigned as vice-president and general manager of the Birmingham Railway, Light & Power Company, of Birmingham, Ala., and Mr. A. H. Ford has been elected to succeed him, and also to act as president of the company in place of Mr. Robert Jamieson, whose resignation from the company was recently announced in these columns. Both Mr. Emery and Mr. Jamieson remain as directors of the company, however. Mr. Emery has been connected with the company for several years, his first work with it being as engineer in the employ of Ford, Bacon & Davis, of New York. In 1903 Mr. Emery was made manager of the company. Mr. A. H. Ford, the newly elected president and general manager, is manager of the operating department of Ford, Bacon & Davis, and has been identified with the Newman interests for the past ten years. He was at one time president of the American Cities Railway, Light & Power Company, which controls the systems of Birmingham, Memphis, Knoxville, Little Rock and Houston, Tex.

MR. GEO. R. FOLDS has resigned as general manager of the South Chicago City Railway Company and the Hammond, Whiting & East Chicago Electric Railway Company, which operate jointly in Illinois and Indiana, to become general manager of the West Penn Railways, with offices at Connellsville, Pa., which operate an extensive system of interurban lines in the coke belt. Mr. Folds was born in Oshkosh, Wis., Aug. 23, 1870. Six years later his parents removed to Minneapolis, and it was in that city that Mr. Folds, after a short mercantile training under his father, entered railroading, becoming connected with the Minneapolis Street Railway Company. His first work with that company, whose service, to be exact, he entered in 1893, was in the cashier's department. Subsequently he held positions successively as transfer clerk, mileage clerk and assistant paymaster. Following this he spent a year in a special line of work connected with statements in the claim department. As a result of his work in this connection, the side running boards upon open cars were abolished upon all cars of the Twin City Company and end entrance cars with gates for closing the platform entrances were adopted. During this time Mr. Folds studied at the night law school of the University of Minnesota, from which he was graduated in 1897. Then he was appointed to the claim department of the Twin City Company, and in 1899 was placed in charge of the claim department of the St. Paul division of the company. In 1902 Mr. Folds was appointed assistant to the general attorney of the Brooklyn Heights Railroad, and the following year he was made assistant to Vice-President and General Manager Calderwood, of the Brooklyn Rapid Transit Company. Mr. Folds made a special study of traffic problems in Brooklyn and was responsible for the introduction on the system of a number of new features.

MR. W. E. HARRINGTON, president and general manager of the Eastern Pennsylvania Railways Company, of Pottsville, Pa., has resigned the latter position and will henceforth retain his office as president of the board of directors only, relinquishing the management of the system to Mr. L. C. Bradley, who has been associated with the company since last June, the latter to hold the offices of general superintendent and general manager. Mr. Harrington, in addition to being president of the Pottsville Union Traction Company, holds the same position as head of the Edison Electric Illuminating Company of Pottsville & Tamaqua, the Minersville Electric Lighting Company, the Citizens' Gas Light Company of Tamaqua, and some twelve subsidiary companies. In 1904-05 Mr. Harrington was a member of the executive committee of the American Street Railway Association and has served for a number of years on the standing rules committee and the committee on the promotion of traffic of that body and its successor, the American Street & Interurban Railway Association. He was largely instrumental in the organization of the Temporary Street Railway Association of Pennsylvania and made a number of addresses at Harrisburg before legislative committees on the four electric railway reform measures which have just passed the legislature. For eight years ending in 1904 he was general manager and vice-president of the Camden & Suburban Railway Company. After the lease of this company to the Public Service Corporation of New Jersey, Mr. Harrington occupied, for a short time, the position of manager of the New York-Philadelphia Railway and its allied properties, but in July, 1905, accepted the position of operating manager of the electric railway, lighting and gas properties of J. C. White & Company, of New York. In this capacity he was called upon to develop the properties of the Eastern Pennsylvania Railways Company, which owns the gas, electric lighting and railway interests centering at Pottsville. Mr. Harrington will retain his active membership as a director of the Mutual Life Insurance Company, of Scranton, and the Camden & Suburban Railway Company, of Camden, N. J. Mr. Harrington is a member of the Philadelphia Art Club, University of Pennsylvania Club and New York Railroad Club, and of the American Institute of Electrical Engineers, of New York; past president of the Franklin Institute, of Philadelphia; chairman of the standing committee on the promotion of traffic of the American Street & Interurban Railway Association, and the Pennsylvania Chapter of the Sons of the Revolution.

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CHANGE IN ADDRESS

Commencing with this issue the address of the main office of The Street Railway Journal is
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Of this issue of the Street Railway Journal 8000 copies are printed. Total circulation for 1907 to date 311,850 copies, an average of 8207 copies per week.

The San Francisco Strike

An interesting sidelight upon the conduct and causes of an extensive street railway strike is presented in this issue in an article relating to the strike on the electric railway lines of the United Railroads of San Francisco. The author was one of the strike-breakers, and describes, in graphic terms, the conditions under which he and his associates worked in what has undoubtedly been the most important labor conflict of its kind in this country, when both length and extent are considered. The reasons for this are difficult to determine when the conditions under which the men worked are considered, except for the unfortunate labor situation in San Francisco in which the reckless domination of agitators prevailed over the sober councils of the more conservative element. It is this condition, in fact, which constitutes one of the chief dangers of unionism—more destructive to the men than to anyone else—and we have no doubt that if the history of many a similar event were written it would appear that tactics were followed very like those described by Mr. Brent.

Of the conditions now existing in San Francisco very little need be said, except that they now seem to be returning to a normal state of affairs. Law and order are gradually replacing the chaotic political situation which existed subsequent and, indeed, prior to the fire. When this is accomplished the street railway situation will naturally improve. We do not believe, however, with the author of the article that peace will be followed by a return of unionism. That name must now be so discredited in San Francisco it seems hardly possible that it could be used as a rallying cry for a long time to come. The experience there has shown that no organization ought to be conducted among a large body of men which in any way countenances violence or in which the rights of the conservative element are not safeguarded in any decision which may be made.

Moderate Speed Through Service Vs. High Speed Local Facilities

The value of through car service as contrasted with facilities requiring several changes between terminals is realized in a general way by electric railway men in relation to the convenience of the public, though it is something of a problem to know when it is profitable to operate rolling stock on foreign tracks and when not. Given about the same maximum speeds on the cars, few would question the ability of the through cars to cover a given distance in a quicker time. The comparison of a through service moved at moderate speeds with a broken or local service at much higher speeds, involving changes en route, however, has not been generally considered. It is surprising how well the through car will often show up in such cases.

Recently a trip was made between two points about twenty miles apart, going by a route which required two changes of electric cars and returning by a through trolley car which covered the entire route. The first line included a trip by steam at about double the maximum speed of the through car on the return trip, and the connections were reasonably close, with maximum waits of ten minutes. In

spite of the advantage of the steam road's private right of way, the sustained schedule speed of the slower through car without waits for connections enabled the journey to be covered a few minutes more quickly by the through car. The convenience of not being obliged to change at crowded squares and transfer points was a strong point with the public, and the resulting better schedule time is well worth considering in cases where very high-speed service cannot be afforded in competition with fast-running rival lines on private rights of way extending over only a part of the total distance between terminals.

Motor Driven Tools in Track Construction

Considering the ease with which power can be obtained from a trolley wire at all parts of an operating system it is singular that so few companies have made general use of motor-driven tools in track construction. Construction work is very generally lighted by trolley current in these days, and in some of the most common track operations, like grinding down joints, pumping out manholes and pits, and drilling holes in rails, there is a useful field for the small motor in preference to hand labor.

Thus, in a recent case it was found that by using an electric drill on a piece of track which was being relaid, a hole in the rail could be drilled in 35 seconds, against 25 minutes by hand. The power for the motor was taken from the trolley wire and ten 1¼-in. holes were drilled in 16 minutes, against nearly half a day per man by the slow and laborious hand method generally in use. The motor did not consume over 1/3 hp, and although it was operated in series with a resistance to cut down the trolley voltage from 600 to 220, the cost of power was insignificant in comparison with the saving in wages per hole or per mile of track. The first cost of the drill, about $150, created fixed charges too small to consider in relation to its economy. Maintenance figures were not given but they would have to be pretty high to make much impression on the saving in labor—so high, in fact, that the drill would scarcely be an operative device. The case is entirely different from that of the depreciation of electric percussion drills in service, which are obliged to withstand severe reciprocating shocks instead of the smooth torsional strains of the track drilling process. In using electric drills on street railway track with power taken from the trolley by a pole, a fuse block is a desirable feature near the top of the pole, since it is then necessary for the operator to remove the pole from the line in replacing the fuse. Insulated cables are, of course, necessary features of all motor-driven track outfits. Drills wound directly for 550 or 600 volts are obviously preferable to those with which a special resistance must be used, on account of simplicity rather than economy of operation.

Small portable grinders driven by motors of ¼-hp rating or thereabouts are now available for a variety of work, and experience has shown that with one of these a man can grind down a joint in five minutes against four or five hours with three men in some cases of hand work. These outfits seldom cost over $50 or $75 each, and do not weigh much in excess of a dozen pounds. Blowers driven by ¼-hp motors and costing about the same as the grinders are especially adapted to the removal of chips and shavings in connection with rail drilling. We hold no brief for the manufacturers of labor-saving appliances, but there is certain to be a wider use of such devices in the interests of intensified construction work as their advantages become more generally realized by practical trials. Defects not now foreseen will doubtless develop in service, but with power so readily available at the trolley a distinct reduction of hand labor in the field of track work is only a matter of time.

The Case of Copper

The break in the price of copper which is now well under way will be a cause of rejoicing to many a harassed street railway manager, and those whom necessity has compelled to buy at the extortionate prices of the past year have our sincere commiseration. The truth is now out and it is, as we have more than once hinted, that the high copper prices have been based neither on real scarcity of the red metal nor upon a great and genuine increase in demand, but upon a fictitious scarcity and a temporarily abnormal demand. During the last year or two of general prosperity and rapidly increasing business a great many plants have undertaken extensive rehabilitation, many copper-using industries have been booming and speculation has been active among those who have had no control of the market. All these causes have co-operated to produce not a healthy and normal growth of demand, but a demand hardly more than ephemeral, which has been adroitly exploited and encouraged by those who had copper to sell. What they could not force upon the public they have stored here and there, and finally when the bluff could be kept up no longer they have been compelled tc show their hands.

Now it behooves the great army of copper users to see to it that the price of this enormously important metal is not again allowed to soar skyward. The same acute speculators who sent the base price to 26 cents are still on hand to work the same old game over again if they have the opportunity. The consumer will suffer again unless he takes full advantage of the situation. To a certain extent the enormous increase in the price of copper has defeated itself. The public has learned that certain things for which copper was once considered necessary can be made as well of steel or of some other cheap substance, and having learned this will keep the lesson in mind. There are few things for which copper is so necessary as to justify paying a doubled price for it. Those things for which copper admits no substitute are not of so great aggregate magnitude as to form a suitable basis for another squeeze, like the one of the past year. Even in purely electrical uses copper no longer is fully dominant. Not only has aluminum come into very great use for line construction, but it has been found well adapted for winding magnets, the oxide forming ample insulation for the small potential differences between coil and coil. Recently a composite cable of steel and aluminum wire has been put into service having a tensile strength fully up to that of the best hand-drawn copper and amply able to compete with it at equal conductivity. It seems to be well settled that

the white metal can stay under its rival's price considerably below any figures quoted of late.

It will, therefore, be increasingly difficult for copper to be boomed unless its exploiters also corner the aluminum market. This is not without the bounds of possibility and should be guarded against if possible. Of course ere long some of the fundamental aluminum patents will expire and there will then be a good chance for such competition as will at least check charging "what the traffic will bear" when a copper corner is again deftly engineered. Such competition in aluminum will be a good thing eventually for those who make it, since it will inevitably bring aluminum into use on a scale hitherto unimagined. It is capable of many minor structural uses for which it would have been employed ere this save for the fact that the sole producers have been behind the demand. Now, with copper fallen and aluminum edging cautiously down just below it, is the time to experiment with such things, thereby still further lessening the normal demand upon the world's store of copper. The copper manipulators deserve to stew in their own juice for a while after the recent violent ebullition. Seriously, the situation is not a pleasant one when all the copper-using industries can be held up and plundered on the strength of a scarcity for the most part fictitious. It is high time to sort out thoroughly the necessary from the merely conventional uses of copper and to act upon the information.

Automatic Signaling on Electric Railways

The importance of controlling the movements of electric cars on single-track roads by signals of some sort is no longer open to debate. The question is to-day one of methods. Operating experience shows more and more the need of reliable automatic signals, and it is gratifying to note that good progress is being made by the manufacturers in the construction of electric railway signals which can be depended upon because of their rugged design and positive action. The importance of designing signals so that all breakages and defects lead to the danger indication is much better appreciated now than it was a few years ago, and it is certain that within the next four or five years the trolley signal question will be greatly simplified.

The first point to insure in the trolley signal is positive action under the given conditions. Proper mechanical and electrical design are the means whereby this can be secured, and absence of complication is greatly to be desired. It is doubtful, however, if the varied requirements of a first-class automatic electric railway signal can be met without a considerable number of inter-related magnets, switches and small wheel gearing. We must know to-day whether the block is clear or occupied, and in which direction the car or cars are moving, if the traffic is to be handled without delay and with safety. To take care of these conditions, which lead to the counting in and out of each car that enters and leaves the block, requires a certain amount of intricacy in the connections and apparatus; but this complication is a small matter when compared with that of the average car wiring diagram with quadruple motors and multiple unit control. If each moving piece of an automatic signal system is designed for positive action under all normal operating conditions, much has been gained. Direct strokes of lightning, cyclones, earthquakes and derailments cannot of course be withstood by any signal system under present conditions, and a deliberate disobedience of instructions will overthrow the most carefully planned indications of the track condition. No signal can be expected to take the place of executive authority.

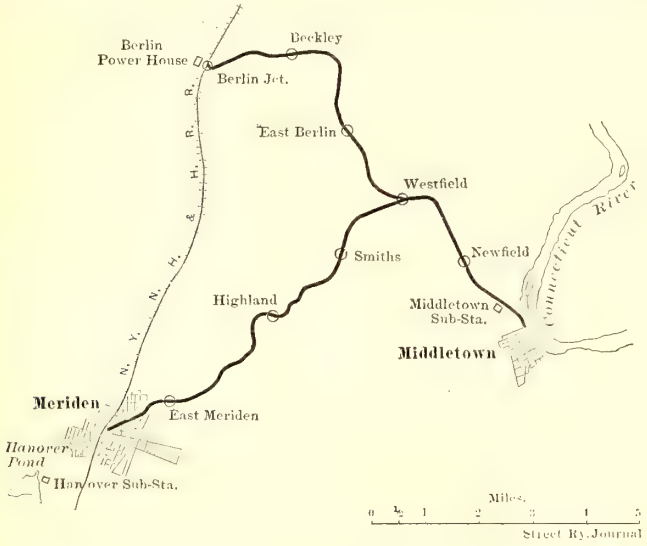
The use of short stroke solenoid magnets wound with many times of wire of high resistance is a step toward increased efficiency and effectiveness of action in some of the later signal equipment. Effort has been made to reduce the arcing at small knife switch contacts by diminishing the current required to actuate the mechanism, by proportioning levers for quick breaks and the danger of contacts "sticking" has been largely overcome in certain instances by the use of side-wiping makes and breaks in the more delicate parts of the mechanism. The tendency is also toward double action in the signal cases at each end of the block; that is, a clear indication is not given at one end until the circuits at the other end indicate that the signal has gone to the position required.

The question of counting cars in and out is one where opinions vary widely. Some managers believe it to be unsafe to run through a block on close headway unless each car keeps its predecessor strictly in sight. On the other hand, other managers consider it a great advantage to know when the last car of a series has passed out of the block, for the operating conditions often preclude running on sufficiently close headway to keep in sight of each car directly ahead. At any rate, signal manufacturers have given long thought to the recording of cars in and out of blocks, and have done their best to build reliable equipment designed to take care of this condition. It will not be long before sufficient experience with counting signals will clearly indicate whether this most difficult and complicated feature of the signal problem warrants the effort made in its solution.

Thus far little has been accomplished in the design of automatic trolley signals for single-phase roads. Just how this will work out cannot well be stated at present, but some sort of signal will surely become desirable as the headway of cars shortens. In subways and on right of way, where the conditions warrant it, double-track roads using direct current are employing alternating current signals with success, leaving the running rail formerly required for signal return current free for conducting purposes. The high voltage in use on some of the later catenary trolley wires is a serious bar to the design of successful signal mechanisms dependent upon the action of the wheel or the bow trolley. The indications are that block signaling will conquer a large part of the 600-volt direct current trolley field before it gains much of a hold in the interurban single-phase field. It will be a help to the operating man and the manufacturer alike if experience with automatic and semi-automatic signals, with repair records and maintenance costs, can be more generally interchanged. Unless one has kept in close touch with recent signal development, he will be surprised at the progress made when he examines the latest apparatus available.

MIDDLETOWN-BERLIN ELECTRIFICATION OF THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD COMPANY

The New York, New Haven & Hartford Railroad Company, realizing the importance of electric traction as a feeder for its main lines and also as a factor in building up



MAP SHOWING LINES EQUIPPED

the smaller towns, has converted several of its branch lines from steam to electric operation. The most recent of these are the two lines running from Middletown, Conn., to Berlin, Conn., and from Middletown, Conn., to Meriden, Conn., and the Middletown-Meriden line branches from the former at Westfield, Conn., and connects Middletown with Meriden, also on the Hartford division, 7.21 miles from Westfield, as shown in the map. These roads are to be utilized as part of the system of the Consolidated Railway Company,

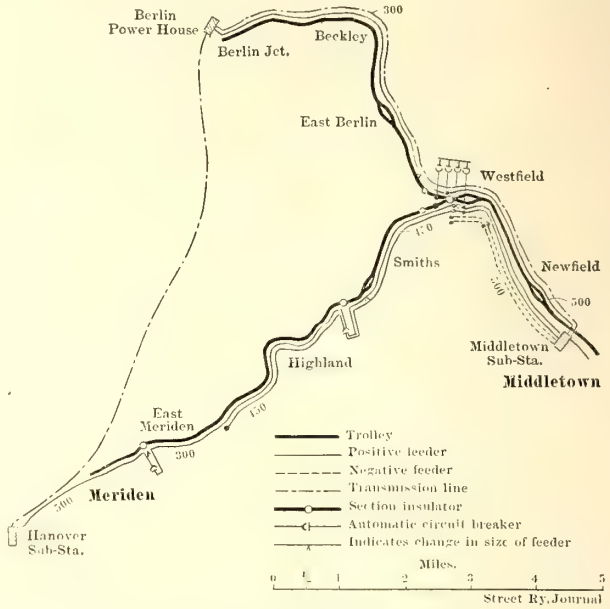


DIAGRAM OF TRANSMISSION CIRCUITS

the power to operate them being obtained from its power and sub-stations. Connections will also be made at each terminal with the local street car line.



CURVE CONSTRUCTION



SMALL TOWER CAR

just completed by Latey & Slater, engineers, of New York City, under the direction of E. H. McHenry, vice-president of the New Haven company.

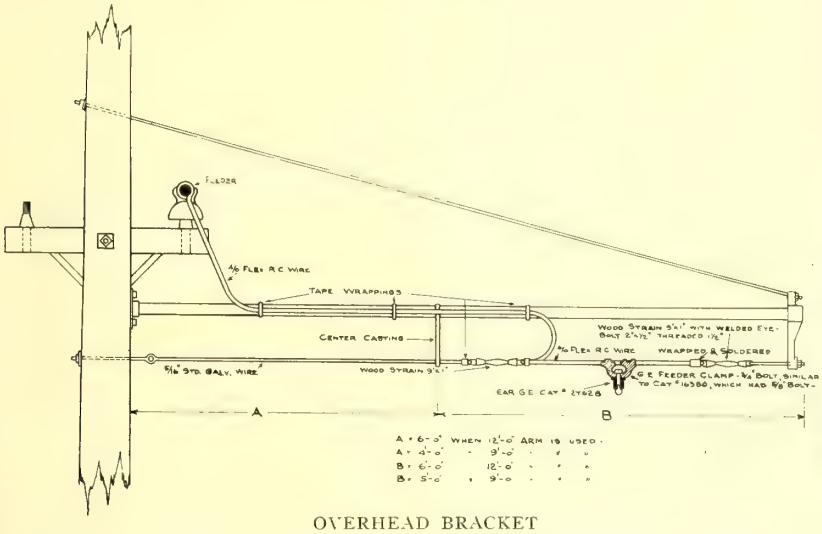
The Middletown-Berlin branch, 9.53 miles in length, connects Middletown with Berlin Junction on the Hartford division of the main line between New York and Boston,

In pushing this work, which was done during the winter months, a much greater use was made of a work train as a factor in the construction work than is usually done.

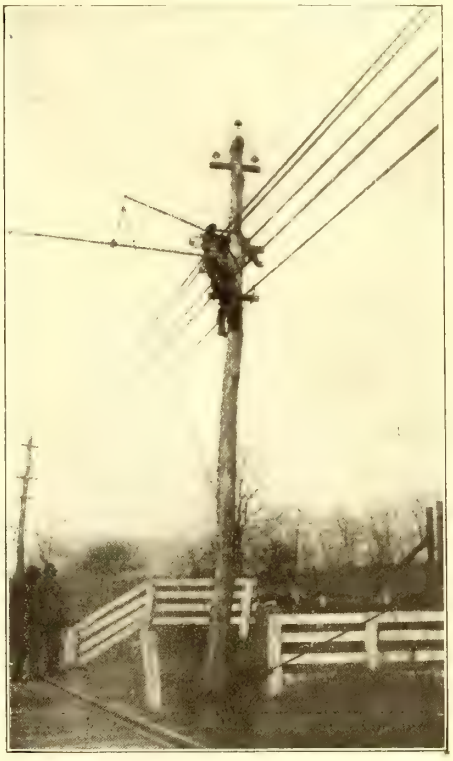
A bracket construction for the trolley wire is used on the tangents and on all curves where the tension of the trolley and feed wires is against the rake of the poles,

12 ft. 6 in. brackets being used on the tangents and 14 ft. brackets on the curves. All other curves, double track and turnouts are of span construction. The poles are of chestnut, having tops 8 ins. in diameter and are spaced approximately 110 ft. apart, with the face of the pole at top of rail 10 ft. from the center line of the track.

The poles were distributed by train and after being framed, graded and armed on the ground were erected in place by the use of a steam derrick mounted on a flat car, as illustrated. This method of setting poles proved quite a satisfactory one and on a line where the work would not be interrupted by trains would be extremely economical, because under the operating conditions on these lines with frequent train interruptions it was possible with twelve men to set and tamp forty-six 35-ft. poles in a nine-hour day.

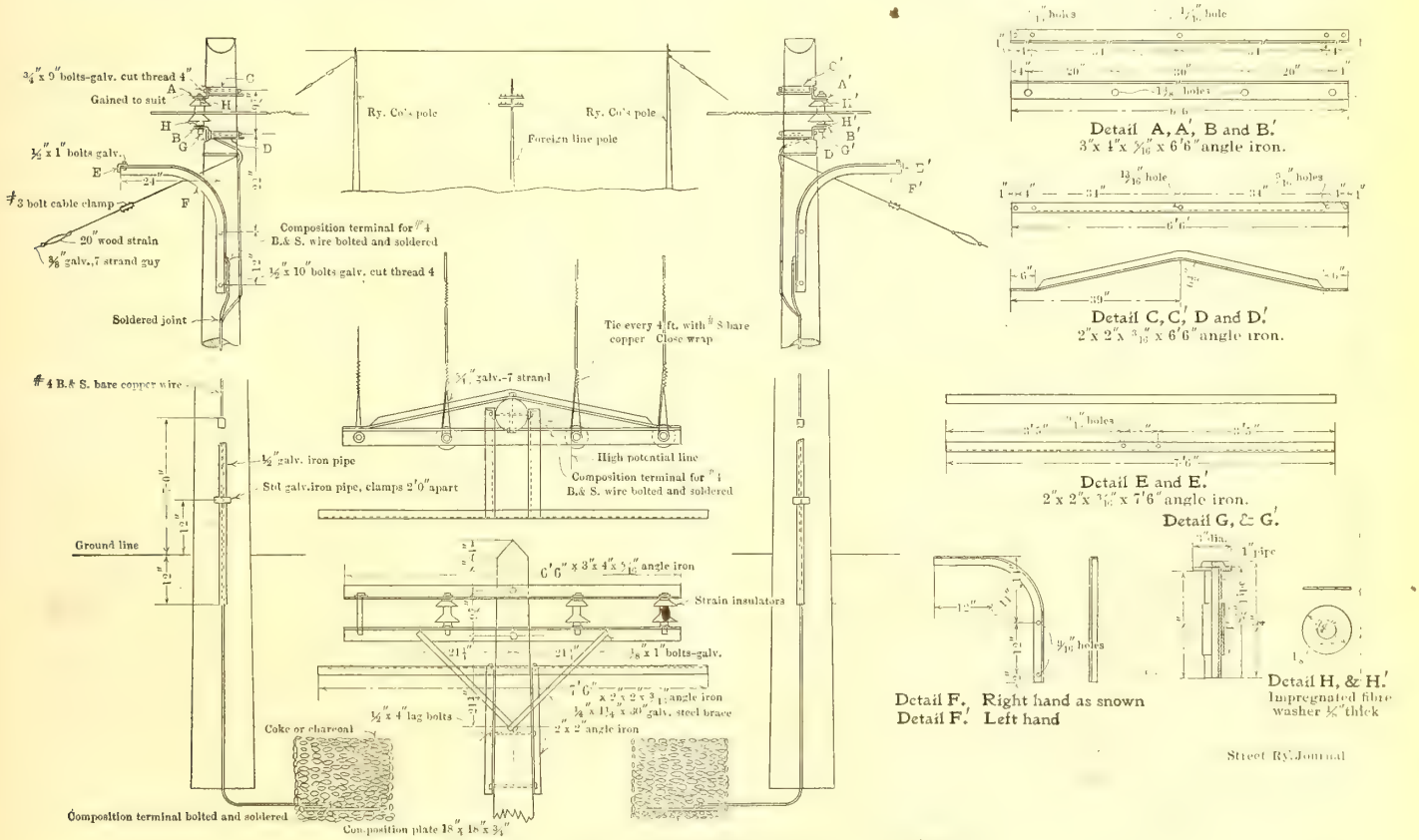


OVERHEAD BRACKET



ERECTING BRACKETS

In order not to interfere with the trains and to obviate the dangers incident to the use of ladders in the erection of brackets, a novel and very economical device was used. This consisted in an arm having a wire head guy on one end the noose of which slipped over the top of the pole, and a curve yoke on its other end which fitted around the pole. At the outer end of this arm was fastened a single block and fall by means of which a man on the ground could hoist the brackets into place for two men up the poles to fasten and adjust them. With this rig it was possible for



HIGH POTENTIAL LINE CONSTRUCTION FOR CROSSINGS

two men on the poles and one man on the ground to erect and adjust thirty-six brackets in one nine-hour day.

The poles are very generously guyed both head and back, 21-inch wood strain insulators being used on the guys on all poles carrying the transmission line, and 9½-inch wood strains on all other poles. The anchors consist of ¾ in. x 6 ft. galvanized iron eye rods run through one-half of a



TOWER CAR TRAIN

5 in. x 8 in. x 8 ft. tie, as a dead man buried 5 ft. underground. The cross-arms are of two lengths for two and four insulators, and all poles on curves are double-armed for both feeder and transmission.

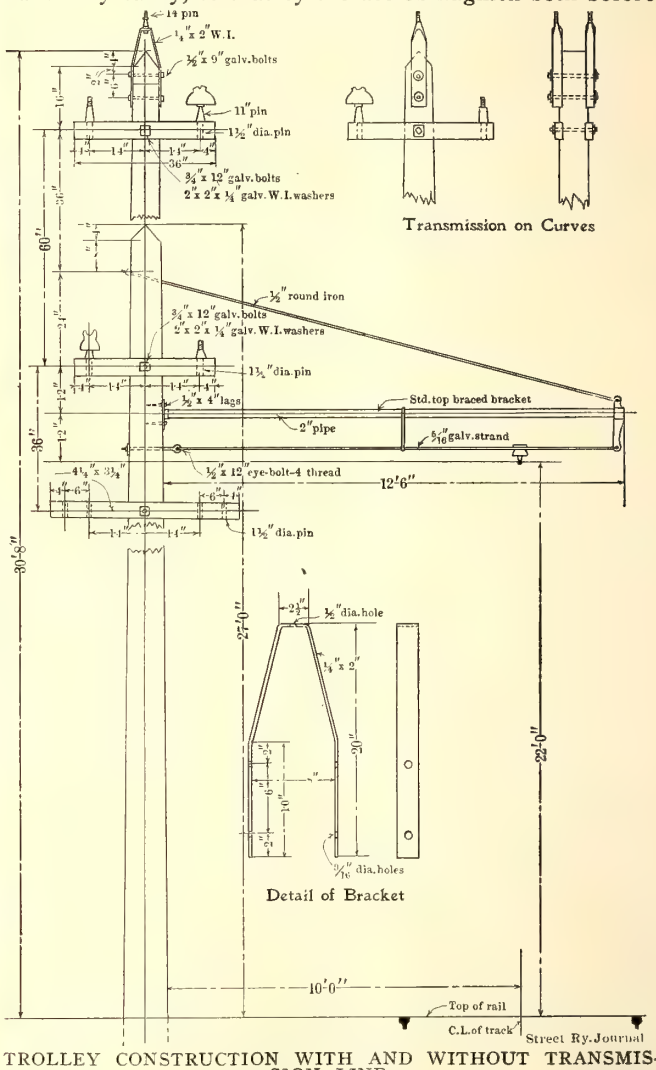
The trolley wire is No. 0000 hard drawn, grooved copper wire, and is erected 22 ft. above the top of rail. The



SETTING POLES BY CONSTRUCTION TRAIN

trolley wire is anchored by means of anchor ears and strain plates in two ways; on bracket construction, head guys are run to the tops of the poles adjacent to the anchor strain plate and the anchor pole is held in alignment by means of a brace pole. On the span construction the strain plates are guyed to the two adjacent poles on each side of the anchor span.

The work of stringing and building the trolley wire in place and obtaining its proper alignment was very greatly expedited by means of two kinds of tower construction. On the portions of the tracks with the least traffic, two box cars were fitted up with collapsible platforms. These were drawn by a locomotive and by having two flat cars placed between them they were spaced so that two poles could be worked upon at a time. On the portions of the roads where the traffic was heaviest a light skeleton tower with a collapsable top was mounted on four wheels. This was of such weight that four men could lift it clear of the track very easily, so that by the use of flagmen both before



TROLLEY CONSTRUCTION WITH AND WITHOUT TRANSMISSION LINE

and behind it was possible to use this tower to the greatest advantage. All the trolley wire was strung with the locomotive and tower cars, the clipping in and building of curves being done by the smaller tower.

At all switches in the trolley wire the end of the switch trolley wire is guyed through a 9½-inch wood strain insulator to the next pole ahead, so that the switches are under no strain from the trolley wire.

On all curves of 2000 ft. radius or under a bridle construction is used with pull-offs, varying in number with the degree of curvature.

The power to operate these lines is obtained from the Berlin power station in the shape of three-phase alternating current at 11,000 volts, in which form it is transmitted aerially to the sub-stations at Middletown and Meriden.

At these sub-stations it is transformed and converted

into 600-volt direct current, in which shape it is delivered to the trolley wire. There is also a rotary converter in the Berlin power station, so that the line is really supplied from its three termini.

The transmission line from Berlin to Middletown is carried on the trolley poles along the right of way and the line to Meriden is carried on poles along the right of way of the Hartford division.

The three conductors, each of No. 4 B & S gage, semi-hard drawn solid copper wire, are supported on and tie to double petticoat porcelain insulators. There are three transpositions of the conductors, making one complete revolution between terminal points. At all transposition points two poles with the standard cross arm construction are placed 25 feet apart and thoroughly head guyed. The conductors are each rotated through an angle of 120 degrees between these poles, are drawn tight and thoroughly tied, so that there will be no sag in them at these points, due to expansion and contraction.

At all points where the transmission line crosses foreign wires and steam railways a special construction was used. The poles on each side of the crossing are securely head guyed and equipped with angle iron cross arms between which are held, on iron pins, porcelaine high tension insulators. Five-sixteenth-inch galvanized iron steel span wires are drawn tight between these insulators and the transmission conductors are brought from the triangular position to a horizontal plane and tied to the span wires at 61ft. intervals. This makes a very safe construction because both span and transmission wires must break before either can fall to the roadway and only the former is under any particular strain. To provide for the possibility of breakage of these wires, galvanized iron arms are carried below the transmission wires, so that if they slacken they will come in contact with the arms. These arms as well as the arm supporting the strain insulators are grounded through a piece of No. 4 wire attached to them and carried down the pole to a copper plate buried in charcoal in moist earth.

The direct current feeders are carried on the trolley poles on both branches and are of weatherproof stranded wire of various sizes. The positive direct current feeders are tapped into the trolley approximately every 1000 ft. Lightning arresters are cut into the positive feeder taps approximately every 2000 ft., the ground being made by means of a coil of trolley wire buried in charcoal in moist earth.



VIEW OF COMPLETED TRACK



STRINGING FEEDERS

The negative direct current feeders are tapped into the track rails approximately every 1200 ft. Both the transmission and direct current feed wires were dropped in place on their cross arms by means of the derrick used for erecting poles, and pulled up to their desired tension by means of the train. This is about the simplest way in which wires can be handled, and that it is very economical can be judged from the fact that it was possible to string and pull up three lengths of 500,000 circ. mils, about 2600 ft. each, of weatherproof cable, two lengths on one side of the pole and one on the other, in 8¼ minutes, with seven men besides the train crew. If the hoisting engine on the derrick had been equipped with a double drum and the derrick boom with revolving hopp, four of these men could be dispensed with.

The track is double bonded at each joint of each rail

with No. 0000 stranded cable bonds around the fish plates, painted to prevent corrosion and make them less conspicuous. These bonds are of the solid compressed terminal type, compressed into holes drilled in the rail, by means of 5-ton, double-screw compressors.

THE STRIKE SITUATION IN SAN FRANCISCO

BY HENRY K. BRENT.

It seems advisable at the outset to call attention to the fact, in explanation of the errors which the article doubtlessly contains, that the writer's knowledge of the practical operation and management of street railroads is only superficial, such knowledge as he possesses having been acquired merely from reading, and by his experience of six weeks as a motorman in the services of the company. Therefore, through lack of competency, no opinion is herein expressed as to the merits, pro or con, of the origin of the strike, viz., as to the questions of wages, hours, arbitration and official recognition by the company of the Carmen's Union. Such opinions as are expressed are founded upon general theories as to the relations of employers and employees, adapted to the special character of the industry involved, and modified by actual observations of existing conditions.

For convenience, the opinions and observations are classified under four general divisions:

1. The final means adopted in the Carmen's Union for inaugurating the strike.

2. The present attitude of the striking carmen towards the union.

3. The probabilities, upon termination of the strike, of the organization of a new union upon the principles of the present union.

4. The adoption by the company of means tending to offset the influence of the union organizers, and tending to create among its employees a loyalty to the company.

It must here be pointed out, as regards the subject matter contained in this article, that the writer's information was derived from conversations with more than thirty of the present striking carmen, and several of the old carmen who went out with the union, but who have since returned to the service of the company. In so far as he knows, none of these individuals was an officer of the union, and therefore, in justice to the union, this lack of information from an authoritative source should be borne in mind.

In securing a position as a platform employee of the United Railroads Company it was the desire of the writer both to have the experiences attendant upon the duties of a motorman during a strike, and, also, to ascertain the general character of the strikebreaking employees. Generalizations in this latter respect are somewhat difficult, since the men are a heterogeneous aggregation. Among them are representatives from every section of the United States; Canada and Mexico are also represented, and practically from every country in Europe a strikebreaker is to be found. At the outset of the strike a large number of men were brought to San Francisco by the professional strikebreaker-organizers, Farley & Field. The new men, so imported, about 400 in all, were principally from Chicago, St. Louis and Milwaukee, and were old hands in the business of breaking strikes, occupying regular places upon the list of the organizers, under whose leadership they go from city to city as the emergencies arise. Since the first few weeks of the strike the present force of employees has been collected individually, but without solicitation by the company, from various cities, including San Francisco.

The heterogeneous make-up of the men is further shown by their occupations prior to coming to San Francisco. Although a large percentage, possibly 40 per cent, have railroaded before, only a small portion of that 40 per cent railroad as their regular business. These irregular railroaders are men who railroad only during strikes. Some of them are cowboys, farmers, sailors and clerks, who are induced to quit their regular jobs for the comparative high pay received during strikes, and for the perquisites of strikebreaking conductors and motormen. All other callings seem to be represented, a dentist, a jockey, a minister, a fruit vendor, a German student, a curb broker from New York, a broken miner from Goldfield, etc. A surprisingly large number of trained artisans are also included, and surprise is still further increased by hearing that these carpenters, plumbers and masons have turned railroad men not from choice but from necessity. They are drawn to San Francisco by the prospects of regular work and high pay, which they have not secured on account of the iron rules of unionism. Either they are flatly turned down by the foreman to whom they apply for work, or else they are told they must join the local union of their craft. The fee for joining a union ranges from thirty to fifty dollars, the Carpenters' Union is forty dollars, and the regular monthly dues from one to two dollars. In addition to this they would be compelled to contribute a portion of their wages to the General Strike Committee in support of the carmen's strike. This is why the company now has in its ranks many unusually capable men. Unfortunately for the company they do not intend to remain, but will return to their homes at the first favorable opportunity.

Another class from which the ranks of the company are being augmented is that of the discharged soldiers returning from the Philippines. Every transport which arrives at San Francisco lands a large number of these men who are literally dead broke. Although they may have had money upon embarkation at Manila they have either dissipated it at intermediate ports in Japan, such being the regular route of the transports, or gambled it away on board the vessel. These men make excellent employees, and, as they now have no permanent occupations, they afford the company a nucleus for forming a first-class operating force.

As the work at the beginning of the strike is usually of a dangerous character it is needless to say that there exists some incentive for the men in addition to the wages which they receive from the company. It is true that the employees of this early stage of the strike receive per day about one dollar more than the wages received by men coming on later, and also, free transportation coming and returning to the city in which they were engaged. But, none the less, this increased pay and free transportation are not the real motive. That motive, which is concealed neither by the men themselves nor by the company, is simply that during the first few weeks of the strike it is tacitly understood that the conductors shall be allowed to reimburse themselves liberally from the fares collected, which additional income is shared by them with the motormen. During the first three weeks of the present strike, on those lines where traffic is heaviest, the conductors appropriated from ten to twenty dollars per day, five dollars of which was shared by them with their motormen; upon the less crowded lines, the amounts were smaller, and after the third week they were gradually reduced until now a fair average may be considered as two dollars per day per conductor. As soon as this reduction began to take effect, due to pressure by the company through its inspectors and spotters, many of the old strikebreakers re-

turned home, and of those who remained many of the conductors, their source of income thus being reduced, secured transfers to the front platform, which position, though not so lucrative, is generally considered more desirable.

But though of a heterogeneous class as regards their origin, the men are most homogeneous in one respect, viz, as to their dishonesty and low standard of morals. So general is their practice of knocking down fares, in other words, stealing from the company, and so callous are they relative to their conduct, that the question forces itself upon the observer as to whether their acts really constitute dishonesty. Do their non-concealment and frankness in discussing among themselves the extent of their peculations show that the ordinary principles of business ethics do not apply to this class of employment, or that inherently there is something fundamentally wrong in the mental and moral qualities of the men themselves? This question is definitely answered in two ways. First, by the relations of the men to one another, and, secondly, by their relations to the general laboring public.

That dishonesty is recognized among themselves as existing is demonstrated by their mutual lack of trust, respect and friendship. Every man is considered prima facie a rogue, and is treated accordingly by his associates. In their conversations accusations of theft are made without the least resentment upon the part of the person accused. Dishonesty is a recognized condition of the position and calls for no discussion among them. Furthermore, this recognition of platform dishonesty is so general that a well-defined ostracism against conductors and motormen exists among other laboring classes, and also, even among other company employees, such as linemen and shopmen. From this recognition of their conduct as constituting dishonesty both by themselves and by the public it would appear that no special allowance should be made for them for special ethical standards, and consequently, that the company should have no hesitation in adopting any means, however radical, which will put a stop to it.

This callousness to conventional standards is further exhibited by their conduct after they have been discharged for misappropriation of fares. Instead of being chagrined, upon their return to the car house from the office they at once announce to their acquaintances the fact of and the reason for their dismissal; "canned for short arm work," as they express it. Upon one occasion a man mounted a convenient wood pile in the yard, and in his speech upon the subject explained that he was just about ready to quit anyhow, since during his five weeks of service he had succeeded in pilfering the company to the amount of $300. Upon another occasion two men who had been discharged for this cause announced the fact by attaching to their coats by means of strings each a large sugar tin, with which they paraded around the yard, as evidence that they had been "canned."

Not only do these knights of the road levy tribute upon the company; the public is also made their victim through the often-practiced art of "short changing." To short change a passenger who presents a quarter requires hurry upon the part of the passenger, or a crowded car. The conditions are similar for a fifty-cent piece or a dollar, but the trick is easier. Where the conductor really reaps his harvest from the public is in those cases where the passenger offers a silver dollar. In his left hand the conductor has palmed a fifty-cent piece. With his right hand he accepts the dollar and makes the change, but change only to the amount of forty-five cents. Upon remonstrance by the passenger he is shown the half dollar which the conductor asserts was the amount handed to him. So neatly and quickly is the trick turned that 75 per cent of such passengers are gulled by the assertion of the conductor that the coin was only a half dollar.

There is also a humorous side to platform life, and, in one aspect of it, many a person has missed a car for want of knowledge. Although a motorman may see a person running for his car down a side street, he will apparently take no notice of such person by looking in that direction and nodding his head. To do so would cause the person to stop running, and thus delay the car. Should the person stop running of his own accord, the motorman generally goes on by as if the passenger had not been seen. Though one such event in the course of a trip would be trivial, a large number of wait-stops would consume sufficient time to put the car off its schedule, and necessitate an explanation by the motorman to an inspector as to his dragging the road.

In San Francisco it is the practice for cars to stop with their front steps at the near crossing instead of continuing past the intersecting street to the far crossing. The regulation frequently results in overcrowding the front platform. Consequently, when a motorman observes waiting for his car Chinamen with large laundry bundles, worthy housewives ladened with market-baskets, milliners' boys with their enormous boxes, etc., he not unnaturally risks a violation of the stop-regulation, and only stops when the rear platform has come abreast such persons. To do so is considered an excellent joke on the conductor, since all such passengers require much assistance in getting on and off the car.

As in the consideration of most people, however, there is a bright side to their character, so with platform men. They are far above the average intelligence of unskilled labor, and the majority of them are men of good school education. They are pleasant to talk to, ready to do a favor, and brave to a degree of recklessness. But such recklessness seldom assumes the form of carelessness in running their cars, or in attending to the ordinary comfort of their passengers. They apply to the management of their cars the same keen intelligence which they manifest for their own benefit in mulcting the company and public, and it will probably be found, when the company compiles and examines the accidents which have occurred during the strike, that neither in their causes, character, nor number are they very different from those which occur under normal conditions.

The experiences of a platform man during a strike are both instructive and interesting; instructive in that he soon learns the value of self control and good humor. At the California Street barn, where the writer was quartered for five weeks, lodged and fed, horse play was the spirit of the men at all hours of the day and night, and good humored forbearance was the only way to secure peace. The rooms in which the men sleep at the California Street barns were formerly part of the old steam road station, and are long, narrow and high. The cots are ranged in line and closely together; so closely, in fact, that the fleas have no difficulty in jumping from one bunk to another until they find a victim suited to their taste. But whether it be from charity, or from the fact that many fleas have many tastes and require many victims, no one man can claim to have a monopoly of their attentions. Sleeping under such conditions is difficult enough, but the trouble is further increased by the presence of electric lights burning all night. The

lights may be necessary because of the coming and going of the night crews. Or they may be necessary to prevent human marauders from examining the pockets of sleeping men, or to assist insect marauders in their ceaseless search for a new victim, or a new spot upon an old victim.

In the dining-room, a long shed containing two long tables, covered with white linoleum, the uninitiated is startled to hear from the members of a hungry crew just arrived the demand for slush. Thereupon a large galvanized pitcher of soup is produced, sooner or later, according to your favor with the waiter. Then comes in rapid succession demands for grease (butter), horse (meat), cow (milk), the gravel wagon (sugar bowl), and paste (pudding), with the request for information as to how in hell the waiter expects a man to eat without tools (knife, spoon and fork). But when fully equipped for operations no reasonable man has a kick, for the food is clean, wholesome and plentiful. Life in the barns is by no means a hard one, and many a sportsman upon hunting trips fares worse in his own camps. Then, too, is the important consideration that all during the strike both food and lodging have been provided gratis, and in addition to the wages.

Experiences while operating a car during a strike can only be called pleasant by making the word pleasant synonymous with exciting, which, to some natures, it really is. In any event, a new sensation is experienced by the lately initiated motorman when, on the third day he is in charge of a car, he finds it going at a tremendous rate down a steep hill at the bottom of which is a sharp curve. Greased rails are the explanation, and brakes are of no avail. In this case fortune favored the innocent and inexperienced, and the car kept the tracks, the only injury being to one lady who jumped from the car while racing down the hill. The new strike-breaker is also occasionally introduced to a new kind of music. Not musical glasses, as are sometimes heard at vaudeville performances, but musical car windows, the instruments being stones, and the musicians being striking carmen or their sympathizers. Shooting the Chutes, and other sources of pleasure where abrupt stoppage of progress is the object, dwindle into insignificance compared with the delightful jolt on a dark night caused by striking a bag of sand on the track. The acme of delight for a motorman, however, pleasure and excitement being synonymous terms, is when his head-light is shot out, and when the next succeeding night a bullet plows its way through the back of his coat collar.

But it is not only aboard his own car that a motorman or conductor may receive stimulating sensations. If of an inquisitive disposition he may desire to know at close range the people who favor him with verbal pyrotechnics, stones and bullets. He goes down town, without his uniform, and hobnobs with the striking carmen who, as pickets, are found upon every prominent corner which a street car passes. Then, to get the real sensation of being in the enemies' country, he boards a Union 'bus, in which he has the pleasure of hearing his acquaintances upon passing street cars called scabs and other choice names. But woe betide the man whose identity is discovered while on a 'bus. A few years ago when the teamsters' strike was in progress in San Francisco, strike-breaking teamsters were pulled from their seats, their arms placed between the wheels of the wagons and broken. No such brutality as that has occurred during the present strike, but more than one non-union carman has been beaten to death by sluggers, a fate he would probably meet if recognized by the occupants of the 'bus. On the way back to the barn from this expedition is performed the great *coup* of the afternoon—that is, securing from one of the striking carmen the large white picket badge which he wears. Sometimes this may be secured by stealth, but more often the Union man must first be knocked down. From the difficulty of the proceedings it follows that such trophies are rare, and correspondingly highly valued.

All you gentle denizens of little old New York, who are accustomed to recreate yourselves with Coney Island sensations, take heed, and for true heart-stirring, soul-inspiring, nerve-wrecking pleasures go to San Francisco, and prove your right as an American citizen to labor in any legitimate occupation you may desire, even if it be to perform the simple duties of a strike-breaking motorman.

CAUSES OF THE STRIKE AND SUGGESTIONS AS TO THE FUTURE

1. The direct and final causes which produced the carmen's strike were the influence and authority of the president of the union and his associate officers, their authority over the affairs and management of the union having attained such magnitude as practically to destroy all individual opinion and initiative among its members.

Within the union there are two circles—one composed of the officials, as above described, and the other composed of a set of "plug ugly" members, who for certain favors and benefits bestowed upon them from time to time by the officers, have passed under the immediate control of the officers to be used as they desire.

After the agitation was well under way these plug uglies were sent among the latest employees of the company, among the men who were receiving the lowest wages, and whose consent to vote for shorter hours and increased pay might be most easily secured. From this point, events moved rapidly to the conclusion. Information was disseminated that, at the approaching meeting for a final vote, should there be any dissenters from the known wishes of the executive circle, such dissenters would be looked after by the plug uglies.

The result of prevailing conditions in the union was that the final meeting was not well attended, many members opposed to the strike not being present. By prearrangement the names of a number of known adherents, plug uglies and new men were first called; then the name of a known opponent to the strike. The vote of this last member was met with hoots and hisses, and he was interviewed then and there by several plug uglies. The result of this demonstration was that there were few opposing votes, and the motion to strike was carried.

2. The attitude of many members of the union is that they were intimidated and imposed upon. The final vote as an expression of individual will and majority sentiment was a farce. Under the open vote system members felt compelled in many instances to vote contrary to their opinions, or else subject themselves, in case the strike should be declared, to the odium attaching to disloyalty to the cause of labor.

3. In spite, however, of existing conditions within the union, and the hardships which those conditions have entailed upon the men, organization as such is still considered desirable. But, owing to their lack of training in considering such matters, the men have no definite idea as to the means to be adopted for reorganization, and for securing the benefits which they imagine will spring from reorganization. Though at sea as regards the means, they are in a fertile frame of mind, and reorganization of the old employees would undoubtedly again occur under efficient leadership.

In view of the fact that the spirit of organization in-

fuses itself to-day in all branches of industry, especially in labor, and especially in San Francisco; and, also, in view of the fact that the desirability of organization and its derivative benefits are in the minds of all working-men, in different degrees of vagueness and activity, it is only reasonable to assume that, although the present unorganized employees of the United Railroads may remain in its service to the exclusion of its old employees, they will themselves eventually be organized. There is, however, the strongest possible evidence, deduced from the general character of the men now employed, as well as from their definite statements, to believe that a very small percentage of them intend to remain permanently. In any event, whether the number which remains be large or small, they will become residents of this community, and, harboring as they do, in common with other working-men, the idea of organization, it will be a matter of comparatively short time before the acute environment and labor influence of the community have their natural effect upon them. That is, upon the advent of a suitable leader, the new men also will be organized.

It would appear, then, in anticipation of future conditions that the company may expect, should its force consist of old employees, reorganization; or if, of new employees, organization. An admixture of old and new employees will result in an organization conflict, the final nature of the organization and its relation to the company depending upon the characteristics of the leader by whom it is molded. On account of local conditions, the new organization will undoubtedly take the form of a union. The vital question is, whether the new union shall operate under its old system of suppressing the individual within the union itself, and also, of suppressing the individual in his relations to the company, thus placing in control a small body of officials with whom the company must negotiate instead of with its individual employees; or, whether relations can be established between the company and its employees, which, while not dispensing with the union, will create among its employees a loyalty to the company equivalent to, or possibly greater than their loyalty to the union.

4. Without doubt, unless the company adopts some means to counteract existing influences, the new union will be formed along the lines of its present expiring predecessor, such being the most probable attitude among the men from whom it may reasonably be supposed the new leader will come. These men, individuals without other duties to distract their attention, have become expert in organization, and to meet them fairly and squarely and efficiently in the conflict for the good will of its employees, the company should appoint some officer with assistants, or a committee with a chairman, to guard carefully the welfare of its employees, and to instill them with an interest in their work which will make them feel they are a component part of the railroad instead of merely its employees. That is, create among them an esprit de corps, founded upon interest in, and enjoyment of their work.

From results secured in other industries where large numbers of men are employed, it would seem that the best means of infusing an esprit de corps is to inaugurate a system by which there is created a vigorous but healthful rivalry within the company; between the men individually, between the inspectors, between barn superintendents, and between division superintendents. To create rivalry, there must be a basis of comparison, and such basis of comparison can only be secured in an instance of this nature by keeping an exact record, this record resting upon a system of merits and demerits. This system of merits and demerits should supersede the present system of seniority by which is determined the assignment of desirable and undesirable runs, and by which other interests of the men are affected.

As regards the application of the system to platform men, switchmen, barn men, etc., their records would depend upon promptness in reporting for work, regularity, adherence to schedule running time, care of cars, number of accidents, honesty and general efficiency.

Among inspectors and other minor officials should be a similar record system based upon merits and demerits.

At the car barns the same system, with proper modifications, should be maintained, based upon the condition in which the cars are kept and sent out. This would require a careful record of the condition of the cars when turned in by the motormen, and consequently would involve an investigation and assignment of definite responsibility for car-accidents; either that the car was not in proper condition when it left the barn, or was not properly cared for by the motorman or conductor when on the road. The records thus kept should be compiled according to the different divisions of the road, and the division superintendent held responsible, thus securing between the division superintendents the rivalry desired.

One step further, however, is needed before this general spirit of rivalry and competition, based upon comparative records, can be created, viz., publicity of the records. To effect this publicity the company should establish a first-class company magazine, not a mere pamphlet, under a competent editor. A magazine such as is published by each of the larger insurance companies and by some of the steam railroads, the magazine of the Erie Railroad being especially noteworthy and especially efficacious towards the desired end. The divisional records should be so compiled and published as to facilitate ready comparison between individuals of the same division, and also between different superintendents, and general conditions between the different divisions. But the magazine should not be simply a compilation of statistics. Within its pages should be noted the transfer of men from one division to another, from one run to another; meritorious mention should be made for meritorious services, accompanied by the individual's photograph; and all other matters of immediate interest to the men should be given space. It should, moreover, contain articles on and illustrations of new cars, new motors, etc.; also descriptions of third-rail systems, single-rail inventions, overhead trolley improvements, and other similar subjects.

It is possible that the interest and rivalry thus put into operation might in themselves be sufficient to hold the men to the company and make them feel themselves a component part of it, and in this manner offset the ever agitating influence of the union leaders. But recognition must be given to the fact that it is a far cry to that desirable condition. Crown, however, this spirit of interest and rivalry with its legitimate reward and loyalty will follow. As the men dealt with are professionals the prize awarded them for superior excellence in this game of records must be a pecuniary one. Therefore, at the end of every third month there should be a recapitulation of records by divisions, and to that division of the road having the best record should be awarded the prize of increased pay for all, from the division superintendent down. To retain this increased pay the division must maintain its position in the lead, otherwise at the expiration of three months it passes to some other division.

Another very important part to be played by the com-

pany's labor organizer in encountering upon an equal footing the union leaders is the establishment of forms of amusement for the men, since one of the strongest holds a union has upon its members is its use as a medium for social intercourse at its meetings. Rivalry is excellent not only in work, but also in play, and in this latter respect it should likewise be established between the different divisions. There should be at the disposal of the employees a field for outdoor sports, billiard tables and bowling alleys. The contests between selected teams of the different divisions would both stimulate the desired rivalry and also give to the men of the different divisions opportunities to become acquainted with one another under auspices and in an atmosphere different from their union meetings. Needless to say the men would not of their own initiative enter into these athletic and social contests. Equally true is it that they do not of their own accord form unions. In both instances there must be leaders, by whom the men are drawn in the desired direction almost unconsciously. Such leaders being in the one case the company's organizer, and in the other the union's organizer.

To summarize the situation. There is every reason to believe that upon the termination of the present strike either the old union will be reorganized or a new union formed. There will undoubtedly be another union of some nature. Unions are not the result of individual initiative of all the employees of an industry, nor the result of spontaneous action by them. They are formed by the strength and personality of some one man, or set of men, trained in the art of organization and versed in the platitudes of labor argument. To mitigate their undue and often unjust influence, but not to prevent the formation of a union, there should likewise be a company organizer, or organizers, who, step by step, meet every move by the labor organizers for influence over and favor with the rank and file of the employees. Let there be a live wire among the executives of the company, which, under harmonious and just conditions, will be strong enough to draw together all concerned for their common benefit; but which, when confronted by unjust conditions, will be able, on account of its established location among the company's employees, to generate force enough to dislodge such outsiders as may endeavor to secure too firm a hold upon the feed wire of the system, viz.: upon the company's employees.

CAR BRAKING IN QUEBEC

Much has been written about the effectiveness of different types of emergency brakes, but perhaps the human factor in the braking problem has not been given the deserved attention. This view is supported by the experience of at least one company which has never had a car run away despite the fact that it operates on very severe grades with only the ordinary braking equipment.

The fortunate railway in question is the Quebec Railway, Light & Power Company, operating the lines of a city which has aptly been termed the American Gibraltar. In fact, the difference in height between the lower and upper portions of Quebec is so great that an elevator and winding trestle are necessary portions of the local transportation system. There are numerous grades over 10 per cent with a maximum of 14.15 per cent on Crown Street. The cars are all of the single truck type, weighing 7½ to 8 tons and furnished with regular hand brakes. No cars are allowed to travel more than eight miles an hour under any circumstances.

In view of the success which the company has had for many years in avoiding all braking accidents, a study of the rules relating to braking may prove helpful to other companies operating under similar conditions.

COOPERATION BETWEEN MOTORMAN AND CONDUCTOR

Before ascending or descending a steep grade and during the ascent or descent, conductors must remain stationed at the brake on the rear platform; and if the motorman finds that his brake shows weakness or want of grip, signal the conductor by two sharp rings of the bell, which will be a signal for the conductor to apply the brakes on the rear end. Do not shout or unnecessarily alarm the passengers. Motormen must see that conductors are on the rear platform before commencing the ascent or descent of any steep grades, and must in all cases come to a dead stop and wait the signal of the conductor to proceed wherever the "stop boards" are placed.

BRAKING REGULATIONS FOR THE MOTORMAN

Except in cases of emergency, brakes must be applied gradually, so as not to throw standing passengers. When stopping, release the brake a little so as to make an easy stop. Never slide the wheels if it is possible to avoid it, and never apply the brake when the current is on. The practice of keeping brakes applied, when running on a bad rail, is absolutely without benefit and has many bad effects, among which are: Considerable waste of power, wear of brake shoes and heating of motors.

Release brakes before starting car.

It is better not to stop on very heavy grades or in curves, if it can be avoided.

In descending a grade do not let the car run even as fast as it would on a level, because you might want to stop suddenly and your brakes might fail you. In running down grades always have trolley on wire, for should your brake fail it might be necessary to reverse the motors.

If the car wheels slip in wet weather while going up a grade, it may be necessary to cut the current off until the wheels get a grip, and then go ahead. If the wheels continue to slip apply sand.

If brakes fail to operate, the car may be stopped by the motors in two ways: First, by reversing the current in motors as follows:

(1) See that controlling handle is at "off."

(2) Reverse the reversing switch.

(3) Throw the controlling handle around to the first notch, and then to second and third notches if necessary, never beyond third notch. If wheels "skid" on rails throw controller handle off and then on again to first notch. Repeat throwing on and off if necessary. As soon as reverse is applied, take up all slack in brake rigging so that brakes may be set on hard as soon as car has stopped.

(4) If fuse blows while reversing current, throw controller handle to last notch and leave it there. If wheels "skid" on rails, throw controller handle off and on again to last notch. Repeat throwing on and off if necessary to get the wheels rolling.

(5) Always move reverser handle of controller with the left hand, and do not take the right hand off the brake handle for one instant.

Second, to stop car when the trolley is on or off the wire. Means of short-circuiting motors.

(This method must be used only after all other methods have failed.)

1. See that the controlling handle is at "off."
2. Throw the platform switch at "off."
3. Throw the reverse switch in opposite direction to way car is running.
4. Throw the controlling handle around to last notch and leave it there if car slows up. If wheels "skid" on rails, throw controlling handle off and on again to last notch, and repeat if necessary to get wheels rolling.
5. If on a grade, the car will run slowly to the bottom before coming to a standstill.

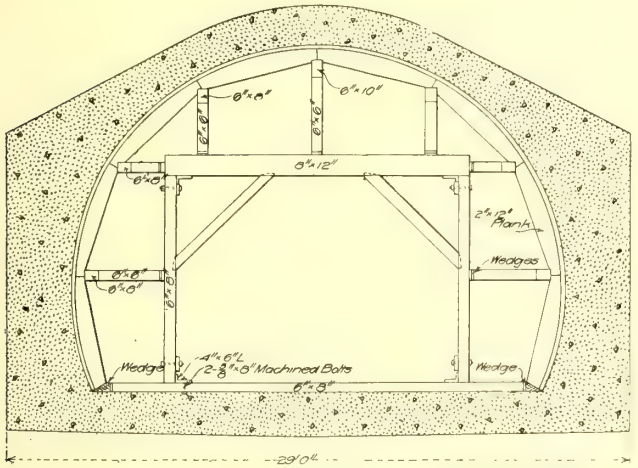
Always ease off the brakes when applying either of these emergency methods of stopping car, but be prepared to apply them hard just as soon as car is under control.

To stop a car when running away on a down grade, use the second method, but do not resort to either except in cases of extreme necessity or sudden emergency.

Reversing is a very severe strain on the apparatus, especially when the car is under high speed, and any abuse of the practice is strictly prohibited.

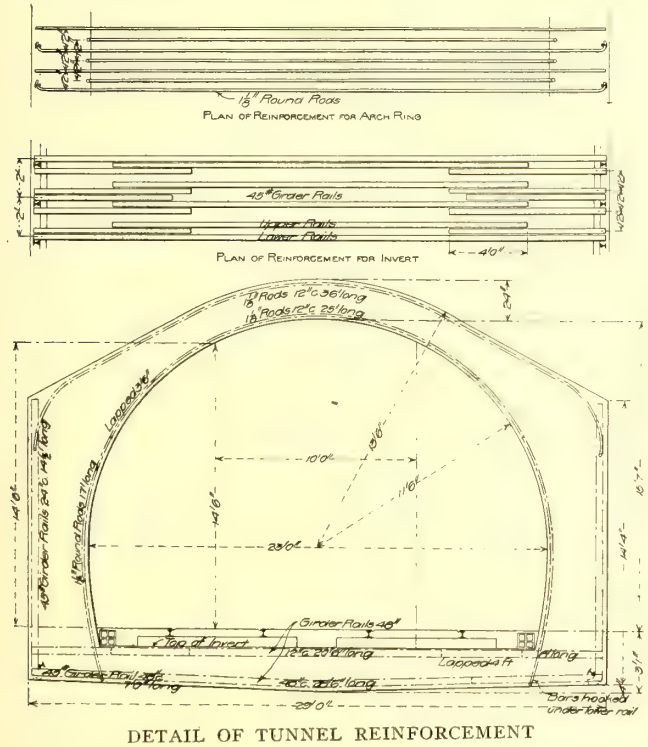
THE SELBY HILL STREET RAILWAY TUNNEL, ST. PAUL MINN.

The Twin City Rapid Transit Company of St. Paul and Minneapolis has recently placed in service a subway which greatly reduces a steep grade on one of the most important street railway lines in St. Paul, and eliminates the necessity of a counterweight formerly used to handle cars



CROSS-SECTION OF TUNNEL AND TIMBER BENTS

up and down this grade. The new tunnel is on Selby Avenue, a short distance from the business district of the city. At the location of the tunnel the grade of the street was 16.5 per cent for several hundred feet, the business district being 125 ft. to 150 ft. lower than the residence sections at the top of this hill. The cars of one of the three interurban lines between Minneapolis and St. Paul, as well as local cars, were operated over this steep grade, on



DETAIL OF TUNNEL REINFORCEMENT

which the counterweight device had been used since electric traction was substituted in 1898 for the existing cable line on this street. The counterweight device consisted essentially of a traveling cable and a counterweight in a conduit below the street surface, and two grip cars, which were used to haul the street railway cars up and down the steep grade. The number of cars passing over this line became so great that the counterweight could not handle them fast enough to avoid delays. To eliminate the delays due to the auxiliary apparatus, and to obtain other operating advantages, the decision was made to build a double-track tunnel from the base of the hill to a point far enough back on Selby Avenue at the high level to obtain a satisfactory grade.

The total length of the improvement required in the grade reduction is 1700 ft., including the tunnel and the approaches. An approach, 230 ft. long, leads up to the portal of the tunnel at the bottom of the hill. The tunnel is 920 ft. long between portals and has an approach 320 ft. in length at the upper end. The lower approach is on a curve with a 500-ft. radius, but otherwise the alignment of the improvement is straight. The grade of the new track is uniformly 7 per cent, as compared with 16.5 per cent on the old track. The approaches are so arranged that after the backfilling has all been placed, the street will again be opened for traffic at practically the original grades.

The approaches are between reinforced-concrete retaining walls, which vary from 3 ft. to a maximum of 20.5 ft. in height. Where these walls are less than 6 ft. high they are built as gravity-section structures. Above that height



ENTRANCE TO TUNNEL

they are vertical, reinforced-concrete slabs, having a horizontal slab footing, and buttresses, 2 ft. wide and 6 ft. apart on centers, on the rear side. The approach to the lower portal of the tunnel is at one side of the street, a roadway parallel with it connecting with the street over the tunnel. The approach to the other end of the tunnel is at the middle of the street, but a 13-ft. drive was obtained on each side of it, so, on the whole, the street is much improved for highway traffic as compared with the old arrangement. The tops of the walls of the approaches and the portals of the tunnel are 0.5 ft. above the street grade, and are surmounted by a 6-ft. ornamental-iron picket fence, to prevent accidents.

The tunnel has a double-centered arch, with a span of 23 ft. at the springing line and a rise of 11.5 ft. The clearance at the center line of both tracks is 14.5 ft., while the center height is 16 ft. 10 in. The arch is 24 in. thick at the crown, and the bench walls are 4 ft. thick. Unlike most tunnels of this type that have been built the invert is perfectly flat, having a thickness of 2 ft., exclusive of the concrete in which the track structure is imbedded. The tunnel section proper required 9.782 cu. yds. of concrete per linear foot.

The details of the reinforcement of the tunnel section are shown in an accompanying illustration. The arch has

two sets of 1⅛-in. round rods, alternating with girder rails, all of which are spaced as shown. The rods in the side walls have their lower ends imbedded in the invert, and extend up into the arch, overlapping those in the latter to produce continuous reinforcement. The invert is reinforced with two layers of old rails, placed transversely. The rails in the lower layer are 28.5 ft. long and are placed 4 ft. apart on centers; those in the upper layer are 28 ft.



VIEW SHOWING THE RETAINING WALLS

long and are 12 in. apart on centers, their tops being 1 in. below the surface of the invert section.

The tracks in the tunnel have 80-lb. T-rails attached to creosoted ties with screw spikes. The ties and rails are imbedded in concrete to within 1¼ in. of the top of the ball of the rail, the concrete being finished to a smooth surface to form the floor of the tunnel. The floor between the rails of each track is practically flat, transversely with the tunnel, and between the tracks is depressed only slightly toward the center line. Connections to a drain are made at intervals of 200 ft. in the tunnel so the floor can readily be flushed clean, thus avoiding any difficulty from dust, or odors from refuse that would collect in stone ballast. At the same time the track structure is believed to be of such design that the concrete in which it is embedded will not have to be disturbed for a long period.

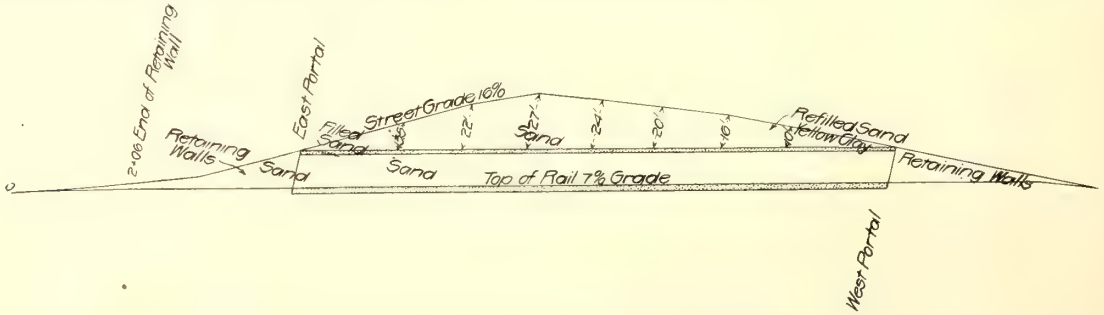
A 15-in. sewer pipe was laid under the invert, along the center line of the tunnel, from the entrance of the upper approach to the lower end of the improvement. An opening covered with a grating is placed across the end of the upper approach to intercept storm water and divert it into this sewer. Similar openings at other points in the approaches and the tunnel provide inlets to the sewer for storm water and for water used in flushing. The ground water back of the tunnel and retaining walls is also drained into this sewer through 4-in. laterals, which are placed 20 ft. apart on both sides of the main drain.

A four-way duct for cables is imbedded in the concrete along each side of the tracks, manholes being provided on these ducts at both ends and at the middle of the tunnel. Connections between the trolley wires and the cables in the ducts are made through conduits imbedded in the tunnel arch. The tunnel is lighted by 32-candle power incandescent lamps, spaced 10 ft. apart along the center line of the arch. These lamps are also connected to the cables in the ducts through conduits buried in the tunnel arch.

The construction of the tunnel was handled entirely in an open cut, 34 ft. in width, the maximum depth of the cut being 52 ft., and the average about 30 ft. The hill through which the cut was made consists almost entirely of a coarse glacial sand, containing some boulders and small stone. As the sand was practically free from clay, it would flow easily when dry. When the street was originally graded it was cut down 15 ft. to 25 ft. below the natural surface on one side for 250 ft. toward the lower portal of the tunnel. A heavy masonry retaining wall had been built along that side of the street to hold back the ground, which continues to rise until a surcharge of from 10 ft. to 30 ft. over the wall is produced within a short distance back from the street.

The cut had to be closely sheeted and heavily shored from end to end, owing to the nature of the sand through which it was made, and the necessity of protecting the adjacent property. The sheeting consisted of 4-in- x 6-in. timbers in 22-ft. and 26-ft. lengths. Against this sheeting were placed horizontally 12-in. x 12-in. waling, or ledger timbers, spaced 6 ft. apart on centers. The waling timbers in the corresponding rows were braced across the cut by poles, 10 in to 14 in. in diameter, and 35 ft. long. The cross braces were spaced 6 ft. apart along the waling timbers, thus making a brace at each corner of every 6-ft. square on the side of the cut. The sheeting was driven by hand in advance of the excavation to a depth of from 8 ft. to 26 ft., and when the excavation had reached that depth, a second set of sheeting was started inside the lowest waling timber for the first set, and was driven to the bottom of the cut. The bracing timbers were wedged in place as the excavation was made, light vertical braces being nailed to them near the middle to prevent sagging.

The 6-in. x 6-in. sheeting was replaced for 250 ft. along the base of the high retaining wall by heavy round piles, 26 ft. to 46 ft. long, which were driven closely together. Since the edge of the cut had to be made close to the base of the wall these piles were driven within 18 in. of the latter. As the excavation was made in this section of the trench the row of piles were braced against the sheeting on the opposite side with the regular heavy poles. Inclined braces, with one end against the sheeting on the opposite side of the trench, were also placed against the wall at various points. After the sheeting and bracing had been built up in this manner, the braces being placed as the excavation was made, the tunnel was built and the backfilling



SECTION ILLUSTRATING THE NATURE OF THE SOIL AND WORK DONE

placed on it without injuring the high retaining wall or adjacent property in any way.

The great pressures brought on the sides of the cut by the loose sand precluded any possibility of removing the bracing or sheeting as the concrete work progressed, without the load on each brace being transferred to another support capable of carrying this load. A system for building the tunnel section was developed, however, which not only provided for the transfer of the loading on the temporary braces, but also greatly simplified the centering for the tunnel arch. As soon as a section of the excavation was made ready for the concrete, the invert of the tunnel was laid nearly to the tops of the upper layer of reinforcement rails in it. Heavy concrete posts 4 ft. x 4 ft. in cross-section, and reinforced with old steel rails, were built against the sheeting on both sides of the trench at the same time the concrete was placed in the invert. These posts were placed between the vertical rows of temporary braces and were 6 ft. apart on centers, a section of the two lower 12-in. x 12-in. waling timbers, 4 ft. long, being embedded in each of the posts. The posts were cast in rough plank forms, and were built enough in advance of the first work on the side walls of the tunnel to permit them to set for several days. They were held at the bottom by the invert and at the top by a temporary timber cross brace between the two corresponding posts on opposite sides of the trench.

Timber bents were then erected on the invert in such position as to form a center for the forms of the walls and the arch of the tunnel. These bents were 12 ft. wide and 11 ft. high. They were built with a 6-in. x 8-in. sill, two 6-in. x 8-in. plumb posts and an 8-in. x 12-in. cross brace at the top. The bents were spaced 6 ft. apart on centers, being directly opposite the vertical 4-ft. x 4-ft. concrete posts. When they had been erected as far as the side walls were to be built at that operation, the lowest row of temporary sheeting cross braces between them were removed one at a time, transferring the load on the bottom of the sheeting to the concrete posts. The inside forms for the walls up to the springing lines of the arch, 5 ft. above the invert, could then be set and braced at the top and bottom against the bents of the centering, the sheeting of the trench forming the outside forms. After these wall forms had been filled, enclosing the lower ends of the concrete posts, the concrete in them was allowed to set for a few days. The cross braces between the second row of walings from the bottom were then removed, the load on the sheeting carried by these braces being transferred to the concrete posts. The arch forms were next erected on the bents of the centering up to a height of 11 ft., or just under the third row of temporary cross braces, and the walls built up to that height. When this concrete had set, the third row from the bottom of the temporary cross braces between the sides of the sheeting, and also the temporary braces between the tops of the concrete posts, could be removed and the balance of the arch built.

In all this sequence of operations no part of the sheeting was at any time unsupported. At the same time the centering and forms for the concrete were erected practically without interference and the concrete could readily be placed. The temporary braces were also all saved, although the waling timbers and sheeting had to be left in place, which would have been required in any case. On the other comparatively little extra work, or extra concrete was required by extending the limits of the walls to permit the construction of the 4-ft. x 4-ft. concrete posts which temporarily carried the load against the sheeting.

The forms for the tunnel had ribs made of 2-in. x 12-in. plank cut to a template to conform with the curve of the arch. These ribs were each in six sections, a section on each side extending up to the 5-ft. level of the walls, a second section on each side extending to the 11-ft. height, and two top sections in the closing part of the arch. They were spaced 2 ft. apart on centers and were lagged with 2-in. x 4-in. timbers. Ordinarily the forms were permitted to remain in place at least 14 days before the centering was removed. The exposed surface of the concrete was all spaded carefully in the forms, with the result that a very uniformly good finish was secured.

The concrete work on the tunnel was carried forward in sections of various lengths, depending on the manner in which the excavation could be prepared. Backfilling was not placed on the arch until the concrete was at least 10 days old. The material from the unfinished sections of the trench was generally piled on the finished concrete work by cableways. The excavation was planned so very little of the material had to be handled twice, the back-filling being carried forward from both ends toward the middle of the tunnel.

The tunnel was designed by the engineering department of the Twin City Rapid Transit Company, of which George L. Wilson is engineer, and was built under the direction of that department by George J. Grant, general contractor of St. Paul. Charles R. Shepley was engineer in charge of the design and construction for the company. Prof. F. H. Constant, professor of structural engineering, University of Minnesota, assisted in the design.

EXTENSION OF TIME IN CHICAGO

The judges of the United States Court of Appeals have denied the motion of the Union Traction interests that the decision of Saturday be so amended as to permit the Chicago Railways Company to take over the property and accept the ordinance allowing it to operate them. The court went further and said nothing could be done legally to relieve the situation.

In view of this the company applied to the Council for an extension of time in the matter of accepting the new franchise grant to the Chicago Railways Company, and the Council consented to fix the date at Feb. 1. Before doing so, however, the condition was imposed that all revenue of the company, after operating expenses had been deducted, should be spent in bettering the service. Interests familiar with the company's affairs say that a judgment will be defaulted and the property sold. In this event the bidders would be the Chicago Railways Company and the Chicago City Railway Company. This is considered a somewhat drastic way of proceeding, but it is agreed that it would terminate the long series of distressing circumstances attending the company's operation and its effort to secure the new grants.

NEW ORLEANS RAILWAY CLOSES SUCCESSFUL PARK SEASON AT LAKE PONTCHARTRAIN

The season at West End, the summer resort on Lake Pontchartrain, operated by the New Orleans Railway & Light Company as an amusement park and general resort, closed Sunday, Sept. 14, and was pronounced by the management as one of the most successful in the history of the place. Nothing definite has been decided on the plans for next season, the matter of the lease being still in abeyance.

MEETING OF THE STANDARDIZATION COMMITTEE OF THE ENGINEERING ASSOCIATION

A meeting was held Sept. 12, 13 and 14, in New York, of the committee on standards of the American Street & Interurban Railway Engineering Association to confer upon the report to be presented at the Atlantic City convention. The committee met at the headquarters of the association, 29 West Thirty-Ninth Street, New York, and the following members were present:

W. H. Evans, Buffalo, chairman.
H. H. Adams, Baltimore (president of the Engineering Association).
H. D. Benedict, Albany.
J. M. Larned, Pittsburg.
H. W. Blake, New York.
C. B. Fairchild, Jr., Cleveland.

The following other representatives of street railway companies were present:

H. C. Page, Springfield, Mass. (chairman of the committee on standards of the parent body).
Charles H. Clark, Buffalo.
W. T. Dougan, New York.
Martin Schreiber, Newark, N. J.

Others in attendance were:

Walter S. Adams, J. G. Brill Company, Philadelphia; Warren Thorpe, Baldwin Locomotive Works, Philadelphia; G. L. Schermerhorn, General Electric Company, Schenectady, N. Y.; J. E. Webster, Westinghouse Electric & Manufacturing Company, Pittsburg; E. S. Lewis, Standard Steel Works, Philadelphia; William Wampler, American Locomotive Company, New York; H. A. Fritz, American Locomotive Company, Schenectady, N. Y.; J. M. Wakeman, STREET RAILWAY JOURNAL, New York; L. F. Gould, "Electric Railway Review," Chicago; A. H. Weston, the T. H. Symington Company, Baltimore; E. B. Entwisle, the Lorain Steel Company, Johnstown, Pa.; G. S. Vickery, Pennsylvania Steel Company, Steelton, Pa.; William C. Cuntz, the Pennsylvania Steel Company, Steelton, Pa.; F. W. Sargent, American Brake Shoe & Foundry Company, Mahwah, N. J.; F. W. Roth, Streeter Journal Bearing Company, Chicago, Ill.; W. L. Boyer, the New York Car & Truck Company, Kingston, N. Y.; J. R. Dickey, Baldwin Locomotive Works, Philadelphia; George M. Hoadley, Keystone Brake Shoe Company, New York; V. B. Lamb, Keystone Brake & Shoe Company, New York; E. L. Jones, American Brake Shoe & Foundry Company, New York; H. S. Bradfield, American Brake Shoe & Foundry Company, New York; Charles R. Ellicott, Westinghouse Traction Brake Company, New York; Victor Angerer, Wm. Wharton, Jr., & Company, Inc., Philadelphia; J. D. Rhodes, National Car Wheel Company, Pittsburg; J. H. Yardley, National Car Wheel Company, Philadelphia; N. B. Trist, Schoen Steel Wheel Company, Pittsburg; P. H. Griffin, New York Car Wheel Works, Buffalo.

At the opening of the session on Thursday morning Mr. Evans discussed the basis upon which the report should be made. He explained that there was such a wide variety in practice that it would be impossible to suit everybody in any set of standards which might be recommended. He was very anxious that the report of the committee should result in definite action at the convention. This could only be done if the subject was considered in a broad way by all, and he believed that the committee should recommend what it considered to be the best practice and should not attempt to try to suit everybody, as that would be impossible. President Adams said that the report is now scheduled on the program for consideration on Tuesday afternoon, Oct. 15, and if it should be approved by the Engineering Association it could then be presented to the committee on standards of the American Street & Interurban Railway Association for submission to the members of that body at its convention. He thought that it would be an excellent idea to notify the members of the latter association of the meeting on Tuesday afternoon of the Engineering Association, so that they could listen to the discussion of the subject at that time and present any points which they might desire.

Mr. Evans then announced that the first subject to be considered by the committee was standard axles, journals, journal bearings and journal boxes, and asked whether there was any discussion on the subject of the four standard journals decided upon at the Cleveland meeting, viz., 3¾ ins. x 7 ins., 4¼ ins. x 8 ins., 5 ins. x 9 ins. and 5½ ins. x 10 ins., and whether there were any remarks on the loading fixed for these journals at that time. Mr. Thorpe said that it was not uncommon to have railway companies specify greater loads than those mentioned, but he approved of the load given by the committee. In answer to a question Mr. Evans stated that the loading included the portion of the weight of the motor on the journals—in fact, all the load carried outside of the wheels.

The question of number of axles was then considered and the discussion developed that it would be desirable to have six axles measuring in the motor fit diameter respectively 4½ ins., 5 ins., 5½ ins., 6 ins., 6½ ins. and 7 ins. The desirability of omitting certain of these axles was considered, but it developed that for each a number of motors were built which could not be employed on any other axle. The manufacturers believed, moreover, that half-inch sizes were about as close as would be required, but if they were not provided many companies would be liable to turn them down and go into quarter-inch and eighth-inch sizes.

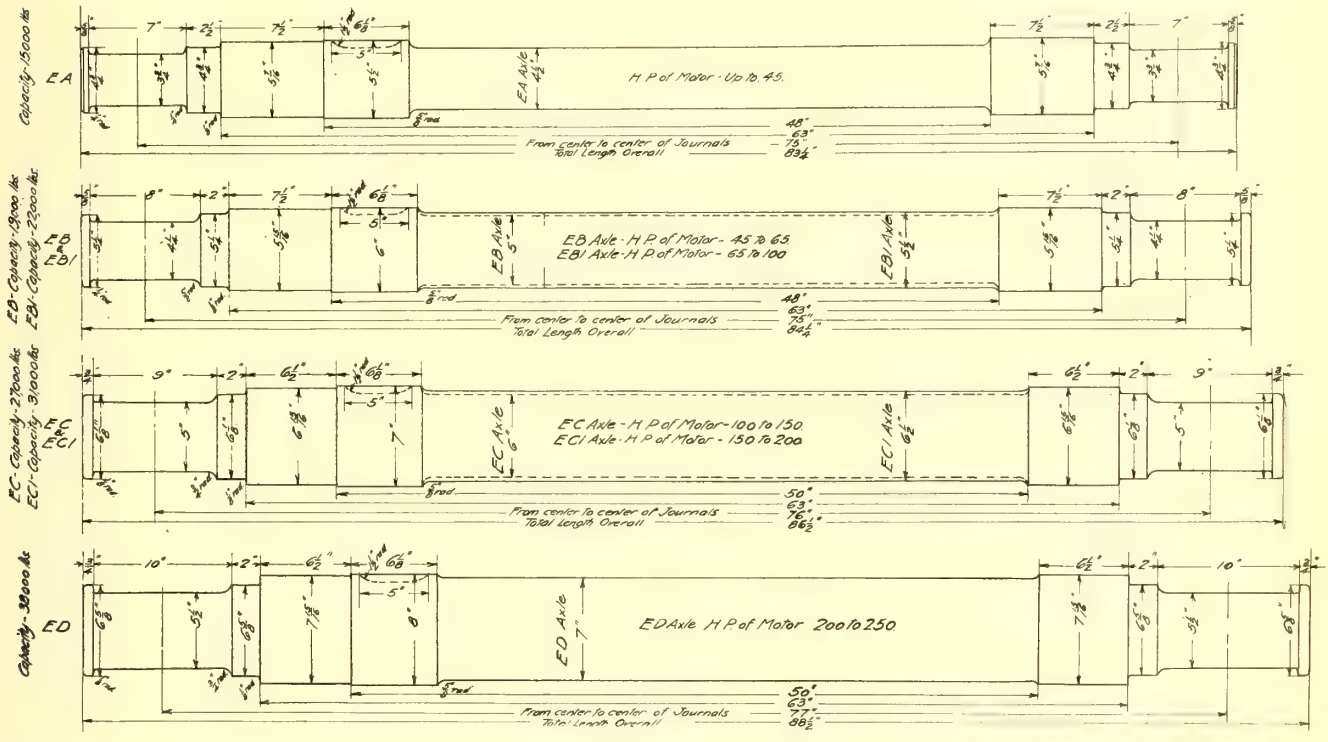
The question of gear fit diameter was then considered and it seemed to be the opinion of all that it would be very desirable to reduce the number of diameters of gear fit to as few as possible. Mr. Webster suggested that the 4½-in. and 5-in. axle could take the same gear fit. Mr. Thorpe stated that his company had been employing for some time a gear fit 1 in. larger than the motor fit, and a wheel fit 1-16 in. smaller than the gear fit.

Mr. Webster then presented a series of suggestions from Mr. Storer, of the Westinghouse Company, in which 51-in. length of motor fit was requested for the large sized axles. It seemed to be the general consensus of opinion, however, that 50 ins. was all that could be allowed on these axles. It was suggested that 51 ins. might be obtained by shortening the length of the wheel fit, but Mr. Lewis, representing the steel wheel manufacturers, said that it would be impossible to allow less than 6¼ ins. on the axle with 5½ in. x 10 in. journals. The electrical manufacturers said that 50 ins. would accommodate all the d. c. motors and all the single-phase except those of one company. The large single-phase motors of this company are 51¾ ins. wide. Mr. Evans appointed a sub-committee consisting of Messrs. Adams, Benedict, Schermerhorn and Webster to see what could be done in the matter. He then took up the question of key way, which it was decided at Cleveland should be 1 in. square for all sizes and 6 ins. long with milled ends. He referred to the fact that Mr. Storer preferred a key way cut with a key seating machine, and asked to what extent that form of key way had proved satisfactory. Mr. Webster said that there was difficulty with a milled key way in preventing the key from riding up when a pinion is put on the shaft and thought the same reason would hold in pressing a gear on an axle. President Adams said that this could be overcome by the use of a sleeve, and that he preferred the key way with the milled ends. There was a discussion on the best fillet to use on the axle, and one ⅝ in. in diameter was finally settled upon as the most desirable.

The next subject considered was journal bearings, on

which Mr. Weston had been requested to report. Mr. Weston stated that since the meeting at Cleveland he had taken up the subject with a number of truck manufacturers and presented some drawings as suggestions to the committee. The dimensions shown on these drawings differed from those considered at the Cleveland meeting, principally in the distance between pedestal guides. The recommendations of Mr. Weston were referred to a committee consisting of Messrs. Blake, representing the committee, and W. S. Adams, Weston, Thorpe, Boyer and Fritz, representing the truck manufacturers present.

The subject of brake shoes was then considered and the discussion hinged mainly upon whether one or more standards should be employed. Mr. Evans explained that the opinion has been gaining ground very rapidly in the West that companies are using wheels with too narrow a tread. He believed that the committee would do well to recommend a brake shoe which would care for a tread of 3 ins. and over, and if a brake shoe and tread for a narrower tread should be adopted it ought to be only for temporary use. Mr. Sargent and Mr. Page discussed this subject at length, the latter stating that on many of his properties a 2½-in. tread was being used where formerly a 2¼-in. tread had been employed. He believed that it would be desirable to use a 3-in. tread where possible, but it would not be possible for a long time to come by the majority of the roads in Massachusetts and elsewhere in New England.



SUGGESTED DIMENSIONS FOR AXLES

FRIDAY'S SESSION

Upon the opening of the session on Friday morning Mr. Evans called for the report of the sub-committee on journal boxes. This report showed that all of the members were agreed upon the dimensions for the boxes designed for the 5 in. x 9 in. and the 5½ in. x 10 in. journals. The journal boxes suggested can be furnished so as to take either a journal box spring or a bar equalizer. For the smaller sizes, or boxes for 3¾ in. x 7 in. and 4¼ in. x 8 in. journals, one member of the committee, Mr. Thorpe, took exceptions to the distance allowed between pedestal guides. Mr. Thorpe explained that this was not because his company would be unwilling to agree to anything the committee might adopt, but he thought the question should be determined by committee as a whole rather than by the sub-committee. His reason was that in the smaller sizes of trucks made by his company these dimensions would add some weight to the trucks. On the other hand, the committee in its majority report had been able to agree on dimensions for the sides and the tops for all four journals. That was a very desirable thing.

In answer to an inquiry as to what the increase would amount to Mr. Thorpe said that he could not tell exactly, because it had not been decided whether it would be better to widen out the pedestal jaw only, or widen out the spreader bar to the pedestal. The increase in weight would probably amount to about 50 lbs. a side, or about 100 lbs. a truck, possibly a little less. His objection was based more on engineering than on commercial objections, as he thought anything looking to the increase of the weight of a truck was a movement in the wrong direction for the small sizes of trucks.

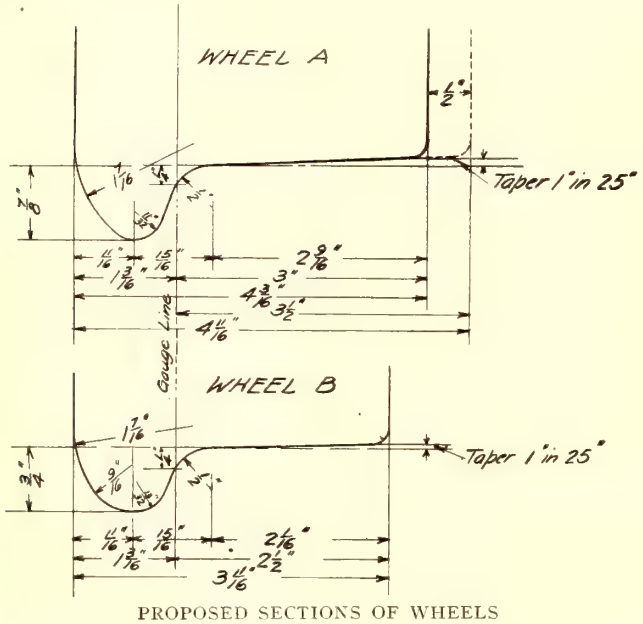
Mr. Weston explained that this increase in weight would not apply to other makes of trucks.

Mr. Evans then called for the report of the sub-committee on the length of gear seats.

Mr. H. H. Adams reported that the dimensions determined on was 6⅛ ins. instead of 6¼ ins. The motor builders claim that this is sufficient length to meet the requirements of their gears, and by adopting 6⅛ ins. for all axles it is possible to meet their requirements for the a. c. motor, with 50 ins. between hubs in the axles with 5 in. x 9 in. and 5½ in. x 10 in. journals.

Mr. Webster further explained that Mr. Schermerhorn and he had gone over the subject quite thoroughly since the meeting Thursday afternoon. Some motors have a pinion head extending outside of the face of the pinion and it is necessary to have a bulge in the gear case to clear that. With the dimensions considered Thursday the gear case was very close to the axle, within ⅝ ins. in some cases, and that of course would be too close. It had been found

after going over the outline drawings of the different motors that if there was a gear hub on both sides of the gear —on the axles having 48 ins. between wheel hubs—there could be a gear hub of 1 in. on the wheel side and ⅛ in. on the motor side. On the gears with the larger axles having 50 ins. between wheel hubs and with a 5¼-in. gear face, there could be a ¾-in. gear hub on the motor side and ⅛-in. gear hub on the wheel side. That would allow a clearance of ¾ in. between the wheel flange and the gear case, which the General Electric Company is using now on some of its motors and considers satisfactory. With the Westinghouse motors it is almost the universal practice to have the pinion nut recessed in the opening, so that there is no bulge in the gear case, and this gives ⅜ in. more clearance. The adoption of the 6⅛-in. gear-fit for all motors would make it possible to put any motor on any axle, provided the bore of the gear is changed in diameter to fit the gear-fit on the axle, which, of course, can easily be done. There would then be a universal clearance between the gear case and the wheel flange. It would be different on the two sides of a motor; but on the larger axles taking 50 ins. between gear hubs, with the Westinghouse motors it would be 1 in. and with the General Electric motors with an extended pinion nut it would be ¾ in. On the smaller motors going on the axles with 48 ins. between wheel hubs, there would be a still larger clearance. The ⅛-in, wheel hub on the motor side of the car will still leave ⅜ in. that



PROPOSED SECTIONS OF WHEELS

the motor bearing flange would extend into the gear case. The sub-committee also thought it would be advisable to standardize the dimensions of the gear hub. That is, group them so that all motors which go on the 4-in., 4½-in., 5-in. and 5½-in. axles would take a standard gear case; that is, have a standard hub bore. That would give a depth of bearing flange against the gear hub from the fit of the motor bearing, that is the dimension of the motor bearing to the outer dimension of the flange, it being understood that the flange of the axle bearing is of the same size as the wheel hub. This would give a wearing depth of 1¾ ins. on the A axle, of 1¼ ins. on the 5-in. axle and 1¼ ins. on the 5½-in. axle. Deducting the fillet it would be on the A axle 1¼ ins. straight, the regular depth of the flange, and on the A, B and B-1 axles 1 in. Then on the C and C-1 axles—that is, the 6-in. and 6½-in. axles—the gear hub could be 9½ ins. That would give a minimum straight wearing surface of 1¼ ins. above the fillet. For the 7-in. axle the companies would like 10 ins. on the wheel hub and bearing flange.

The following table of dimensions was then submitted by the sub-committee:

AXLE DIMENSIONS

Type.	Journals.	Motor Fit.	Gear Fit.	Wheel Fit.	Distance Between Hubs.	Centers of Journals.	Capacity, Lbs.	Length of Gear Seat.
E A	3¾″x 7″	4½″	5½″	5 7/16″	48″	75″	15,000	6⅛″
E B	4¼″x 8″	5″	6″	5 15/16″	48″	75″	19,000	6⅛″
E B-1	4¼″x 8″	5½″	6″	5 15/16″	48″	75″	22,000	6⅛″
E C	5″ x 9″	6″	7″	6 15/16″	50″	76″	27,000	6⅛″
E C-1	5″ x 9″	6½″	7″	6 15/16″	50″	76″	31,000	6⅛″
E D	5½″x10″	7″	8″	7 15/16″	50″	77″	38,000	6⅛″

HORSE-POWER FOR AXLES

A—45 horse-power.
B—45 to 65 horse-power.
B-1—65 to 100 horse-power.
C—100 to 150 horse-power.
C-1—150 to 200 horse-power.
D—200 to 250 horse-power.

STANDARD GEAR DATA

Axle.	Gear Pitch.	Gear Face.	Diameter of Gear Hub Bearing Flange.	Finished with Gear Hubs.
E A	3	5″	8″	1″ wheel side ⅛″ motor side
E B	3	5″	8″	1″ wheel side ⅛″ motor side
E B-1	3	5″	8″	1″ wheel side ⅛″ motor side
E C	2½	5¼″	9½″	⅛″ wheel side ¾″ motor side
E C-1	2½	5¼″	9½″	⅛″ wheel side ¾″ motor side
E D	2½	5¼″	10½″	⅛″ wheel side ¾″ motor side

Gear key to be 1 in. square and key to be 5 ins. long.

H. H. Adams asked Mr. Sargent if ¾ in. outside of the back of the wheel flange be clearance enough for any brake shoe. Mr. Sargent replied that it would be plenty; that many do not have 1-16 in. It was very desirable to have at least ⅜ in. lift to the flange.

WHEEL TREAD AND FLANGES

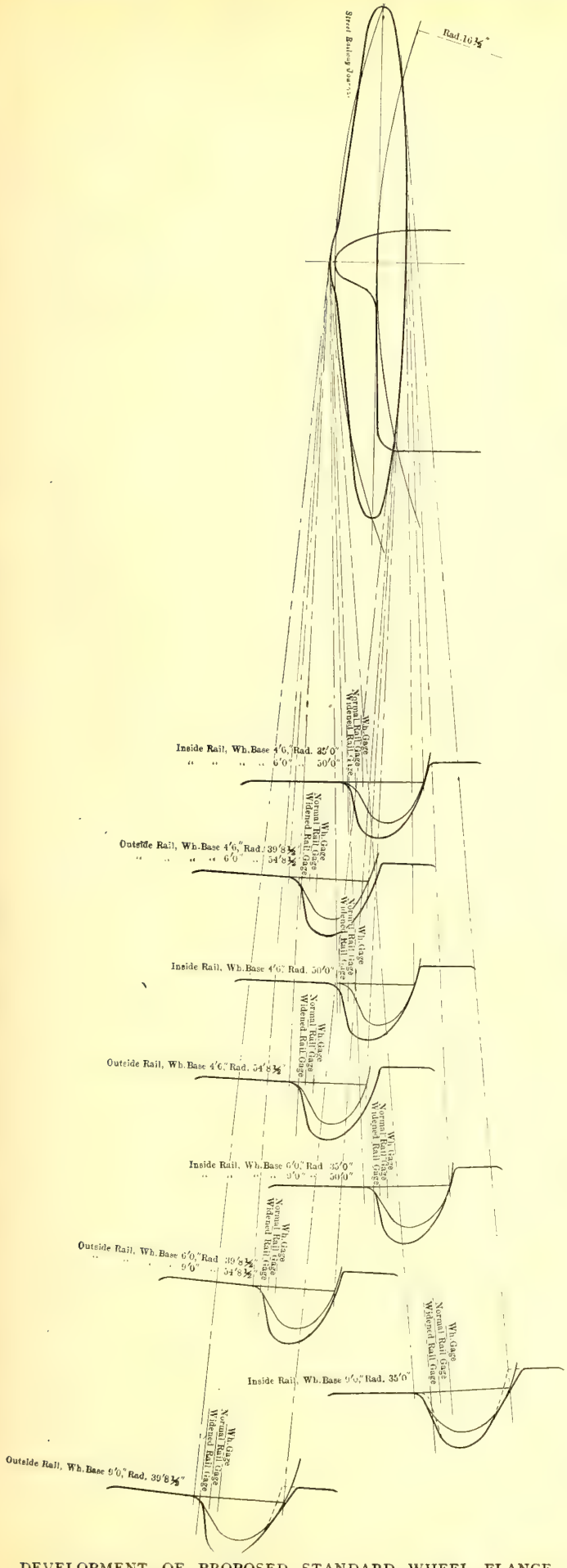
Mr. Evans then announced that the committee would pass to the regular subject for the morning, that is the subject of wheel tread and flanges, standard section of tread and flange of wheel. As Mr. Griffin had not arrived he asked Mr. Angerer, of the Wharton Company, chairman of the committee of special work manufacturers, for his report on the subject. Mr. Angerer read his report, which was as follows:

REPORT OF MR. ANGERER

From the plan of action decided on at the meeting held at Cleveland in July, the writer had expected that a conference of the sub-committee on the subject of wheel treads and flanges with the wheel manufacturers and special work manufacturers would precede this meeting, so that a complete report would be submitted at this time. No such conference having come about, the writer, on the suggestion of the chairman, W. H. Evans, acted upon his own initiative and addressed a letter to various special work manufacturers with the idea of getting at least their opinion and submit the same in condensed form to this meeting. The letter was sent to the Lorain Steel Company, the Pennsylvania Steel Company, the Cleveland Frog & Crossing Company, the Paige Iron Works, the Barbour-Stockwell Company and later also to the New York Switch & Crossing Company, and read as follows:

PHILADELPHIA, Aug. 23, 1907.

At a meeting of the standardization committee of the American Street & Interurban Railway Association, which was held at Cleveland, last month, the matter of the establishment of a standard section of wheel tread and flange for electric railways was discussed and finally referred to a sub-committee, to formulate recommendations and report at a further meeting



DEVELOPMENT OF PROPOSED STANDARD WHEEL FLANGE FOR VARIOUS WHEEL BASES AND RADII AND ITS POSITION IN PROPOSED STANDARD GROOVE FOR GUARD RAIL, PRESENTED BY MR. AUGERER.

to be held by the general committee in New York on Sept. 12 and 13 at the Engineering Societies Building, 29 West Thirty-Ninth Street. As this question affects wheel manufacturers as well as manufacturers of special track work, their opinions on the subject are desired, and so as to facilitate the work, it was suggested that one of each group of manufacturers act in an advisory capacity to the committee. Mr. Griffin, of the Griffin Wheel Company, was appointed as the representative of the chilled wheel manufacturers and the writer was appointed as the representative of the special work manufacturers, by the members of the committee and representatives of the manufacturers present.

I would thank you if you would co-operate with me on this subject by giving me your opinion and answering the following questions, which I am sending you on suggestion of the chairman of the general committee, W. H. Evans:

(a) Do you consider it feasible and proper to recommend one common standard for both city and interurban railways? Please give your views on the subject.

(b) If the first question is answered in the affirmative, would you consider the proposed standard wheel as per blue print herewith as the proper compromise wheel? Or, if not, what modifications from this proposed outline would you recommend?

(c) If question (a) is answered by you negatively, please let me have your suggestions as to separate standards for city and for interurban railways.

(d) Do you consider the ⅛ in. difference between wheel gage and track gage on each side, making ¼ in. total difference, a correct standard? If not, what would you recommend?

(e) What do you consider the proper point from which to measure the wheel gage? On the enclosed blue print the point is fixed where a horizontal line ¼ in. below the tread line intersects the fillet at the root of the flange. Would you consider this proper?

(f) Do you consider that an allowable variation in the setting of the wheels of ⅛ in. above normal width of wheel gauge and ⅛ in. below the normal width of wheel gage, making a total variation of ¼ in., is proper? Or what, in your opinion, should be the limits?

To assist you in the consideration of these questions, I further beg to enclose you herewith blue print showing the development of the proposed standard flange in a minimum radius curve of 35 ft. center-line, and also in a 50 ft. center-line radius curve, in combination with a minimum wheel base of 4 ft. 6 ins., a medium wheel base of 6 ft. 0 ins., and a maximum wheel base of 9 ft. 0 ins., and the relation of these developed flanges to the proposed groove of a guard rail; at the same time also indicating how much the gage of such curves would have to be widened in each case to make the guard of the inside rail effective. The groove of the guard rail is drawn to a width of 1⅝ ins., measured on a level with the top of the tread, and, as you will observe, would answer without planing out for all except the combination of the maximum wheel base with the minimum radius.

An early answer, so as to enable me to formulate a résumé of the various answers received, will be very much appreciated. The meetings of the committee in New York will be open, the same as they were at Cleveland, and if you are interested in the subject, the committee will undoubtedly be pleased to have your representative at the meeting.

What few answers were received to these questions, adding thereto the writer's own answers on behalf of Wm. Wharton, Jr., & Company, were as follows:

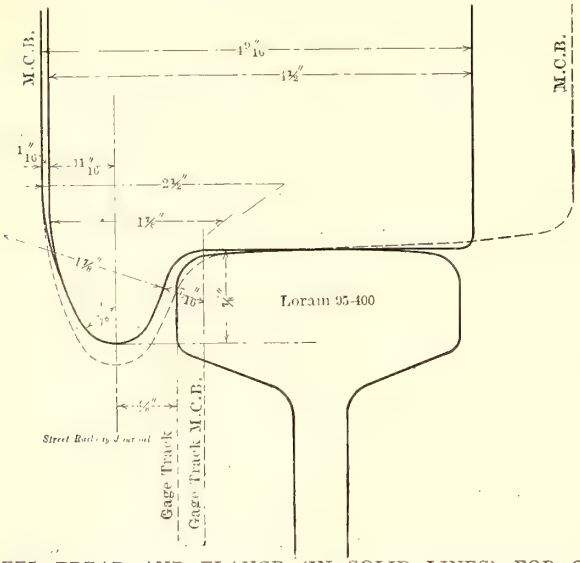
Question A. Do you consider it feasible and proper to recommend one common standard for both city and interurban railways?

Answer from Lorain Steel Company. Mr. Entwisle considers that one standard tread for city and interurban railways should be recommended, but is doubtful of the city flange which it will be necessary to use on account of existing work, will not be too small for the high speed which is the rule on some interurban railways. The width of tread apparently recommended by Mr. Entwisle by drawing referred to in the answer is 3¼ ins.

Answer from Pennsylvania Steel Company, as per interpretation of drawing submitted with the answer, recommends a wheel with 3½-in. tread and flange very similar to the standard ⅞-in. deep flange recommended by the standardization committee of the Central Electric Railway Association for rail-

ways with partly city and partly interurban railway conditions, but it appears to consider the tread too wide and the flange too deep, although not too thick, for railways operating entirely under city conditions.

Answer from Wm. Wharton, Jr., & Company recommends the adoption of a common standard for both city and interurban railways, as per blue print herewith, being practically the Central Electric Railway's standard with such modifications in the flange as discussed at the Cleveland meeting, and with the tread widened out 3½ ins.



WHEEL TREAD AND FLANGE (IN SOLID LINES) FOR CITY AND SUBURBAN TRAFFIC SUGGESTED BY LORAIN STEEL COMPANY

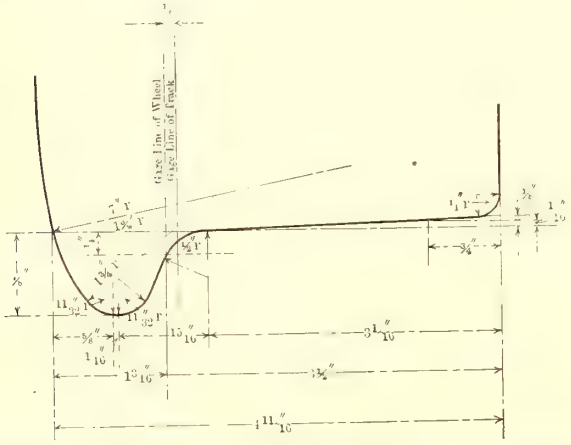
Cleveland Frog & Crossing Company.—Nothing.

Paige Iron Works.—Yes, as far as flange is concerned, the tread being subject to variations without affecting the special work, but should be at least 3½ ins. wide.

Barbour-Stockwell Company.—Yes. The reasons for our answering in the affirmative are many, but the principal reason, in our opinion, is the fact that there are so many city and interurban roads that have cars which fulfil service in both cases that the standards should be the same for both roads.

New York Switch & Crossing Company.—Nothing.

Question B. If the first question is answered in the affirmative, would you consider the proposed standard wheel as per blue print (referring to the blue print submitted by Wm. Wharton, Jr., & Company) as a proper compromise wheel?



WHEEL SUGGESTED BY WM. WHARTON, JR., & COMPANY

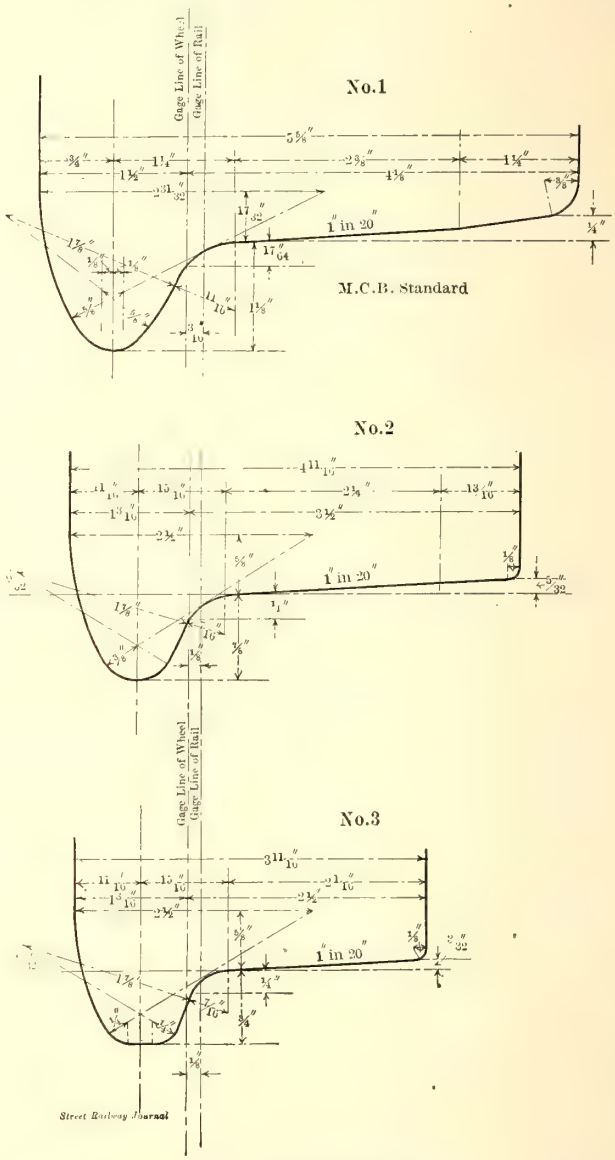
Answer from Lorain Steel Works, Mr. Entwisle.—The flange should not be less than 1 in. deep and about midway between the lines of the M. C. B. flange and a ⅞-in. flange shown on blue print submitted by Lorain Steel Company herewith.

The opinion of the other companies is covered by their answer to Question A.

Question C. If Question A is answered by you negatively, please let me have your suggestions as to separate standards for city and for interurban railways.

Answer from Lorain Steel Company, by inference, that the wheel tread should be the same on all wheels, but that a possible wheel for combined city and interurban traffic should have a 1-in. deep flange, as above mentioned, while for city traffic a smaller flange should be used to suit present conditions in the various cities.

Answer from Pennsylvania Steel Company is represented by three standards, as per blue print submitted, as follows: (1) The regular M. C. B. standard for railways operating under steam railroad conditions; (2) a compromise wheel with 3½-in. tread and ⅞-in. deep flange, as mentioned in answer to Question A for railways with both city and interurban conditions; (3) a wheel with a 2½-in. wheel tread and a flange on wheel No. 2, but stubbed off to ¾ in. deep for railways operating wholly under city conditions.



NO 1 RECOMMENDED
WHEELS SUGGESTED BY PENNSYLVANIA STEEL COMPANY

Flange 1.—Recommended wheel for railways operated over systems in all parts under steam railroad conditions.

Flange 2.—Recommended wheel for railways over systems partly under city conditions and partly under steam railroad conditions, but over which no M. C. B. flanges are used.

Flange 3.—Recommended wheel for railways operated over systems wholly under city conditions. This wheel will require flange-bearing frogs.

Answer from Wm. Wharton, Jr., & Company covered by Question A.

Cleveland Frog & Crossing Company.—Nothing.

Paige Iron Works.—Covered by Question A.

Barbour-Stockwell Company.—Covered by Question A.

New York Switch & Crossing Company.—No answer.

Question D. Do you consider the 1/8 in. difference between wheel gage and track gage on each side, making 1/4 in. total difference, a correct standard?

Answer from Lorain Steel Company.—Yes.

Answer from Pennsylvania Steel Company.—Yes, except for M. C. B. standard wheels, where the difference should be 3/16 ins. on the side.

Answer from Wm. Wharton, Jr., & Company, Inc.—Yes.

Answer from Paige Iron Works.—Does not consider 1/8 in. sufficient, wants to make it 3/16 ins. on the side, making the distance from back to back same as M. C. B. (?)

Answer from Barbour-Stockwell Company.—Yes.

Question E. What do you consider the proper point from which to measure the wheel gage (referring to wheels other than M. C. B. standard for electric railways)?

Answer from Lorain Steel Company.—From a point on the fillet to root of the flange, 1/4 in. below the tread line.

Answer from Pennsylvania Steel Company.—One-quarter in. below the tread line on all except M. C. B. standard wheels, where it should be from a point 17/64 in. below the tread line.

Answer from Wm. Wharton, Jr., & Company, Inc.—One-quarter in. below the tread line on standard wheel for electric railways. When M. C. B. standard is used 5/8 in. below tread line, in accordance with Master Car Builders' standard rules.

Cleveland Frog & Crossing Company.—No answer.

Paige Iron Works.—A point 1/4 in. below tread satisfactory.

Barbour-Stockwell Company.—We consider the point as fixed on your blue print as correct.

Question F. Do you consider that an allowable variation in the setting of the wheels of the 1/8 in. above the normal width of wheel gage and 1/8 in. below the normal width of wheel gage, making a total variation of 1/4 in., is proper?

Answer from Lorain Steel Company.—We consider the allowable variation in setting of wheels on axle should be 1/8 in. maximum, or a variation of 1/16 in. on each side.

Answer from Pennsylvania Steel Company.—We consider the maximum allowable variation in setting wheels to gage 1/32 in.; that is, 1/64 in. wider or narrower than the normal.

Wm. Wharton, Jr., & Company.—One-sixteenth in. below and 1/16 in. above the normal for each wheel, making a variation of 1/8 in. above and 1/8 in. below the normal width of wheel gage, or a total variation of 1/4 in.

Cleveland Frog & Crossing Company.—No answer.

Paige Iron Works.—Should be as small as possible, 1/16 in. above and below a standard of 4 ft. 8 1/8 ins. should be sufficient.

Barbour-Stockwell Company.—We consider the wheels should be set to standard gage without an allowance either way.

New York Switch & Crossing Company.—No answer.

From the above few answers it would appear that there is a considerable difference in opinion as to the feasibility of the establishment of a common standard wheel tread and wheel flange for both city and interurban railways. The opinions, however, as to what such a wheel should be, if it was found feasible, seem to be quite close together, particularly in regard to the width of wheel tread. If the objection to a common standard is to the depth of 7/8 in. or more for the flange for city conditions, on account of present shallow rails and special work, the suggestion of the Pennsylvania Steel Company to stub off this flange without reducing its thickness may form the solution.

In reference to the difference between wheel gage and track gage, the opinions seem to be practically unanimous, except for M. C. B. standard wheels, which latter, however, are really outside of this consideration, and a difference of 1/4 in. would appear to be correct in the opinion of all.

In reference to the point from which the wheel gage is to be measured, the opinions likewise seem to be unanimous, except in the matter of the M. C. B. wheels, that is, that it should be measured from a point 1/4 in. below the tread line on the fillet at the root of the flange.

In reference to the allowable variation in the setting of the wheels, it is of course desirable from the standpoint of the special work maker, that it should be as small as possible; but it is really a question that should be determined by the wheel and axle manufacturer, and the railway companies themselves and be kept within the smallest limit that has been found practicable. The blue prints submitted and also blue print of development of the proposed standard wheel and flange mentioned in the letter to the special work manufacturers, are attached hereto.

Mr. Evans, after stating that the thanks of the committee were due Mr. Angerer for the very active interest he had taken in the subject, said that he was particularly interested to notice that the manufacturers of special work are practically unanimous in favor of a wheel which has a 7/8-in. flange for interurban work, and in some cases recommend it for both city and interurban work. As it has been said that the special work in a good many of the cities would not permit such a wheel, especially in cities which employ the grooved rail, he asked Mr. Angerer to discuss that question.

Mr. Angerer said that present conditions in cities may not permit of a standard of a 7/8-in. flange, which certainly is the minimum depth of flange which should be used on interurban railways. He thought that this transition state would exist for some years,—a number of years, in fact. This remark, however, did not apply to the tread which could be widened. In regard to the depth of flange, the same width of flange could be used but it could be stubbed off. As far as going over existing special work is concerned, with the exception of such cities as Washington, where special flange is prescribed, such a flange would go through, all special work that is now in existence and made for the present ordinary flanges. As the development will show, the grooves in guard rails at present are 1 9/16 in. when new, and this 1 5/8 in. will let this new standard wheel through on all except with the 9-ft. wheel base and on a 35-ft. radius curve. But that condition is very seldom met. Only the depths of the flange would be an objection, not its other dimensions. If the 3 1/2-in. wheel tread were adopted, it would make a flange bearing unnecessary, so that all new special work would be made with grooves deep enough to take the 7/8-in. flange, and wheels with a stubbed-off flange would run over that special work without detriment.

Mr. Cuntz said that his company was guided in its suggestions to some extent by the fact that the tendency at the last meeting was to adopt a 2 1/2-in. tread and 3/4-in. depth.

Mr. Vickery said that his company would like to see a wheel adopted with the flange shown but with 3 1/2-in. tread. He realized, however, that in a great many of our cities where the cars do not run high speed, this will be a hard thing to do, and that is why his company suggested a 2 1/2-in. tread.

Mr. Rhodes thought that it would be difficult to get a standard wheel for both interurban and city work, on account of local conditions. The chief difficulty with the 3 1/2-in. tread was the paving.

Mr. Larned called attention to the fact that the discussion had borne upon the effect of the wheels on the special work but not on the rails. The special work forms a very small proportion of the number of feet of track laid in the cities. Most of these rails have a step not over 1 1/8 in. in depth and such a rail is not economical with a 7/8-in. wheel flange. A company would get on the average at least from four to six years less life of rails using a 7/8-in. flange than with one 3/4 in. in depth. He thought this had considerable

bearing on the question as to whether the committee adopt two different depths of flanges or only one.

Mr. Page said that in the city of Springfield the same pattern of rail is used as in New York. There are about thirty miles of grooved rail in Springfield, and it would be impossible to operate cars economically over the line, especially in the winter time, if the wheel-flange was 7/8 in. high. In fact, the 3/4-in. flanges now employed rub on the sides of the curves. Rails have been designed within the last few years to take a 7/8-in. flange, but it will be a number of years before the street railway companies in Massachusetts will be able to use a 7/8-in. flange, or even the stubbed off flange mentioned, as they will be compelled to employ considerable grooved rail. Mr. Page also thought that a wide tread would present difficulties on account of projecting paving and thought that a width of tread of 2 1/2 ins. would have to be employed.

Mr. Evans then read a part of a letter which he had received from F. G. Simmons, of Milwaukee, the vice-president of the Engineering Association. Mr. Simmons was unable to be present at the meeting, but wrote the following upon the work of the committee:

"Regarding the work of the Committee, I believe you can arrive at conclusions so that your report to the Association will be able to bear absolute recommendations as to standard wheels, standard axles and standard brake shoes. On the rail matter I scarcely think that the Committee will be able to make a final report, but my idea is that when the final report on rails is made, it should recommend as absolutely best practice two types of Shanghai T-rail; first, the heavy type to be used in larger cities and under conditions where city traffic is heavy; second, a lighter type of Shanghai T-rail to be used in smaller cities and under less exacting conditions. The Committee should also recommend as best practice a type of rail similar to the A. S. C. E. standard for interurban work.

Mr. Adams then presented the following written opinions which he had received in reply to three questions which he had sent to prominent managers:

Question 1. Do you consider it possible to adopt for the service on your system one wheel having a width of tread 3 inches and a flange 7/8 inch high? If this wheel is not practical for you to adopt under present conditions, do you feel that you would be warranted in working to a wheel of this character by making provision for the same in new rail and new special work, either to provide for the possible use of your tracks in the future by high-speed interurban cars or for any other object?

I do not consider it possible on account of city ordinance prohibiting T-rail. Richard McCulloch, United Rys. of St. Louis, Mo.

I consider this the most practical wheel to adopt and we are equipping our road bed to make this wheel standard. W. W. Cole, Elmira W., L. & P. Company.

The development of the rail and special work should be in the direction of using a 3-in. tread and a 7/8-in. flange. F. W. Brooks, Detroit United Ry.

I fully realize that it would be of great advantage to all companies if they were able to adopt one standard wheel, but believe it impossible to do so for years to come. E. W. Olds, Milwaukee E. R. & L. Company.

We could not run a 3-in. tread and 7/8-in. flange on all the lines here and in the vicinity. H. C. Page, Springfield St. Ry. Company.

I doubt very much if it could be used with present track, but if no objection from city, it might be employed in the future. H. D. Wright, Rhode Island Company.

We could use this wheel, but it would necessitate relaying pavement to bring it lower than the rail. W. J. Hield, Twin City Rapid Transit Company.

Question 2. If the 3-inch tread and 7/8-inch flange wheel is not a practical wheel for your system, or one for you to consider in the future, kindly give me your opinion on the use of a wheel with a width of tread 2 1/2 inches and a flange 3/4 inch in height, to be used for strictly urban and light suburban service.

Our present wheel of 2 1/2-in. tread and 5/8-in. flange differs so little from 2 1/2-in. tread and 3/4-in. flange that we would not care to change. Richard McCulloch, United Railways of St. Louis.

I consider one standard wheel desirable, viz., one with a 3-in. tread and 7/8-in. flange. W. W. Cole, Elmira W., L. & P. Company.

At present, under conditions existing in Detroit, I should advocate a 2 1/2-in. tread and 3/4-in. flange. F. W. Brooks, Detroit United Ry. Company.

The standard for our city lines is 2 1/2-in. tread and 3/4-in. flange. H. C. Page, Springfield St. Ry. Company.

Recommend a 2 1/2-in. tread and 3/4-in. flange. H. D. Wright, Rhode Island Company.

I am of the opinion that a 2 3/4-in. tread and 7/8-in. flange are sufficient. W. J. Hield, Twin City Rapid Transit Company.

Question 3. One object of making this inquiry is to determine to what extent city roads should make provision in their track construction for taking care of future interurban roads which desire to enter the city over the city company's tracks. It has been suggested that these interurban roads in the larger cities will probably enter the cities over private right of ways, or elevated roads or through subways, and hence would use the M. C. B. wheel. For this reason your opinion upon this point and the direction in which the association should work in the direction of widths of treads and heights of flanges would be helpful.

I believe in the use of a special rail for city tracks that will take either 2 1/4-in. tread and 5/8-in. flange or 3-in. tread and 3/4-in. flange. For suburban, I recommend a 90-lb. rail, which will allow the passage of a wheel with a 3 3/4-in. tread and 7/8-in. flange. F. H. Lincoln, Philadelphia Rapid Transit Company.

Every effort should be made to bring about a form of track construction in cities that will enable interurban cars to pass over city tracks. F. W. Brooks, Detroit United Railway Company.

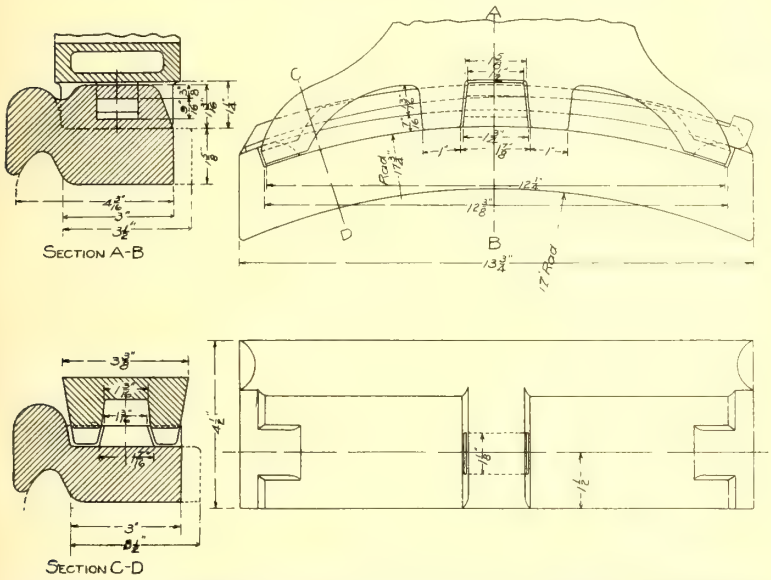
I consider that where interchange occurs the road must eventually come to the M. C. B. tread and flange. I advocate, therefore, continually increasing the width of tread and depth of flange until the M. C. B. standard is reached. E. W. Olds, Milwaukee E. R. & L. Company.

Mr. Yardley said that he did not believe that the large roads in the East like those in Washington, Baltimore, New York, Philadelphia or Boston, could use a tread of 3 ins. or over. In most cases the paving is the limiting condition. In Washington there is the additional limit that the head of the rail is fixed by the District of Columbia Commissioners. A rail with a head beveled on the outside like that being installed in Philadelphia now would overcome the trouble. Under present conditions in the East he did not see how a wheel with a 3 1/2-in. tread could be adopted for ten or fifteen years.

Mr. Page said that personally he should be much pleased to see a T-rail recommended for city work. In time the girder rail will go out of existence almost entirely. It is not a practical, common sense, reasonable rail. There never has been one built that balanced right, or that was economical to use. But at the present time in Massachusetts it is like putting a red flag in a bull's face to say anything about T-rail in the city of Springfield. He thought the roads were largely to blame for this condition because of the poor T-rail construction which they had installed in the early days. If the work had been done with the same care as is now used in installing grooved rail there is no reason why the city authorities would not have been perfectly satisfied with it. The only way the companies are going to get back to T-rails in city streets is to gradually work in a small lot so that the authorities can see it in use. This has been done in Boston, where an 8-in. T-rail has been laid in good granite block paving. It has been there for two years, and one can walk up and down the track and cannot find a block that has moved a particle. It is like solid granite. If the companies are willing to wait long enough the 3-in. wheel tread, if it is recommended, will be what will come. But

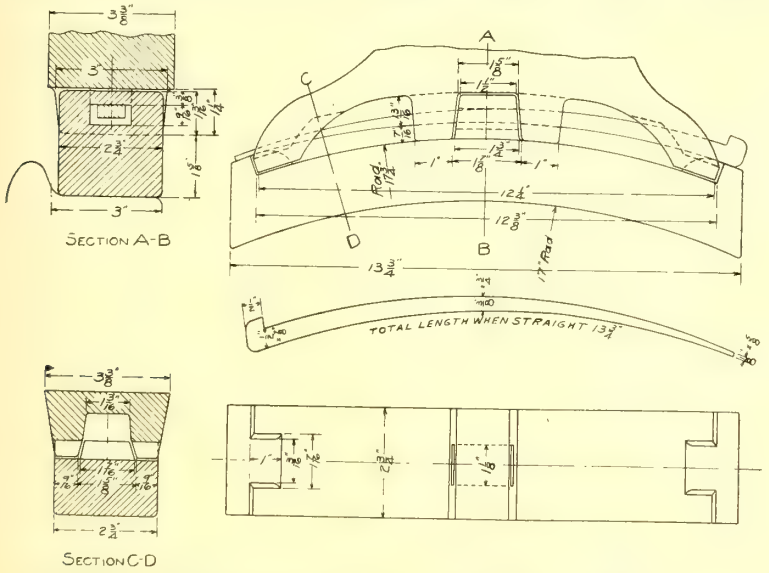
it seemed to him that two treads will be desirable at this time.

Mr. Angerer explained that the 3½-in. tread was recommended because it was the minimum width which would allow the manufacturers to make special work without a flange bearing. A 3-in. tread is not wide enough. A 3½-in. would be. There are now a number of systems that do use 3-in., 3¼-in. and 3½-in. treads. They are not, however, as Mr. Yardley remarked, in the large cities. They do run into smaller cities, like Scranton and Altoona, Pa.; but the tendency of the larger cities, with the exception of such cities as Washington and Cincinnati, is to work toward wider tread by adopting rails providing for it. In this



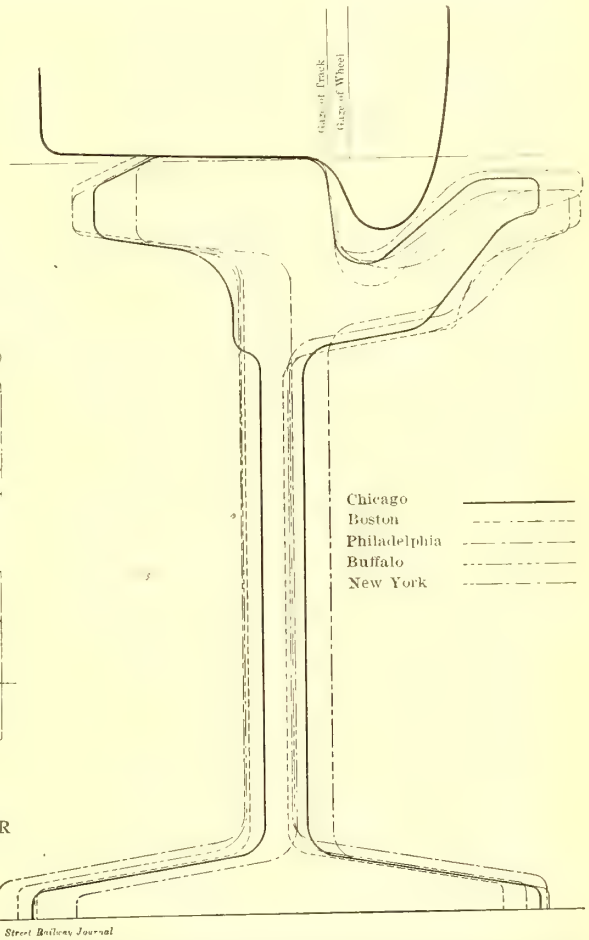
PROPOSED STANDARD BRAKE HEAD, FLANGED SHOE AND KEY FOR WHEELS, WITH 3-INCH TREAD AND OVER

connection Mr. Angerer exhibited the accompanying composite drawing of the rails of Chicago, Boston, Philadelphia, Buffalo and New York, showing the position on them of a ⅞-in. flange and a 3½-in. wheel tread. He said that while the wheel overhangs even the wide head to some slight extent, it is not any worse than the 2¾-in. tread



PROPOSED STANDARD BREAK HEAD, UNFLANGED SHOE AND KEY FOR WHEELS, WITH 3-INCH TREAD AND OVER

which is used in Brooklyn now. He thought no doubt some chipping of treads would take place, but so far as he had been able to learn it has not been very serious, and while the first wide wheels put on had been interfered with by the paving, the paving blocks have usually proven softer than the wheels and have chipped away rather than the wheels. While both chipped at first, the paving blocks went faster, so that after a while the trouble diminished. He said he did not speak from experience, only from observation, but



DRAWING SUBMITTED BY MR. ANGERER, SHOWING POSITION OF 3½ IN. TREAD WHEEL ON DIFFERENT CITY RAILS

so far as he had been able to learn from people who have used wider rails than the head of the rail was calculated to bear, they have not experienced any serious difficulty over it. It diminished very much after a short time. Another reason which might be given for a wider wheel is that the weight of the cars calls for a stronger wheel, both laterally and in bearing load. A 3-in. tread would require a flange bearing.

Mr. Rhodes said that the taper of the wheel was an important point. The majority of wheels in street car service have a 1-32 taper. The B. & O. have a taper of 1-16, and the Pennsylvania a taper of 1-20, with a double taper. If the companies are going to adopt a wide tread wheel it would be necessary to decide what the standard taper should be.

Mr. Page thought that if the wheels had to make a path for themselves outside of the rail in the paving there would be a good deal of breakage with chilled wheels.

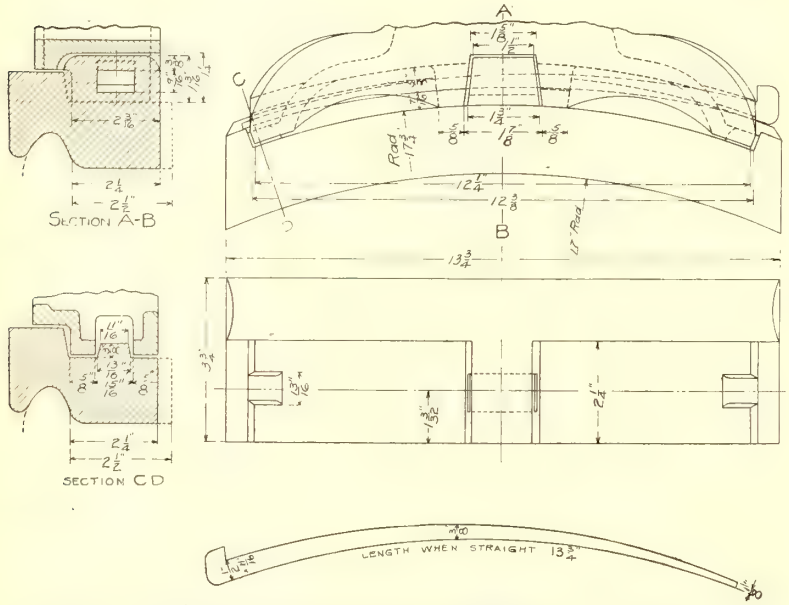
Mr. Dougan thought that a wheel with a 2½-in. tread and ¾-in. flange could be used on most of the larger roads in the country.

Mr. Thorpe said the question of gaging electric railway wheels had been a serious one with his company for three

reasons. In the first place, different kinds of rails are used by different companies; some have both T and grooved rail, some T, and some all grooved. In the second place the wheel flanges are innumerable in contour; and in the third place the amount of play allowed varies very largely. The method of measuring has also varied very largely. His company had adopted the practice of sending to its customers a white print showing the contour of a grooved rail and the contour of a T-rail, and asking them to specify what play they want and the point from which they take the measurement. The usual allowance for play is ¼ in.

BRAKE SHOES

Mr. Evans then brought up the subject of brake shoes and explained that the sub-committee on brake shoes had practically decided that two heads were necessary, one that would follow closely along the lines of steam railroad practice and would be applied to wheels of 3-in. tread and over. The unflanged shoes with this head would be reversible on their own wheels, and the flanged shoes would be reversible by changing the shoes from end to end of the brake beam.



PROPOSED STANDARD BRAKE HEAD, BRAKE SHOE AND KEY FOR NARROW TREAD WHEELS

To accommodate wheels in service with treads narrower than 3 ins. the committee suggested a second brake head which can use either a flanged or unflanged shoe. These shoes would be reversible in like manner to those of the wider head.

Mr. Sargent was asked whether there was any advantage in the flanged shoe over the unflanged. He replied that the flanged shoe was better whenever it could be used properly. For instance, on freight cars, with the brake beam hanging over the body of the car, and sometimes over the outer edge of the truck, a flange shoe cannot always engage the flange of the wheel. In that kind of service an unflanged shoe is best to use, but wherever the beams hang between the wheels, as with an inside hung brake, a flanged shoe is an advantage, because the flanges of the shoe hold the brake shoe to the proper place on the wheel. With a flanged shoe the shoe always engages the wheel in the same place, tending to wear the flange and outer tread proportionately, and undoubtedly giving better wear to the top of the wheels. Not only that, but the flanged shoe gives better braking effect, gives a stronger grip on the wheel, a better control and more uniform braking in a car or train. The flanged shoe is the one in general use on electric roads.

Mr. Griffin at this point entered and was asked his opinion of the sections of wheels under discussion. He replied that the wheel makers would naturally be in favor of a wider tread. He continued: "On the question of flanges, after an experience on that question of some ten or fifteen years I find people who have had large experience on that question have different views. For instance, in England they favor the use of a very light and shallow flange, and in most Continental work—in Germany, for instance—they favor a thin flange. The question of tread, after all, is one that wheel makers can only deal with as their customers ask them. As to what will be the best type of flange, that is the question still to be worked out with practice. We have had quite a large experience in the matter of wheels in almost every country in the world and have exported a great many. Some years ago we made a flange similar in construction to the one now proposed, but with a flat bottom, and it was very extensively used in Pittsburg. Generally speaking, there should be an ideal combination on the part of the special work and the part of the wheel. You also have to consider the type of flange that would best support the load in going over a crossing. But the trouble with that ideal condition is, it cannot be maintained, so a good many railroads adopted the practice of going to one extreme, getting a condition of special work or wheel flanges that after an average amount of service—that is, after a reasonable amount of service—would approach the ideal. The tendency of a good many car wheel makers is to put on the thickest flange they could put on in the belief the wear on that flange and the service it had to do would leave the wheel in the best position after a certain period of time. That utterly disregards the fact that the flange is too heavy to go through the special work. There will be an extreme amount of friction in using that flange. So far as using a shallow flange is concerned, the car wheel makers will naturally favor a shallow flange, because that does not produce as much chipping of the flange. As you all know, a large proportion of the wheels taken out of electric service to-day are taken out on account of defective condition of flanges. So far as steel wheels are concerned, you do not have the chips, but you have the extra wear, and between the two you will have to decide as to which is the better wheel to use."

In reply to a question on the wheel taper used on steam roads Mr. Griffin said: "At the present time the Pennsylvania Railroad differs in its practice from that of the master car builders and has a slightly increased taper over the M. C. B. The sole purpose of the taper on a car wheel is to center the car on the track. One-thirty-second in. or even 1-16 in. taper on a car wheel under a heavy car would not last long because the contact must be, while the taper is there, over a very small dimension of the wheel, and it will wear that off soon."

A further discussion then followed on the tread and flange, after which the meeting adjourned. A subsequent meeting of the members of the committee was held Saturday to draw up the report, which will be issued by the secretary at an early date.

SNOW FIGHTING AND SNOW COSTS IN QUEBEC

The electric railway companies of the United States who are apt to bewail the profit shrinkage that comes with a severe winter may find some comfort in the fact that what is only intermittent with them is the annual lot of many of their Canadian friends. This is especially true of Quebec, where narrow and hilly streets add to the company's burdens. Despite conditions so unfavorable for winter operation, the Quebec Railway & Light Company manages to keep up its schedules in the worst blizzards because of its efficient and abundant snow-fighting apparatus.

The city or citadel division of the Quebec company's system embraces 17.22 miles of track, for which two double wing plows and six sweepers are provided. Ten of the passenger cars are furnished with double-end scrapers, while twenty-five cars have scrapers at one end and track brushes at the other. These brushes and scrapers are found sufficient to care for light snowfalls, but as soon as the cars begin to slow up the sweepers and then the plows are placed in service. On the suburban, or Montmorency division, the customary rail flangers attached to the cars or locomotive pilots are used.

An unusual and onerous condition imposed on the railway is the allowance made to property owners for snow piled in front of their houses by the plows and sweepers. The company first measures the property parallel with the route and then makes the landlord an annual allowance, which averages about 13 cents per running foot. Different rates are fixed, according to the width of the street. The company now pays out $8234 a year for this purpose exclusive of all other snow costs.

INTERURBAN INSPECTION TRIP BETWEEN INDIANAPOLIS AND DETROIT

A number of officials of Indiana lines recently made a trip to Detroit from Indianapolis over the four lines which form the chain between Indianapolis and Detroit. The private car "Martha" was used, and considering the stops excellent time was made. H. A. Nicholl of the Indiana Union Traction Company and president of the Central Electric Railway Association; Frank D. Norveil and C. C. Reynolds, of the Terre Haute, Indianapolis & Eastern; A. A Anderson, of the Indianapolis, Columbus & Southern; J. B. Crawford, of the Fort Wayne & Wabash Valley; F. B. Carpenter, of the Western Ohio, at Lima, and vice-president of the Central Electric Railway Association; J. L. Smith and John Collins, of the Toledo Urban & Interurban Company, composed the company. The car went through to Fort Wayne by way of Peru, thence to Lima, Ohio, and Toledo, and thence to Detroit. The distance between the cities of the route traveled is 336 miles, and the average speed, including stops and layouts, was a little more than thirty-six miles an hour. The object of the visit to Detroit was to interest the officials of the Michigan lines in the Central Electric Railway Association. As a result a number of Michiganders are expected to attend the September meeting of the association at Columbus, Ohio, Sept. 26.

The Connecticut Company has issued blank applications for school children's half fare tickets, which have to be signed by the parent or guardian of the pupil and a principal or teacher. The tickets are being issued this year in books of forty instead of twenty-five, so the school children would not have to come so often.

HIGH-TENSION PAPERS AT THE ANNUAL MEETING OF THE CANADIAN ELECTRICAL ASSOCIATION

At the last annual convention of the Canadian Electrical Association, held in Montreal on Sept. 11-13, two papers were presented which are of equal interest to electric railway engineers dealing with high-tension transmission systems. M. A. Sammet, of the Montreal Light, Heat & Power Company, wrote on the "Trials of the Operating Man," and C. E. Delafield on "High-Tension Insulators from an Engineering and Commercial Standpoint."

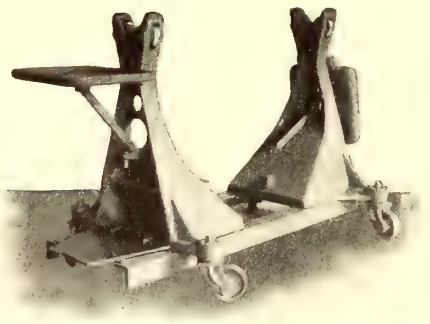
Mr. Sammet confined the greater part of his paper to troubles that can be cured rather than those beyond control, such as lightning. He considered it essential that the power plant and sub-stations should be capable of carrying 25 to 50 per cent overloads for considerable periods without injurious heating. Good voltage regulation was another important point in the operation of such systems. One difficulty he had met was that of operating differently designed transformers in parallel; if they will not divide the load in proportion to their capacities corrective reactances must be added to the transformers to equalize them in this respect. As to transformers in general, he believed the air-blast type was open to criticism, as it accumulates dust too easily, which involves objectionable increases in temperature. Compressed air for blowing out the dust adds another source of danger if it contains moisture, and still another disadvantage is the ease with which flames are carried from one transformer to the other through the air chamber. The disadvantages of the oil-insulated type are principally the possibility of water getting at the winding and the breaking up of the oil to form a thick, non-condensing mass. The first difficulty may be overcome by using a water coil capable of withstanding 200 lbs. hydrostatic pressure and proper connection of the coil to outside piping, while care in removing the water from the coils by an air pump or by filling it with oil under pressure will prevent water freezing in the pipes. As to the second difficulty, it has been found that the breaking up of the oil occurs only at high temperatures. A sample of oil subjected to 90 deg. C. formed a heavy deposit in two weeks. Further tests could not be made at the time, but from the one mentioned it is concluded that it is not advisable the transformer oil should exceed 70 deg. C.

In selecting insulators, aside from dielectric strength, the surface leakage should be such as to have under rain conditions a factor of safety three times the normal voltage. For voltages of 60,000 and over, however, this factor would have to be reduced to avoid the cost of very large insulators. Another point requiring consideration is the constitution of the local atmosphere, both natural and artificial. An insulator with a factor of safety of four for arcing over under a breakdown test will justify the expenditure for a more costly but safer insulator that minimizes breakdowns.

Mr. Delafield called for an insulator capable of successively carrying transmission potentials over 100,000 volts. As the pin type seems to have reached its limit, he asked that consideration be given to a suspended form. The latter would have the advantage that ample arcing distance could be provided without making the insulator top heavy and difficult to manufacture. It should be so designed that arcing cannot occur until the voltage is sufficient to rupture the air and cause the current to arc from end to end, this feature being of great importance where the insulators are mounted on steel towers.

ARMATURE WINDING STAND

An armature stand designed to take the place of the wooden buck and trestles commonly found in car barns and which embodies features of strength and convenience for winding and repairing armatures not possessed by the bucks and trestles is manufactured by the Device Improvement Company, of Hanover, Pa. It consists of two cast-iron standards mounted on angle steel sills, one standard bolted stationary to the sills, the other easily adjustable to armatures of various lengths. Each standard carries a hinged shelf which can be lowered out of the way when desired. The flaring bases of the standards provide small



ARMATURE WINDING STAND

lockers with doors in which the armature winder can store his tools, such as hammers, chisels, pliers, files, clips, tape, etc. The armature revolves on brass rollers, preventing any possibility of damage to the shaft and admitting easy rotation. The safety stops prevent the armature from accidentally getting off the bearings while being pushed around the shop.

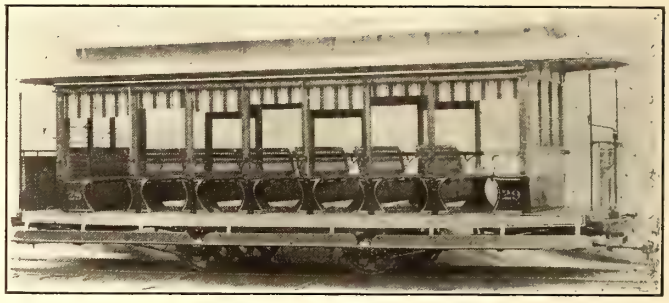
The stand is mounted on four large casters so that it may be placed under chain block or hoist, and the armature placed in position and easily moved by one man to any desired location. The shelves are strong enough to be used as seats when putting leads into the commutator, thus bringing the operator close to the work. In winding an armature the coils may be thrown over one shelf and the armature winder therefore has everything necessary for the operation within easy reach without changing his position, considerations that make for speed and low cost. An armature to be wound or repaired may, when it is ready, be moved to the banding machine for banding and need not touch the floor.

POLE REMOVALS IN MONTREAL

An interesting decision in favor of a street railway company in connection with pole removals was handed down recently by City Attorney Archambault, of Montreal. It concerned the laying of a track by the Montreal Street Railway Company on Papincan Avenue, in which iron poles were used for the overhead suspension. The Montreal Light, Heat & Power Company has a line of 2300-volt wires on this street, and the correspondence submitted to the road committee showed that the power company considered the placing of the iron poles near its line detrimental to public safety. The power company therefore asked the Montreal Street Railway Company to defray the cost of raising its wires. The street railway replied that as its poles had been placed there by the city officials, it was the city which was responsible for any extra expense in the matter. Mr. Archambault was also of that opinion and quoted a judgment of the Superior Court in support.

MOTOR AND TRAIL CARS FOR SERVICE BETWEEN LERDO AND TORREON, MEXICO

One of the first roads to be electrified in Mexico was the F. C. Electrico de Lerdo a Torreon. Lerdo and Torreon are about five miles apart and are situated on the borders of the States of Durango and Coahuila. The J. G. Brill Company and the American Car Company have furnished the entire rolling stock for the line, which consists of 20 ft. 8 in. closed cars, 8-bench open trail cars, 10-bench open motor cars (first and second class), 12-bench open "Narragansetts," and also combination cars of the "California" type. Repeat orders have been received for the 20 ft. 8 in. closed cars, trailers and "California" cars, which are the



MEXICAN TRAIL CAR

standard cars for the road. About two months ago the J. G. Brill Company shipped the third lot of 20 ft. 8 in. closed cars; also four 8-bench trailers and a number of gondola cars for trailer service, although both motor and trailer gondola types are operated. In the accompanying illustration may be seen one of the drop-sash closed cars (first class) and also an 8-bench trail car. The former cars measure 20 ft. 8 ins. over the end panels, 28 ft. 8 ins. over crown pieces and vestibules; width over sills, including panels, 7 ft. 4 ins.; size of side sills, 3½ ins. x 5⅜ ins.; end sills, 3½ ins. x 6⅝ ins. The cars are mounted



MEXICAN MOTOR CAR.

on the No. 21-E truck with 7 ft. 6 ins. wheel base; the motors used have a capacity of 40 hp each. The trailers measure 27 ft. ⅜ in. over the end panels, are 6 ft. 3 ins. wide over the sills and are mounted on gear trucks.

In connection with the contract recently placed by the Utah Railway & Light Company with the General Electric Company for motors, as noted in the Street Railway Journal of Sept. 14, it is learned that the Utah Company has placed a contract with the St. Louis Car Company for fifty steel cars. The new cars will be longer and wider than those now in service and have greater seating capacity. A feature of them will be a Detroit platform 6 ft. wide. The seats in the middle of the cars will be turnovers, while those at the ends will be longitudinal. The National Brake & Electric Company was awarded the contract for the brakes.

EXHIBITS AND AWARDS JURY AT JAMESTOWN

The jury of awards of the Jamestown Exposition, comprising about seventy-five members, chiefly university officials, government experts and men prominent in technical bodies, under the presidency of Dr. Albert Shaw and the vice-presidency of Ambrose Swasey, began its work last week. From this body and its departmental groups no appeal is permitted by the rules of award, but a superior jury has been constituted to take care of various difficult points that arise in such work. The whole week was devoted by the jury of awards to its task, and the present week will probably see the close of the work of its jury of review. It is understood that the awards will be announced in October. While the exposition is relatively small, it is in some respects very select, and the rules have aimed to limit the award of only one medal to any exhibitor in any given department. Hence the work of the jury has been of an unusually critical nature.

In the general group of machinery, electricity and transportation, J. M. Dodge was made chairman of the machinery and transportation section, and Dr. Carl Hering chairman of the electrical section. The department group for electricity comprised Dr. Carl Hering, Prof. B. V. Swenson, secretary of the American Street & Interurban Railway Association; T. C. Martin, editor "Electrical World," and C. T. Malcolmson, expert U. S. Fuel Testing Plant.

The jury of awards of the transportation group consisted of five members, three of whom were present, viz., Prof. B. V. Swenson, Prof. G. Lanza, of the Massachusetts Institute of Technology, and C. T. Malcolmson.

NEW CARS FOR TERRE HAUTE, INDIANAPOLIS & EASTERN AND CHICAGO, SOUTH BEND & NORTHERN INDIANA COMPANIES

The Cincinnati Car Company is delivering to the Terre Haute, Indianapolis & Eastern Traction Company and the Chicago, South Bend & Northern Indiana Traction Company the first of a lot of twenty-five cars, which are handsome examples of the interurban type of car for high speed on long runs and which combine all the features to be found in the most modern steam and electric coaches. The overall length of the cars is 64 ft. and the width 9 ft. 4 ins., admitting of ample room in the main passenger, smoking and baggage compartments, commodious seats with end arm rests and wide aisles. Some of the salient features in the cars are roomy, metal lined, cement floor toilet rooms, equipped with flush sanitary closets; nickelline wash basins, water coolers, etc.; Pullman type platform, steps and doors; Edwards trap door fixtures and rubber matting, Edwards bronze window fittings throughout, decorated art glass set in metal above the double windows. The interior finish is in Honduras mahogany.

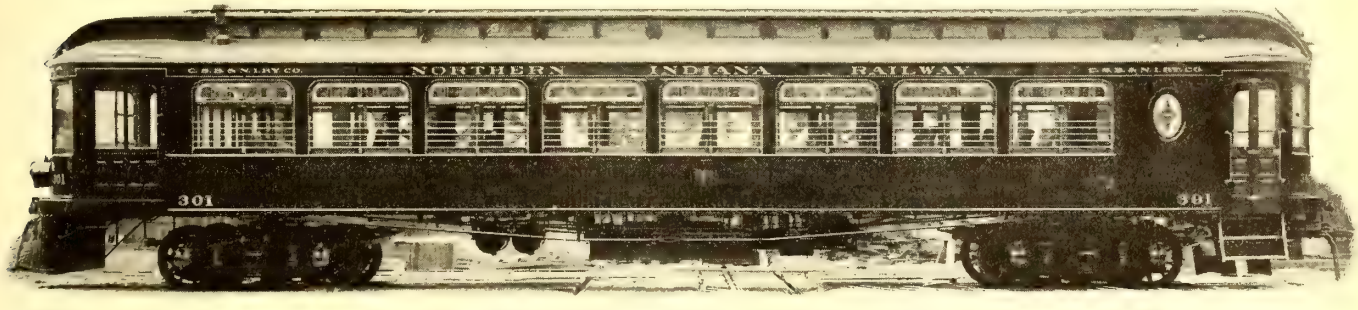
The coach bodies are carried on Baldwin heavy M. C. B. interurban trucks, having 7-in. axle at gear seat, 6-in. motor axle bearings, 5½ in. x 9 in. journals fitted with Symington boxes and 37¼-in. steel tired wheels. All the cars have been furnished with Westinghouse automatic air brakes



INTERIOR NORTHERN INDIANA RAILWAY CAR

with train connections, D-2 compressors and 14-in. brake cylinders, with American automatic slack adjusters.

Fifteen of the cars, which will be immediately put into through service between Terre Haute and Indianapolis, are equipped with four Westinghouse No. 121 90-hp motors with Westinghouse unit group switch control. Ten of the cars, for service between South Bend and Chicago, will be equipped with General Electric No. 73 motors with its latest style multiple unit control apparatus.



EXTERIOR NORTHERN INDIANA RAILWAY CAR

The Cincinnati Car Company is also shipping the present month five semi-convertible suburban cars to the Eastern Pennsylvania Railways Company at Pottsviile, Pa., five 30-ft. double-truck cars to the Consolidated Railways at New Haven, Conn., and three 55-ft. single compartment coaches to the Northern Electric Company, California.

FINANCIAL INTELLIGENCE

Wall Street, Sept. 18, 1907.

The Money Market

There has been no notable change in the monetary situation during the past week. The tone of the market has been easy, but rates for all classes of accommodation have ruled practically unchanged from those recently quoted. The demand for money at all the Western and Southern points continues active as a result of the preparations making for financing the grain and cotton crops, but in New York the inquiry for accommodation has fallen off considerably. Money has been offered here during the past week with more freedom, some of the large banking houses putting out considerable amounts on the basis of 6 per cent for six months. For the shorter maturities rates have eased off a trifle, sixty-day money being obtainable in quantity at 5¼ per cent, while money for four months was placed at 5¾ and 6 per cent. Present indications are that the market will rule easy for some time to come. It is understood that some of the large railroad companies are in the market as lenders of large amounts on time. Many of the railroads and other corporations contemplated large expenditures for betterments and improvements, but in some cases the plans have been abandoned entirely, while in others the expenditures have been materially reduced. The money which would have been expended on these improvements is now, it is said, being placed for short periods and on call. Corporate borrowing has practically ceased. The subscriptions to the $1,500,000 6 per cent notes offered by the American Light & Traction Company were closed on last Saturday and it is understood that a very large portion of the notes was taken by the shareholders. The balance of the issue was to be taken by the underwriting syndicate. The foreign exchange market continues to display a downward tendency, rates for sterling sustaining a further sharp decline under freer offerings of bills against cotton and grain shipments. Rates for sterling, however, are well above the gold import point, but the opinion prevails in foreign exchange circles that the inward movement of the yellow metal will be larger this year than usual. It is pointed out that during the present season the advances made to our bankers by Europe have been extremely small, which has placed local bankers in a much stronger position than has been the case for some time. The European money markets have improved considerably, rates for money at all of the principal financial centers showing further slight recessions.

The bank statement published on last Saturday was somewhat disappointing. Loans increased $375,000 and deposits decreased $1,632,600; cash decreased $861,800. The reserve required was $408,150 less than in the preceding week, which, deducted from the loss in cash, resulted in a decrease in the surplus reserve of $453,650. The surplus now stands at $6,918,700, compared with a surplus of $3,536,400 in the corresponding week of last year and a surplus of $4,635,300 in the corresponding week of 1905.

The Stock Market

The good feeling engendered in the stock market through the overwhelming success of the New York City bond sale and which was reflected in a considerable enhancement in security values, was completely obliterated during the past week. The copper situation was entirely responsible for this change in conditions. As is well known, copper metal prices have for several weeks been steadily declining from the fictitious figures that prevailed a few months since, which resulted in a complete deadlock between producers and consumers that even thus far has not been broken, notwithstanding that quotations are now almost 10 cents a pound under the high prices current earlier in the year. The climax was reached during the past week when it was announced that many of the largest copper mines would shut down in whole or in part and that several of the larger companies, chief among which was the Calumet & Hecla, had decided to curtail their dividends to stockholders. By some the decision temporarily to suspend mining operations was regarded as a good move, as it would afford the various companies an opportunity to work off their enormous supplies, but even at the reduced level of prices for lake and electrolytic, there was no apparent increase in the demand, and the feeling in the trade was that still further cuts would have to be made before buyers would come into the market in any quantity. All this very naturally had an extremely depressing influence on the shares of the entire copper group, with severe declines, accompanied by heavy liquidation, in Amalgamated, Smelters and Anaconda.

Relatively speaking, the general market ruled firm for a time, this having been especially true of the railway shares, but eventually all stocks gave way in sympathy with the fall in the "coppers," the industrials leading in the downward movement, which, however, was due more to bear selling than to any such liquidation as that which took place during the month of August. The reason for the heaviness in the industrial list is contained in the fact that fears are entertained that the decline in prices for copper metal may sooner or later lead to cuts in other commodities, especially iron and steel. While such a condition of affairs may arise, there is not at the present writing any evidence of a shading off in quotations on any of this country's leading manufactures, and thus far at least, all talk in that direction is nothing more or less than pure conjecture. However, the mere possibility of such an occurrence was sufficient to bring about sharp declines in many stocks in this category, the United States Steel issues being conspicuous cases in point.

As for conditions otherwise, they were such as would have ordinarily resulted in a continuance of the upward movement inaugurated during the closing days of last month. The Government crop reports indicated at least satisfactory yields of wheat, corn and cotton, monetary conditions improved somewhat, there were signs of a possible early beginning of gold importations and the railroads generally reported a large business, with a shortage of cars. Despite all these important considerations, the market sagged and at the close was heavy.

About the only noteworthy happening in connection with the local traction stocks during the week was the decision of Judge Hendrick denying the application of the Attorney-General of the State for permission to proceed against the Interborough-Metropolitan Company with a view to the annulment of its charter. Nevertheless the shares of that company, together with all others of a similar character, yielded more or less in sympathy with the declining tendency of the general stock market, even Brooklyn Rapid Transit receding several points in the face of prospective enormous earnings to result from the Mardi Gras festival now being conducted at Coney Island.

Philadelphia

Trading in the local traction shares developed large proportions during the past week, and price fluctuations were unusually violent. At the outset there was heavy selling of Philadelphia Rapid Transit which was accompanied by many rumors concerning the affairs of the company. For a time all stock offered was well taken, but later on, under heavy liquidation, the price yielded from 20 to 15½, the lowest price attained on the present downward movement. The decline was subsequently checked by a statement issued by President Parsons, of the company, in which the many rumors regarding the company were characterized as false. President Parsons also stated that the company has no floating indebtedness or overdue accounts and has cash in the bank to the amount of upward of $3,000,000, and that the cash balance of the company and the money to be secured on the next and last call will completely finance the company's requirements and complete all extensions and betterments under way. At the low level, excellent support was rendered, and on strong buying the price recovered to 19½, or nearly all of its early loss. Upward of 35,000 shares were traded in. The stocks of the Philadelphia Traction and Union Traction companies were sympathetically affected by the drop in Philadelphia Rapid Transit. From 90½ Philadelphia Traction declined to 87, but later recovered to 89, while Union Traction, after an extreme loss of 7 points to 45, moved up to 49½. Transactions in the latter stock aggregated 9000 shares. Otherwise trading was rather quiet, and while prices displayed heaviness, the net changes were for the most part confined to the fractions. Other transactions included Philadelphia Company common at 39 to 38, preferred at 41; American Railways at 46½ to 47½; Consolidated Traction of New Jersey at 66½ to 67½, and United Companies of New Jersey at 241 to 240.

Chicago

Trading in the local traction shares was extremely quiet and unimportant. Metropolitan Elevated rose from 21 to 22, while the preferred rose 2 points to 62 on the declaration of the usual dividend. Northwestern Elevated sold at 21, and Chicago & Oak Park common at 3⅛ to 3.

Certain interests in the Chicago Union Traction Company are trying to put through a modification of the plan that was

rejected by the Court and it is understood that the new plan calls for default on the bonds of the underlying companies of the Chicago Union Traction Company. Naturally the bondholders would be opposed to such a plan, and it therefore seems certain of failure. Another plan will be presented within the next month or two which will more fully protect, and it is believed, will meet with the approval of both stock and bondholders.

Other Traction Securities

The feature of the Boston market was the activity in Boston & Worcester which was attended with rather sharp fluctuations. At the opening the stock sold at 19, from which it ran off to 18, and later recovered to 18½. More than 1000 shares changed hands. Trading in the other issues was quiet and without noteworthy change in prices. Boston Elevated held firm at 130 and West End common and preferred brought 85 and 100½, respectively. Boston & Suburban sold at 14; Massachusetts Electric at 12½ to 12, and the preferred at 50 to 49½. The Baltimore market was extremely quiet but steady. United Railway 4s sold at 85 to 85½, the incomes at 51¾ and the funding 5s at 78¼. Other sales were Norfolk Railway & Light 5s at 95, Baltimore City Passenger 5s at 102 and Knoxville Traction 5s at 102½.

As a result of the cutting in two of the October dividend on the preferred stock of the New Orleans Railway & Light Company, the stock took a decided drop Sept. 11, falling 3½ points on the opening call and later going down again half a point, bringing the quotation to 54, compared with quotation of Sept. 10, of 59½—59.

Considerable activity was shown in traction securities on the Cleveland Stock Exchange the past week. The larger transactions were in Cleveland Electric, which showed a weakening over the price to which it advanced suddenly a few days ago. On Wednesday it dropped two points, 120 shares going at 50 and on Friday two 150-share lots were sold, one at 48 for immediate delivery, and the other at 49½, buyer sixty days. It closed Tuesday at 49 bid. On Wednesday ten shares of Aurora, Elgin & Chicago preferred went at 74, the price being unchanged, and a day or two later ninety shares were sold at the same figure. Common declined ½ to 31½ on Saturday. Forest City dropped to 97 on Thursday, but has held its own pretty well, considering the fact that political matters are assuming shape in the way of a proposed settlement of the street railway troubles. Washington, Baltimore & Annapolis pooling certificates have remained about 11 for the past few days.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Sept. 11	Sept. 18
American Railways	46½	47¼
Boston Elevated	129	129
Brooklyn Rapid Transit	45⅜	45¼
Chicago City	150	150
Chicago Union Traction (common) certificates	2⅞	—
Chicago Union Traction (preferred) certificates	—	—
Cleveland Electric	50	—
Consolidated Traction of New Jersey	67	67
Detroit United	64	62
Interborough-Metropolitan	8¾	9
Interborough-Metropolitan (preferred)	26	25½
International Traction (common)	—	—
International Traction (preferred), 4s	—	—
Manhattan Railway	117	114
Massachusetts Elec. Cos. (common)	12	12½
Massachusetts Elec. Cos. (preferred)	50	a49½
Metropolitan Elevated, Chicago (common)	21	21
Metropolitan Elevated, Chicago (preferred)	—	61
Metropolitan Street	37	41
North American	60	59½
North Jersey Street Railway	40	40
Philadelphia Company (common)	38½	38½
Philadelphia Rapid Transit	19¾	19⅜
Philadelphia Traction	91	89
Public Service Corporation certificates	65	65
Public Service Corporation 5 per cent notes	92	92
South Side Elevated (Chicago)	80	80
Third Avenue	50	50
Twin City, Minneapolis (common)	91	91
Union Traction (Philadelphia)	51¼	49¼

a Asked.

Iron and Steel

According to the "Iron Age" there is increasing interest in the pig iron market, particularly in the East. Some of the large iron makers have taken the lead in meeting the new conditions and have reached a basis upon which business is being done. This level is close to $18.75 delivered for basic pig and $20 delivered for No. 2 foundry. While it is acknowledged quite generally in the finished trade that a diminished tonnage must be expected during the winter, it looks as though prices will be kept steady at close to present levels by the large interests. Steel continues scarce.

REPORT OF THE PHILADELPHIA COMPANY FOR THE YEAR

At the annual meeting of the stockholders of the Philadelphia Rapid Transit Company, held Wednesday, Sept. 18, the annual report of the company was submitted. It showed a deficit on the year's operations of $364,048, compared with a surplus of $303,996 in the preceding twelve months. The gross earnings exceeded $18,000,000, the largest in the company's history. The earnings follow:

	1907.	1906.
Gross receipts	$18,095,503	$17,483,144
Operating expenses	10,046,487	9,153,603
Net earnings	$8,049,016	$8,329,541
Other incomes	196,577	193,103
Total income	$8,245,593	$8,522,644
Taxes and licenses	1,120,683	1,075,216
Balance	$7,124,910	$7,447,428
Fixed charges	7,488,958	7,143,431
Deficit	$364,048	*$303,997
Passengers carried	492,137,038	448,576,785

*Surplus.

Philadelphia Rapid Transit's general balance sheet as of June 30, compares as follows:

ASSETS.

	1907.	1906.
Cash	$379,521	$442,458
Fire insurance fund	850,000	850,000
Advances to leased lines	656,633	580,316
Supplies	1,255,248	746,859
Construction and equipment	29,159,320	19,863,238
Real estate	1,013,522	891,669
Accounts received	56,947	8,845
Sundry stocks	2,597,750	2,597,500
Franchise accounts	115,325	115,325
Total	$36,084,268	$26,096,210

LIABILITIES.

Capital stock	$20,882,140	$12,850,060
Accounts and notes due	183,463	490,955
Charges and taxes accrued	1,342,705	631,906
Open accounts	1,311,028	3,347,328
Profits and losses—surplus	1,074,912	1,063,960
Proceeds, sales of bonds of underlying companies	11,200,000	7,712,000
Package tickets	90,019	.....
Total	$36,084,268	$26,096,210

President Parsons in his report says:

"During the past twelve months there has been considerable criticism about the affairs of your company, much of it of a frenzied character. This in a great measure accounts for the large sums paid out in the settlement of claims, which during the past year amounted to $1,217,586, an increase of $236,266 over the previous year. Ten years ago 2½ per cent to 3 per cent took care of the accident account. To-day it is approaching 7 per cent, equivalent to a dividend of $2 a share upon the stock.

"This increase is due largely to a new enterprise which has grown up and which has been termed 'ambulance chasing.' The slightest accident is hunted up and reported by runners in the employ of lawyers of doubtful standing, many of whom are briefless except for this class of business, but who are most expert in preparing cases of this character in such a manner that they will meet the requirements of the law and catch the sympathy of the jury. There are many physicians in league with these lawyers, whose testimony is of such a nature as to exaggerate the injury and to show that any trouble the claimant may be suffering from might have been caused by the accident."

After the annual report had been read, Mr. Parsons addressed the meeting. He said among other things:

"For the past year our company has been the subject of much criticism. There has been a wave of unrest and socialistic clamor throughout the city. There has been no more fruitful subject for the demagogues or the theorists than to attack street railway companies. The city is in a turmoil over fares, yet during the last few years the average of fares has been reduced from 4 83-100 to 3 18-100 cents."

TRANSIT MATTERS IN NEW YORK—REPORT ON EAST RIVER SUBWAY

The Public Service Commission, on Monday, held the first of a series of hearings on the subject of increased service on certain lines. The New York City Company was requested to show cause why thirty additional cars should not be put on Madison Avenue south of 116th Street between 6 and 9 a. m., why twenty more cars should not be run south from 135th Street during the same hours, why the same additions to the service should not be made during the evening rush hours, and why other increases in the service both week days and Sundays should not be made.

Vice-President and General Manager Root, of the company, as a witness, said that the company found it impossible to live up to its present rush hour schedule, which called for 190 cars on the line, whereas 170 were about all that could be operated. He ascribed the entire trouble to what he called controlling points—places where it was impossible to get the full quota of cars past a given point, owing to the traffic conditions. These points were Grand Street and the Bowery, Twenty-Third Street and Fourth Avenue, and Forty-Second Street in front of the Grand Central. Between 5.15 and 6.15 o'clock in the evening, he said, the company tried to get 645 cars of all lines past Twenty-Third Street and Fourth Avenue, but it seldom succeeded in passing more than 550.

The hearing was then adjourned until Sept. 23 at 2 o'clock.

In connection with traction affairs in New York the startling statement was made on Sunday that President Shonts, of the Interborough-Metropolitan Company, had expressed the opinion that all tunnels and bridges should be operated by the city, and that Mr. Shonts had formally communicated with the Public Service Commission regarding the sale to the city of the Belmont tunnel under the East River to Long Island City. While nothing official regarding the matter was given out for publication by Mr. Shonts, the statement is now made on authority that the rumor has no foundation in fact.

Chief Engineer Rice, of the Public Service Commission, has submitted a report of the work being done on the Battery tunnel. He says the tunnel will probably be ready for the operation of trains within two months. Referring to the tubes of the East River tunnel, Mr. Rice said in his report:

"The tubes are practically complete and ready for track laying and the installation of the signal system, except for that section which runs from the middle of the river to the Brooklyn shore. The work on that section is being pushed with extraordinary rapidity; the reconstruction work is entirely finished, the piles are all in, and the lining has been made watertight already.

"The main work that now remains to be done before track laying consists in lining the roof and sides of the tunnel with reinforced concrete over the two sections where the bottom is in fine sand, and finishing the ventilating shaft in Brooklyn.

"The details of the interior work were not determined until after the contract had been let, as at that time the exact conditions which would be necessary for the proper operation of the road were not known.

"For over a year the engineers of the Rapid Transit Subway Construction Company were in consultation with the engineers of the Rapid Transit Board in perfecting the details for this particular work, and plans for the interior construction of the tubes had been carefully designed. These contemplated the building of a concrete lining over the entire length of the tunnel in the bottom, sides and top of the tubes.

"The section of the tunnel as originally designed was made large so in case of changes the operation of trains would not be seriously affected. Because of the methods pursued by the subcontractors the extent of the variation provided for was exceeded, and those portions of the tube in sand have been reconstructed in parts so that a clearance of 4 inches as a minimum can always be maintained throughout the work.

"I consider that the work has been well done, but, like all work where the conditions are questionable, the time for the completion has been extended beyond the contract time."

The effort of Borough President Coler, of Brooklyn, and other prominent citizens of that place, to have the Public Service Commission take up the subject of the Fourth Avenue subway to Coney Island, has resulted in a mass of protests against the building of the line from civic bodies and citizens' associations in other parts of the city who feel that a grave mistake was made in selecting the Fourth Avenue route. It is urged that a subway be built up Gates Avenue to Broadway and thence to Jamaica. The argument made is that this is a more densely populated district than the South Brooklyn territory and that South Brooklyn is not suffering near so much as the Eastern district from congestion.

FINANCING IMPROVEMENTS AT NEW ORLEANS—REDUCTION IN DIVIDEND.

At a meeting of the directors of the New Orleans Railway & Light Company Sept. 10, it was decided to cut the quarterly dividend of $1.25 per share on preferred stock in two, paying the share-holders only sixty-two and one-half cents, the half of the regular dividend to be devoted to betterment and improvement which represent additions to the company's property and an increase in its capital and investments.

The company's report for the seven months ending Aug. 1, 1907, shows:

Gross earnings	$3,532,903.25
Operating expenses	1,864,880.88
Net earnings	$1,668,022.37
Taxes, interest and fixed charges	1,170,471.60
Surplus	$497,550.77
The estimated amount of surplus for the month of August, 1907, based on 1906, is	16,000.00
Making a total surplus for the first eight months of 1907	$515,550.77

Of the above surplus $250,000 was paid in dividends on April 15, 1907, and July 15, 1907.

Between July 15, 1905, and Aug. 1, 1907, the company expended in betterment and improvements of its property $5,863,500.57, and has also spent $210,432 in the acquisition of additional stock of its constituent companies.

WORCESTER COMPANY SEEKS TO ISSUE ADDITIONAL BONDS

In asking the Massachusetts Railroad Commission for approval of an issue of additional bonds to the amount of $1,364,000 last week the Worcester Consolidated Street Railway Company, through President F. H. Dewey and Treasurer J. W. Lester, filed a balance sheet showing its condition June 30, as follows:

ASSETS.

Roadway and traction	$3,276,196.81	
Electric line	598,227.88	
Engineering	99,283.99	
Total cost of railway		$3,973,708.68
Cars and rolling stock	$695,599.97	
Electric equipment of same	702,382.56	
Horses and other property	160,036.80	
Total cost of equipment		$1,558,019.33
Power stations and machinery	$505,307.03	
Land and buildings	893,802.74	
Total cost of land and buildings		$1,399,109.77
Total permanent investment		$6,930,837.78
Cash	$29,205.50	
For collection	212,312.26	
		$241,517.76
Material for supplies		154,651.74
Total assets		$7,327,007.28

LIABILITIES.

Capital	$3,550,000.00
Funded debt	1,060,000.00
Loans and notes payable	2,286,000.00
Audited vouchers	138,581.54
Interest accrued	54,051.17
Taxes accrued	81,836.92
Profit and loss	156,537.65
Total	$7,327,007.28

Additions and improvements for which this issue is intended to meet the cost foot up $941,295, of which the Leominster, Sterling & Boylston line cost $618,938.96; track and roadway, $52,202.65; line, $73,210.95; land, $22,043; buildings, $52,577.15; car equipment, $54,252.47; electric equipment, $50,950.23; other equipments, $5,313.15; office furniture, $375; power-house and machinery, $6,278.87; telephones and signals, $2,409.30; state highway, $2,381.19.

There was no opposition at the hearing and the board took the case under advisement.

ABSTRACT OF STATISTICS OF RAILWAYS IN THE UNITED STATES FOR THE YEAR ENDING JUNE 30, 1906

Advance figures of railroad operation have just been made available, based on summaries in the Nineteenth Annual Statistical Report of the Interstate Commerce Commission, prepared by its statistician, as the complete report for the year ending June 30, 1906. This report contains tables showing details of mileage, capitalization, earnings and expenses by roads, and besides includes many summaries of statistics for the roads as a whole.

On June 30, 1906, the report shows that the total single-track railway mileage in the United States was 224,363.17 miles, or 6,262.13 miles more than at the end of the previous year. The operated mileage for which substantially complete returns were rendered to the Commission was 222,340.30 miles, including 7,865.97 miles of line used under trackage rights. The aggregate length of railway mileage, including tracks of all kinds, was 317,083.19 miles. This mileage was thus classified: Single track, 222,340.30 miles, as just mentioned; second track, 17,936.25 miles; third track, 1,766.07 miles; fourth track, 1,279.66 miles, and yard track and sidings, 73,760.91 miles. These figures indicate that there was an increase of 10,286.45 miles in the aggregate length of all tracks, of which 3,819.24 miles, or 37.13 per cent, represented the extension of yard track and sidings.

The number of railway corporations for which mileage is included in the report was 2,313. During the year railway companies owning 4,054.46 miles of line were reorganized, merged, or consolidated. The corresponding figure for the year 1905 was 3,802.02 miles.

The report shows that for the year ending June 30, 1906, the mileage of roads operated by receivers was 3,971.43 miles, or an increase of 3,175.61 miles as compared with 1905. The number of roads in the hands of receivers was 34.

On June 30, 1906, there were in the service of the carriers 51,672 locomotives, the increase being 3,315. These locomotives, excepting 1,090 were classified as: Passenger, 12,249; freight, 29,848, and switching, 8,485. The total number of cars of all classes was 1,958,912, or 116,041 more than for the year 1905. This rolling stock was thus assigned: Passenger service 42,262 cars; freight service, 1,837,914 cars, and company's service, 78,736 cars. These figures do not include cars owned by private commercial firms or corporations.

The reported number of persons on the pay rolls of the railways in the United States on June 30, 1906, was 1,521,355, which is equivalent to an average of 684 employees per 100 miles of line. These figures show an increase in the number of employees as compared with the year 1905, of 139,159, or 47 per 100 miles of line.

On June 30, 1906, the par value of the amount of railway capital outstanding was $14,570,421,478, which is equivalent to a capitalization of $67,936 per mile. Of this capital there existed as stock $6,803,760,093, of which $5,403,001,962 was common and $1,400,758,131 preferred; the remaining part, $7,766,661,385, represented funded debt, consisting of mortgage bonds, $6,266,770,962; miscellaneous obligations, $973,647,924; income bonds, $301,523,400; and equipment trust obligations, $224,719,099. Of the total capital stock outstanding $2,276,801,333, or 33.46 per cent, paid no dividends. The amount of dividends declared during the year was $272,795,974, being equivalent to 6.03 per cent on dividend-paying stock. For the year ending June 30, 1905, the amount of dividends declared was $237,964,482.

The report indicates that the number of passengers carried by the railways in the year ending June 30, 1906, was 799,507,838, this item being 60,673,171 more than for the year ending June 30, 1905. The passenger mileage, or the number of passengers carried 1 mile, was 25,175,480,383, the increase being 1,375,330,947 passenger miles.

The number of tons of freight shown as carried (including freight received from connections) was 1,631,374,219, which exceeds the tonnage of the year 1905 by 203,642,314 tons. The ton-mileage, or the number of tons carried 1 mile, was 215,877,551,241, the increase being 29,414,441,731 ton-miles. The number of tons carried 1 mile per mile of line was 982,401, indicating an increase in the density of freight traffic of 121,005 ton-miles per mile of line.

The average revenue per passenger per mile for the year ending June 30, 1906, was 2.002 cents. For the preceding year the average was 1.962 cents. The average revenue per ton per mile was 0.748 cent; the like average for the year 1905 was 0.766 cent. The earnings per train mile show an increase both for passenger and for freight trains. The figures show an increase in the average cost of running a train 1 mile. The ratio of operating expenses to earnings for the year 1906 was 66.08 per cent. For 1905 this ratio was 66.78 per cent.

The gross earnings of the railways in the United States from the operation of 222,340.30 miles of line were, for the year ending June 30, 1906, $2,325,765,167, being $243,282,761 greater than for the year 1905. Their operating expenses were $1,536,877,271 or $146,275,119 more than in 1905. The following figures present a statement of gross earnings in detail and show the increase of the several items over those of the previous year: Passenger revenue, $510,032,583—increase, $37,337,851; mail, $47,371,453—increase, $1,945,328; express, $51,010,930—increase, $5,861,775; other earnings from passenger service, $11,314,237—increase, $274,095; freight revenue, $1,640,386,655—increase, $189,613,817; other earnings from freight service, $5,645,222—increase, $564,956; other earnings from operation, including unclassified items, $60,004,087—increase, $7,684,939. Gross earnings from operation per mile of line averaged $10,460, the corresponding average for the year 1905 being $862 less.

The operating expenses assigned to the four general classes were: For maintenance of way and structures, $311,720,820; maintenance of equipment, $328,554,658; conducting transportation, $836,202,707; general expenses, $59,752,230; undistributed, $646,856. Operating expenses averaged $6,912 per mile of line, this average showing an increase of $503 per mile in comparison with the year 1905.

The income from operation or the net earnings of the railways amounted to $788,887,896. This amount exceeds the corresponding one for the previous year by $97,007,642. The net earnings per mile of line for 1906 averaged $3,548; for 1905, $3,189, and for 1904, $2,998. The amount of income attributable to other sources than operation was $256,639,591.

DECISION AGAINST TRENTON COMPANY IN PAVING SUIT

Justice Reed, of the Mercer County Branch of the New Jersey Supreme Court, handed down a decision Friday, Sept. 13, to the effect that the Trenton Street Railway Company must pay to the city of Trenton the sum of $45,290.15, with interest, the total amounting to $55,756.42, as its share of the cost of repaving certain streets within the city. The cause of the trouble dates back to Feb. 12, 1894, when the Board of Public Works, since defunct, granted to the Trenton Passenger Railway Company certain privileges, stipulating among other things that the company should pave and repave, when necessary, between the track or tracks and for a distance of 2 ft. on each side of a single track, and 3 ft. each side of a double track. The Trenton Passenger Railway Company was, in turn, succeeded by the Trenton Street Railway Company.

In 1902 and 1903 ordinances were passed for the repaving of a number of streets, and the paving of certain other streets, with asphaltum or vitrified brick, depending upon the locality, and a part of this cost was assessed against the Trenton Street Railway Company, after it had been notified to perform the work and failed to do so. It was held by the railway company that the Act of 1898, assessing such parts of the cost upon abutting property owners as they might be benefitted, abrogated the effect of the ordinance of 1894, but Justice Reed denied that this was so.

The defense of the street railway company that it was not allowed to do its share of the work, on its own account, was dismissed by the justice with the statement that the company failed to do such work, after it had notice that it was to be done, and further, that such action upon the part of the city worked no hardship to the company inasmuch as the city only assessed a proportionate share of the cost for the whole area of the streets covered, whereas that portion occupied by the railway tracks undoubtedly cost more than the rest owing to car traffic and the special features associated with it. It would be neither reasonable nor feasible, Justice Reed said, to repave that portion of the street not affecting the street railway company and leaving the balance pending legal settlement of the case. In view of this he refused to reduce the amount asked for by the city.

The Trenton Street Railway being the original company to operate cars on Trenton's streets is most affected by repaving plans.

THE CLEVELAND SITUATION

The suits of the Cleveland Electric Railway Company against the Forest City Railway Company to prevent its using portions of the tracks of the old company have been on trial in Common Pleas Court the past week before Judge Lawrence. The main point sought to be made is that Mayor Tom L. Johnson was financially interested in the Forest City Railway Company at the time most of the grants were made to it. To this end the evidence has mostly been regarding the transfer of shares of stock and the guaranteeing of contracts made for material. If it can be established that the Mayor guaranteed orders and furnished money on stock that was eventually turned over to some one else, the attorneys for the Cleveland Electric believe that they will be able to show an interest that will invalidate all rights granted the company originally and that will make the curative ordinance passed on Aug. 3 void.

Congressman Theodore E. Burton, who was nominated for Mayor by the Republicans of Cleveland a few days ago, has announced that he will take a square stand on the traction issue. As proof of his sincerity in the matter, he has asked both President Horace Andrews of the Cleveland Electric and A. B. DuPont of the Municipal Traction Company to call upon him and discuss the matter either together or separately, and afterward to furnish their views and all the information possible in writing. Mr. Burton wants full information as to rates of fare in the zone plan, as proposed by the new companies, and the general fare of seven tickets for a quarter, to apply to the entire territory. With this before him, he expects to map out a plan and plank for his campaign, but he still adheres to his original declaration that the campaign must not be allied with any corporation and that the final settlement, if he is elected, will be made fair to the people and all concerned.

A resolution was adopted by the City Council at its session last week, directing that the Cleveland Electric Railway Company place in the hands of H. J. Davies and A. B. DuPont all the data relative to the operation of the Central Avenue and Quincy Street lines between Jan. 14 and April 23. It seems that the Council is not satisfied with the report on the receipts from these lines, as made by these gentlemen some time ago, and is planning to secure further information. It is questionable whether the subject will receive much more attention from the company, as it submitted its books to the committee when the first investigation of the matter was made.

MEETING OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

The first regular fall meeting of the Central Electric Railway Association will be held at Columbus, Ohio, Sept. 26. The program, which is now being prepared, will include the report of the standardization committee and two papers—one, "The Single-Phase System," by George D. Nichols, electric engineer of the Indianapolis & Cincinnati Traction Company, and the other "One Thousand Two Hundred Volt System of Operating Electric Trains," by a representative of the Westinghouse Company. A good attendance is anticipated, as a special invitation has been extended to the officers of Michigan, Illinois and Kentucky companies.

THE CLEVELAND & SHARON RAILWAY COMPANY

Francis B. Morgan, president of the Cleveland & Sharon Electric Railway Company, Cleveland, Ohio, states that the bonds have all been underwritten. The road will be built directly out of Cleveland and will pass through Burton, Middlefield, Mesopotamia, North Bloomfield, Greensburg, Gustavus, Kinsman, Vernon, Weldon, Brookfield, Orangeville and terminate at Sharon. Here connections will be made for other towns over roads that are already in operation, and it is believed that finally a through route between Cleveland and Pittsburg will be formed through mergers or connections. The track will be laid with 80-lb. steel rails and for the freight trains it has been decided to use locomotives. It is believed that a 2-hour express schedule between Cleveland and Sharon can be maintained without trouble. With three-mile turnouts, the road will be practically double-tracked and there will be no necessity for delaying cars. The power house and plant will entail a cost of about $475,000, and the generating equipment will probably be furnished by the General Electric Company.

B. R. T. SEEKS TO RAISE FUNDS FOR FOUR TRACKING "L"

The Brooklyn Rapid Transit Company proposes to raise $20,000,000 to be spent in improving its elevated lines, the most important new work in contemplation being the building of a third and fourth track in some instances. To this end the company has applied in the name of the Brooklyn Union Elevated Railroad to the Public Service Commission to issue a mortgage for $20,000,000, and a hearing was held regarding the matter last week. Of the total new issue proposed, some $7,000,000 will go to reimburse the Brooklyn Rapid Transit Company for money it has advanced the Brooklyn Union Elevated Company. Mr. Williams, for the company, last Thursday said it was the intention of the company to apply to the commission for permission to extend its Flatbush Avenue lines to the Manhattan Bridge, and made the following statement in regard to the extensions and improvements contemplated by the company:

"Our plans for the Flatbush Avenue extension to the Manhattan Bridge are nearly ready and will be submitted to the commission probably within a week. If that extension is approved plans for third and fourth tracks on certain other sections of the system will also soon be submitted to the commission. If the Flatbush Avenue extension should not be approved, the third and fourth tracks would be useless. We believe these improvements, however, are vitally important in relieving Brooklyn's traffic conditions."

William S. Menden, general superintendent and chief engineer, testified in detail as to the cost of the proposed improvements and expenditures.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED SEPT. 3, 1907.

864,794. Car Fender; Carl Meyer, Toledo, Ohio. App. filed May 29, 1907. Provides means for causing the forward end of the fender to recede and descend when struck by an object and means for automatically returning the forward end to elevated position when the object is removed.

864,808. System for Railroad Trains; Eli D. Small, Little Rock, Ark. App. filed Feb. 15, 1906. An office car through which the passengers pass to other cars of the train after paying their fares.

864,848. Pivoted Car Step; Robert M. Lamb, Woodbine, Ga. App. filed Dec. 24, 1906. Details of a supplemental car step pivoted under the regular step and adapted to be swung back and fastened when not in use.

864,866. Automatic Train-Stop; Hiram G. Sedgwick, Mill Valley, Cal. App. filed Nov. 28, 1906. The track rails are constructed with long and with intermediate short insulated sections, and special contact plates are also employed engaged by a brush or shoe on the train. This arrangement closes the circuits for operating the train-stop relay magnets.

864,867. Compound Railway Rail; Alonzo E. Smith, New York, N. Y. App. filed Oct. 10, 1906. The web of the rail comprises a slot to receive a lug depending from the tread, whereby the tread may be removed and replaced.

864,870. Railway; Herbert L. Stillman, West Acton, Mass. App. filed Dec. 26, 1906. Relates to improvements in railways adapted for light cars having rubber tires or a combination tire of rubber and metal, and consists of an inverted channel rail, the depending members of which are embedded in the cross-tie. The tread of the rail has transverse furrows.

864,879. Automatic Switch Mechanism; Carroll M. Bell, and August Dykstra, Goodland, Ind. App. filed June 26, 1907. Mechanism for effecting the closing of a switch in case it be left open by accident. Consists of a stub shaft operatively connected with the switch rails and provided with a tappet, an operating shaft having terminal fingers for engagement with the tappet and a track device for rotating the operating device to effect the closing of the switch.

864,895. Rail Joint; Carl C. Jantzen, Hood River, Ore. App. filed April 11, 1907. A triangular plate is dovetailed in diagonal grooves in the thread of the abutting rails.

864,912. Jointed Trolley Pole; Harry Padley, Elyria, Ohio. App. filed June 1, 1906. The pole is hinged substantially at its middle and the hinged members are constructed each with an

abutting face at an inclination to a right angle whereby the trolley pole will bend when the car backs against an obstruction, thereby avoiding breakage.

864,961. Automatic Electric Gong-Ringing Device for Street Cars; Nathan Fallek and George F. Wolfe, Denver, Col. App. filed April 22, 1907. Provides means for automatically and continuously ringing the gong when a car is standing still, unless the motorman holds the crank handle against the stop post of the controller.

864,963. Mechanism for Moving and Locking Railway or Like Points; Luis de M. G. Ferreira, London, England. App. filed May 16, 1907. Details of construction.

865,013. Railway Block-Signal System; Winthrop M. Chapman, Needham, Mass. App. filed Jan. 24, 1906. Relates to the arrangement of the apparatus, circuits and contacts whereby the signals cannot be improperly actuated under abnormal conditions.

865,035. Switchback Apparatus; Cyril J. Hartley, Stone, and Robert Hodges Bishop, Islington, England. App. filed May 21, 1907. A wheel of cam-like contour having a track on its periphery, the car being held stationary while the wheel is rotated thereunder.

865,087. Car Mover; James R. Doty, Knoxville, Tenn. App. filed March 28, 1907. Details of construction.

865,163. Railway Switch; Joseph A. Cappock, Pinehurst, Ga. App. filed June 11, 1907. The track when the switch is open is continuous as to both rails, and the points are so constructed as to lift the wheels to cause the flanges thereof to clear the main tracks when the train is taking the switch.

865,169. Signal: Charles R. Dowler, Denver, Col. App. filed Sept. 12, 1906. Indicates dangerous conditions to a railroad comprising a weight buried in an embankment and connected to a semaphore apparatus whereby the semaphore will be displayed when the embankment is washed away and the weight allowed to fall.

865,210. Air Brake Apparatus; William T. Robinson, James W. Neighbours and Wilbourn O. Pierce, Pulaski, Va. App. filed June 10, 1907. A main reservoir, an air pump therefor, a brake valve in communication with the reservoir, a train pipe leading from the brake valve, and pipes extending from the main reservoir for the conduct of air therefrom in opposite directions.

865,227. Rail Joint; Joseph F. Bastel, St. Louis, Mo. App. filed May 3, 1907. Comprises a rail chair for inclosing the meeting ends of the rails, said chair having notches in the flange portions thereof, transverse braces provided with recesses to accommodate the rails and the chair, said braces engaging the notches in the chair and notches in the base flanges of the rails.

865,258. Car Fender; Henry M. Lambert, Portland, Ore. App. filed May 31, 1907. Two fenders or catchers are provided, one behind the other, for fore fender being particularly adapted to catch a standing person and the latter a person lying on the track.

865,287. Safety Appliance for Railroad Cars; James T. Andrew, Montgomery, Ala. App. filed March 18, 1907. Means carried by the trucks for automatically lifting and applying braking action in case of accident, said means including spring-supported shoes and anti-friction rollers located near each end of the shoes.

865,317. Railroad Crossing; John E. Reese, Louisville, Ky. App. filed Feb. 1, 1907. Intersecting track rails, each embodying a movable section divided to comprise end to end separable members, and means for simultaneously shifting the members of opposite sections into and out of position, including a double set of toggle levers.

865,323. Trolley; Leslie S. Wilder, Northampton, Mass. App. filed Jan. 10, 1906. Flaring arms spring-mounted upon a U-shaped frame which is in turn mounted on the axle of the trolley wheel. The arms are yieldable downward and laterally in passing hangers, etc.

UNITED STATES PATENTS ISSUED SEPT. 10, 1907.

865,375. Collapsible Step; Charles E. Frye, Laconia, N. H. App. filed June 20, 1907. A step for attachment to the corner of a car whereby the conductor can mount to the roof. Folds upwardly and inwardly when not in use.

865,412. Attachment for Electric Motor Controllers; Albert H. Mathewson, Thompsonville, Conn. App. filed March 28, 1907. A mechanical arrangement for the handle of a motor controller, including inclined blades and balls which co-operate therewith to insure a momentary stoppage at the notches of the controller when the current is being turned on.

865,456. Passenger Street Car; William S. Twining, Philadelphia, Pa. App. filed June 24, 1907. Details of construction.

865,474. Trolley; Joseph Ashurst, Chicago, Ill. App. filed March 25, 1907. The trolley consists of a pair of vertically mounted rolls with flanges at their lower ends to receive the conductor.

865,501. Motor Truck; William F. Kiesel, Jr., Altoona, Pa. App. filed March 25, 1907. Relates to method of hanging the motor frames upon the trucks of electric railway cars, and consists in so constructing the truck and arranging the "noses" of the motor frames that the points of support shall be directly under the center line of the center-plate.

865,500. Steel Railway Car; William F. Kiesel, Jr., Altoona, Pa. App. filed Feb. 23, 1907. Details of construction.

865,552. Automatic Switch Apparatus; Reginald H. Wentworth, Santa Monica, Cal. App. filed March 20, 1907. Means whereby a track switch is thrown from a moving train.

865,730. Controlling System for Railways; Max Trautmann, Dresden, Germany. App. filed March 21, 1907. A series of conductors divided into two groups and corresponding to the number of passing trains, which conductors lead from the line to indicators and are put in circuit by suitable line contacts operated by the passing trains at the place to be controlled.

865,742. Railway Switch and Automatic Signal Apparatus; Thomas Wolfe, Kansas City, Mo. App. filed Feb. 19, 1907. Signal operating mechanism consisting of two pair of cylinders and pistons, pipeways connecting one pair of cylinders with the other pair, connections between the pistons of each pair of cylinders, and a non-compressive fluid in each pipeway adapted for transmitting movement from one piston of each pair to the companion piston of the other pair of cylinders.

865,770. Rail Joint; Augustus Doratella, Steelton, Pa. App. filed June 6, 1907. The tread of each rail comprises a tongue and recess adapted to interlock. No fish plates are used.

865,781. Electric Railway Signaling Device; Edward B. Howell, Butte, Mont. App. filed June 25, 1906. System whereby signals are automatically produced in two trains when they approach each other within a predetermined distance. Has special trolleys with circuit connections to the train.

865,848. Automatic Signaling Apparatus; James E. Anderson, Ames, Neb. App. filed May 20, 1907. A pair of longitudinal rails or shoes are mounted on top of the locomotive for contact with depending plates above the track.

865,866. Block Signal; Pierre I. Chandeysson, St. Louis, Mo. App. filed Dec. 23, 1905. A three-position semaphore arm operated by an electric motor having a magnetic clutch to control the positions of such semaphore arm.

865,879. Electric Contact Rail; Ed. W. Farnham, Chicago, Ill. App. filed July 17, 1905. A U-shaped third-rail from which current is taken from the under side and having a cable inclosed therein.

865,882. Combination Amusement Vehicle and Boat; John E. Garrette, Indianapolis, Ind. App. filed March 24, 1906. An amusement vehicle and boat comprising a conveyance made to imitate a passenger car adapted to move and provide with suitable attachments adapted to be shifted into positions to represent a boat.

PERSONAL MENTION

MR. FRANCIS DUNCAN BRIGHT, for nine years president of the Railway World Publishing Company, of Philadelphia, is dead.

MR. THEODORE H. BAILEY, who has been with the General Electric Company for the past twenty years as assistant general manager, has gone to St. Louis to take charge of the automobile department of the St. Louis Car Company.

MR. A. J. McCLURE has been appointed storekeeper for the New London lines of the Consolidated Railway Company of Connecticut, succeeding Mr. Charles B. James. Mr. McClure is a graduate of Princeton, of the class of 1906.

MR. FRANKLIN D. SHERWOOD, vice-president of the Hornellsville Electric Street Railway, of Hornellsville, N. Y., is dead. Mr. Sherwood was prominent in business affairs in Hornellsville and vicinity, and was well known throughout the state on account of his active participation in the affairs of the Republican party.

MR. W. S. TOWNSEND, master mechanic of the East Liverpool Traction & Light Company, of East Liverpool, Ohio, has been appointed as a member of the Standardization Committee of the Central Electric Railway Association to succeed Mr. W. H. Evans, formerly of Indianapolis, who now is with the International Traction Company of Buffalo, N. Y.

MR. H. C. WARREN, superintendent of the Toledo, Port Clinton & Lakeside Railway, has resigned to accept a similar position with the Toledo & Indiana. It is understood that Mr. Warren will take up the duties performed by Mr. E. Darrow, whose resignation was presented a few days ago. Mr. Warren was formerly with the Wheeling & Lake Erie and later with the Toledo & Indiana, so in making the change he goes to work that is familiar to him.

MR. FRANK B. BATCHELDER has been appointed acting superintendent of motive power of the United Railways & Electric Company of Baltimore, Md., having charge of the operation of the power plant and sub-stations. Mr. Batchelder is peculiarly well fitted for this position on account of his long experience, first as chief clerk and later as assistant to the superintendent of motive power and machinery of the Boston Elevated Railway Company, of Boston, Mass. Mr. Batchelder resigned from the Boston company last January and came to Baltimore as assistant to Mr. Chas. F. Baker, superintendent of power and construction for Mr. L. B. Stillwell, consulting engineer, of New York, who has the contract for the reconstruction and operation of the plants for the United Railway Company.

MR. JAS. L. RICHARDS, president of the subsidiary companies of the Massachusetts Gas Companies, has been chosen president of the subsidiary companies of the Boston Suburban Electric Companies, to succeed Mr. Samuel L. Powers, who has resigned to devote all his time to the practice of law. Mr. Powers was president of the subsidiary companies only a short time, succeeding Mr. Adams D. Claflin, who resigned to give his whole attention to the Claflin estate. Mr. Claflin continues as president of the Boston Suburban Electric Companies, which is the holding company. The Boston & Suburban system includes the Newton Street Railway, the Lexington & Boston, the Newton & Boston, and all the electric railways which touch Waltham. The Boston & Suburban is a voluntary association, the subsidiary companies retaining their individual corporations.

MR. W. D. YOUNG has resigned as electrical engineer of the Baltimore & Ohio Railroad and Mr. Lucius T. Gibbs has been appointed as his successor. Mr. Gibbs was born in New York in 1869. He served an apprenticeship in the machine shop of the Otis Elevator Company and was assistant to the mechanical engineer of the Chicago, Milwaukee & St. Paul Railway. He graduated at Cornell University in 1891 and was afterward made electrical engineer of the Milwaukee Electric Railway & Light Company. He was also vice-president and chief engineer of the Gibbs Electric Company of Milwaukee. During the Spanish-American War Mr. Gibbs was assistant engineer on board the Newark and was afterward transferred to the Brooklyn. After the war he resigned from the navy and went to New York, where he was engaged in various capacities as consulting engineer and with the Westinghouse Company. Mr. Gibbs is a brother of Mr. George Gibbs, Chief Engineer of Electric Traction of the Pennsylvania Railroad.

MR. E. DARROW has resigned as general manager and chief engineer of the Toledo & Indiana Railway Company to accept a position as expert engineer with a syndicate of New York and St. Louis bankers, with headquarters in New York. The new field offers an opportunity for the exercise of engineering knowledge and experience in the broadest sense and the selection of Mr. Darrow is a compliment to his ability in that direction. Graduating from the engineering department of the University of Michigan in 1892, Mr. Darrow soon became general superintendent of the Edison Company at Cincinnati. He served six years in this position, after which he became constructing engineer of the Cincinnati & Columbus Traction Company and the Cincinnati, Newport & Covington Railway Company, serving four years in this capacity. The next three years were spent as chief engineer of the Toledo, Bowling Green & Findlay Railway, during which the entire roadbed was reconstructed and brought up to its present degree of excellence. Two years ago Mr. Darrow took the position from which he has just resigned, and under his management the physical condition of the property has been brought to the standard of the best interurban roads in the country. As announced elsewhere in these columns, Mr. Darrow's old duties will be taken up by Mr. H. C. Warren.

MR. F. J. STOUT, general manager of the Lake Shore Electric Railway Company, died in the Toledo Hospital, Toledo, Ohio, Saturday, Sept. 14. Mr. Stout was operated on about a month ago, and was improving when complications set in. For the past two weeks he was in a precarious condition. Mr. Stout was born at Deerfield, Mich, and began his railroad career when fifteen years of age as a brakeman on the Toledo-Elkhart division of the Lake Shore & Michigan Southern. Within a few years he became a freight conductor and then was promoted to passenger conductor, then train master and finally yard master of the division, with headquarters in Toledo. This latter position he retained until 1893, when he became superintendent of the Wheeling & Lake Erie Railroad, with offices in Toledo. The headquarters were later moved to Norwalk and then to Massillon, where the division terminals were moved. This position Mr. Stout retained until the road went into the hands of a receiver, when he became general superintendent, reporting directly to the receiver. In the summer and fall of 1896 Mr. Stout, as superintendent of the road, spent most of his time in Canton looking after the crowds that went to that city during the campaign of President McKinley. In 1900 he resigned the superintendency of the Wheeling & Lake Erie to become general manager of the Toledo, Fremont & Norwalk Electric Railway. Two years later, when the line was acquired by the Everett-Moore syndicate, he was made general superintendent of the Lake Shore Electric System under General Manager Danforth. In April, 1903, he was made general manager, with headquarters at Norwalk. Mr. Stout is said to have been the first man to apply steam railroad methods to the operation of electric roads. His work has always been of the highest character and he was looked upon as an authority in the management of electric railway systems. The funeral took place at the late residence of the deceased in Norwalk on Tuesday. Officials of the company from the office in Cleveland went to Norwalk in a special car. The body was sent to Detroit for burial. Mr. Stout leaves a widow.

MR. CHARLES N. BLACK, who since January, 1905, has been general manager and chief engineer of the Metropolitan Street Railway Company of Kansas City, Mo., has just been appointed vice-president and general manager of the United Railroads of San Francisco, succeeding to the duties of the late Mr. Geo. F. Chapman. Mr. Black's connection with the Kansas City company dates from the time when as chief engineer for Ford, Bacon & Davis, of New York, the reconstruction of the system was entrusted to him. This work was finished in September, 1903, and Mr. Black was induced to continue with the company as its chief engineer. Two years later he was appointed manager in 1905, when Mr. Bernard Corrigan, president and general manager, relinquished the latter office duties. Mr. Black is by profession an electrical engineer. Princeton is his alma mater. In 1888 he was graduated with the degree A. B., and two years later secured the degree E. E. He was subsequently connected with the Brush Electric Company, the Short Electric Railway Company and the Walker Company. Mr. Black will assume his new duties Sept. 23.



MR. CHARLES N. BLACK.

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DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1907 *to date* 319,850 *copies, an average of* 8,201 *copies per week.*

The New York State Convention

The quarterly meeting of the Street Railway Association of the State of New York, held in Kingston on Sept. 21, demonstrated anew the substantial progress which can be accomplished when a meeting gives its attention to two or three subjects. Those who are familiar with the good work this organization is achieving may well wonder why every electric railway company in New York has not joined the body. All the more credit then is due to those who recognize its value and give it their hearty support.

Elsewhere in this issue appears an extended report of the meeting, from which it will be seen that the principal result accomplished was the adoption of a standard code of rules for interurban railway service. Although these rules are based on those of the American Railway Association, the New York society did not overlook those differences peculiar to electric service. The operation of cars under a combination of steam railroad and electric street railway conditions, as is the case on electric interurban railways, is a unique development and required an immense amount of thought so that regulations should be devised to meet every class of interurban transportation.

A happy feature of the meeting was the attendance of two representatives of the Public Service Commission, who followed the proceedings with the greatest interest. Whatever their opinions may have been before the meeting, the points brought out in the very active discussion on rules must have convinced them how anxious the railway companies are to give good and safe service. It is to be hoped that these and other members of the Commission will attend future meetings and lend their aid to the solution of important traction problems.

The discussion on fare collection showed that the ideal system of securing fares remains to be discovered. It would seem, however, that the less the money paid on the train the less danger from loss. Hence, Mr. Frankel's suggestion that ticket stations should be established wherever feasible is one that deserves attention. Some of the delegates recited their experiences with different patented registering and duplex devices, but the association has wisely refrained from making such details public, as it does not follow that the results on one line necessarily will be duplicated on another, and such disclosures might injure many manufacturers who are honestly striving to improve their devices in co-operation with those who are using them.

That many companies are still in the dark regarding the actual results from handling freight and express is apparent from the diverse opinions expressed in the papers and discussion. It must be admitted that the early electric railway companies which entered this field made many errors, but no pioneers ever yet found sign boards and macadamized roads in a virgin forest. The great differences between trunk line steam and interurban electric freight practice on one hand, and of interurban old line company express practice on the other hand have been discovered through costly experience. The conditions must be very favorable indeed, if an electric railway company can handle a dozen carloads of freight at the same rate and profit as a steam railroad company which will haul a thousand cars in the same

period. A slavish following of the steam classification has often prevented the electric railway company making rates which are justified by its quicker service. It would also appear that it is usually better to leave the wagon deliveries in connection with an electric express service to a local truckman. The load factor is just as important in the profit of a delivery service as of a power station. An arrangement such as here suggested would make it unnecessary to keep equipment idle and eliminate the trouble of looking after something not in keeping with electric railroading. The advertising value of the wagon service need not be impaired, as it is quite customary nowadays to see wagons carrying one firm's name making deliveries for a dozen others beside.

No doubt these and many other points of the freight and express business will be threshed out thoroughly by the committee which President Wilson will appoint to consider this subject. It is to be hoped that the members will be given every facility for securing the necessary data, to the end that this branch of electric railway service may be placed on a secure footing.

Steam or Electric Locomotives?

We abstract this week an interesting paper by Mr. Toltz on the possibilities of traction with improved types of locomotives and the resulting discussion at the New York Railroad Club. Mr. Toltz has no grudge against electric locomotives, but he holds and very properly that in making comparisons of cost between steam and electric traction the former should be credited, like the latter, with its reasonable possibilities. A somewhat ideal electric traction based on extensions and improvements on present practice ought not to be set over against steam working that is clearly and demonstrably inferior to that which could readily be introduced at moderate expense. This attitude was taken by certain of the other steam railroad operators present and is certainly fair in the discussion of relative economy, since the gain claimed for electric locomotives is the result of computation rather than experience and is based on averages for steam traction derived from ordinary, rather than selected data. To a certain extent Mr. Toltz's paper is critical of the late paper on electric traction by Stillwell and Putnam, and antagonistic to the adoption of electricity, and this fact brought a number of prominent electrical engineers to their feet to defend electrical operation. Mr. Toltz explained, however, that his main purpose was to demonstrate the possibilities for economy of which the steam locomotive is capable, and claimed that future comparisons should be based upon this reduced power cost, to be effected by the use of superheaters, feed-water heaters and other economical devices of proven desirability.

Taking up then the performance of steam locomotives, Mr. Toltz reckons the average consumption of coal per hp-hour in locomotives to be about 4½ lbs. on the basis of average steam consumption and evaporation. This figure is certainly as low as the facts of present practice will warrant and indeed most tests of ordinary locomotives on actual runs have tended to still higher values. On the other hand, the St. Louis tests, under the most favorable conditions, with improved locomotives, showed a coal consumption below 2½ lbs. per hp-hour. Let us look at the facts of the case to see where locomotive economy really stands. The locomotive, so far as the engine is concerned, is in most cases a simple steam engine of large capacity and high piston speed, having a rather rudimentary form of valve gear and employing nearly saturated steam at, however, a good stiff working pressure. Its capacity, speed, and pressure help its economy while crude admission of saturated steam is an adverse factor as in any engine. The net result is that the steam economy is fairly good, between 25 lbs. and 30 lbs. per hp-hour. This is about what is obtained with simple Corliss engines of the older types, the locomotive gaining enough from its high pressure to compensate at least in large part for its rudimentary valve gear. Of course the locomotive, like any other engine, has its most economical cut-off point, and to this corresponds the load and speed of maximum economy which Mr. Toltz points out as a rather neglected factor in railroad economics. His analysis of this matter will bear close reading since it so directly affects the quality of the service, which has been too often neglected.

Now the steps in the improvement of ordinary locomotives considered merely as engines are tolerably obvious and work with stationary plants has been carried so far that one can tell with reasonable certainty what the effect of improvements will be. Unfortunately the lines of greatest progress in stationary engines, condensation and multiple expansions cannot easily be followed in locomotives. Plain compounding and superheating are practically available and were they generally employed would make a very considerable change for the better in locomotive steam consumption. Compound locomotives have been in limited use abroad for years and have been tried somewhat in this country. The result has been to show an economy for the compound engines still using saturated steam of approximately 15 to 20 per cent. This is about what should be expected from compounding without condensation. As regards superheating there are fewer data available. For a long time designers of power stations pretty uniformly discouraged any considerable superheating, possibly because its adoption would compel variations in steam engine standards. It is only since the coming of the steam turbine that the advantages of superheating have come to the front. But the results abroad have shown that it is quite easy to gain as much from reasonable superheating as from simple compounding. The tests on the Canadian Pacific quoted by Mr. Toltz are very much to the point in proving the effectiveness of superheating. The simple locomotive so operated beat out a compound locomotive by about 12 per cent.

There is, however, another side to the matter. The boiler of a locomotive is operated under conditions which are decidedly strenuous. It has to be forced at times beyond all reason and has to contend with condensation to a very serious degree. It has to work with forced draft and with difficult conditions of firing, so that its average performance is much worse than that of a stationary boiler. From Mr. Toltz's showing its practical evaporation is only about 6 lbs. of water per pound of coal, while under ideal conditions, as in the St. Louis tests the boiler would give fully 10 lbs. instead of 6. Although by compounding and superheating less serious demand would be made on the boiler, it still

has to work under bad conditions. Practically both compounding and superheating have been only moderately successful thus far. Railway men naturally look askance at any sort of added complication, and on Mr. Toltz's own showing the superheaters thus far tried have been rather prolific of trouble, although economical in fuel. We cannot see how the addition of the superheater would reduce the repair figures—in spite of the Canadian Pacific figures quoted on this point. Either the superheated locomotives must have been exempt from some repairs or the ordinary locomotives have been the victims of extraordinary and unexplained troubles. It seems to us that in spite of the good gains in fuel that can be made there is every reason to expect very material increase of repairs and renewals when compounding and superheaters are resorted to, and while these features ought to be introduced to a far greater extent than now, we see small hope of bringing the average fuel consumption anywhere near the figure of the St. Louis tests without paying heavily for the gain elsewhere. In other words, Mr. Toltz seems to us to have taken a rather roseate view of the situation, considering the practical difficulties which most steam engineers believe to stand in the way of the refinements which might be applied readily to locomotives were they not under the inconvenient necessity of running upon track.

Increasing Demand for Results of Scientific Research

There is an increasing demand for reliable scientific data on matters pertaining to the technical side of electric railway operation. The industry is growing so rapidly that the supply to this demand is far from being adequate. The larger manufacturing companies of course conduct research work along the lines in which they are interested. But this work is prosecuted at considerable expense and is a part of the conduct of the company's business, so that while some of this information appears in printed form, the greater part of the results of these investigations are not usually made public. We must look in large part, therefore, to outside interests to carry on systematic scientific research, notably either to the Government or to the technical institutions of the country. The work of the former in forestry, agriculture, mining and other branches of industry has of course been very creditable, but as yet little or nothing has been attempted in the field of electric transportation, if we except questions relating to the values of different kinds of fuel and the preservation in various ways of wooden ties and poles. On the other hand, it is not altogether feasible for our technical institutions to do all that should be done in this direction, even within certain limits, owing to the heavy demands upon them to carry on the work of teaching, the small compensation paid to the professors for their services often necessitating their assumption of outside commercial employment, and the lack of funds necessary for special apparatus.

This condition has existed for many years, but particularly in our eastern states. In the Middle West some noteworthy attempts have been made at co-operation between the universities and the different State governments in the investigation of traction matters, and at the time of the St. Louis Exposition exceedingly valuable results were accomplished in the study of electric traction data under the direction of the management of that enterprise. The effect of these spasmodic though fruitful efforts in the direction of solving electric railway problems emphasizes strongly the possibilities which can be secured through systematic work.

The opportunities for research in traction matters are omnipresent, and in cities like New York, Chicago and Boston are practically unlimited. The sphere of investigation should not be confined to a few theoretical subjects, but should include extended tests of all kinds, covering those pertaining to train movement, studies of trucks, brakes, energy consumption of cars, electrical characteristics of rails, bending moments of poles, transmission losses, energy values of fuels, ways of improving operating features, protective devices, electrolytic corrosion and numerous other subjects. Where funds are provided for carrying on such investigations their expenditure should not be hampered with "red tape."

The rapid commercial advance of Germany during the past four or five decades is attributed largely, by those who have made a study of this development, to the encouragement given to independent research of this character. This phase of the subject has recently been discussed in an interesting way by J. McKien Cattell, professor of psychology at Columbia University, in a pamphlet entitled "A Statistical Study of American Men of Science," in which he considers the study of 1000 scientific men in this country, of which number 126 were from foreign countries. In comparing the conditions here and abroad, Professor Cattell states that one chemical firm in Germany employs 300 doctors of philosophy to carry on scientific investigations. Research work in that country has been advanced immensely by the universities, which in turn have been greatly benefited by the commercial aspect given to their laboratory work. The professorships there are given as a reward for successful investigation as well as for teaching, and there is a tendency to permit certain professors to engage almost exclusively in research. A parallel is found in this country in the astronomical observatories of Harvard, Chicago and California universities, which are purely research institutions. Further steps in this direction have been taken in the endowment of such bodies as the Carnegie Institution and the Rockefeller Institute. Professor Cattell, however, considers the most logical advance to be in the conduct of research work by the Government. He thinks that if the Government proposes to control the monopolies, it should conduct studies of the kind indicated not for the benefit of a single individual, but for that of the people as a whole.

The subject is an important one, and whether the suggestions briefly referred to above are the best or not they call attention to a topic which is of vital interest to the industrial growth of the nation. Perhaps the most immediate assistance can be secured from our technical institutions by whom most creditable work, although on a limited scale, is now being done. Let this be broadened by the assistance where possible of the manufacturers and railway companies through the loan of apparatus and become better known by publication of the results in the technical press or before engineering societies. It might even be possible for the street railway and electrical associations of the country to effect arrangements with certain institutions by which the latter would undertake to carry on through each scholastic year work along definite lines laid down in advance.

THE EVANSVILLE & EASTERN TRACTION SYSTEM

The Evansville & Eastern Electric Railway, which was put into operation June 10 last, has the distinction of being one of the very few electric lines in the country which does not parallel a steam railroad.

The road proper extends a distance of 21 miles from Newburg, Ind., which has a population of about 1500 people, to Rockport, having about 3500 inhabitants, with a 3-mile spur north to Richland. However, traffic arrangements have been made with the Evansville Suburban & Newburg Railroad whereby cars are operated into Evansville over the tracks of the latter company.



A LONG TANGENT ON THE EVANSVILLE & EASTERN TRACTION SYSTEM

The road passes through a rich farming country. Corn is raised on the river bottom farms on one side, while the land to the north is devoted to wheat raising. Wheat which took one of the first prizes at the Chicago World's Fair was cultivated on land near the line in Warrick County.

Heretofore, farmers of the region traversed have been compelled to haul their grain distances up to 10 miles to Rockport, Boonville and Newburg. Those near the river made shipments by way of unreliable river boats. Practically all these shipments from the territory 6 miles from the line are now being carried over it. Before the road was completed the farmers made such insistent demands that arrangements were made to haul car-load lots of grain by means of the construction locomotive and about two hundred car loads were hauled.

The road, it may be seen, is practically a farmers' line, and the greater portion of the receipts will no doubt be derived from the farmers. There is, however, considerable through passenger traffic between Evansville and Rockport. The steam-road route between the two cities is 51 miles long as against 31 by the electric line. The time over the steam road is not to be considered, since very unreliable connections are made at Rockport Junction. During the first month's operation of the road an investigation showed that only five through steam-road tickets had been sold between Rockport and Evansville, and in three instances business along the line compelled the purchasers to take this route.

Owensboro, Ky., a city of about 15,000 people, located on the Ohio River, 8 miles below Rockport,, is also served by the line through boats which make connections with trains at Rockport. Other than the terminals the only towns on the main line are Yankeetown and Hatfield, with about 400 people each. Eureka, with probably 600 people, lies about 1 mile south of the line, and Richland, on the spur already referred to, has a population of about 800 inhabitants.

TRACK AND ROADWAY

All of the route, but particularly the western portion, is extremely picturesque. For about two miles after leaving Newburg the track is laid over bluffs on the bank of the Ohio River. The road then crosses behind the hills and passes over Cypress Creek on truss steel construction 115 ft. long. The only other steel structure on the line is that over Pigeon Creek, which is 130 ft. in length. Both rest on concrete abutments. Near Yankeetown the tracks are carried over a ravine on a wood trestle which will probably be displaced later by a fill.

The heaviest grading was necessary near Yankeetown where some 22-ft. cuts were made. East of Yankeetown the country is comparatively level. All cuts were made 22 ft. wide at the bottom and fills are 14 ft. at the top.

The track is laid with 70-lb. rails on oak ties, obtained largely from the neighboring country. The entire road was bonded with brazed bonds, the work being done by the Electric Railway Improvement Company, of Cleveland, Ohio.



TRESTLE OVER A RAVINE NEAR YANKEETOWN

Sidings vary in length from 100 to 300 ft. and are located at about 3-mile intervals. All passing sidings are

double end; others are stub end. The sidings were placed more frequently than otherwise to provide for the simultaneous operation of freight trains and passenger cars.

Throughout its length the road is ballasted with gravel taken from the bed of the Ohio River, just above Newburg. The gravel was dug up and loaded into barges by a dredge boat, and a tug towed the barges down the river to a coal-mine incline, which extends over the tracks of the electric line. The coal-mine engines were used to pull small cars of gravel up the incline, and these cars were dumped, either directly into the ballast cars or into a hopper underneath the incline. The gravel is almost entirely free from sand and makes an excellent roadbed.

As the road was built partly for freight traffic, heavy grades were eliminated wherever possible. There is, however, one short grade of 2.4 per cent near Yankeetown.

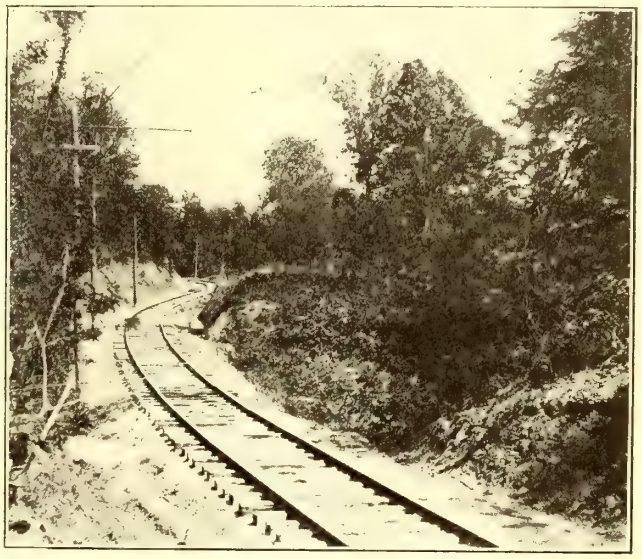
OVERHEAD CONSTRUCTION

The trolley poles, which are of chestnut, 30 ft. and 35 ft. long, are spaced 100 ft. apart on tangents and as close as 75 ft. on curves. The poles are always placed on the outside of curves and are braced, either by deadmen, as shown in one of the accompanying illustrations, or by guy anchors. As no high-tension wires are carried on the poles, unnecessary height of poles was avoided by using a tubular steel bracket braced on the under side. A single trolley of No. 000 round wire is used. Telephone wires and feeders are carried on a cross-arm just below the bracket. Shaw non-arcing lightning arresters grounded to steel rods are placed three to the mile. All of the overhead material with the exception of the lightning arresters was furnished by the Ohio Brass Company.

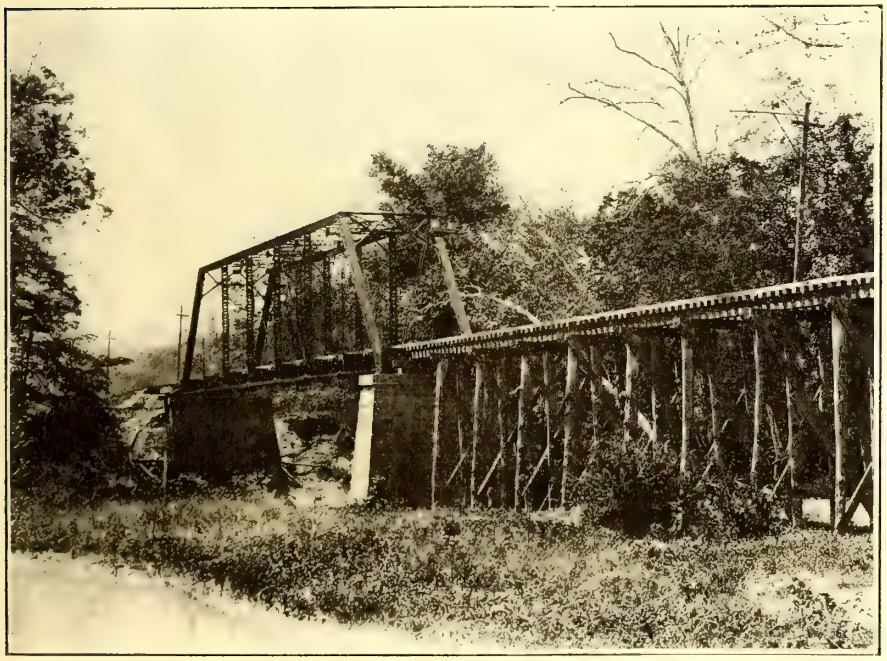
POWER STATION AND FEEDER SYSTEM

The power station is located about midway of the length of the line, at Hartfield. It is a brick structure, divided into a boiler and engine room by a transverse wall. The boiler room contains two 300-hp B. & W. boilers served by one steel stack. In the engine room are installed two 375-kw units each, consisting of a Westinghouse compound non-condensing engine and a Westinghouse 600-volt generator. The switchboard is of Western Electric Company manufacture and consists of two generator and two feeder panels. Water for the boilers is obtained from wells sunk near the power house, and coal is hauled in the company's cars from mines at Newburg.

A 500,000 circ. mil feeder leaves the power house in each direction. The feeders continue at this size to points 5 miles from the station where they are reduced in size to 350,000 circ. mil. These smaller feeders are carried to within 1 mile of the ends of the line.



A PICTURESQUE SPOT ON THE EVANSVILLE & EASTERN TRACTION SYSTEM



ONE OF THE TWO STEEL BRIDGES ON THE EVANSVILLE TRACTION SYSTEM

REPAIR SHOPS

A brick repair shop adjacent to the power house at Hatfield contains three storage tracks and space along one wall for the installation of requisite machinery.

CAR EQUIPMENT

The road is equipped with five passenger cars built by the American Car Company. The cars are 46 ft. long over all, 9 ft. wide and seat forty-eight people. The inside finish is dark oak. All are built with a small baggage compartment at one end and are intended for double-end operation. They are equipped with four Westinghouse 101-J motors of 50 hp each, and these are mounted on 21 E-1 Brill trucks. K-14 controllers are used. The cars are provided with Westinghouse Traction Brake Company straight air brakes, and Peter Smith hot-water heaters. They are painted a Big Four yellow, which color has been adopted by the company as a standard and is being used wherever possible.

Package freight is hauled in an express car of practically the same dimensions as the passenger cars.

For handling heavy freight a steam locomotive and twelve standard steam-road freight cars are employed.

Passenger cars are operated between Evansville and Rockport on an hourly schedule. The run requires 1 hour and 20 minutes and three cars are employed. The express car makes two round trips per day.

At Rockport an agent is employed who gives all of his time to the company. In the other towns the agent is employed on a commission basis. Tickets are sold at approximately 2 cents per mile. An extra charge of 25 cents per piece is made for baggage.

The operating offices, which are now located in Evansville, will ultimately be moved to Hatfield.

The road was constructed and partially financed by the Tennis Company, of Cincinnati, with C. H. Battin as engineer in charge. The officers of the Evansville & Eastern Traction Company are: W. H. McCurdy, president; W. L. Sonntag, vice-president; M. S. Sonntag, secretary and treasurer; C. H. Battin, general manager, and F. C. Storton, superintendent.

This company and the Evansville & Mt. Vernon Electric Railway are held and are operated by the Evansville Railways Company.

TRAFFIC

Including the two terminal towns the population along the line, it is safe to say, is not more than 400 per mile, taken 2½ miles back on each side of the track. In the Northern portion of Indiana very few lines have been built through territories not showing a population of twice or three times as great. However, in estimating the possible earnings of the Evansville & Eastern Traction Company it must be remembered that the territory is entirely dependent on the line both for passenger and freight service, and that this exclusive territory extends back from the line in some places as great a distance as 6 miles. Moreover, it must be remembered that Evansville, though not on the line proper, must, under the present operating conditions, be regarded as a terminal.

During the first few months operation the receipts have been such as to justify the belief that in electric railway construction there has been too great a tendency to parallel already existing steam lines, rather than to push out through thickly settled farming country, remote from steam roads.

FIRST ELECTRIC EXPRESS TRAIN FROM INDIANAPOLIS

The first express train out of Indianapolis, Ind., operated by the U. S. Express Company, was run between Indianapolis and Lafayette Sept. 17. At Lafayette the express was transferred to the Ft. Wayne & Wabash Valley car to be taken north to Ft. Wayne and intermediate points. A movement is on foot by the United States Express Company to obtain the right to operate on all traction lines out of Indianapolis.

MEXICAN CONSOLIDATION ANNOUNCED

It is announced that control of the Puebla (Mex.) Tramway, Light & Power Company has been purchased by a syndicate in London, England, of which Sir Weetman Pearson is head. The transaction, it is said, involves the consolidation of the Anglo-Mexican Electric Company, Limited, with the Puebla Company. The same interests are identified with the Mexican Light & Power Company.

THE CHICAGO PAY-AS-YOU-ENTER CAR

President T. E. Mitten, of the Chicago City Railway, has submitted to Mayor Busse, of Chicago, a report dealing in detail with the operation of the 300 pay-as-you-enter cars to be installed, beginning next week. The car is of the Montreal standard design, which was described in the Street Railway Journal of Sept. 16, 1905, except that the cross seats have been widened, the heating and ventilating methods improved and certain safety devices have been introduced. The car body is 32 ft. 5 ins., the length over all 45 ft. 9 ins., inside width 8 ft. 2½ ins., outside width over all 9 ft. There are seven pairs of transverse seats



"TAKE NEXT CAR, PLEASE," SHOWING CONDUCTOR'S POSITION WHEN HIS CAR IS LOADED TO AGREED MAXIMUM

and longitudinal corner seats, each for four passengers, making the total seating capacity forty-four. Although the platforms were built to make possible the use of the Minneapolis folding gate (which is closed by the motorman before starting), Mr. Mitten does not consider it sufficiently flexible for Chicago conditions. The Continental system of no seat no fare is also considered impracticable. Platform accidents in 1906 amounted to about 30 per cent of the total number of casualties.

The method of operating the pay-as-you-enter car will be as follows:

Large platforms are used at either end of the car, the arrangement being such that the car may be operated in either direction. The rear platform is supplied with two doors, one nearest the platform step for exit only, and one at the inner side of platform for entrance only. From the body of the car to the front platform one door gives exit only, and upon the front platform only is smoking allowed. Thus smokers are accommodated and at the same time objectionable smoking or expectoration is eliminated in the passageways or on platforms traversed by non-smokers. Passengers are permitted to alight from the front platform, but not to enter, the closing of the door being controlled, through the use of a lever, by the motorman. This eliminates a very numerous class of accidents caused by passengers attempting to board moving cars by the front entrance and falling beneath the wheels.

In entering the car all passengers will pass the conductor, who is stationed on the rear platform in the space provided between the exit and entrance doors. The entrance part of the rear portion of the rear platform, which is barred off from the exit passage, will hold as many as twenty persons, so that there need be no delay even at busy corners, although no fare passenger enters the door of the

car without having first paid fare to the conductor, who is provided with every facility for making change rapidly. The conductor being on the rear platform at all times, and with the divided entrance, cannot only control the overloading of the car, but is never out of sight of the car step, and thus has no excuse for giving the go-ahead signal while persons are boarding or alighting therefrom.

Under the terms of the settlement ordinance the company is required to "increase as rapidly as possible the number of double truck cars . . . until there shall be in operation . . . at least 800 such cars." Five hundred and five double truck cars are now in operation and 300 additional are for delivery during October and November.

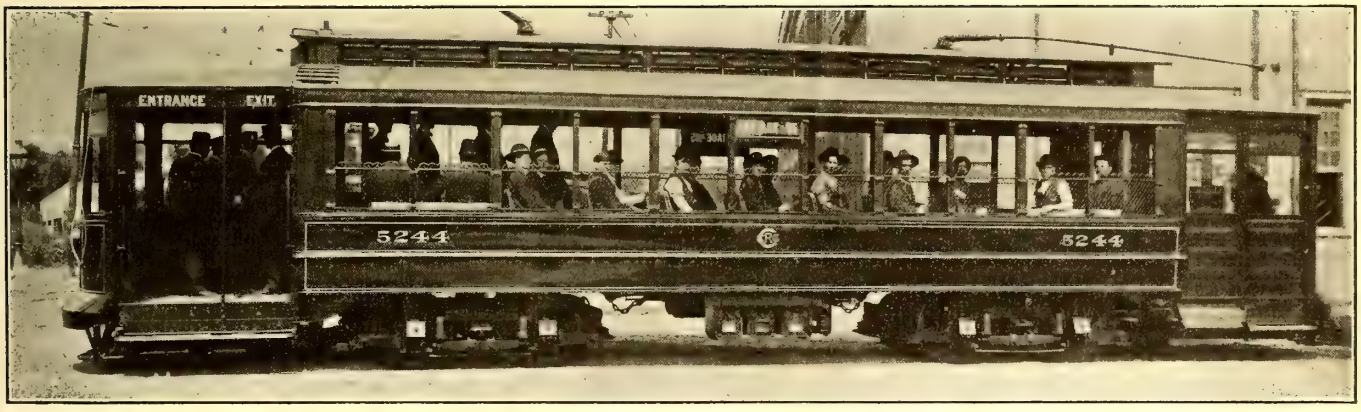
As the "pay-as-you-enter" car can be readily adapted to the present method of fare collection, the 300 cars now under contract have been so designed as to permit of the trying out of that feature as an experiment, with the idea of either adopting the plan as a whole or of later making such changes as may be found necessary to fit the Chicago conditions. All of the standard 1905 and 1906 cars can be readily adapted to this "pay-as-you-enter" feature, as it means simply the lengthening of platforms and the rearrangement of doors.

As arranged, there is a certain flexibility to the Chicago plan, so that in case of extreme rush the conductor might, at the outset, allow passengers to go into the car rather than create a blockade, thereafter following into the car, collecting the fares and returning to his post. Mr. Mitten is quite satisfied, however, that eventually all the fares will be collected from passengers before entering the car. The rear platform will be at all times kept clear, except when car is fully loaded, when conductor will step to the edge of the platform notifying prospective passengers to "Take next car, please."

Each conductor will be supplied with a change carrier containing $25 in change. The published rates of fare which appear in cars are as follows:

RATES OF FARE—CITY ORDINANCE.

Passengers twelve (12) years of age or over, five (5) cents. Children under twelve (12) years of age, three (3) cents. For two children under twelve (12) years of age, when accompanied by an adult, five (5) cents will be accepted. Children under seven (7) years of age, accompanied by a person paying full fare, will be permitted to ride free. Children under seven (7) years of age, not accompanied by a person paying full fare, will be charged three (3) cents fare. Conductors are not required to furnish passengers with change for bills of a larger denomination than two (2) dollars.



CHICAGO PAY-AS-YOU-ENTER CAR IN SERVICE

PROGRESS ON THE BALTIMORE & ANNAPOLIS SHORT LINE

Interests identified with the work of electrifying the Baltimore & Annapolis Short Line Railroad report that about 80 per cent of the work has been completed. The line which is being electrified is part single and part double-track road, extending from Baltimore to Annapolis, a distance of about twenty-five miles. The northern terminus of the Short Line tracks is at Clifford Junction, about four miles from Baltimore, and from this point the trains have been operated over the South Baltimore branch of the Baltimore & Ohio Railroad. In order to extend the tracks of the Short Line to the city it has been necessary to move over 200,000 yards of earth for a distance of about two miles. In preparation for the electrification, new 80-lb. steel rails are being laid over the entire road. All curves possible are being eliminated, others are being reduced, easements being used on all curves of more than two degrees.

The cars will be of high-speed, interurban type with inclosed vestibules. They will be finished inside in mahogany. The express cars will seat between fifty and sixty persons. The local cars will be equipped with baggage and express compartments, and both classes of cars will also have smoking compartments. The cars are being built by the Southern Car Company.

Each of the cars of the company will be equipped with four 100-hp alternating-current motors, and will be capable of attaining a maximum speed of fifty-five miles an hour. They will be equipped with the Westinghouse electro-pneumatic multiple unit control system. The trucks are being especially constructed for this road by the American Locomotive Company, and are designed for the heavy requirements of the high-speed service contemplated.

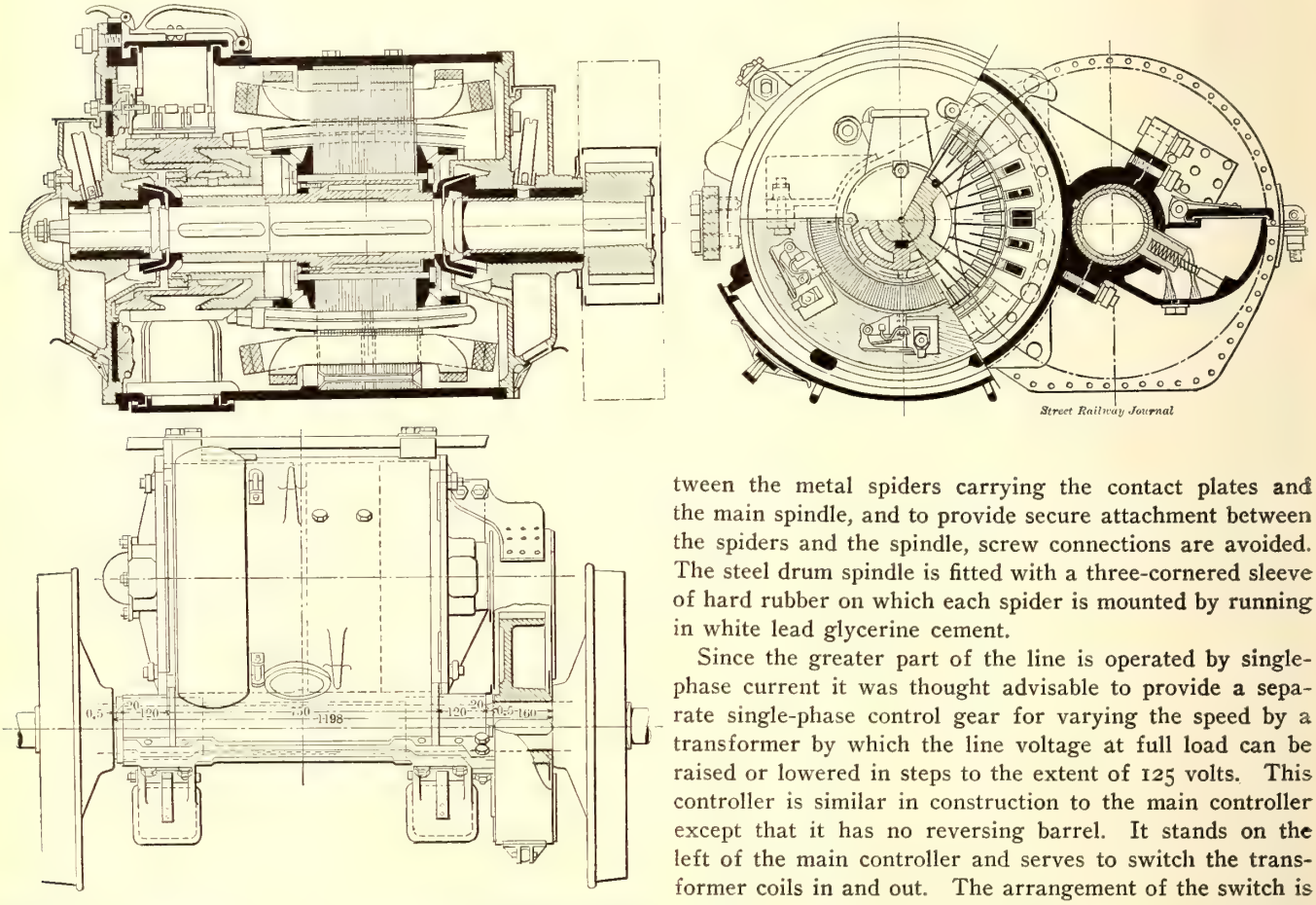
Power will be supplied by the Consolidated Gas Electric Light & Power Company from its Westport powerhouse, and the current will be fed to the trolley at 6600 volts and 25 cycles. The transmission voltage will be 22,000. There will be only one sub-station, at Jones' Station, nineteen miles from Baltimore and six miles from Annapolis. This building will be constructed of brick and concrete, and will be about 15 ft. by 45 ft.

All of this work is being carried out under the joint supervision of J. G. White & Company, of New York, through their representative, Waldo H. Sawin and Dr. J. B. Whitehead, associate professor of applied electricity at the Johns Hopkins University, as consulting engineer.

COMBINATION DIRECT-CURRENT AND SINGLE-PHASE EQUIPMENT FOR THE VIENNA-BADEN RAILWAY

The Vienna-Baden Railway is one of the latest single-phase interurban lines operated on the Continent. As part of the route in Vienna and Voeslau is over city lines using direct current, the motors are arranged for service on either circuit. Overhead construction is used throughout, which condition required a special design of the current collectors as there are three bridges where the trolley wire is less than 16 ft. above the rails.

The fourteen motor cars are each equipped with four 40-hp single-phase commutating motors with single reduction gearing. In addition to the magnet and compensating windings, the motors have another commutation winding for reducing sparking at the brushes. No resistances are inserted between the commutator and armature windings.



SECTION AND ELEVATION OF ONE OF THE VIENNA-BADEN RAILWAY'S SINGLE-PHASE MOTORS (DIMENSIONS IN MM.)

The motors have long commutators and sets of three brushes 10 mm (.4 in.) thick. The bearings are constructed for oil lubrication. Characteristic operating curves for direct and alternating current are given in two of the accompanying cuts.

The control is of the series parallel type, the motors being permanently connected in two groups of two in series each. The motors are designed to haul a train of one motor car and two trailers weighing sixty-two tons at a speed of twenty-four miles an hour on a 7 per cent grade with 250 volts a. c. at the motor terminals; with 300 volts a. c., the speed is over thirty-seven miles an hour on a 3½ per cent grade. Over the 500-volt d. c. lines the motors will propel a train at about ten miles an hour on a 15 per cent grade when all the motors are in series.

The controller has eight running steps, four series and four parallel, with six braking steps. Owing to the use of two kinds of current and also to the large amounts of power sent through the controller, a solenoid blow-out coil is used by which the arcs are blown out parallel to the arc shield and away from the controller barrels. This results in a very small wear of the sparking contacts and the spark gaps can be so reduced as to keep down appreciably the size of the controller.

To avoid damage to the contacts when switching off the short-circuit brake, the circuit is not broken in the usual way, but the excitation of the motor is short-circuited. To prevent unnecessary heating of the magnetic blow-out coil the controller connections have been arranged so that the coil is switched off at the same time that the last resistance is disconnected. To prevent leakage, or short circuits, between the metal spiders carrying the contact plates and the main spindle, and to provide secure attachment between the spiders and the spindle, screw connections are avoided. The steel drum spindle is fitted with a three-cornered sleeve of hard rubber on which each spider is mounted by running in white lead glycerine cement.

Since the greater part of the line is operated by single-phase current it was thought advisable to provide a separate single-phase control gear for varying the speed by a transformer by which the line voltage at full load can be raised or lowered in steps to the extent of 125 volts. This controller is similar in construction to the main controller except that it has no reversing barrel. It stands on the left of the main controller and serves to switch the transformer coils in and out. The arrangement of the switch is similar to that of a battery switch, the change from one coil to the next being made by an auxiliary resistance which prevents the short-circuiting of any coil, though the main circuit is never broken. Severe sparking at the contacts is thus avoided.

The handles of the switches are only removable in the "off" position, and only one set is provided per car. The transformer controller is interlocked with the main controller and when it is in the "off" position the transformer is entirely disconnected from the circuit. When working with direct current the main controller alone is used and the transformer controller remains in its "off" position. To insure that this should be so the spindle of the transformer controller is always locked when direct current is in use or when the current supply fails. When alternating current is being used a small electromagnet connected in

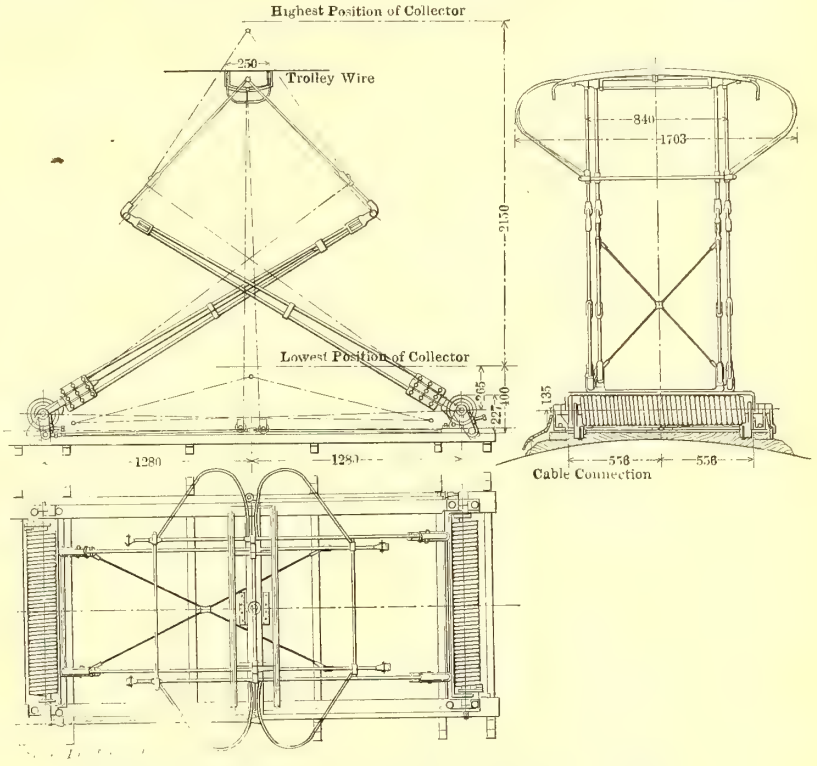
the secondary circuit of a small auto-transformer withdraws the lock and leaves the spindle free. The small auto-transformer is placed under the platform, and has a primary winding of sufficient resistance to prevent excessive current flowing in it when the car is using direct current. Similarly the main controller is locked so that when working with direct current (or when current fails) it cannot be turned beyond the full series position. This prevents the possibility of running at too high a speed within city limits. The alternating current relay magnets of the main controller and transformer controller are connected in the same circuit, so that only one auto-transformer is required for supplying them.

The transformer used for controlling the speed of the motors on the single-phase section of the line is constructed as an auto-transformer. It is hung under the middle of the car floor supported in a cast-iron frame. The coils and their terminals can be removed without taking the transformer from the car by opening the sheet-iron cover.

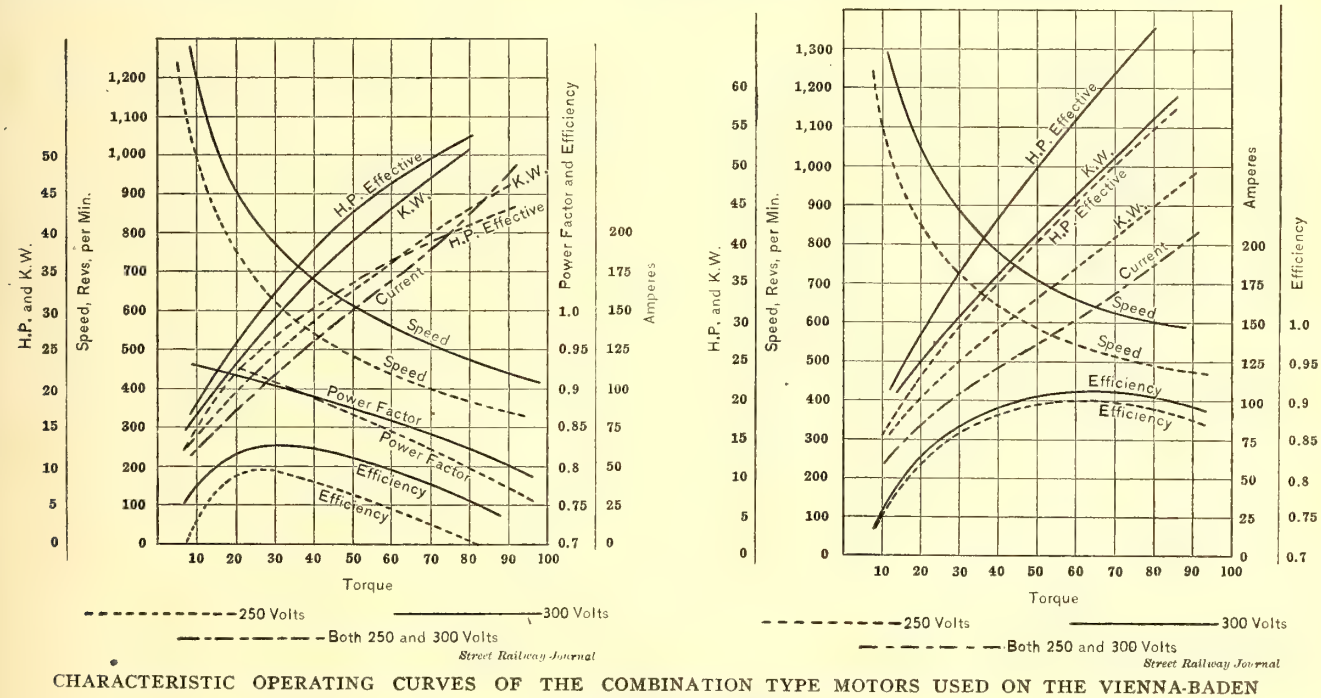
The vacuum brake equipment is also furnished with a. c.-d. c. motors.

Each car has one pantograph bow collector carrying two aluminum contact strips. The collector is balanced for wind pressure and designed to allow for the extreme differences in the height of the trolley wire without appreciable variations in pressure. The contact strips are of U section and are so supported that both sides of the U are in contact with the trolley wire in whichever direction the car runs. This insures good contact and allows the grease in the U to lubricate the wire and thus reduce the wear of both contact strips and wire. The bow does not require reversal when changing the running direction. The collector can be pulled down to the roof of the car in a moment by a cord which leads into the motorman's cab.

A maximum automatic cutout is placed in each cab to protect the car apparatus against excessive currents. The switch can be opened by hand and also serve as an emergency cutout, for which purpose it is arranged to be opened by alarm-knobs in the car. Each car is also provided with an overload fuse mounted in an accessible position under the car. The primary winding of the regulating transformer is protected by two fuses and also by a horn lightning arrester. Each car is also equipped with a horn lightning arrester and electric heating and lighting.



DETAILS OF THE PANTOGRAPH CURRENT COLLECTOR



CHARACTERISTIC OPERATING CURVES OF THE COMBINATION TYPE MOTORS USED ON THE VIENNA-BADEN SINGLE-PHASE RAILWAY

The facts and engravings published above are taken from a recent article in the London "Electrician," which mentions the Austrian Siemens-Schukert Works as being the contractors for the electrical equipment.

RECENT TESTS ON CURTIS TURBINES

The General Electric Company lately has released some interesting reports of tests on the Curtis steam turbine. Two of these trials show degrees of steam economy which are asserted to be considerably better than accomplished by other engines or turbines operating with the same range of pressure.

During the past year four 9000-kw units have been in-

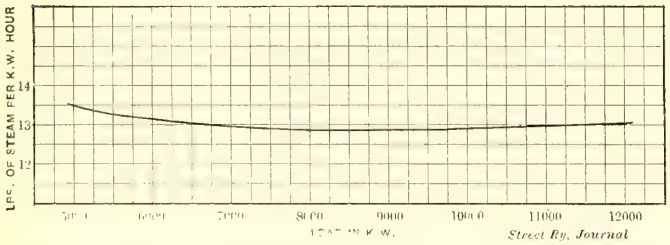


FIG. 1.—LOAD-WATER RATE CURVE FOR A 9000-KW TURBINE OPERATING AT 200 LBS. GAGE PRESSURE WITH 125 DEGS. SUPERHEAT AND 29-IN. VACUUM

stalled in the Fisk Street station of the Commonwealth Electric Company, of Chicago. One of these machines has been tested at different loads by engineers employed for the purpose by the owners. These tests were part of a general investigation of station conditions which has not yet been

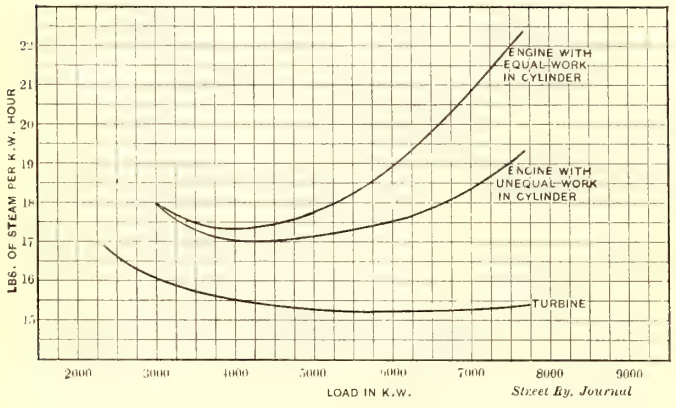


FIG. 2.—COMPARISON OF A 5000-KW FOUR-CYLINDER COMPOUND ENGINE AND A 5000-KW TURBINE OPERATING UNDER THE SAME CONDITIONS

published. The following figures give the results of five tests that were made:

TESTS OF 9000-KW TURBINE GENERATING UNIT AT CHICAGO

Load in Kilowatts.	Gage Pressure, Pounds.	Vacuum, Inches.	Superheat, Degrees F.	Water Rate, Pounds per Kw-Hour.
5,374	182	29.43	133	13.15
8,070	179	29.55	116	13.0
10,186	176	29.47	147	12.9
12,108	182	29.34	148	13.05
13,900	198	29.31	140	13.6

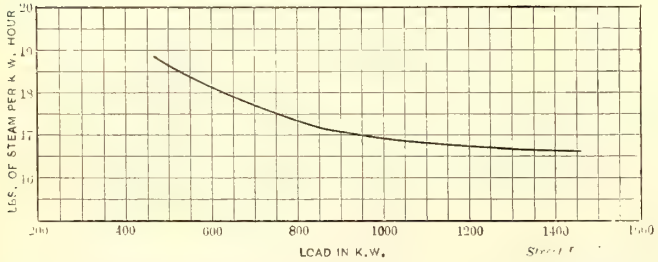


FIG. 3.—LOAD-WATER RATE CURVE FOR A 1000-KW TURBINE OPERATING AT 170 LBS. PRESSURE WITH 170 DEGS. SUPERHEAT AND 28-IN. VACUUM

A test conducted in Boston, Mass., on Jan. 29, 1907, on a 2000-kw five-stage, 720-r. p. m. machine operating under normal full-load conditions gave the following results: Load on generator, 5915 kw; steam pressure, 173.7 lbs.; vacuum, 28.8 ins.; superheat, 142 degs. F.; steam consumption, 13.52 lbs. per kw-hour. This turbine is mounted on a base condenser which forms part of the unit, and it is believed that this method has much to do with the high vacuum obtained.

A third interesting test is shown by the comparison curves in Fig. 2 between the 5000-kw machine used in Boston and a 5000-kw compound-engine unit, both units operat-

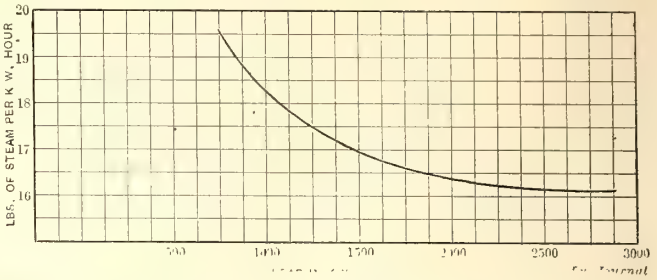


FIG. 4.—LOAD-WATER RATE CURVE FOR A 2250-KW TURBINE OPERATING AT 160 LBS. PRESSURE WITH 150 DEGS. SUPERHEAT AND 28-IN. VACUUM

ing under the same conditions. These curves illustrate the value of the high overload efficiency of the turbine and it should be noted that 50 per cent overload on the engine with equal work in the cylinders requires 43 per cent more steam than the turbine for the same purpose. This construction, of course, is of great importance in connection with the peak capacity of the station with a given equipment of the boilers and auxiliaries and also shows that the change to turbines effects improvement on the normal operating economy.

The high overload efficiency of this turbine is shown to a marked degree in Figs. 3 and 4; Fig. 3 showing the results on a 2250-kw machine made in April, 1907, and Fig. 4 the result of tests on a 1000-kw machine made in May, 1907. Both of these tests were conducted at Schenectady.

TWIN CITY RAPID TRANSIT PROGRESS

Thomas Lowry, president of the Twin City Rapid Transit Company, is quoted as follows in an interview secured by a financial paper:

"I will soon bring before the Twin City directors the question of an increase in the dividend rate. The next quarterly declaration is due in October. I doubt whether the present is a good time to increase dividends. Such action is sure to be interpreted as an effort to advance the stock. If the increase in our dividend comes the early part of next year the stockholders should be satisfied.

"Much pressure has been brought to bear on me in the past to put the stock on a 6 per cent basis, but I felt the property needed money for extensions and improvements. This work is about completed. Our system will be rounded out next year. So it becomes good form to talk about an increase in the dividend. The question is whether it would be good policy to take such action right away.

"The company's earnings for the year will be between 9 and 10 per cent on the common stock.

"We have spent $3,000,000 a year the past three years on the property, and $2,000,000 this year, or a total of $14,000,000 in four years. Now we have the best traction system in the United States. The property is in splendid condition.

"Our franchises in St. Paul and Minneapolis are impregnable. Not only are our rights exclusive and perpetual, according to court decisions, but we can charge straight 5-cent fares. The city of St. Paul attacked our franchise three years ago, but the court ruled in our favor."

NEW YORK RAILROAD CLUB PAPER AND DISCUSSION ON STEAM VS. ELECTRIC LOCOMOTIVES

The first meeting of the New York Railroad Club after the summer intermission was held on Friday evening, Sept. 20, 1907. The paper presented was by Max Toltz, general manager of Manistee & Grand Rapids Railroad. Before the paper was read, Eugene Chamberlain, chairman of the nominating committee, stated that all of the officers and committee members of the preceding year had announced their willingness to serve another term, although the committee had met with declinations at first from President Vreeland and Vice-President Deems. The report of the committee was unanimously adopted and the present officers and committees duly re-elected. An abstract of Mr. Toltz's paper appears below:

STEAM LOCOMOTIVE VERSUS ELECTRIC LOCOMOTIVE

At the 213th meeting of the American Institute of Electrical Engineers, New York, Jan. 25, 1907, a paper on "The Substitution of the Electric Motor for the Steam Locomotive" was presented by Lewis B. Stillwell and Henry St. Clair Putnam.* According to their estimate, if all the railways of the United States were to-day operated by electricity the aggregate cost of operation, which in 1905 amounted in round numbers to $1,400,000,000, would be reduced by about $250,000,000. This bold statement seems to have scared some editors of eastern railroad periodicals, so much so that one of them at once propounded the question: "What will be done with steam locomotives if electricity should become the motive power on the steam railroads within the next few years?" In such an event he fears that large numbers of steam locomotives would be thrown out of service and a vast amount of invested capital lie idle.

It is not the intention of the writer to discuss all the details of the second subdivision of the above-named paper comprising the comparative cost of operation by steam and electricity applied to railways in operation, and including both passenger and freight service, but he will confine himself only to the items pertaining to steam locomotives, viz., repairs and renewals of locomotives, engines and roundhouse men, fuel for locomotives and water supply for locomotives.

Incidentally it may be stated here that the writer does not agree with the statements made by the two gentlemen relating to maintenance of way estimates in which the items of cost of renewals of rails, ties, bridges and culverts have been reduced about $21,000,000 and for repairs and renewals of building and fixtures about $13,500,000. It has been found that the construction of the track and the roadway must not alone be fully as good, but better, when operating upon them an electric railroad, and more pains and labor will be necessary to keep up the repairs. Why repairs and renewals of buildings and fixtures should be less when operating electrically, is not explained.

The writer will show in the following that the steam locomotive properly improved is by far more economical than the electric locomotive, even taking it for granted that a kilowatt hour of electrical power could be furnished at the low figure of 0.6 cents at the bus-bars and at 0.8 cents effective for traction as named by Messrs. Stillwell and Putnam, who further state that a horse-power effective for traction will cost therefore 0.6 cents, of which 0.35 cents is for fuel when coal of 1400 B. t. u. per pound costs $3 per ton of 2240 lbs., and 0.25 cents is for other supplies, labor and maintenance equipment.

To analyze these statements it will be necessary first to establish the cost of an effective locomotive horse-power to be hereafter called draw-bar horse-power of the locomotive. From the figures given by the authors who estimate that for the operation of the entire freight and passenger service of the United States as existing in 1905, the aggregate energy required at the bus-bars of power-houses would approximate 12,500,000,000 kw-hours per annum. This converted into horse-power would give 16,625,000,000 hp-hours. To check this statement, the writer refers to the report of the Interstate Commerce Commission of 1904. The locomotives in service were in round numbers 47,000. The average freight locomotive is actually on the road not more than six hours in each twenty-four hour period and the same figure is approximately correct for the passenger locomotives. Assuming that each locomotive will develop during the six hours' work at every time 250 draw-bar hp (a very low estimate) the total number of hp-hours per annum will then be nearly 26,000,000,000. In the reports of the Interstate Commerce Commission 1905, it is also stated that nearly $156,500,000 was expended on fuel for locomotives. Dividing this item by the total hp-hours per annum would give a cost of 0.6 cents for fuel per draw-bar hp-hour compared with the estimated cost of fuel of 0.35 cents as above mentioned when assuming the railroads are operated electrically. This former figure is practically correct because we know that in the average a steam locomotive will use twenty-eight pounds of steam per hp-hour. The average coal used in a locomotive boiler will evaporate about six pounds of water, which would necessitate 4½ lbs. of coal per hp-hour, at $3 per ton of 2240 lbs. will amount to 0.6 cents per hp-hour. This, indeed, shows that more fuel per hp-hour is being consumed in locomotives than in modern stationary plants which furnish power for electrical operation.

But is it fair to compare the up-to-date power plant with the average locomotive? About 60 per cent of the locomotives now in use were built over fifteen years ago, are of the smaller type and cannot be worked as economically as the latest type, such as the Prairie, the four-cylinder balanced compound and the Mallet articulated compound with wide fire boxes. The reasoning for comparison should therefore be made upon the basis of the latest type of locomotives and therefore the writer refers to the locomotive tests made during the World's Fair at St. Louis, which have established the fact that the coal consumption per draw-bar hp-hour was considerably less than 2½ lbs. Yet properly to dissect the economy in the locomotives, it will be in place to call attention to the fact that each locomotive has one most economical speed limit, or in other words, that on a given grade at a certain speed with a defined maximum load the locomotive will turn out the most work at the lowest cost.

For further explanation the writer submits three graphostatic diagrams showing different characteristics of a Consolidation engine, Great Northern Railway F8 type; of a Prairie, Great Northern Railway J type, and of a Mallet Compound, Great Northern Railway L1 type. These diagrams give the coal consumption per draw-bar hp-hour at different speeds, the train tons on different grades (this train tonnage does not include the engine proper but does include the tender), the different draw-bar pulls in pounds

*See STREET RAILWAY JOURNAL for Feb. 2, 1907.

at the draw-bar between the locomotive and the tender, the maximum draw-bar hp developed at the different speeds, the ton miles on the different grades and at different speeds, the coal consumption per 1000 ton miles for saturated steam as well as for superheated steam, the increase of coal consumption over five miles per hour, the ton miles increase over five miles per hour and the actual cost of hauling 1000-ton miles at the different speeds in which only cost of coal and wages of train crews have been considered. From these diagrams it can readily be seen that each locomotive does the most economical work at certain speed, for instance, the F8 engine working with saturated steam on a 1 per cent grade will work at the lowest cost at the speed of 11 miles, while with superheated steam at a speed of little over 12 miles. On a 2.2 per cent grade this locomotive working with saturated steam will work most economically at 10 m. p. h. and with superheated steam at 11½ m. p. h. It can further be seen that the total coal consumption is increased slightly over that of a speed of five miles per hour, while the ton miles per hour are increased considerably. The data referred to in the diagrams are arrived at from the given details of cost in each case under the condition that the locomotive is working on the mentioned grade between stations and performing continuous work. No delay or stops at stations nor any broken grades of the road have been considered.

The question of the most economical work to be obtained from any locomotive seems to be not fully understood because the management of roads generally have prescribed the policy of big train tonnage to the detriment of the service. The Mechanical Departments' recommendations regarding smaller tonnage and higher speeds are often not accepted and in consequence it will be found that the locomotives do not work to the best advantage.

Although a good deal has been said and written lately about the best train tonnage, it is within the province of the Mechanical Department of a railroad to establish such tonnage by computing the different data corresponding to the diagrams and the tests of the locomotives.

The basis of later calculation of the cost per draw-bar hp will be made from the figures given on the diagram of the Mallet compound engine, in which it is shown that the best performance is made at nine miles per hour on 2.2 per cent grade, working with saturated steam, while with superheated steam it is at a speed a little over 10 miles. Taking the first case, the increase of coal consumption over 5 miles per hour is only 8 per cent, while the increase in ton mile hours over 5 miles is 72 per cent. At this speed the coal consumption per draw-bar hp-hour is 2.6 lbs.

This is a remarkable showing, but we should not be satisfied with the result obtained in this type of locomotive because more economy can be derived from further improvements, especially in superheating.

During the last two years a successful attempt has been made to improve the steam by superheating, which not alone gives steam economy, but also saves the coal pile. Mr. Vaughan, of the Canadian Pacific, in his recent paper on superheated steam locomotives read before the American Society of Mechanical Engineers at Indianapolis, reported an average saving of coal of 15 per cent with superheated over saturated steam locomotive, although in European practice these results average over 25 per cent.

The accompanying service records of May and June, 1905 made with a 2-4-4 high-speed compound saturated steam locomotive and a 4-4-0 simple superheated steam locomotive on the Prussian State Railway, were furnished by Herr Robert Garbe, director of the mechanical department, to the writer, who was able to verify them in January, 1906.

There is no doubt that this economical feature of steam engineering will be adopted and, with a little more vim and proper attention (see Mr. Vaughan's remarks made at the recent convention of the Master Mechanics—they are opportune, important and correct) to the parts of the superheater, better results will unquestionably be obtained. Great credit should be given Herr Schmidt, who for the last ten years has done excellent work in this line in Europe, and the writer is fully convinced that in a few years, after the locomotive superheater has been adapted to and tried in our railroad practice, a greater economy in coal than has been shown so far will be recorded. Consequently, the saving in coal by the use of superheated instead of saturated steam will be assumed to be 20 per cent.

Locomotive	Train Load			Water		Coal		Time		Highest Temperature Taken			
	Axles	Metric Tons	Increase	Used Gal.	Saving	Used Lbs.	Saving	On Road, Minutes	Saving	° F Smoke Box	Vac. in in.	° F Flues	° F. Steam Superheated
Comp. satur.	36	317.5	.....	6450	.....	10150	.....	190	.....	428	5.1	.....	.....
Simple superheated	36	328	4%	3960	38%	7820	23%	170	10%	627	4.3	1202	625
Comp. satur	44	387.5	.....	7200	.....	12000	.....	200¼	.....	446	7.5	.....	.....
Simple superheated	44	410	6%	4640	36%	8600	28%	173	14%	602	5.5	1202	625
Comp. satur	51	437	.....	7600	.....	12450	.....	229¾	.....	446	5.5	.....	.....
Simple superheated	52	482	10%	5070	33%	9150	27%	187	18%	644	5.7	1292	644

Higher superheat should and must be used to derive the advantages from superheated steam. This has been shown in the locomotive of the Canadian Pacific, which was equipped with the first Schmidt smoke-box superheater, in 1901. Under E. A. Williams, formerly superintendent of motive power of that road, a test was made with three locomotives, one the simple superheated, one a simple saturated and one Vauclain compound saturated steam engine. This test was carried on from July 1, 1901, to Dec. 21, 1902, with the following results:

Engine	Ton Miles Per Ton Coal	Relative Per Cents.		Mileage	Cost of Repairs	Cost, Repairs, Per Mile
Simple superheated	21185	133.4%	100%	64926	$1726.28	2.66c.
Simple saturated	15877	100 %	75%	67969	$3719.51	5.49c.
Vauclain compound sat	18611	117.2%	88%	61645	$2496.45	4.05c.

This remarkable showing is due to the high degree of superheat derived from the great heating surface of the

superheater and from the greater temperature of the gases which were carried from the fire box by a large fire flue of 14-in. diameter in the bottom of the boiler. As far as the writer knows, the connection of this big flue with the tube sheets has not given any trouble due to leakage, but Schmidt abandoned this design merely to avoid the danger which

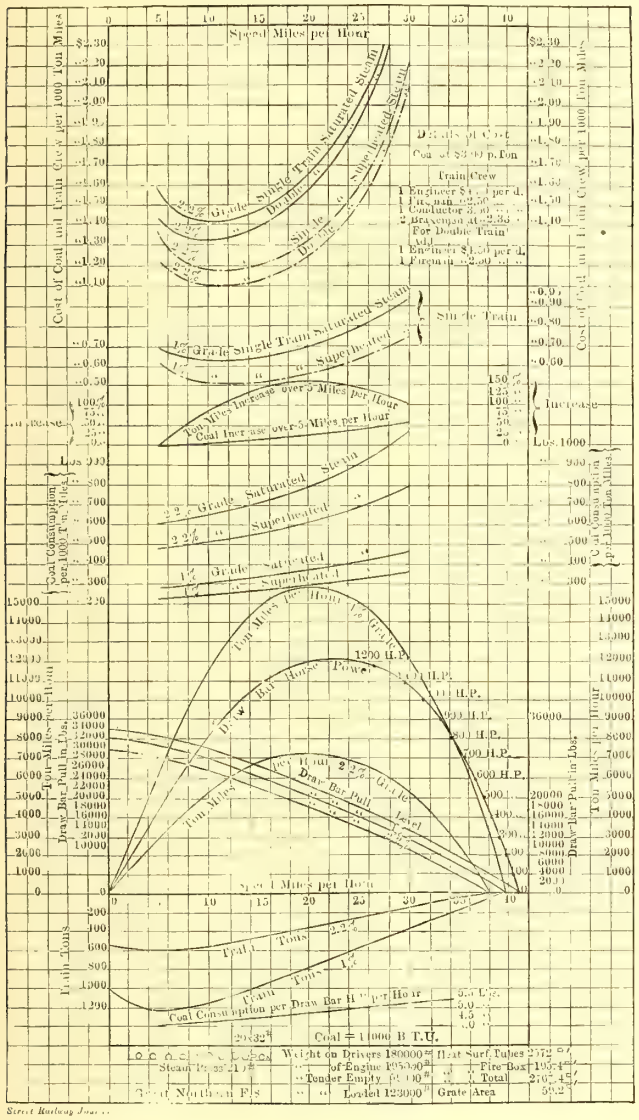


FIG. 1

may develop on account of it. A greater number of locomotives of the Belgian State Railway is equipped with this superheater and according to the statement of Monsieur Flamme, general superintendent of motive power, the saving of coal amounts to over 25 per cent.

Next to the saving in coal, by the use of superheated steam, comes the increase in the capacity of the boiler and the saving of feed water, which averages more than 30 per cent. This feature is very important because in many instances a water station with exceptionally bad water can be abandoned or used for emergency. Boiler washings will be reduced and cost of water supply decreased proportionally.

According to the statistics of railways for 1904, compiled by the Interstate Commerce Commission, the repairs and renewals of locomotives amounted to $115,000,000, while for engine and roundhouse men about $130,450,000 was expended. With improvements to boiler and to feed water apparatus as outlined above, these items in the opinion of the writer, could be reduced 30 per cent, which would make a saving over $73,635,000.

Although it is maintained that the work of the engine crew has been increased, due to the magnitude of the latest type of machine, so much that the limit of its capacity has been reached, it is believed, that by applying the improvements, which are possible from a mechanical engineering standpoint, the work of the crew will be decreased in many respects. For instance, in superheating the steam less coal will be handled by the fireman, and in connection with perfect lubrication, the work of the steam in the cylinders will be greatly improved. There should be no blown out cylinder heads due to accumulation of water. Better and quicker starting of the train will be attained. Failures of non-steaming will be avoided by heating the feed water. There will be fewer leaky flues and fire boxes and the hard work of the fireman can be reduced considerably by a perfect stoker. Roundhouse labor on the boiler will be minimized, though the use of some coals, such as Illinois and Iowa, will require more attention to the cleaning of the smoke flue superheater. Fire boxes and flues will last longer, and last but not least, the curse of uncleanliness, due to locomotive smoke, will be abated under conditions of perfect combustion in the fire box.

In making statements as to saving in the items of

(1) Repairs and renewals of locomotives,
(2) Engine and roundhouse men,
(3) Fuel for locomotives and
(4) Water supply for locomotives,

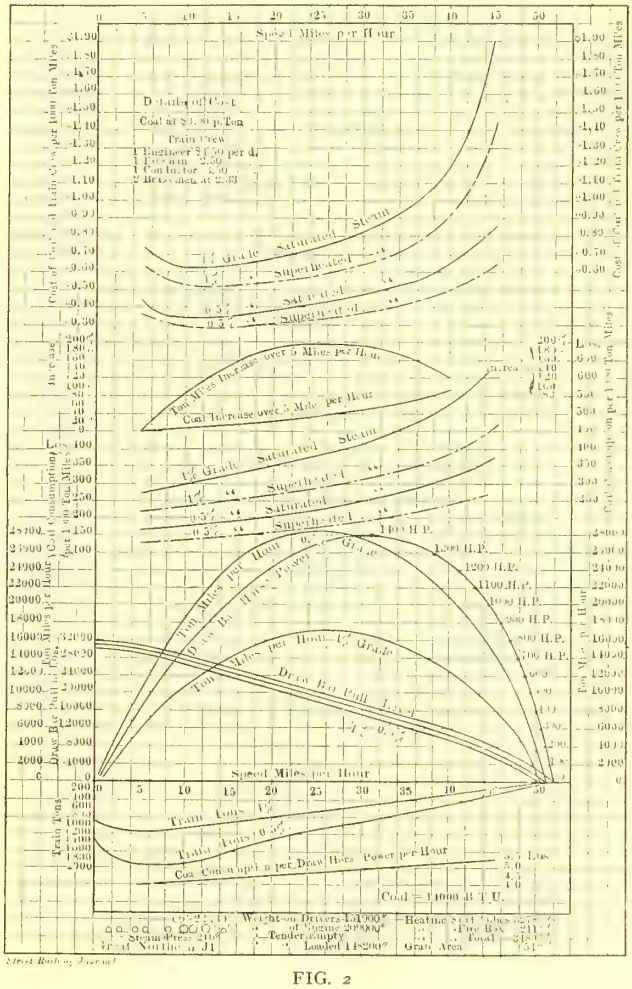


FIG. 2

assuming that all locomotives are equipped with the aforesaid improvements, different propositions are computed.

The saving in coal can be figured at 20 per cent by superheating, at 20 per cent by feed water heating, and at 5 per cent by perfect combustion, an aggregate of 39.2 per cent; the saving in locomotive repairs, items 1 and 2, 30 per

cent, the saving in water supply for locomotives, 30 per cent.

The first proposition which naturally presents itself is to deduct from the items of the 1904 report of the Interstate Commerce Commission these various percentages, which will give the following results:

30%	of $130,500,000 for engine and roundhouse men (2)	$39,150,000
39.2%	of 156,500,000 for locomotive fuel (3)	61,348,000
30%	of 9,150,000 for water supply (4)	2,745,000
	Total saving per year	$103,243,000

In this no account has been made for reduction of repairs and renewals, item (1).

The second proposition, assuming that all existing locomotives are of the latest types using, instead of 4¼ lbs., only 2.6 lbs. of coal per draw-bar hp, as stated above, and are

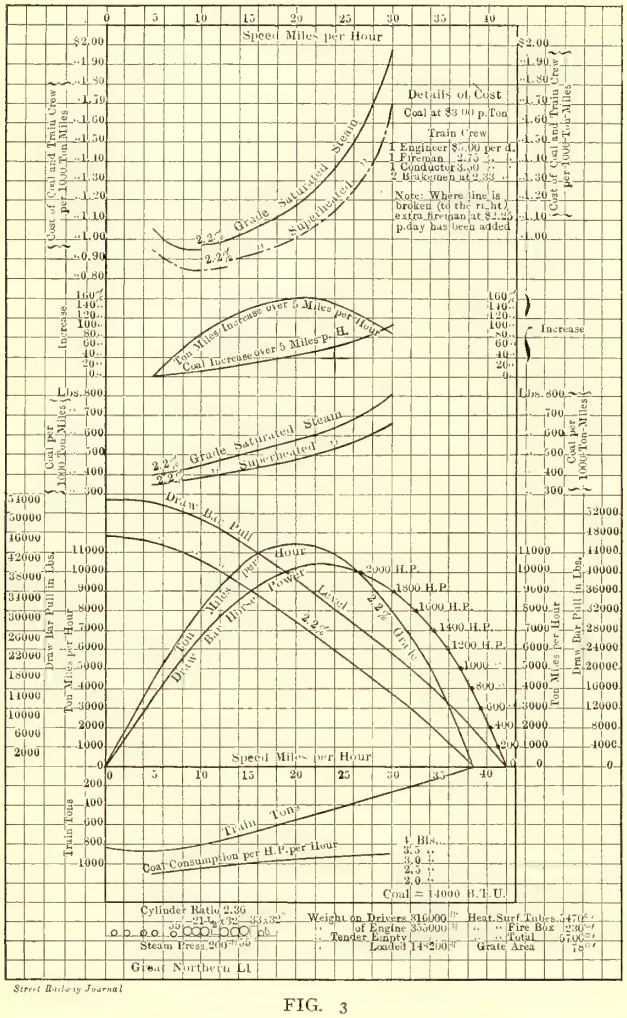


FIG. 3

equipped with the saving devices, will resolve itself into the following:

42.2%	less coal for modern equipment	$66,040,000
39.2%	of $90,460,000 (item 3) about	35,460,000
	($90,460,000, $66,040,000, $156,500,000, total item 3)	
30%	of $115,000,000 (item 1)	
30%	of 130,500,000 (item 2)	73,635,000
30%	of 9,150,000 (item 4)	2,745,000
	Total saving per year	$177,880,000

It is estimated that the three improvements, viz.: superheater, feed water heater and smoke consumer or stoker, can be added at a cost of less than $4,000 per locomotive, which will make a total expenditure of $188,000,000 for 47,000 locomotives. According to propositions I and II this amount would be repaid within 22 months and 12.5 months respectively from the saving.

It is proper to repeat the statement made by Messrs. Stillwell and Putnam relative to the reduction of the four items referred to when all roads are electrically operated. They assumed a saving of

70% in item 1, Repairs and renewals of locomotives;
50% in item 2, Engine and roundhouse men;
50% in item 3, Fuel for locomotives, and
100% in item 4, Water supply for locomotives.

Accordingly, the savings would be as follows:

Item 1—	70% of $115,000,000	$80,500,000
Item 2—	50% of 130,500,000	64,860,000
Item 3—	50% of 156,500,000	78,250,000
Item 4—	100% of 9,148,000	9,148,000
	A total of	$232,758,000

This indeed, looks very attractive, but the writer leaves the criticism of these assumed figures to his brother engineers.

The amount of capital which must be expended to obtain these doubtful results can hardly be imagined. A conservative estimate would be several billions of dollars. Although the estimated savings by an electrical equipment might warrant such an immense expenditure, the improvement of the steam locomotive offers like inducements. It has been the boast of the advocates of railroad electrification that with an electric locomotive double the trailing tonnage can be hauled at double the speed of the present steam locomotive. The writer begs to state that the steam locomotive of to-day (and not the most powerful one yet built) takes 800 tons singly and 1600 tons doubly over a mountain grade of 2.2 per cent with a speed of ten miles per hour.

The electric locomotive, either in single or multiple units, has its place in big terminals and in tunnels, but it cannot in its present development replace the steam locomotive for trunk-line service. The writer has investigated some of the greatest water powers in the Rockies and in the Cascades, and he ventures to say that none of them can deliver electrical power per draw-bar hp per hour for less than 5 cents. Another feature over which most enthusiasts of electrification stumble is the high power factor which is assumed. If electrically operated to-day, the load factor would not exceed 48 per cent on three typical American railroads; the Great Northern, Northern Pacific and Canadian Pacific. These are facts as Daniel Webster once said, which can invariably be proved, and it will therefore be a little time yet before our old standby, the steam locomotive, will be regulated to the scrap heap, if our fraternity will assist in making this old friend of ours what it should be.

DISCUSSION

The discussion was opened by William McClellan, consulting engineer of New York City. He referred first to superheaters, saying that his experience with them in connection with stationary boilers had convinced him that they form the most troublesome part of the boiler plant. Superheaters, like other improvements, would have to go through a long course of experiments before they could be successfully operated on the average road engine. He could not understand why the cost of maintenance of the locomotive should be so much reduced by the superheater as shown in the paper because a superheater is usually expensive to maintain. As to the general subject of the electric locomotive, he felt that the performances already on record were a pretty good defence. He regreted there should have been so much controversy over steam vs. electric operation. It would have been better if from the very first electric engineers had made themselves more familiar with steam operating conditions and the steam engineers had more carefully studied electrical possibilities. The cost of the

change to the later motive power certainly is very great and the electrical engineer who admits that fact does more good to the cause than one who does not. The cost should be compared not with what the steam road now has, but what it would cost to supply the service by steam which could be given by electricity, viz., a half-hour service, brilliantly lighted cars, etc. Mr. McClellan admitted with regret that comparative costs of operation were very hard to obtain, especially such items as the cost of fuel and water station, ash pits, repairs, etc. It seemed that on an average about 15 per cent of the general repairs of steam locomotives were due to the boiler, but even this factor was not universal. The only way that such costs could be obtained would be to follow the method of W. S. Murray, electrical engineer of the New York, New Haven & Hartford Railroad, who prepared a table showing the performance of a given number of steam and electric locomotives operated on the same system. The electric locomotive is no more complex than the New York subway cars, and as the latter had proved easy to care for despite their great number of movements he did not apprehend any difficulty in maintaining electric locomotives in a service requiring far less movements, nor would the track repairs in electric service be greater than that due to the introduction of higher acceleration, quicker braking and increased speeds. In summing up, the speaker said that there were other factors to be considered besides the financial ones, such as multiple unit operation, cleanliness, desirability of a subway service on trunk lines through large cities, the independence of weather conditions, etc.

N. W. Storer, chief engineer of the railway department of the Westinghouse Electric & Manufacturing Company, said that his only fear was that the demand for electric locomotives would be greater than the facilities of the manufacturers to supply them. He said in humorous vein that as there are 47,000 steam locomotives to be replaced, or 4700 locomotives a year on the basis of ten years life, he really did not want to see them replaced so rapidly. He wanted to bring out, however, the fact that in the steam locomotive the maximum speed is fixed by the boiler capacity and the economical rate of expansion in the cylinders, but in the electric locomotive with gearless motors a certain tractive effort can be had at any speeds up to 70 m. p. h. with economical voltage regulation. The New Haven locomotive has an efficiency of 60 to 65 per cent with a continuous tractive effort up to 10 m. p. h. and 87 to 88 per cent at 50 m. p. h. with normal voltage. The latter speed can be exceeded 10 to 20 per cent simply by increasing the applied voltage, and at the same time the efficiency increases as the speed increases. Hence the most economical speed is the highest that is safe to operate. Instead of 10 m. p. h. up a 2 per cent grade it is just as easy to make 20 or 25 miles, which, of course, means a great increase in the capacity of the road. He was glad that the steam locomotive is still showing some life, but the harpoon was in its neck and it was bound to be landed sooner or later.

The next speaker, J. E. Muhlfeld, superintendent of motive power of the Baltimore & Ohio Railroad, who began his remarks with a reference to the paper presented by him on Feb. 16, 1906, before the club, on "Large Electric and Steam Locomotives," in which figures were given of the cost of operating the electric locomotives used by his company and wherein certain suggestions were made for the improvement of electric locomotives in general. (This paper was published in the STREET RAILWAY JOURNAL of Feb. 24, 1906.) He said that while the electric locomotive might be a necessity in tunnel service it was an expensive proposition where the question was simply one of handling a given tonnage. He then presented a comparison of shop charges made for one and one-half years to two and one-half years previous on steam and electric locomotives used by the Baltimore & Ohio Railroad. These figures, which cover the running repairs and supervision per 100 miles are given herewith:

Three passenger electric locomotives, tractive effort 28,000 lbs.; weight, 196,000 lbs.; cost of mechanical and electrical repairs, $19.20.

Three freight electric locomotives, tractive effort 70,000 lbs.; weight, 320,000 lbs.; cost of mechanical and electrical repairs, $12.70.

Mallett articulated type steam locomotives, tractive effort 64,000 lbs.; weight, 335,000 lbs.; cost for repairs per 100 miles, $5.75.

Thirty-five passenger steam locomotives Pacific type, tractive effort 35,000 lbs.; weight, exclusive of tender, 230,000 lbs.; cost for repairs, $4.35.

One hundred and seventy-five steam locomotives, Consolidation type, tractive effort 42,000 lbs.; weight, 209,000 lbs.; cost for repairs, $3.15.

Compared on the basis of average cost per 1000 lbs. of rated power, the figures per 100 miles were as follows:

Passenger electric locomotives, 68c.; freight electric locomotive, 18c.; Pacific type steam locomotive, 12½c.; Mallett type freight locomotive, 8c.; Consolidation type freight locomotives, 7½c.

Compared on the basis of the same tractive effort, the average cost was $84 for the electric and $41 for the steam locomotive.

The figures given by Mr. Muhlfeld do not include interest, depreciation or taxes in either case, nor are the electric locomotives debited with the cost of maintaining feeder, third-rail, bonding wires, switches and other equipment incident to electric service.

The original cost of the different locomotives made on the basis of total working weight is as follows: Passenger electric, 20c. per pound; freight electric, 12c.; Mallett, 9c.; Pacific, 8c., and Consolidation, 8c.

Mr. Muhlfeld said that the brilliantly lighted cars, hourly service and first-class signals mentioned by Mr. McClellan were regular features of his company's line between Baltimore and Philadelphia, and hence were not peculiar to electric operation. In regard to the multiple-unit operation of electric locomotives, he had found that when two locomotives were at the head of a train their combined tractive effort is only 90 per cent of what it would be if one of the locomotives were at the end of the train. The points made about the time lost in round houses by steam locomotives did not apply to the Baltimore & Ohio Railroad, as it had passenger locomotives running anywhere from 8000 to 12,000 miles per month and freight locomotives giving 6000 miles monthly. As to Mr. Storer's remarks about the ten-year life of steam locomotives his experience was that the average life was twenty to twenty-five years.

C. A. Seeley, mechanical engineer of the Rock Island Pacific Railroad, Chicago, referred to the proposed electrification of the terminals of the steam railroads in Chicago, which he said had attracted considerable attention recently on account of the visit to New York of the Mayor, who had been making a study of the New York Central results. In Mr. Seeley's opinion, however, such electrification in Chicago would not at the present time be either profitable or desirable. When the New York Central electrification is finished and all the bills are paid it would then be an appropriate time to determine the desirability of electricity for steam railroad terminal service. The installations at both Baltimore and New York were necessary on account of tunnels, heavy traffic and other local conditions. There is little direct evidence at present pointing to any direct

economy of electric operation. In his opinion density of population was the deciding factor. He was a believer in electricity under favorable conditions; he also believed that improvements were possible in the present steam locomotive. The Rock Island Railroad is now trying experiments with superheaters on its locomotives.

The next speaker was L. B. Stillwell, consulting engineer, New York. Mr. Stillwell referred to the figures given in Mr. Toltz's paper relative to the possible saving of 1.65 lbs. of coal per drawbar horse-power by using different auxiliaries. Such a large saving seemed rather strange to him in view of the fact that inventors have been trying for years to reduce the coal consumption per horse-power in large central stations. The latter are equipped with large generating units using condensers, stokers, feed water heaters, superheaters and other auxiliaries, some even pop-valves and carbon-dioxide recorders, yet they had not succeeded in securing a drawbar horse-power for 1.65 lbs. of coal. If Mr. Toltz is right, it would seem that the proper thing to do would be to build 200 250-hp stations instead of one 50,000-hp station, and perhaps also to put these power stations on wheels to secure this high economy. The first Mallett locomotive tested in St. Louis had developed a drawbar horse-power per 2.6 lbs. of coal, although equipped with automatic stokers, smoke preventers and other fuel saving devices. Referring to the exceptions taken by Mr. Toltz to the figures given in the paper by Mr. Putnam and himself on the amount and cost of fuel used by locomotives throughout the United States, Mr. Stillwell said their comparison was based not only on the reports of the Interstate Commerce Commission, but also on confidential information from many railroad officials. In fact, the results given covered the experiences of many of the greatest railroads, included about 25 per cent of the total mileage of the country and a locomotive mileage for the periods for which the data were given of 314,000,000 miles. The average price of coal per long ton was found to be $1.96 and the coal consumption per locomotive mile over 174 lbs. for freight and 101 lbs. for passenger service. He wanted it understood that the objects of their paper were three: to promote the early standardization of electric traction equipment; to create the proper perspective to impress electrical engineers with the magnitude of the change; and to secure an alternating current frequency having reference to the purchaser's interests rather than the manufacturer's convenience, whereby the maximum drawbar pull per dollar invested would be secured. While some of the savings given in their paper were assumed, most of them were drawn from practice. For instance, the figures on repairs and renewals of electric locomotives were based on the experience of six roads with a motor car mileage of over 60,000,000 miles. The New York subway results were based on 400-hp equipments on each car of, say, an eight-car express train, the total of 3200 horse-power being equal to double that of the most powerful steam passenger locomotive. Considering the figures obtained from this service a number of interurban roads and the Valtellina line in Italy, the maintenance costs mentioned by Mr. Muhlfeld were surprisingly high. In conclusion, Mr. Stillwell referred to several other items in the paper by Mr. Putnam and himself and explained how the costs were obtained.

The next speaker was A. H. Armstrong, of the General Electric Company, who said that Mr. Muhlfeld had taken a rather narrow view of the problem in comparing the cost of maintenance of the earliest type of electric locomotive with the latest type of steam locomotive. It would be very much as if some one were to compare the performance of the "DeWitt Clinton" and an electric locomotive. In his mind the problem was not one of small economies, but of satisfying the demand for service that could not be filled by steam locomotives. The increase of the carrying capacity of a railroad over mountain grades was a case in point. The electric locomotive recognized no such thing as a ruling grade and this makes it available for severe grades where the traffic has been hitherto limited by the conditions inherent to steam railroad operation. A saving of 20 per cent in the cost of fuel was a very small item compared to the benefits of doubling the capacity of the line.

LOW POWER COSTS IN HARRISBURG

Through the courtesy of Mason D. Pratt some interesting figures have been made available on the excellent performance of the Central Pennsylvania Traction Company's station, which was designed and built under Mr. Pratt's direction with C. O. Mailloux and W. C. Gotshall as the advisory engineers. This station was described in the Street Railway Journal of April 27, 1907. Its power generating equipment consists of five 327-hp Keeler water-tube boilers, three 984-hp (with superheat) Allis-Chalmers horizontal cross-compound condensing Corliss engines direct-connected to 600-volt railway generators of the same manufacture. An interesting feature of the boiler equipment is the use of the Reagan hand-fired shaking grate.

The figures on coal consumption and cost follow:

	March.	April.	May.	June.	July.	Aug.
Total cost per kw-hour on switchboard—cents	0.925	0.715	0.658	0.666	0.640	0.620

Includes coal at $2.55 per gross ton; plant, salaries and wages; oil, water, supplies and repairs.

	March.	April.	May.	June.	July.	Aug.
Coal consumption: Pounds per kw-hour	4.05	3.55	3.22	3.14	2.99	2.96
Load factor, per cent	48	47	44.5	45.7	46.5	46.0
Cost of power per car-mile, cents	2.45	2.03	1.76	1.77	1.68	1.60

In connection with the load factor Mr. Pratt states that he bases this figure on the total rated capacity of the three 650-kw generators on a twenty-four-hour basis. As a matter of fact the traction company operates only two engines most of the time, and hardly once in three months is it necessary to start up the third engine to help over the peaks. The operating period is only twenty hours a day. The actual load factor based on engine hours operated is about 85 per cent.

Another interesting fact is that 10 per cent annual interest on the cost of the plant added to the total cost figures to cover interest and depreciation on the plant (although it will be noted that all repairs are included in the cost figures given) will not run the cost per kw-hour on the switchboard much over nine mills. A fairly good grade of bituminous coal is used.

The cost per car mile is given simply as a check on the other figures and will indicate to any street railway manager that the low figures for power are not caused by a racing meter. Thomson wattmeters are installed to show the performance of each engine, and there is every reason to suppose that the meters are registering within the usual accuracy. If anything, the meters are more liable to lag than to run ahead. Considering the size of the station the figures given certainly are very low.

KINGSTON MEETING OF THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK

The fifth quarterly meeting of the Street Railway Association of the State of New York was held at Kingston Point Park Pavilion, Kingston, N. Y., on Sept. 21. The use of the handsome pavilion was granted through the courtesy of C. Gordon Reel, vice-president and general manager of the Kingston Consolidated Street Railway Company. The convention was very well attended, there being over 75 gentlemen present, most of them from the electric railways of the Hudson Valley and Central New York. The meeting also was honored by the presence of J. E. Sague, member of the Public Service Commission for District No. 2, and C. R. Barnes, electrical expert of the Public Service Commission. Both gentlemen followed the discussions with a great deal of interest. Mr. Barnes took a very active part in the discussion on rules, making several valuable suggestions.

REPORT AND DISCUSSION ON INTERURBAN RULES.

The morning session was called to order at 10.15 o'clock by President Wilson, who said the first subject to be taken up would be the report of the Committee on Interburban Rules. Instead of discussing the report as a whole it was decided that the importance of the subject demanded separate consideration for each item, and hence the discussion was most thorough. The chairman of the rules committee, J. E. Duffy, superintendent of the Syracuse Rapid Transit Company, said that he and his associates, Messrs. Sheehan and Ryon, regreted they had not been able to give the subject as much attention as its importance deserved, but they had carefully studied the rule books furnished by interurban railway companies of New York and other states and the standard code of rules provided by the American Railway Association. They felt that the experience the steam railroads had gained from many years of operation should govern them at least partially in their recommendations for an electric railway rule book for interurban railway operation. Most interurban railways were developing speeds not exceeded by steam railroads and this condition required careful training in the selection of employees for train service. They believed that in view of the fact that many of the interurban electric railways had adopted a large number of the rules in the standard code and had found them to serve their purpose satisfactorily the committee could not do better than recommend the adoption of the standard rules of the American Railway Association with such alteration as might be necessary to fit electric railway conditions. Mr. Duffy then proceeded to read the rules which as finally adopted are published on page 465.

The following comprise the principal changes made from the original committee report:

Rule A under General Rules was strengthened in that employees will be required to have the rule book with them when on duty, whereas the steam code simply states that employees must be provided with a copy.

General Rule C C was amended to permit employees to give information about accidents, delays or other troubles to those authorized by law to ask for the same.

After prolonged discussion under the head of definitions it was decided to define an engine as a locomotive propelled by any form of energy. It was also decided that where the word "motor" is used it should be followed by "or engine," to avoid all misunderstanding on the part of employees.

Rule E E was amended to include "names and addresses" of all witnesses instead of "names of all witnesses," and the word "superintendent" changed to "proper officer."

In Rule G G the word "observed" was changed to "obeyed."

In discussing signal rules it was decided to use green as a "proceed" signal and yellow for "proceed with caution."

The discussion on communication signals disclosed some important differences between city and steam practice. As so many interurban railways are operated by men accustomed to the city standards, some members feared there would be confusion if they were asked to use the other system. One of the members whose electric cars are now operating under steam railroad conditions said he found no difficulty of this kind. It was decided, however, to print Rule 16 in two forms, A and B, the latter to be optional.

It will be noticed that blanks are left in the rules for time, distance and titles of officials to whom reports must be made. This was done to allow each company to fill them in to suit its conditions.

Owing to the active interest displayed on the subject of rules, it was found necessary to carry the discussion over to the afternoon session. Before adjourning to luncheon, Mr. Reel announced that the steamboat "Central Hudson" had been engaged for the use of the members, and that there would be a dinner on board the boat at 6 o'clock, after which there would be a moonlight sail down the Hudson to Poughkeepsie. Those who desired could leave at Poughkeepsie to make train connections for their homes, while the rest remained on board until the next morning for landing at Kingston. It may be added here that this program was carried out and proved very enjoyable.

Mr. Reel also announced there would be a joint meeting and reception of the Empire State Gas & Electric Association and the Street Railway Association of the State of New York, in the Concert Room, at Madison Square Garden, on Oct. 1. Full details of the program for this meeting are announced elsewhere in this issue.

The afternoon session opened with a continuation of the discussion on rules. The second paragraph of Rule 90 of the steam code was changed to add the words "when on time" after the words "the superior train."

Rule 208-A, on the transmission of train orders, was not entirely satisfactory to all present and it was therefore considered desirable to insert 208-B for optional use.

In the discussion on forms, a member pointed out the importance of ruling train orders. Several serious accidents have been caused by the fact that on a carelessly written order it is not easy to identify the corresponding time and place. Such mistakes in reading would be practically impossible if the form were plainly ruled.

Upon completing the discussion of the report Mr. Duffy said that as the committee's time had not permitted it to incorporate all classes of rules he would recommend that it be continued for further work, but that something be done with the rules already discussed. Several members declared their willingness to accept immediately all the rules as amended, and upon motion the rules were unanimously adopted and a vote of thanks tendered to the committee which was asked to continue in office to prepare additional regulations. It was understood that the rules as adopted will be printed by the different companies in one kind of type and that any additions will be printed in another to indicate variations. The optional paragraphs have already been mentioned.

The next subject discussed was the collection and registration of interurban fares on which the following paper

was presented by B. A. Frankel, chief of the treasury department of the Utica & Mohawk Valley Railway Company:

THE COLLECTION AND REGISTRATION OF INTERURBAN FARES

The collection and registration of interurban fares is one feature of the railway business in which local surroundings and conditions must take a prominent part. A system of collection which would be a success on a well patronized road might overburden a light carrying line, and the same can be said where the conditions are reversed. In our section of the state we are blessed with more than the average density of population. This coupled with the riding habit formed by the people compels us to use a system enabling the conductor to pick up his fares, take care of his car and make up a report that will show us where we are at.

Like all other interurban railways, we have gone through the experimental stages, having used several different systems of cash collections and discarding them as we found that they did not answer our purpose. At the present time we are using the "tear-off cash fare receipt" on one division and the duplex on another, both of which are working out with a fair degree of success. This we consider is due to the difference in the sales of tickets at our ticket offices. At the opening of the Utica & Mohawk Valley line, the conductor used the "zone" collection of fares, making thirteen different collections and registrations in a distance of thirty-eight miles. This method was more than the passenger could stand and we soon abandoned it. Since then there has been used the tear-off, the duplex, a patent ticket box with tear-off and back to the present tear-off which has been found the most practicable for our use. The distances between stations and the heavy travel on this line are such that this system was found the more successful, although the other systems used have a number of good features. Inasmuch as there is no inducement for the passenger to buy single trips as there is only a reduction of five cents on the round trip, they have gotten into the habit of getting on a car and paying the conductor. The sale of tickets and opening of ticket offices did not commence until several months after the opening of the line, which gave the public the opportunity of paying cash on the car. The average sales are from 56 to 60 per cent, which is very light in comparison to the sales on the West Shore or Oneida railway.

I consider the cost of installing ticket offices money well spent and think it proper to charge a slight excess fare over the ticket fare when the passenger pays on the car. We have followed out this policy in making up the schedule of rates on the Utica-Syracuse division and up to the present time, after a three-months' trial, can say that the number of complaints because of this charge is very few. The sale of tickets averages from 85 to 90 per cent as compared with the 56 to 60 per cent on the Utica & Mohawk Valley line. I attribute this to the excess between the cash and ticket rate, and the fact that the sale of tickets was started when the line was put in operation. I think it advisable therefore to commence the use of tickets on the day a new line or division is opened for business. Should the passengers once get into the habit of paying fare on the car, it would take a long time for them to give it up unless the inducement of buying tickets is enough to pay them for the trouble.

On the West Shore the duplex system of collection has been very successful because of the large sales of tickets. The excess is from five to ten cents on single trip, depending on the distance, and from five to thirty cents on round-trip tickets. The simpler the ticket is printed the better the passenger likes it. We make no conditions, merely stating that it is good when properly stamped and placing no time limit on the use. A great many passengers buy in lots of half dozen or more. This also obviates the complaint a passenger might make if the ticket office is not opened.

For the use of the transportation department, some managers would like to know where the travel begins and where it ends, so that the section showing the heavy travel can be given the consideration it deserves as compared with the light-carrying division. We have found that with the use of the duplex and the report of ticket sales, this information can be compiled and tabulated to give the information desired. This statement is made up and embodied in our monthly report. It has been our aim to lessen the work of the conductor as much as possible, as we found through this, he is in a position to take care of his passengers and car to better advantage. For their convenience on the heavy carrying sections of the Utica & Mohawk Valley the conductor registers all five cents fares, giving no receipt whatever, but for all cash fares above this amount a receipt is given.

On the opening of the electrified West Shore between Utica and Syracuse, we tried the experiment of making but one collection for a through rider instead of the usual practice of collecting in sections. This policy has been favorably commented on by passengers, as they can now enjoy their ride without being disturbed by the conductor. The latter also seems to have taken up with this method, as after hatchecking the passenger to the point of destination, he has nothing further to trouble about except to get the hatcheck before the passenger leaves the car.

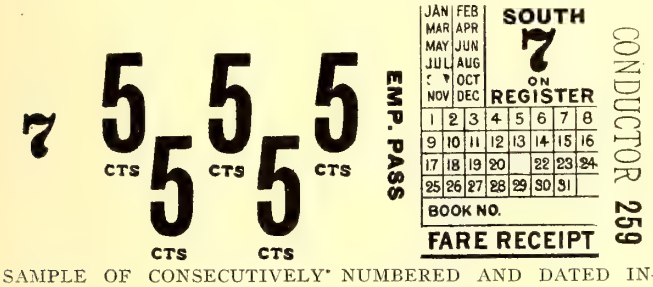
In conclusion, I would strongly recommend the use of tickets and installation of ticket offices, and the use of a cash-fare receipt to give the conductor a chance to pick up his fares, look after the car, make up his report, and attend to such other duties that he may have. Where the percentage of ticket sales is high enough, the duplex will cover this, especially as it shows the "from and to" travel, and the collection of the fare at one time.

DISCUSSION ON FARE COLLECTION AND REGISTRATION ON INTERURBAN RAILWAYS

The discussion on Mr. Frankel's paper was opened by John G. Phillips, assistant general manager of the Hudson Valley Railroad Company, who said that he agreed with Mr. Frankel's ideas on the ticket selling question. On his system they had cash fares exclusively and had found that on heavy days it was impossible for the conductor to get all his fares. Several years ago they had used a duplex ticket but they had found that the conductors would punch, say 5 cents on one ticket and 75 cents on another.

N. P. Baker, division superintendent of the International Railway Company, explained the method now in use on his company's interurban lines. On the Niagara Falls route there are some 25 to 30 different fares and the conductors carry nine or ten forms of tickets which of course makes matters very difficult for them with heavy traffic. They had found it hard to get conductors competent enough to handle the situation and turn in clear records. On this point he was sure an improvement could be effected if interurban conductors were paid more than local conductors, thus offering some inducement for a higher class of men. Their former method of checking this line was to use special agents, but this has proven very unsatisfactory, as it

took them so long to become acquainted with the details of the fare collection that by the time they had learned the method they were known by all the conductors on the line. These men cost the company from $3 to $5 a day and seldom could check more than 4 to 5 conductors daily. Finally the company threw out this system and selected two of its oldest and best conductors, who were appointed as regular inspectors for the registration and collection of interurban fares. Owing to their experience these men check a far greater number of conductors and find discrepancies much more easily than could the outside men. Conductors found at fault are called into the office and the discrepancies explained to them. In some cases they are discharged but in other instances an endeavor is made to make them feel that they are holding a responsible position in which accurate reports are a necessity. Since this method of checking was adopted the revenue on this line has shown a steady increase. Referring again to the subject of ticket sales, he said that at first when the ticket office was in an out-of-the-way part of the city they had met with little success, but now tickets are sold at the point where the car leaves, so a



SAMPLE OF CONSECUTIVELY NUMBERED AND DATED INTERURBAN FARE RECEIPT

great many passengers buy tickets before the car starts, thus relieving the conductor of considerable work.

In reply to a question as to how he checked up tickets, Mr. Frankel said they know how many were sold every day from the daily report and how many were accepted, and usually these figures were in close agreement. Another delegate said that this company's practice was to set aside the difference between tickets sold and turned in, not counting it as daily receipts. There was then an animated discussion on different forms of registers and tear-off devices. One of the delegates said that they had used a notching scheme which worked very well at first but after some use the notchers would become dull and no longer tear accurately. Another delegate submitted the accompanying form of ticket which had come to his attention. Tickets of this kind are serially numbered, the one reproduced, for example, being the seventh in the pad. The fare receipt is punched for month and date. With any ordinary straight edge the conductor tears off the number of five-cent fares that the passenger has paid, the stub being turned over to the auditor. If the stub contains no 5 the auditor knows that 25 cents was collected; if one 5 is left, 20 cents; two 5's, 15 cents, and so on. The fare receipt also contains the conductor's number and the direction of riding. On the back there is a notice to passengers that the conductor must give them a receipt showing the amount of fare paid.

After the conclusion of the foregoing discussion telegrams were read from J. S. Kennedy, secretary, and F. W. Stevens, chairman of the Public Service Commission for District No. 2, regreting their inability to attend the meeting.

EXPRESS RATES AND SERVICE

The subject of express rates and service was then opened by the following paper by Frank Walsh, general manager of the Electric Express Company, of Schenectady.

During the past few years many electric street railway companies have given considerable thought to handling freight and express matter on their lines. The business is one deserving considerable attention, as it is not only a great convenience to the public but also a source of revenue which, of course, is the primary object of railway managers.

For a number of years I was in the employ of the old line express companies, who operate over the steam roads and cover thousands of miles of territory. When I entered the service of the electric lines who do only a local business, I felt that it would be so easy after my previous experience, that "There would be nothing to it." I soon found I was mistaken, and that there was very much to it, for it opened an entirely new field which made necessary the application of methods suited to the locality.

I have learned that each company handling freight and express has its own methods of doing business, and while I believe local conditions bear largely on the methods used, I think some uniform system should be adopted. We all agree that for the present our business will be purely local, but with the progress made in the last few years in electric service, there is no telling what the future has in store. It is not my purpose to submit a large amount of data, but simply to discuss the plan of operation and to try to set forth some ideas that could eventually be worked into a system applicable to most places.

I have already stated that local conditions govern to a large extent. One of the first things to do is to size up the territory thoroughly to ascertain if it produces or consumes. Another very important point is the rate question. Some managers advocate class rates as adopted by steam roads, while others favor the flat rate as used by the old line express companies. I may be prejudiced, on account of my previous experience, but personally I favor the flat rate. However, I think it is only a question of time before we will have to adopt class rates, but rather than use the present steam road classification we should make a classification to suit ourselves. The steam roads have eight different classifications whereas four, or even three, would be enough for electric railways.

In my judgment, the low class freights do not pay for the trouble of handling, and considering the prompt service electric lines are able to give on local freight they should look for the high-class commodities. If any merchant is in a great hurry for heavy, rough material and to save time is compelled to ship by electric railways, he will gladly pay what the difference would be in the classification.

In most cases I find we can get all the steam road asks and often a trifle more, for it stands to reason that our service is much better in securing shipment and delivery at destination.

The method of delivering freight and express is an important one. At one time we hired wagons to make our collection and delivery on a percentage basis, but after trying it for several months, found it did not work to our satisfaction and finally put on our own wagon equipment. From the time of that change our business increased. We were able to pick our own men for drivers, which we could not do on hired rigs, and also found that the attention our neat looking wagons attracted was a good advertisement.

I have been asked several times what is the difference between freight and express. While this is rather hard to answer, there is as much difference between them (looking at them from the steam-railroad freight and the old line express company business standpoints) as there is between

chalk and cheese. While the Electric Express Company's system may not be perfect, I think we have a good one. The easiest way to answer the question of the difference between freight and express is to give you our method of operation and point out the distinction as we see it.

We divide our business into three classes, viz.: Class "A," express service, includes collection and delivery; class "B," freight, no wagon service; and class "C," fast freight, wagon service on one end.

Under class "A" we handle at a flat rate all goods which we are expected to pick up by wagon and deliver, and give this class of business preference in loading and delivering. The class "B" rate is applied on all shipments delivered at our terminals and called for at destination by consignees. Class "C" freight is applied mostly on shipments from wholesale houses to stores in different places. The last class is used by most people and is a popular one with the big shippers.

Under this class "C" we handle a lot of groceries and like commodities that formerly went by steam railroad consigned to town truckmen for delivery to the consignees. I may safely state that 50 per cent of our business is handled under this class. We simply charge, in addition to the freight rate, a fair delivery cost. We do not apply this class on perishable goods that would in any event be sent forward by express.

We maintain that any company which does not use wagons in connection with its freight cars is doing only a freight business and where wagons are maintained they are doing express business also.

I strongly advocate a meeting of the freight men whose companies are members of this association thoroughly to discuss the matter of rates and classifications of freight, feeling that the steam railroad classification is not just what is needed for us. We have an entirely different proposition than the steam roads or old line express companies, but yet worthy of much consideration by the electric railways, as there certainly is money in the freight and express business.

After the paper by Mr. Walsh had been read, C. H. Armatage, traffic manager of the United Traction Company, offered the following contribution on freight and express matters:

FREIGHT AND EXPRESS RATES

In the development of freight and express service on electric railways, conditions existing and anticipated, the general merchandise and character of the products of the different industries along the line and through the territory the railroad serves are important factors which require careful and deliberate thought toward the progress and ultimate success of this modern method of transportation.

Managers of electric railways are constantly on the lookout for new sources of revenue, and in the installation of an express service on their individual roads lose sight of the actual value of the service contemplated and given. In their eagerness to secure business they quote ridiculously low rates for the transportation of the different commodities offered. Finding after a few months' operation their serious error, they attempt to increase the rates. This action invariably meets with pronounced opposition and jeopardizes the already established harmonious relationship existing between the company, the shipper and receiver.

The value of an electric express service lies in the great saving of delay, the frequency of its trips over short mileage routes, the speedy transportation of farm products and garden truck from the rural district to the cities, the filling of rush orders by telephone and the ability to make fast time and deliver at highway crossings or at store doors. All of these are elements of inducement and recognition to shippers and receivers and absolutely demand an adequate compensation for such valuable service.

The one item of expense in operating an electric express service, and which practically absorbs an enormous part of the net earnings is that of wagon call and delivery. Some roads have a practice of adding a certain per cent to their tariff rates to cover the expense of such delivery, other roads maintain a regular schedule of express rates covering call and delivery service.

I have visited several electric express companies operating in the New Eigland States and find upon investigation that the cost of maintaining teams for delivery service consumes such a large proportion of the profits that managers are considering the cutting out of this item of operation.

It is a fact that the Consolidated Railway Company, which is the holding company for the N. Y., N. H. & H. R. R. electric properties, has eliminated this item of expense in several of the cities in which it operates and is now confining itself strictly to frequent service and cooperation with the shipper, feeling that such methods more than compensate its patrons for any advantage that might be gained in maintaining a call and delivery service by team.

Good sound judgment should be exercised in determining the character of freight and express matter handled. It does not matter whether consignments consist of feathers or lead with some shippers, who insist upon their rights as described in printed folders giving rates and information and demand transportation of their goods accordingly.

Such shipments as wool, rags, paper junk and other material that not only block platforms, but impede the work and fill the cars to the detriment of good paying freight should be termed excepted articles and rated accordingly.

I think also that iron, steam piping (unless short lengths), heavy machinery, doors, sashes and lumber be excepted, and that household goods, such as stoves and furniture, unless properly boxed or crated, be accepted for transportation only upon release from the consignee from all claim for breakage and damage in transit.

The handling of such goods should be well paid for, for it takes valuable time and invariably requires carting to the very extreme of the delivery boundaries. The teamsters in almost every instance require assistance to unload them. This, of course, refers to such service requiring call and delivery.

I believe a rate classification in electric express business should be avoided if possible, if such rate classification is to be considered on the lines of the official classification as used by steam roads. My experience has taught me that local agents do more guessing than they ought to, and in many instances such guessing, when shippers happen to make comparisons, lead to charges of discrimination.

Steam railroads vary in their distinction of classes. Some classes are subject to certain rules. The agent does not take time to think it necessary to perfect himself on these rules and the result is that a conflict is opened between the shipper and the carrier.

To avoid such contingencies on railroads having short mileage hauls, I would recommend or suggest that flat rates be established, with the necessary exceptions; also a minimum rate to suit the locality and the conditions.

I am of the opinion that a first-class commercial agent attached to any electric express company who has the personality to reach the shipper and can offer a tariff which would be a compromise between the freight rates of steam roads and the express rates of regularly incorporated express companies in competition would in a very short time produce astonishing results and materially increase the item of profit to the carrying company.

The United Traction Company is undoubtedly the pioneer in electric express and freight service, having been in operation some thirteen years, and from a business of $9,000 the first year has steadily increased to $49,000 for 1907. We owe this phenomenal showing to our constant endeavor to please our shippers and to display a spirit of cooperation, which we are satisfied has had great influence on the growth of our business.

The suggestions, recommendations, or you may say ideas, as set forth in this document are based simply upon the conditions and circumstances that appear locally with our company. Facilities, localities, length of haul, character of the products of the different industries offered for transportation, competition and numerous other things that arise from time to time are to be taken seriously into consideration and treated according to existing conditions to the end that the freight and express department of an electric railway becomes at once a valuable tributary to the revenue and income of the parent company.

After Mr. Armatage had concluded the reading of his paper one of the members of the association presented the interesting cost analysis given herewith:

FREIGHT AND EXPRESS ACCOUNTING

The transportation of freight on trolley lines seems to be the great dream of the majority of promoters, managers and operators throughout the country. In looking over the statistical reports of the different trolley lines it is noticeable that almost all of the lines that have attempted or that are handling freight almost invariably show that the handling of freight is on a paying basis; in some instances even it is claimed to be practically a case of "clean velvet."

For some time the writer thought in the same manner, until a short time ago he was able to get hold of the cost accounts of operating freight departments on several of the roads throughout the country, when it became very noticeable that the only items entered as making up the cost of handling freight were simply those that were purely visible, together with an arbitrary pro rate charge for several of the operating men without regard to the real pro business handled by them.

After looking these reports over the writer began to analyze the same account on his home road and discovered the same practice to be in vogue there. Consequently he decided, in 1906, to reduce the entire traffic of the road, both passenger, freight and work train service, to a basis of a ton carried a mile, and then pro rating the cost of the different operating accounts on this basis between these three services. In arriving at the ton mileage handled over the road the rolling stock was figured as empty cars at their actual weight. The passenger load was figured from the average distance of passenger carried on a basis of 135 lbs. average weight per passenger. The freight and express was figured at the actual weight from point to point. This gave us 27,545,397 ton-miles of passenger, freight and express and work train service chargeable to Accounts 1, 2 and the power, and 26,873,247 ton-miles of passenger, freight and express service chargeable to Accounts 6 and 7; 2,153,412 ton-miles of work train service chargeable to Account 8, and 2,190,135 ton-miles of freight and express chargeable to Account 39. The above figures include rolling stock and load.

The revenue express was 12,139 ton miles, the local freight 1,070,461 ton-miles and carload freight 108,092 ton-miles. The operating expenses chargeable to combined freight and express per revenue ton-mile were as follows:

Account No. 1	.00082
Account No. 2	.00003
Power	.00262
Account No. 6	.00053
Account No. 7	.00029
General Expense, less Account 39	.00152
Account 39	.01242
making a total of	.01824

The revenue freight and express ton mileage amounted to: freight, 99 per cent of the total; express, 1 per cent.

The express is handled on the same basis as by the other express companies operating over the steam roads. The collection and delivery charge for cartage is 40 per cent of the express receipts, consequently in making a pro rated charge between freight and express, this 40 per cent must be deducted from Account 39 and charged direct to the express account, and then the other accounts, together with 39, would come under the pro rate on the basis of 99 and 1 per cent. These pro rate accounts between freight and express would come out as follows:

	FREIGHT	EXPRESS
Account No. 1	.0082	.0008
Account No. 2	.00003	.0000
Power	.00261	.0026
Account No. 6	.0063	.0005
Account No. 7	.000029	.0002
General Account, less Acc't 39	.00163	.0015
Account No. 39	.01048	.2103
making a total of	.01646	.2159

Recapitulation of operating expenses and income per ton-mile:

Express	.50
Local freight	.01148
Carload freight	.02626
Average of freight	.01284
Average of freight andexpress	.0178

Income per ton mile,

Operating

Express	.2159
Freight	.01646
Freight and express	.01824

Gain or loss,

Express, gain	.2841
Freight, loss	.00362
Freight and Express, loss	.00044

This same year (1906) under our system of charging against freight and express only such charges to Account 39 as are actually seen, a gain of .00505 per ton mile is shown in receipts over expense, whereas, according to the above analysis, it should have been a loss of .00044 per ton-mile.

From an inspection of the different costs and receipts of the freight and express handled, it will be seen that the entire loss comes through the handling of package freight. The reason for this is that scarcely any of the trolley roads are so situated to be in any kind of shape for properly handling this class of freight. Consequently the continuance of handling this package freight merely resolves itself to a question of policy, whether the railroad company is a gainer in the long run by handling package freight as an accommodation to the public and a loss to the company, or

reorganize the freight business and place it on a paying basis.

Personally, I believe it better for the majority of electric roads to cut out the local freight business and handle nothing but express, dividing it into two classes—one that the roads collect and deliver like the other express companies and the other class involving no collection or delivery. The rates charged for the second class should be 40 per cent lower than the first class, and such roads as have interchange connections with steam roads should only handle such freight as can be transported in carload lots where the shippers do their loading and unloading.

These interesting papers provoked some very interesting arguments on the best methods of estimating the actual profits from this class of business, and the desirability of re-arranging the steam railroad express company classification to suit electric railway conditions. One of the members who has been very successful in the express and freight business, said that last year their profits were 30 per cent of the gross business, the gross earnings being some $5,000 per mile of track operated in a well populated district. A member from Central New York said that his company averaged about $1,000 gross earnings per mile of track.

P. E. Wilson, general passenger and freight agent of the Rochester Railway Company, said no one could say definitely whether it is profitable to handle freight and express on a particular road. Much depends upon having suitable warehouses, whether delivery must be made at stores, whether the company owns combination passenger and express cars, and on other factors. The interurban companies had been giving express service at freight rates and it would be very difficult to raise the rates without disturbing the relations with the different towns. It was his idea that express matter should be carried on light passenger runs, and that while freight should continue to be carried it should not be given express service but rather that the freight cars should be operated say twice a week.

C. Loomis Allen, vice-president and general manager of the Utica & Mohawk Valley Railway Company, suggested that a committee be appointed to gather detailed information on the methods of handling, classifying and charging for express and freight service throughout the state. For his part he would gladly furnish such a committee all the information at his command. From the data thus gathered it might be possible to agree upon certain standards. Mr. Wilson, of Rochester, was afraid that such a conference would not be successful, that every line would have to work out its own salvation. J. H. Pardee, secretary of the association, said that the electric railway was attempting to carry freight with an electric car representing an investment of about $10,000 and two men in competition with a steam railroad hauling freight cars costing about $1,000 each and requiring say four men for forty cars. He mentioned a case he had noticed in Indiana where a car filled with doors and other bulky woodwork had been hauled 25 miles in a $10,000 car at regular steam freight rates. That sort of thing did not make electric freight service appeal to him as a profitable proposition.

Mr. Clark, of the Auburn & Syracuse Electric Railroad, said that his company was operating between Syracuse and Auburn on the New York Central classification and rates and was making money.

J. W. Nugent, general freight and passenger agent of the Oneonta & Mohawk Valley Railway, said the locality through which a road was operated had much to do with the success of the business. His road is a cross-country one with connections to two steam railroads. They are receiving for a 28-mile route practically all of the carload business taken north from the Delaware & Hudson. At the same time they are running a local freight car service and also an express service carried on passenger cars. The express rates are based on a mileage equal to the old line companies graduated scale. The freight rates are somewhere along the lines of steam road charges. He could assure the members that both classes of business were profitable.

One of the members who handles the express business as an independent company said: Nothing that can be charged directly to the express company is overlooked, including rental for the use of terminal stations, a charge of 25 cents per car mile, wages of crew, etc. Despite this the operating expenses do not exceed 80 per cent. Another member whose company also runs the express business as a separate proposition said they paid 40 cents a car mile and all terminal charges, but still made money.

E. J. Ryon, superintendent of transportation of the Schenectady Railway Company, said it should not be overlooked that sometimes the old line express companies make a rate which does not pay in a particular district but is evened up somewhere else. As the electric railway express service is confined to a much more restricted territory it would not be wise to follow the methods of the old line companies too closely.

Mr. Pardee believed that under ordinary circumstances there was money in the express business for an electric railway, but only under exceptional circumstances was the freight business profitable. Too many mistakes had been made in the past by electric railways rushing into it without sufficient study of the conditions. If the managers of different roads would confer and check up the articles upon which they are losing money he was sure that in a short time a revenue-producing tariff could be worked out that would still be low enough to secure the business.

Mr. Walsh said that the present steam railroad classifications were not suitable for electric railways and he was anxious to see something done toward getting up a new classification. Such items as furniture and bulky iron pipes should have a first-class rate placed on them. Mr. Fassett said that the papers and the discussion had brought out the necessity for such a meeting. Mr. Allen then renewed his motion that a committee of three be appointed to consist of one express and freight man, one representative of the accounting department and one manager; that all of the roads turn over full reports of their express and freight business for twelve months to enable the committee to tabulate them properly and work out the question; and that the subject be considered for six months and reported at one of the quarterly meetings.

Mr. Pardee offered an amendment to Mr. Allen's motion to the effect that the number of freight and express men be three and the other members should be one accountant and one manager as proposed by Mr. Allen. He made this suggestion for an increase in freight men because so much of the work would consist of a comparison of tariffs involving too much detail for one man. The amended motion was adopted and Mr. Fassett, acting as chairman, announced that President Wilson would appoint a committee later. The meeting then adjourned for dinner on the boat, after tendering a vote of thanks to Mr. Reel for his splendid efforts in providing for the comfort of the attendants.

REPORT OF COMMITTEE ON INTERURBAN RULES*

The rules herein set forth govern the railroads operated by the..... ..... Railroad Company.

They take effect ....., 190.., superseding all previous rules and instructions inconsistent therewith.

Special instructions may be issued by proper authority.

To enter or remain in the service is an assurance of willingness to obey the rules. Obedience to the rules is essential to the safety of passengers and employees, and to the protection of property.

The service demands the faithful, intelligent and courteous discharge of duty. To obtain promotion, capacity must be shown for greater responsibility.

Employees, in accepting employment, assume its risks.

GENERAL NOTICE.

The safety of passengers and trains is of the first importance, and all operations of working, repairing, or constructing this road must be subservient thereto. To this, with the regularity and punctuality of the trains and the comfort and convenience of patrons, all work must be entirely subordinate.

It is of the utmost importance that proper rules for the government of the employees of a railroad company should be enforced, in order to make such rules efficient. If they cannot or ought not to be enforced, they ought not to exist. Officers or employees whose duty it may be to make or enforce rules, however temporary or unimportant they may seem, should keep this clearly in mind. If in the judgment of any one whose duty it is to enforce a rule, such rule cannot or ought not to be enforced, he should at once bring it to the attention of those in authority.

GENERAL RULES.

A. Employees whose duties are prescribed by these rules will be provided with a copy and will be required to have it with them when on duty.

B. Employees must be conversant with and obey the rules and special instructions. If in doubt as to their meaning, they must apply to proper authority for an explanation.

C. Employees must pass the required examinations.

D. Persons employed in any service on trains are subject to the rules and special instructions.

E. Employees must render every assistance in their power in carrying out the rules and special instructions.

F. Any violations of the rules or special instructions must be reported.

G. The use of intoxicants by employees while on duty is prohibited. Their use, or the frequenting of places where they are sold, is sufficient cause for dismissal.

H. Smoking tobacco by employees while on duty, in or about passenger stations or on passenger cars, is prohibited.

I. Employees on duty must wear the prescribed badge and uniforms and be neat in appearance.

J. Persons authorized to transact business at stations or on trains must be orderly and avoid annoyance to passengers.

Employees must treat all passengers with politeness, avoid difficulty and exercise patience, forbearance and self-control under all conditions. They must not make threatening gestures or use loud, uncivil, indecent or profane language, even under the greatest provocation.

K. In case of danger to the company's property employees must unite to protect it.

L. All employees whose duties are in any way affected by the time-tables must have a copy of the current time-table with them when on duty.

M. When an employee is discharged from the company's service he will not be re-employed without the consent of the officer who dismissed him, or that of the head of the department from which he was dismissed.

N. If an employee should be disabled by sickness or other cause the right to claim compensation will not be recognized. An allowance, if made, will be a gratuity justified by the circumstances of the case and the employee's previous good conduct.

O. No employee is allowed to contract any bill or other obligation on account of the company, or to use the company's credit, unless authorized by the proper officer.

P. Employees are required to exercise great care to avoid injury to themselves and others, and are required to inform themselves respecting the location of all structures or obstructions along the line that will not clear them when on the top or sides of cars or motors, also as to the conditions of equipment and track.

Employees are warned that extra and special trains may run at any time, and trains may run on any track in either direction without notice except to those whom it is necessary to advise in order to insure proper movement of such trains. Employees must be governed accordingly and exercise proper care to avoid being injured.

Q. Every employee, while on duty connected with the trains on any division of the road, is under the authority and must conform to the orders of the superintendent of that division.

R. Employees are required to keep the premises in their charge in a neat and orderly condition.

S. No employee will be allowed to absent himself from duty without special permission from the head of the department in which he is employed, nor will any employee be allowed to engage a substitute to perform his duties.

T. In the selection of new men for the service, care should be taken to get only persons of good character, and who give promise of being able to improve and to deserve promotion. Application for employment should be made on the prescribed form.

U. The assignment or attaching of an employee's wages by garnishee proceedings in aid of execution will be sufficient cause for dismissal in absence of satisfactory explanation.

V. All articles furnished by the company for use of employees must, on leaving the service, be returned to proper officer. The right is reserved to withhold from wages due the value of such articles lost or that are not surrendered on leaving the service.

AA. All persons in the employ of the company must devote themselves exclusively to its service during the prescribed hours of the day or night, and must properly obey instructions of executive and general officers and of the heads of their departments in matters pertaining to their respective branches of the company's service. No employee will be allowed to engage in any trade, directly or indirectly, for himself, or as an agent for others, without special permission from his superior officer.

BB. Every employee is hereby warned that before exposing himself in working, or being on the tracks or grounds of the company, or in working with or being in any manner on or with its cars, machinery or tools, he must examine, for his own safety, the conditions of all machinery, tools, tracks, cars, or whatever he may undertake to work upon or with, before he makes use of or exposes himself on or with the same, so as to ascertain, so far as he reasonably can, their condition and soundness; and he is required promptly to report to his immediate superior officer any defect in any track, machinery, tools or property of the company affecting the safety of any one in using or operating upon or with the same, and such superior will report the defect to such agent of the company who has authority to remedy it. It is made hereby the right and duty of every employee under all circumstances to take sufficient time, before exposing himself to danger, to make such examination as is here required and refuse to obey any order which would imperil his life or limb.

Responsibility for Damages.—Employees will be held responsible for any damages caused by their neglect or carelessness or by disobedience of rules.

CC. Give Information to Proper Persons.—No employee shall, under any circumstances, give any information whatever concerning any accident, delay, mishap of any kind or business of the company to any person except to a properly authorized representative of the company, except as provided by law.

DD. All employees should as a first consideration promote safety of trains and passengers by all means in their power, report any defect in track, bridges or equipment to the proper official.

In case of accident to trains or roadway, employees are required to give their best efforts to clear the road or to assist as may be required at the time, whether in the line of their usual duty or not.

Employees, especially track and bridgemen, should notice the condition of passing trains, and if they observe anything in bad order should notify the trainmen by proper signals, giving a signal to stop, if, in their judgment, the train is endangered by the defect. In all cases of doubt take the safe side.

EE. Every employee who may witness any accident which may affect the interests of the company, must forthwith make a detailed written report thereof, including the names and addresses of all witnesses, and send same at once to the proper official.

FF. Hearing by Superintendent.—A hearing will be given by the superintendent to every employee who desires to complain. Reports or suggestions for the betterment of the service will always receive consideration.

GG. In addition to these rules special orders will be issued from time to time, as may be found necessary, and such orders posted on the various bulletin boards, when given by proper authority, whether in conflict with these rules or not, shall be fully obeyed while in force.

HH. Every employee accepting free transportation specifically agrees, in consideration of such free transportation, that the company shall not be liable under any circumstances for any injury to his person or loss or damage to his property while using such free transpotation.

JJ. All persons entering the service of this company will be required to sign an acknowledgement that they have read, understand and do agree to obey the rules and regulations of the company.

DEFINITIONS

Engine.—A locomotive propelled by any form of energy.

Train.—An engine or more than one engine, or a motor or more than one motor coupled with or without cars displaying markers.

Regular Train.—A train authorized by a time-table schedule.

Section.—One of two or more trains running on the same schedule displaying signals or for which signals are displayed.

Extra Train.—A train not represented on the time-table. It may be designated as ————————.

Extra.—For any extra train except work extra.

Work Extra.—For work train extra.

Superior Train.—A train having precedence over other trains. A train may be made superior to another train by right, class or direction.

Right is conferred by train order; class and direction by time-table.

Right is superior to class or direction. Direction is superior as between trains of the same class.

Note.—Superiority by direction is limited to single track.

Train of Superior Right.—A train given precedence by train order.

Train of Superior Class.—A train given precedence by time-table.

Train of Superior Direction.—A train given precedence in the direction specified in the time-table as between trains of the same class.

Note.—Superiority by direction is limited to single track.

Time-Table.—The authority for the movement of regular trains subject to the rules. It contains the classified schedules of trains with special instructions relating thereto.

*Adopted at the Kingston meeting of the Street Railway Association of the State of New York, Sept. 21, 1907.

Division.—That portion of a railway assigned to the supervision of a ————————.

Subdivision.—A part of a division so designated on the time-table.

Schedule.—That part of a time-table which prescribes the class, direction, number and movement of a regular train.

Main Track.—A track extending through yards and between stations, upon which trains are operated by time-table or train order or the use of which is controlled by block signals.

Single Track.—A main track upon which trains are operated in both directions.

Double Track.—Two main tracks, upon one of which the current of traffic is in a specified direction and upon the other in the opposite direction.

Three (or More) Tracks.—Three (or more) main tracks, upon any of which the current of traffic may be in either specified direction.

Current of Traffic.—The direction in which trains will move on a main track under the rules.

Station.—A place designated on the time-table by name at which a train may stop for traffic or to enter or leave the main track or from which fixed signals are operated.

Siding.—A track auxiliary to the main track for meeting or passing trains, limited to the distance between two adjoining stations.

Fixed Signal.—A signal of fixed location indicating a condition affecting the movement of a train.

Yard.—A system of tracks within defined limits provided for the making up of trains, storing of cars and other purposes, over which movements not authorized by time-table or by train order may be made, subject to prescribed signals and regulations.

Yard Motor or Engine.—A motor or engine assigned to yard service and working within yard limits.

Pilot.—A person assigned to a train when the motorman or conductor or both are not fully acquainted with the physical characteristics or running rules of the road or portion of the road over which the train is to be moved.

RULES FOR SINGLE OR DOUBLE TRACK. STANDARD TIME

1. Standard time obtained from ..... observatory will be telegraphed to all points from designated offices at..... .... m. daily.

2. Watches that have been examined and certified to by a designated inspector must be used by conductors, motormen and such other employees as may be designated. The certificate in prescribed form must be renewed and filed with ..... every .....

FORM OF CERTIFICATE

CERTIFICATE OF WATCH INSPECTOR

This is to certify that on ....., 19...., the watch of ....., employed as ..... on the .....R, was examined by me. It is correct and reliable, and in my judgment will, with proper care, run within a variation of thirty seconds per week.

Name of maker.....
Brand ....
Number of movement.....
Open or hunting case..... .....
Metal of case.....
Stem or key winding..... .....

Signed,

.....
Inspector.

Address, ...

3. Watches of conductors, motormen and such other employees that may be designated must be compared before starting on each trip with a clock designated as a standard clock. The time when watches are compared must be registered on a prescribed form.

TIME-TABLES

4. Each time-table from the moment it takes effect supersedes the preceding time-table and its schedules take effect on any division ,or subdivision) at the leaving time at their initial stations on such division (or subdivision). But when a schedule of the preceding time-table corresponds in number, class, day of leaving, direction and initial and terminal stations with a schedule of the new time-table, a train authorized by the preceding time-table will retain its train orders and assume the schedule of the corresponding number of the new time-table.

Schedules on each division (or subdivision) date from their initial stations or such division (or subdivision).

Not more than one schedule of the same number and day shall be in effect on any division (or subdivision).

5. Not more than two times are given for a train at any station; where one is given it is, unless otherwise indicated, the leaving time; where two, they are the arriving and the leaving time.

Unless otherwise indicated, the time applies to the switch where an inferior train enters the siding; where there is no siding it applies to the place from which fixed signals are operated; where there is neither siding nor fixed signal, it applies to the place where traffic is received or discharged.

Schedule meeting or passing stations are indicated by figures in full-faced type.

Both the arriving and leaving time of a train are in full-faced type when both are meeting or passing time, or when one or more trains are to meet or pass it between those times.

When trains are to be met or passed at a siding extending between two adjoining stations, the time at each end of the siding will be shown in full-faced type.

Where there are one or more trains to meet or pass a train between two times, or more than one train to meet a train at any station, attention is called to by ————————.

6. The following signs when placed before the figures of the schedule indicate:

"S"—regular stop.
"F"—flag stop to receive or discharge passengers or freight.
"L"—leave.
"A"—arrive.

SIGNAL RULES.

7. Employes whose duties may require them to give signals must provide themselves with the proper appliances, keep them in good order and ready for immediate use.

8. Flags of the prescribed color must be used by day, and lamps of the prescribed color by night.

9. Night signals are to be displayed from sunset to sunrise. When weather or other conditions obscure day signals, night signals must be used in addition.

VISIBLE SIGNALS.

Color.	Indication.
(a) Red.....	Stop
(b) Green.....	Proceed, and for other uses prescribed by the rules
(c) Yellow.....	Proceed with caution, and for other uses prescribed by the rules.
(d) Green and white.	Flag stop. See Rule 28.
(e) Blue.....	See Rule 26

11. A fusee on or near the track burning red must not be passed until burned out.

12. HAND, FLAG AND LAMP SIGNALS.

Manner of Using.	Indication.
(a) Swung across the track.....	Stop
(b) Raised and lowered vertically.....	Proceed
(c) Swung vertically in a circle at half arm's length across the track when the train is standing.....	Back
(d) Swung vertically across the track in a circle at arm's length when the train is running.....	Train has parted
(e) Swung horizontally above the head, when the train is standing	Apply air brakes
(f) Held at arm's length above the head, when the train is standing.	Release air brakes

13. Any object waved violently by any one on or near the track is a signal to stop.

AUDIBLE SIGNALS

Engine Whistle Signals.

14. Note.—The signals prescribed are illustrated by "o" for short sounds, "———" for longer sounds. The sound of the whistle should be distinct, with intensity and duration proportionate to the distance signal is to be conveyed.

Sound	Indication
(a) o	Stop. Apply brakes.
(b) — —	Release brakes.
(c) — ooo	Flagman go back and protect rear of train.
(d) — — — —	Flagman return from west or south.
(e) — — — — —	Flagman return from east or north.
(f) — — —	When running, train parted; to be repeated until answered by Rule 12 (d).
(g) o o	Answer to any signal not otherwise provided for.
(h) o o o	When train is standing, back. Answer to 12 (c) and 16 (a). When train is running, answer to 16 (d).
(j) o o o o	Call for signals.
(k) ——— o o	To call the attention of yard engines, extra trains or trains of the same or inferior class or inferior right to signals displayed for a following section.
(l) ——— ——— o o	Approaching public crossing at grade.
(n) ————	Approaching stations, junctions and railroad crossings at grade.

A succession of short sounds of the whistle is an alarm for persons or cattle on the track.

15. The explosion of one torpedo is a signal to stop; the explosion of two not more than 200 ft. apart is a signal to reduce speed and look out for a stop signal.

15A. Torpedoes must not be placed near stations or road crossings where persons are liable to be injured by them.

BELL CORD SIGNALS,

Conductor to Motorman

(a)	Two	When train is standing, start.
(b)	One	When train is running, stop at next station.
(c)	Four	When train is standing, back the train.
(d)	Three	When train is running, stop at once—emergency.
(e)	Three	When train is standing, apply or release air-brakes.
(f)	Four	When train is running, reduce speed.
(g)	Five	When train is standing, call in flagman.
(h)	Five	When train is running, increase speed.

COMMUNICATING SIGNALS (OPTIONAL)

	Sound	Indication
(a)	Two	When train is standing, start.
(b)	Two	When train is running, stop at once.
(c)	Three	When train is standing, back the train.
(d)	Three	When train is running, stop at next station.
(e)	Four	When train is standing, apply or release air-brakes.
(f)	Four	When train is running, reduce speed.
(g)	Five	When train is standing, call in flagman.
(h)	Five	When train is running, increase speed.

Motorman to Conductor

	Sound	Indication
(a)	One	Come to cab.
(b)	Two	Watch trolley.
(c)	Five	Pull trolley down to roof.
(d)	Four taps by motorman is signal to conductor that he wishes to back train and answered by conductor before train is backed.	

TRAIN SIGNALS

17. The head-light will be displayed to the front of every train by night, but must be concealed when a train turns out to meet another and has stopped clear of main track or is standing to meet trains at the end of double track or at junctions.

18. Yard motors will display the head-light to the front and rear by night. When not provided with a head-light at the rear two white lights must be displayed. Yard motors will not display markers.

19. The following signals will be displayed, one on each side of every train, as markers, to indicate the rear of the train. By day, green flags; by night, green lights to the front and side and red lights to the rear, except when the train is clear of the main track, when green lights must be displayed to the front side and rear.

20. All sections except the last will display two green flags and in addition two green lights by night in the places provided for that purpose on the front of the motor or engine.

21. Extra trains will display two white flags and in addition two white by night in the places provided for that purpose on the front of the engine motor.

22. When two or more motors are coupled the leading motor only shall display the signals as prescribed by Rules 20 and 21.

23. One flag or light displayed where in Rules 19, 20 and 21 two are prescribed will indicate the same as two, but the proper display of all train signals is required.

24. When cars are pushed by a motor (except when shifting or making up trains in yards) a white light must be displayed on the front of the leading car by night.

25. Each car on a passenger train must be connected with the motor by a communicating signal appliance.

26. A blue flag by day and a blue light by night displayed at one or both ends of an engine, car or train, indicates that workmen are under or about it; when thus protected it must not be coupled to or moved. Workmen will display the blue signals and the same workmen are alone authorized to remove them. Other cars must not be placed on the same track so as to intercept the view of the blue signals without first notifying the workmen.

USE OF SIGNALS

27. A signal imperfectly displayed or the absence of a signal at a place where a signal is usually shown must be regarded as a stop signal and the fact reported to the .....

28. A combined green and white signal is to be used to stop a train only at the flag stations indicated on its schedule. When it is necessary to stop a train at a point that is not a flag stop on its schedule a red signal must be used.

29. When a signal (except a fixed signal) is given to stop a train it must, unless otherwise provided, be acknowledged as prescribed by Rule 14 (g) or (h).

30. The engine or motor bell must be rung when a train is about to move.

31. The engine or motor bell must be rung on approaching every public road crossing at grade and until it is passed, and the whistle must be sounded at all whistling-posts.

32. The unnecessary use of either the whistle or the bell is prohibited. They will be used only as prescribed by rule or law or to prevent accident.

33. Watchmen stationed at public road and street crossings must use red signals only when necessary to stop trains.

SUPERIORITY OF TRAINS

71. A train is superior to another train by right, class or direction. Right is conferred by train order; class and direction by time-table. Right is superior to class or direction. Direction is superior as between trains of the same class.

72. Trains of the first class are superior to those of the second; trains of the second class are superior to those of the third, and so on. Trains in the direction specified by the time-table are superior to trains of the same class in the opposite direction.

73. Extra trains are inferior to regular trains.

MOVEMENT OF TRAINS

82. Time-table schedules, unless fulfilled, are in effect for ..... after their time at each station. Regular trains ..... hours behind either their schedule arriving or leaving time at any station lose both right and schedule and can thereafter proceed only as authorized by train order.

83. A train must not leave its initial station on any division (or subdivision) or a junction or pass from double to single track until it has been ascertained whether all trains due, which are superior or of the same class, have arrived or left.

84. A train must not start until the proper signal is given.

85. When a train of one schedule is on the time of another schedule of the same class in the same direction it will proceed on its own schedule. Trains of one schedule may pass trains of another schedule of the same class and extras may pass and run ahead of extras.

86. An inferior train must clear the time of a superior train in the same direction not less than ..... minutes, but must be clear at a time a first-class train in the same direction is due to leave the next station in the rear where time is shown.

87. An inferior train must keep out of the way of opposing superior trains and failing to clear the main track by the time required by rule must be protected as prescribed by Rule 99. Extra trains must clear the time of regular trains ..... minutes unless otherwise provided, and will be governed by train orders with respect to opposing extra trains.

88. At meeting points between trains of the same class the inferior train must clear the main track before the leaving time of the superior train. At meeting points between extra trains the train in the inferior time-table direction must take the siding unless otherwise provided. Trains must pull into the siding when practicable; if necessary to back in, the train must first be protected as prescribed by Rule 99, unless otherwise provided.

89. At meeting points between trains of different classes the inferior train must take the siding and clear the superior train at least ..... minutes and must pull into the siding when practicable. If necessary to back in the train must first be protected as prescribed by Rule 99, unless otherwise provided.

90. Trains must stop at schedule meeting stations if the train to be met is of the same class unless the switch is right and the track clear. When the expected train of the same class is not found at the schedule meeting station the superior train when on time must approach all sidings prepared to stop until the expected train is met. Trains must stop clear of the switch used by the train to be met in going on the siding.

91. Unless some form of block signal is used trains in the same direction must keep at least ..... apart, except in closing up at stations.

92. A train must not arrive at a station in advance of its schedule arriving time. A train must not leave a station in advance of its schedule leaving time.

93. Within yard limits the main track may be used protecting against ..... class trains. ..... class and extra trains must move within yard limits prepared to stop unless the main track is seen or known to be clear.

94. A train which overtakes another train so disabled that it cannot proceed will pass it if practicable and if necessary will assume the schedule and take the train orders of the disabled train, proceed to the next open telegraph or telephone office and there report to the ..... The disabled train will assume the right or schedule and take the train orders of the last train with which it has exchanged and will when able proceed to and report from the next open telegraph or telephone office. When a train, unable to proceed against the right or schedule of an opposing train, is overtaken between stations by an inferior train or a train of the same class having right or schedule which permits it to proceed, the delayed train may, after proper consultation with the following train, precede it to the next telegraph or telephone station, where it must report to..... When opposing trains are met under these circumstances it must be fully explained to them by the leading train that the expected train is following.

94-A.—Should it become necessary for crews to change off before the completion of their trip they must exchange all orders and special instructions, read them aloud to each other and know that they are understood before proceeding.

95. Two or more sections may be run on the same schedule. Each section has equal time-table authority. A train must not display signals for a following section without orders from the .....

96. When signals displayed for a section are taken down at any point before that section arrives the conductor will, if there be no other provision, arrange in writing with the operator, or if there be no operator, with the switchtender, or in the absence of both, with a flagman left there for that purpose, to notify all opposing inferior trains of the same class leaving such points that the section for which signals were displayed have not arrived.

97. Extra trains must not be run without orders from the .....

98. Trains must approach the end of double track, junctions, railroad crossings at grade and drawbridges prepared to stop unless the switches and signals are right and the track is clear. Where requied by law tains must stop.

98-A. Trains must be brought to a full stop at a safe distance approaching railroad crossings at grade and motorman must not proceed until the conductor has gone ahead to the center of crossing, looking both ways, and given the "proceed" signal. Before starting the motorman will look back to see that no passengers are getting on or off, and in no case proceed, even after conductor's signal, until he has also examined the crossing and satisfied himself that it is clear and may be safely used. When there is more than one track the conductor must remain in advance of the train until the last track is reached.

99. When a train stops or is delayed under circumstances in which it may be overtaken by another train the flagman must go back imme-

diately with stop signals a sufficient distance to insure full protection. When recalled he may return to his train, first placing two torpedoes on the rail when the conditions require it. The front of a train must be protected in the same way when necessary by the .....

100. If a train should part while in motion trainmen must, if possible, prevent damage to the detached portions. The signals prescribed by Rules 12 (d) and 14 (f) must be given. The detached portion must not be moved or passed until the front portion comes back.

101. When cars are pushed by an engine or motor (except when shifting and making up trains in yards) a flagman must take a conspicuous position on the front of the leading car.

102. Messages or orders respecting the movement of trains or the condition of track or bridges must be in writing.

103. Switches must be left in proper position after having been used. Conductors are responsible for the position of the switches used by them and their trainmen except where switchtenders are stationed. A switch must not be left open for a following train unless in charge of a trainman of such train.

105. Both conductors and motormen are responsible for the safety of their trains and, under conditions not provided for by the rules, must take every precaution for their protection.

106. In all cases of doubt or uncertainty the safe course must be taken and no risks run.

RULES FOR MOVEMENT BY TRAIN ORDERS

201. For movements not provided for by time-table train orders will be issued by authority and over the signature of the ..... They must contain neither information nor instructions not essential to such movements. They must be brief and clear; in the prescribed forms when applicable and without erasure, alteration or interlineation.

202. Each train order must be given in the same words to all persons or trains addressed.

203. Train orders will be numbered consecutively each day, beginning with No. .. at midnight.

204. Train orders must be addressed to those who are to execute them, naming the place at which each is to receive his copy. Those for a train must be addressed to the conductor and motorman and also to any one who acts as its pilot. A copy for each person addressed must be supplied by the operator. Orders addressed to operators restricting the movement of trains must be respected by conductors and motormen the same as if addressed to them.

205. Each train order must be written in full in a book provided for the purpose at the office of the ....., and with it recorded the names of those who have signed for the order, the time and the signals which show when and from what office the order was repeated and the responses transmitted and the train dispatcher's initials. These records must be made at once and never from memory or memoranda.

206. Regular trains will be designated in train orders by their numbers, as "No. 10" or "2d No. 10," adding engine or motor numbers if desired. Extra trains will be designated by motor numbers and the direction as "Extra 798 'East' or 'West.'" Other numbers and time will be stated in figures and words.

207. To transmit a train order the signal "31" or the signal "19" followed by the direction must be given to each office addressed, the number of copies being stated if more or less than three—thus "31 West copy 5" or "19 East copy 2."

208 (A). A train order to be sent to two or more offices must be transmitted simultaneously to as many of them as practicable. The several addresses must be in the order of superiority of trains, each office taking its proper address. When not sent simultaneously to all the order must be sent first to the superior train.

208 (B)—(Optional).

A train order to be sent to two or more offices must be transmitted simultaneously to as many of them as practicable. The several addresses must be in the order of superiority of trains, and when practicable must include the operator at the meeting or waiting point, each office taking its proper address. When not sent simultaneously to all, the order must be sent first to the superior train. Copies of the order addressed to the meeting or waiting point must be delivered to all trains affected until all have arrived from one direction.

209. Operators receiving train orders must write them in manifold during transmission and if they cannot at one writing make the requisite number of copies, must trace others from one of the copies first made.

210. When a "31" train order has been transmitted operators must (unless otherwise directed) repeat it at once from the manifold copy in the succession in which the several offices have been addressed and then write the time of repetition on the order. Each operator receiving the order should observe whether the others repeat correctly. Those to whom the order is addressed, except ....., must then sign it, and the operator will send their signatures preceded by the number of the order to the ..... The response "complete" and the time, with the initials of the ....., will then be given by the train dispatcher. Each operator receiving this response will then write on each copy the word "complete," the time and his last name in full and then deliver a copy to each person addressed.

211. When a "19" train order has been transmitted operators must (unless otherwise directed) repeat it at once from the manifold copy in the succession in which the several offices have been addressed. Each operator receiving the order should observe whether the other repeats correctly. When the order has been repeated correctly by an operator the response "complete" and the time, with the initials of the ....., will be given by the train dispatcher. The operator receiving this response will then write on each copy the word "complete," the time and his last name in full and personally deliver a copy to each person addressed without taking his signature. When a "19" train order restricting the superiority of a train for it at the point where such superiority is restricted the train must be brought to a stop before delivery of the order.

212. A train order may when so directed by the train dispatcher be acknowledged without repeating by the operator responding "X" (number of train order) to (train number)," with the operator's initials and office signal. The operator must then write on the order his initials and the time.

213. "Complete" must not be given to a train order for delivery to an inferior train until the order has been repeated or the "X" response sent by the operator who receives the order for the superior train.

214. When a train order has been repeated or "X" response sent, and before "complete" has been given, the order must be treated as a holding order for the train addressed, but must not be otherwise acted on until "complete" has been given. If the line fail before an office has repeated an order or has sent the "X" response the order at that office is of no effect and must be there treated as if it had not been sent.

215. The operator who receives and delivers a train order must preserve the lowest copy.

216. For train orders delivered by the train dispatcher the requirements as to the record and delivery are the same as at other offices.

217. A train order to be delivered to a train at a point not a telegraph or telephone station, or at one which the office is closed, must be addressed to "C. and M. ..... (at .....), care of .....," and forward and deliver by the conductor or other person in whose care it is addressed. When form 31 is used "complete" will be given upon the signature of the person by whom the order is to be delivered, who must be supplied with copies for the conductor and addressed, and a copy upon which he shall take their signatures. This copy he must deliver to the first operator accessible, who must preserve it and at once transmit the signatures of the conductor and motorman to the train dispatcher. Orders so delivered must be acted on as if "complete" had been given in the usual way. For orders which are sent in the manner herein provided to a train, the superiority of which is thereby restricted, "complete" must not be given to an inferior train until the signatures of the conductor and motorman of the superior train have been sent to the .....

217-A. When necessary for train crews to receive train orders by telephone the conductors must receive and make a written record of the order. The motorman must repeat it back from the record made by the conductor. The order must not be acted upon until "complete" is given by the train dispatcher to motorman and acknowledged by the conductor.

218. When a train is named in a train order by its schedule number alone all sections of that schedule are included and each must have copies delivered to it.

219. Unless otherwise directed, an operator must not repeat or give the "X" response to a train order for a train which has been cleared or of which the motorman has passed his train-order signal until he has obtained the signature of the conductor and motorman to the order.

220. Train orders once in effect continue so until fulfilled, superseded or annulled. Any part of an order specifying a particular movement may be either superseded or annulled. Orders held by or issued for or any part of an order relating to a regular train become void when such train loses both right and schedule as prescribed by Rules 4 and 82 or is annulled.

221 (A) A fixed signal must be used at each train-order office, which shall indicate "stop" when there is an operator on duty, except when changed to "proceed" to allow a train to pass after getting train orders or for which there are no orders. A train must not pass the signal while "stop" is indicated. The signal must be returned to "stop" as soon as a train has passed. It must be fastened at "proceed" only when no operator is on duty. Operators must have the proper appliances for hand signaling ready for immediate use if the fixed signal should fail to work properly. If a signal is not displayed at a night office trains which have not been notified must stop and ascertain the cause and report the facts to the ..... from the next open telegraph or telephone station. Where the semaphore is used the arm indicates "stop" when horizontal and "proceed" when in an inclined position.

222. Operators will promptly record and report to the ..... the time of departure of all trains and the direction of extra trains. They will record the time of arrival and report it when so directed.

223. The following signs and abbreviations may be used:

Initials for signature of the .....
Such office and other signals as are arranged by the .....
C. & M.—For conductor and motorman.
X.—Train will be held until order is made "complete."
Com.—For complete.
O. S.—Train report.
No.—For number.
Eng.—For engine.
Mot.—For motor.
Sec.—For section.
Psgr.—for passenger.
Frt.—For freight.
Mins.—For minutes.
Jct.—For junction.
Dispr.—For train dispatcher.

Opr.—For operator.
31 or 19—To clear the line for train orders and for operators to ask for train orders.
S. D.—For "stop displayed."
The usual abbreviations for the names of the months and stations.

FORMS OF TRAIN ORDERS

Form A. Fixing Meeting Points for Opposing Trains

(1).....meet.....at.....
(2).....meet.....at..... .....at.....
(and so on).

Examples

(1) No. 1 meet No. 2 at "B."
No. 3 meet 2d No. 4 at "B."
No. 5 meet extra 95 east at "B."
Extra 652 north meet extra 231 south at "B."
(2) No. 2 and 2d No. 4 meet Nos. 1 and 3 at "C" and extra 95 west at "D."
No. 1 meet No. 2 at "B," 2d No. 4 at "C" and extra 95 east at "D."

Trains receiving these orders will run with respect to each other to the designated points and there meet in the manner provided by the rules.

STANDARD TRAIN ORDER BLANK FOR 31 ORDER

Form 31 **Form 31**

(Name) **Company**

TRAIN ORDER No. 10

March 21, **19**06

To **At**

X (Initials) **Opr.;** 1 45 A M

Conductor and Engineman must each have a copy of this order

Repeated at 2 20 A M.

Conductor	Engineman	Train	Made	Time	Opr.
Jones	Brown	45	Complete	2 20 a.m.	Black
	(Omit				
	this column				
	where				
	Engineman				
	is not				
	required				
	to sign.)				

Form B. Directing a Train to Pass or Run Ahead of Another Train

(1).....pass.....at.....
(2).....pass.....when overtaken.
(3).....run ahead of..... .....to.....
(4).....run ahead of..... .....until overtaken.
(5).....pass.....at.....and run ahead of ....to.....

Examples

(1) No. 1 pass No. 3 at "K."
(2) No. 6 pass No. 4 when overtaken.
(3) Extra 594 east run ahead of No. 6 "M" to "B."
(4) Extra 95 west run ahead of No. 3 "B" until overtaken.
(5) No. 1 pass No. 3 at "K" and run ahead of No. 7 "M" to "Z."

When under (1) a train is to pass another both trains will run according to rule to the designated point and there arrange for the rear train to pass promptly.

Under (2) both trains will run according to rule until the second-named train is overtaken and then arrange for the rear train to pass promptly.

Under (3) the second-named train must not exceed the speed of the first-named train between the points designated.

Under (4) the first-named train will run ahead of the second-named train from the designated station until overtaken and then arrange for the rear train to pass promptly.

When an inferior train receives an order to pass a superior train right is conferred to run ahead of the train passed from the designated point.

Form C. Giving Right to a Train Over an Opposing Train.

.....has right over..... .....to.....

STANDARD TRAIN ORDER BLANK FOR 19 ORDER

Form 19 **Form 19**

(Name) **Company**

TRAIN ORDER No. 10

March 21, **19**06

To **At**

X (Initials) **Opr.;** 1 45 A M

Conductor and Engineman must each have a copy of this order

Made complete **time** 2 16 P M Black **Opr.**

Examples

(1) No. 1 has right over No. "G" to "X."
(2) Extra 37 east has right over No. 3 "F" to "A."

This order gives right to the train first-named over the other train between the points named.

If the trains meet at either of the designated points the first-named train must take the siding unless the order otherwise prescribes.

Under (1) if the second-named train reach the point last named before the other arrives it may proceed, keeping clear of the opposing train as many minutes as such train was before required to clear it under the rules.

Form—(A)

(Name) **Company**

CLEARANCE CARD

Dover 9 15 a. m. March 21 19 06

Conductor and Engineman No. 12

I have (3) (No) (No further) orders for your train.

Signal is displayed for Extra 452

John Jones Operator

This does not affect any orders you may have received.

Conductor and Engineman must each have a copy, and see that their train is correctly designated in the above form.

Under (2) the regular train must not go beyond the point last named until the extra train has arrived unless directed by train order to do so.

Form D. Giving Regular Trains the Right Over a Given Train

Form E. Time Orders

(1).....run.....late.....to.....
(2).....run.....late.....to..... and .....late.....to.....etc.
(3).....wait at.....until.....for.....
(4).....wait at.....until.....
.....until.....
.....until.....
.....until.....

Examples

(1) No. 1 run 20 mins. late "A" to "G."
(2) No. 1 run 20 mins. late "A" to "G" and 15 mins. late "G" to "K," etc.
(3) No. 1 wait at "H" until 10:00 a. m. for No. 2.
(4) Nos. 1 and 3 wait at "H" until 10:00 a. m.
"P" until 10:30 a. m.
"R" until 10:55 a. m., etc.

(1) and (2) make the schedule time of the train named between the stations mentioned as much later as stated in the order and any other train receiving the order is required to run with respect to this later time as before required to run with respect to the regular schedule time. The time in the order should be such as can be easily added to the schedule time.

Under (3) the train first named must not pass the designated point before the time given unless the other train has arrived. The train last named is required to run with respect to the time specified at the designated point or any intermediate station where schedule time is earlier than the time specified in the order as before required to run with respect to the schedule time of the train first named.

Under (4) the train (or trains) named must not pass the designated points before the times given.

Other trains receiving the order are required to run with respect to the time specified at the designated points or any intermediate station where schedule time is earlier than the time specified in the order as before required to run with respect to the schedule time of the train (or trains) named.

All of these examples may be used in connection with an extra train created by example (3) of Form G and the times at each point stated in that example have the same meaning as schedule times in the foregoing examples.

Form F. For Sections

(1).....display signals and run as.....to.....
(2).....run as..... .....to.....
(3).....display signals.....to.....for.....
(6).....is withdrawn as.....at.....
(7).....instead of.....display signals and run as .....to.....
(8).....take down signals at.....
(9).....and.....reverse positions as.....and ....to.....

Examples

(1) Eng. 20 display signals and run as 1st No. 1 "A" to "Z."
(2) Eng. 25 run as 2d No. 1 to "A" to "Z."
(3) No. 1 display signals "A" to "G" for eng. or mot. 65. 2d No. 1 display signals "B" to "E" for eng. or mot. 99.

These examples may be modified as follows:

(4) Engs. or mots. 20, 25 and 99 run as 1st, 2d and 3d No. 1 "A" to "Z."

Example (1) is to be used when the number of the engine for which signals are displayed is unknown and is to be followed by example (2), both being single order examples.

Under examples (2) and (3) the engine or motor named will not display signals.

Under example (4) the engine or motor last named will not display signals.

For changing sections:

To add an intermediate section the following modification of example (1) will be used:

(5) Eng. or mot. 85 display signals and run as 2d No. 1 "N" to "Z." Following sections change numbers accordingly.

Under (5) engine or motor 85 will display signals and run as directed and following sections will take the next higher number.

To drop an intermediate section the following example will be used:

(6) Eng. or mot. is withdrawn as 2d No. 1 at "H." Following sections change numbers accordingly.

Under (6) engine 85 will drop out at "H" and following sections will take the next lower number.

To substitute one engine or motor for another on a section the following will be used:

(7) Eng. or mot. 18 instead of eng. or mot. 85 display signals and run as 2d No. 1 "R" to "Z."

Under (7) engine or motor 85 will drop out at "R" and engine or motor 18 will run as directed.

If engine or motor 85 is last section the words "display signals and" will be omitted. Following sections need not be addressed.

To discontinue the display of signals the following example will be used:

(8) 2d No. 1 take down signals at "D."

Under example (8) 2d No. 1 will take down signals as directed and a following section must not proceed beyond the point named.

To pass one section by another the following will be used:

(9) Engs. or mots. 99 and 25 reverse positions as 2d and 3d No. 1 "H" to "Z."

Under (9) engine or motor 99 will run ahead of engine or motor 25 "H" to "Z," and, if necessary, both engines or motors will arrange signals accordingly. Following sections, if any, need not be addressed.

The character of a train for which signals are displayed may be stated. Each section affected by the order must have copies and must arrange signals accordingly.

To annul a section for which signals have been displayed over a division or any part thereof, when no train is to follow the signals, Form K must be used.

Form G. Extra Trains

(1) Eng. or mot.....run extra.....to.....
(2) Eng. or mot.....run extra.....to.....
and return to.....

Examples

(1) Eng. or mot. 99 run extra "A" to "F."
(2) Eng. or mot. 99 run extra "A" to "F" and return to "C."
Under (2) the extra must go to "F" before returning to "C."
(3) Eng. or mot. ..... run extra, leaving ..... on ..... as follows with right over all trains:
Leave.....
Leave.....
Arrive.....
(3) Eng. or mot. 77 run extra, leaving "A" on Thursday, Feb. 17, as follows, with right over all trains:
Leave "A" 11:30 p. m.
" "C" 12:25 a. m.
" "E" 1:47 a. m.
Arrive "F" 2:22 a. m.

This order may be varied by specifying the kind of extra and the particular trains over which the extra shall or shall not have right. Trains over which the extra is thus given right must clear the time of the extra ..... minutes.

Form H. Work Extra

(1).....works.....until.....between.....and.....

Examples

(1) Eng. or mot. 292 works 7 a. m. to 6 p. m. between "D" and "E."

Under (1) the work extra must, whether standing or moving, protect itself against extras within the working limits in both directions as prescribed by rule. The time of regular trains must be cleared.

This may be modified by adding:

(2) Not protecting against (eastward) extras.
(3) Not protecting against extras.

Under (2) the work extra will protect only against (westward) extras. The time of regular trains must be cleared.

Under (3) protection against extras is not required. The time of regular trains must be cleared.

When a work extra has been instructed by order to not protect against extra trains and afterward it is desired to have it clear the track for (or protect itself after a certain hour against) a designated extra an order may be given in the following form:

(4) Work extra 292 clears (or protects against) extra 76 east between "D" and "E" after 2:10 p. m.

Under (4) extra 76 east must not enter the working limits before 2:10 p. m. and will then run expecting to find the work extra clear of the main track (or protecting itself) as the order may require.

To enable a work extra to work upon the time of a regular train the following form will be used:

(5) Work extra 292 protects against No. 55 (or ..... class trains) between "D" and "E."

Under (5) the work extra may work upon the time of the train or trains mentioned in the order and must protect itself against such train or trains as prescribed by Rule 99. The regular train or trains receiving the order will run expecting to find the work extra protecting itself.

When a work extra is to be given exclusive right over all trains the following form will be used:

(6) Work extra 292 has right over all trains between "D" and "E," 7 p. m. to 12 night.

This gives the work extra the exclusive right between the points designated between the times named.

Work extras must give way to all trains as promptly as practicable.

Whenever extra trains are run over working limits they must be given a copy of the order sent to the work extra. Should the working order instruct a work extra to not protect against extra trains in one or both directions extra trains must protect, as prescribed by Rule 99, against the work extra; if the order indicates that the work extra is protecting itself against other trains, they will run expecting to find work extra protecting itself.

The working limits should be as short as practicable, to be changed as the progress of the work may require.

Form J. Holding order

Hold.....

Examples

Hold No. 2.
Hold all (or .....ward) trains.

When a train has been so held it must not proceed until the order to hold is annulled or an order given to the operator in the form:
"..... may go."

These orders will be addressed to the operator and acknowledged in the usual manner and will be delivered to conductors and motormen of all trains effected.

Form J will only be used when necessary to hold trains until orders can be given or in case of emergency.

Form K. Annulling a Schedule or a Section

.....of.....is annulled.....to.....

Examples

No. 1 of Feb. 29 is annulled "A" to "Z."
2d No. 5 of Feb. 29 is annulled "E" to "G."

The schedule or section annulled becomes void between the points named and cannot be restored.

Form L. Annulling an Order

Order No. ..... is annulled.

Examples

Order No. 10 is annulled.

If an order which is to be annulled has not been delivered to a train the annulling order will be addressed to the operator, who will destroy all copies of the order annulled but his own and write on that:

Annulled by Order No. .....

An order which has been annulled must not be reissued under its original number.

Form M. Annulling Part of An Order

That part of Order No. ..... reading ..... is annulled.

Examples

That part of Order No. 10 reading No. 1 meet No. 2 at "S" is annulled.

Form P. Superseding An Order or a Part of An Order

This order will be given by adding to prescribed forms the words "instead of ....."

(1).....meet.....at.....instead of.....

(2).....has right over..... .....to..... instead of.....

(3).....display signals for..... .....to..... instead of.....

Examples

(1) No. 1 meet No. 2 at "C" instead of "B."

(2) No. 1 has right over No. 2 "G" to "R" instead of "X."

(3) No. 1 display signals for eng. or mot. 85 "A" to "Z" instead of "G."

An order which has been superseded must not be reissued under its original number.

SPECIAL RULES

Train Dispatchers

311. Train dispatchers report to and receive their instructions from the .....

312. They will issue orders governing the movement of trains and see that all such orders are transmitted and recorded according to the prescribed forms and rules, and will keep a careful record of the movement of all trains or engines or motors over the district or division, noting all important incidents on the prescribed forms.

(Transfer)

313. Each train dispatcher going off duty must enter in ink on the train dispatcher's order book, a transfer of all orders that have not been fully executed, and must see that all such orders are understood by the relieving train dispatcher.

(Time of Relief)

314. A train dispatcher and the operator working with him must not be relieved at the same hour.

Station Masters.

Report to:

322. Station masters report to and receive their orders from the superintendent and will comply with the instructions of the .....

Duty:

323. They will have charge of passenger stations and yards and persons employed therein.

324. Inspect all cars, station apartments and grounds and see that they are kept in condition for the comfort and convenience of passengers.

325. See that passenger trains are made up in the order designated that crews report for duty at the prescribed hour and that trains leave on time.

326. They must not permit a train to start with a motorman, conductor or trainman who has apparently been drinking intoxicating liquors or is unfit for duty, nor fail to report such occurrences at once to the superintendent.

(Keep Proper Records)

327. Keep a record of all trains and cars, note all irregularities and see that reports of same are made to the proper officer.

(Announcement)

328. Before the arrival or departure of a train announce in the waiting-room and on the platform its direction, its destination, state whether local or through and mention the next and principal stops.

(This duty may be delegated to doormen or ushers.)

Station Agents

Report to:

329. Station agents report to and receive their orders from the superintendent and will obey the instructions of the..... They will comply with instructions issued by the Passenger, Freight and Accounting Departments.

Duty:

330. They will have charge of the business of the company at the station, all property connected therewith and all persons employed thereat.

Switching Lists:

331. They must furnish conductors on arrival complete list of all station switching to be done by them and will report failure to properly perform the work.

Condition of Premises:

331. See that the station and grounds are in proper condition for the safety, comfort and convenience of patrons.

Signal Appliance:

332. See that the station is supplied with the necessary lanterns, flags and torpedoes and that they are ready for immediate use.

(Cars at Stations Properly Secured)

333. Know that all cars standing on sidings are entirely clear of passing trains and that brakes are properly set. When on grades, see that wheels are blocked. In case of high winds extra precaution must be taken to prevent cars from fouling adjoining tracks.

Obstructions:

334. See that street crossings and sidewalks are not obstructed by cars standing on sidings.

335. See that lumber or other material is not piled within eight (8) feet of any track.

Insure Safety:

336. Unless otherwise ordered they must know that all switches and frogs at their stations are in safe condition for use and that all signals are in proper working order. They must take every precaution to insure the safety of trains.

Switch Lamps:

337. Be responsible for the care and proper display of switch lamps as per Rule No. 9.

Printed Information for Public:

338. Post in a prominent place time-tables and tariffs and other matter issued by the Freight and Passenger Departments for the information of the public.

Hold Traffic:

339. Use every proper means to secure and hold traffic for the road.

Condition of Cars:

340. Know that all cars are in proper condition before loading and do not permit them to be loaded in excess of the weight given in special instructions nor beyond the proper limits of height and width. The dimensions of loading will be furnished on application to the superintendent. Heavy logs or timber on cars must be properly staked and wired or chained.

Long Timbers:

341. Long timbers reaching over two or more cars must be loaded and placed as per instructions. All such cars must be chained together in addition to the regular coupling.

Order and Politeness:

342. Enforce order and require all persons employed at the station to be polite and considerate in their intercourse with the public.

Passenger Conductors

Report to:

343. Passenger conductors report to and receive their orders from the superintendent and will obey the instructions of the ..... They must comply with instructions issued by the Passenger and Accounting Departments.

Duty:

344. They will be responsible for the movement, safety and care of the train and for the vigilance and conduct of the men employed thereon and must report any misconduct or neglect of duty.

When there are two or more cars in a train the conductor of the leading car will be in charge of operation.

345. They must know that the men employed on their trains are familiar with their duties.

Report for Duty:

346. Report for duty in uniform at least ..... minutes before leaving time and assist in making up the train when necessary.

Bulletin Rules:

347. Examine bulletin board before starting and at each point possible thereafter and compare time with the motorman before starting.

Registers:

348. At points where train registers are kept enter all the information required by their form.

Handling Passengers:

349. Never permit the train to be moved while passengers are getting on or off.

Running by Station:

350. When a train runs past a station notify the passengers not to alight until the train has backed, which movement must not be executed until the conductor has given the proper signal and motorman has acknowledged same.

Unauthorized Passengers:

351. No persons, excepting those specified in the instructions governing free travel, will be allowed to ride on any train without a proper ticket or pass or payment of fare.

Ejectment:

352. If any person shall refuse to produce proper ticket or pass or pay fare cause the train to be brought to a stop at a regular station or near some dwelling-house and request such person to leave the train. In case of refusal remove such person therefrom.

It should not be in such a place in such weather or such unseasonable hour as might ordinarily endanger the health or safety of the person ejected. The person ejected must not be a child, a person of unsound mind or in such feeble or helpless condition as to be unable to take care of himself or herself at the point of ejection.

Protect Passenger:

It is the duty of conductors to protect passengers who are lawfully on their trains from rudeness, threatened violence, abusive or obscene language, and any passenger acting in a disorderly manner or who annoys

passengers as stated above may be removed from train at the next station whether provided with ticket or not.

Each conductor will be held responsible for the exercise of reasonable discretion in the performance of this duty, maintaining self-control and being careful to use no unnecessary force that might subject the company to litigation or annoyance.

When necessary to eject a person from the train ascertain name and address of such person and the names and addresses of a number of passengers who witnessed the removal and report the occurrence to the proper officer on the prescribed form.

Conduct of Train Employees:

353. Train employees must not occupy seats with passengers nor enter into conversation with them further than is required in the discharge of their duty and in answering questions politely.

Seating of Passengers:

355. Passengers must not be allowed to use seats in coaches on which to deposit their baggage when such seats are required for passengers. When necessary conductors will request the owners in a polite manner to remove baggage or packages from seats or aisles, and in case they refuse to do so, conductors will remove them in a careful manner, placing them in the overhead racks or on the floor within easy reach of the owner; but they must not be placed or allowed to remain in aisles of cars. In carrying out this order avoid unnecessary argument with passengers and be courteous.

Accidents:

356. In case of injury to persons, loss of life or damage to property report at once to..... Use utmost care in obtaining a full statement of facts and names and addresses of persons who witnessed or have any knowledge of the accident. Report on the prescribed forms.

Reports:

357. At the end of each trip make out all reports required, observing all special instructions, and deposit such reports in the prescribed places.

Articles Left On Trains:

358. All articles left by passengers should be marked to indicate on what date and train they were found and by whom and left with station master or designated place at division terminal.

Display of Signals:

359. Display proper signals at rear of train and have all appliances ready for use.

Responsibility:

360. When there is more than one car in train the conductor in rear car will be held equally responsible with the conductor of the first car for the display of signals and markers.

361. When there is more than one car in train the conductor of the second or last car will protect train when ordered by the conductor in charge to do so.

362. When a train needs protection the conductor of the second or last car of the train or both must never wait for a signal or order from the conductor in charge when their train needs protection.

Announcing Stations:

363. In announcing the names of stations observe the following:

Just before arriving at a station at which the train stops announce the arrival in the same manner from inside of the car as follows: "This station is ....." (the name of the station to be repeated).

Before a passenger train leaves a junction station announce in each car the destination of the train thus: "This train for .....; the next station is ....."

If a train stops before arriving at the station platform after the announcement has been made the conductor must call out: "This is not the station stop," so that passengers will not be mislead or tempted to leave the train.

Freight Conductors

Report to:

364. Freight conductors report to and receive their orders from ....., and at stations and yards will obey the instructions of the agent.

Duty:

365. They will report for duty at the required time and assist in making up train when necessary.

Examine Bulletin Boards:

366. Examine bulletin board before starting and at each point possible thereafter and compare time with the motorman before starting.

Inspect Train:

367. Look over the train carefully before starting and know that the couplings, brake and running gear are in good order and that the prescribed signals are correctly displayed.

Frequent Inspection:

368. Inspect the train as often as opportunity offers during the trip.

Responsibility:

369. Be responsible for the movement, safety and proper care of the train and for the vigilance and conduct of the men employed thereon.

370. They must know that the men employed on their trains are familiar with their duties.

Authority:

371. Have the proper authority for the movement of each car in the train.

Passengers on Freight Trains:

372. Passengers must not be carried on freight trains without proper authority.

Card Defective Cars:

373. Card any cars found defective between terminals.

Make-up of Trains:

374. See that all cars equipped with air-brakes are placed first in the train and air used on all of them. Cars or tanks containing oil or other inflammable substances must in no case be hauled next to the engine or motor or coupled next to the caboose when there are other cars in the train; they should be at least ..... cars from the engine or motor or ..... cars from the caboose when practicable. Flat cars must be placed on the rear of the train and boarding cars must be placed next to the caboose.

Train Orders:

375. Require flagman or rear brakemen to read all train orders.

Secure Cars:

376. See that brakes are set on cars left on sidings and when on grades or during high winds that the wheels are blocked. So far as possible all cars on sidings must be left coupled.

Switching:

377. In switching where it is necessary to disturb cars that are being loaded or unloaded notice must first be given to all persons in or about the cars that are to be moved.

When cars are so moved they must be returned to the same position as found.

Obstruct Crossings:

378. See that the train does not obstruct any public crossing longer than five minutes. They will be held responsible for violation of local ordinances relating to the obstruction of public crossings.

379. In leaving cars upon side tracks they must see they are entirely clear of any street, highway or private crossing.

Braking:

380. See that hand brakes are applied in such manner as will prevent sliding or excessive heating of the wheels. Braking should be changed in descending long grades.

Collect Material:

381. Collect all brasses, draw-heads, car doors and other material broken from cars when practicable and when not practicable report to the ....., where they are left.

Position On Train:

382. They will station themselves upon the train in the best position possible to enable them to see that their trains are intact and that their trainmen properly perform their duties so as to insure the best possible management of the train. Know that their flagmen go back promptly when necessary to flag.

383. In approaching yard limits ..... distance before reaching and while passing railroad crossings at grade, drawbridges, junctions, water stations and other points where the train may be required to stop, also in ascending and descending heavy grades, trainmen must all be in proper position on top of the train.

Compare Time:

384. They must compare time with the brakeman, who will act as flagman each trip before departure of train, and they must never entrust the duties of a flagman to any person not entirely familiar with them except in emergency and then they must give the fullest instructions in such duties which circumstance will permit.

Cars Not Safe to Run:

385. Do not take cars that are improperly or too heavily loaded or that are not in condition to run safely. Report all such cases to the superintendent.

Disabled Cars:

386. When disabled cars are left on sidings report the fact by telephone or telegraph to the superintendent. In case they are left where there is no agent take the slips or way-bills to the next regular station with endorsements as to action taken.

Way-bills:

387. Carefully check with the way-bills (in conjunction with the agents if possible) all freight loaded or unloaded and make a record of freight over, short or in bad order. When necessary to transfer freight from one car to another record the transfer on face of way-bill together with the number of the car to which it is transferred.

Accidents:

388. In cases of injury to persons, loss of life or damage to property in connection therewith, report at once ....., giving all the information necessary to a clear understanding of the case and the assistance required. Use the utmost care in obtaining a full statement of facts and names and addresses of persons who witnessed or have any knowledge of the accident. Report on the prescribed forms.

Trespassers:

389. Tramps or other persons who have no legitimate business on the trains must not be allowed to ride and every precaution must be taken to prevent cars being robbed while in transit.

Make Out Reports:

390. At the end of each trip make out all reports required, observing all special instructions, and deposit such reports in the prescribed places.

Freight Brakemen

Report to:

391. Freight brakemen report to and receive their instructions from the ..... and while on trains are subject to the orders of the

conductor and at terminal stations they must obey orders of the agent or .....

Duty:

392. They will report for duty at the required time and assist in making up train when necessary.

Inspect Train:

393. Look over the train carefully before starting and know that all couplings, brake and running gear are in good order. Inspect train as often as possible during the trip.

Braking:

394. See that hand brakes are applied so as to avoid sliding or overheating the wheels. Braking should be changed in descending long grades.

Position On Train:

395. In approaching yard limits ..... before reaching and while passing railroad crossings at grade, drawbridges, junctions, water stations and other points where the train may be required to stop, also in ascending and descending heavy grades, trainmen must be in proper position on top of the train.

Flagman Compare Watch:

396. The brakemen acting as flagman will compare watches with the conductor before assuming such duties and they must be governed by the rules of conductors in so far as the rules pertain to their duties.

Duty of Flagman:

397. Rear brakemen or flagmen will consider it their special duty to protect the rear of their train in accordance with the rules and they must allow nothing to interfere with the prompt and efficient discharge of that duty. They must obey the signal from the motorman prescribed by the rules, but must never wait for the signal or orders from the conductor when their train needs protection.

Motormen

Report to:

398. Motormen report to and receive their instructions from the superintendent in all matters connected with the movement of trains and will report to ..... all troubles that may arise with their cars or equipment and receive their instructions from him concerning same.

Responsibility:

399. The motorman is jointly and equally responsible with the conductor for the safety of his train and the movement of the same in strict compliance with the rules and he must decline to obey any orders which involve peril to his train or violation of the rules. When there is no conductor, or he is disabled, the motorman will have charge of the train and will be governed by the rules prescribed for conductors.

Duty:

400. They must report for duty at the appointed time; see that the engine or motor is in good working order and furnished with necessary stores and supplies and a full set of signals; examine the bulletin board before starting on and at the end of each trip and compare time with the conductor before starting.

401. They will see that the car, motor or engine is supplied with the required tools.

Signal Appliances:

402. The motorman must have necessary signal appliances at hand and ready for use and be prepared to protect the front of his train when necessary. He will be held responsible for the proper display of signals on the front of the train.

Improper Signals:

403. Report all switch or other signals not properly lighted or not properly displayed.

Handling of Air-brake and Air Whistle:

404. Before leaving a terminal station the motorman must apply the air-brakes and allow them to remain on long enough for the inspectors or trainmen to see that the apparatus is in perfect working condition throughout the train, and when cars have been attached to or taken out the brakes must again be applied to know that they are in workng order before proceeding on the trip. In making regular stops they must be applied in such manner as to avoid discomfort to the passengers or injury to the equipment. They must also know that the communication signal is in proper working order.

Air-brake Test:

Motormen must test the air-brake ..... distance from stations where engines or motors have been changed or where cars have been taken on or left. Also at least ..... before reaching railroad crossings, drawbridges and at other hazardous places and before going down heavy grades and in case the brakes do not hold must at once signal for brakes. Such test to be made by applying the brakes with sufficient force to ascertain whether they are working properly.

Crossing Bridges:

405. Brakes must not be applied or released while crossing bridges or trestles except in case of emergency.

Look Back Frequently:

406. When running freight trains look back frequently to see that no portion of the train has become detached or derailed.

Train Orders:

407. Show their train orders to the forward brakeman and require him to read them.

Not to Leave Engine, Motor or Car:

408. They must not leave their car, motor or engine while on duty, except in the case of necessity, and then the conductor or some competent person must be left in charge.

Running By Station:

409. When a passenger train runs past a station or other stopping-place the motorman must give the back-up signal and receive a response from the conductor before backing the train. Great care must be exercised in backing the train to avoid injury to passengers or others by a sudden or unexpected movement.

Not to Cut Out Trains at Stations:

410. They will use great care in approaching station where a train is due to stop or is receiving or discharging passengers and in no case run between such train and the station.

No one to ride on motor or car's front platform.

411. They will not permit any person to ride on the front platform, except designated employees in the discharge of their duties without a written order from proper authority.

Accident:

412. In case of accident motorman must assist conductor in obtaining names of witnesses.

Law of State of New York:

413. The attention of motormen is called to the following extract from the laws of the State of New York:

"Section 421. (Amended 1900). Duties of Motormen.—A person acting as motorman, driving a motor or any railway in this State, who fails to ring the bell or sound the whistle upon such motor, or cause the same to be rung or sounded, at least 80 rods from any place where such railway crosses a traveled road or street on the same level (except in cities), or to continue the ringing of such bell or sounding such whistle at intervals until such motor, and the train to which the motor is attached, shall have completely crossed such road or street, or any officer or employee of a corporation in charge of a motor, train or car who shall wilfully obstruct, or cause to be obstructed, any farm or highway crossing with any motor, train or car for a longer period than five consecutive minutes, is guilty of a misdemeanor."

COLUMBUS MEETING OF CENTRAL ELECTRIC RAILWAY ASSOCIATION

(By Telegraph)

At the opening of the fall meeting of the Central Electric Railway Association, on Sept. 26, at Columbus, President Nicholl feelingly touched upon the recent death of two members, F. J. Stout, of Norwalk, and A. W. Anderson, of Dayton. Messrs. Spring, Sloat and Ohmer were named a committee to prepare resolutions of condolence and to present them to the families of the deceased. The report of the committee on train rules was presented and accepted, though the reading was dispensed with, the idea being that while these rules should furnish a standard method of operation their use is not obligatory upon members. Chairman F. D. Carpenter stated that they had been selected from rules of systems all over the country. G. D. Nichols read a paper on catenary construction and for an hour afterward was kept busy answering questions regarding the operation of the system on the Indianapolis & Cincinnati traction line. The use of the bow trolley was one of the interesting points discussed. Henry N. Staats, chairman of the committee on insurance, read a detailed report, which called out considerable discussion on rates and plans for securing reductions.

R. C. Taylor, chairman of the standardization committee, read a report on axle journals, journal boxes, brake shoes, tread and flange of wheels and rails for street and interurban purposes. The report was adopted. Mr. Starkey read a report from the committee on express in the absence of Chairman A. A. Anderson. This report embodied opinions from twenty different companies as to contracting with old line express companies allowing exclusive rights over lines. While many opposed the plan the majority favored it. The discussion following showed a great variety of opinions.

E. H. Anderson, of the General Electric Company, gave an interesting talk on the 1200-volt direct current system and described several machines made under it.

A more extended account of this meeting will be published next week.

PREPARATIONS FOR THE ATLANTIC CITY CONVENTION

Those who are expecting to attend the meetings of the American Street & Interurban Railway Association and its affiliated associations at Atlantic City will find an elaborate program prepared for them. During the past two weeks a large number of the committees which are to report at the Atlantic City Convention, have held meetings in New York and elsewhere, to assist in preparing the final drafts of their reports. An account of the meeting on Sept. 12-14, of the Standardization Committee of the Engineering Association, was published in The Street Railway Journal last week. On Sept. 20 a meeting was held in New York by the chairmen of the committees of the American Association of Municipal Ownership and on Public Relations, with William J. Clark as a representative of the National Civic Federation. On the same day a meeting was held in Baltimore of the Committee on Car House Construction of the Engineering Association. This meeting was attended by Messrs. Adams, Porter, Parker and Pumfrey, members of the committee, and also by members of the fire insurance interests, including C. H. Patton, chairman of the committee of the National Board of Fire Underwriters, and E. R. Townsend, of Chicago. On Sept. 23 a meeting was held in New York of the Insurance Committee of the American Association, which was attended by Messrs. Davies, Estabrook and Stearns, members of the committee. After a preliminary discussion in the morning of the character of the report to be presented at Atlantic City, the committee met in the afternoon prominent members of the insurance interests.

RAILROAD RATES

The secretary of the association has announced that the Trunk Line Association, the New England Passenger Association, the Eastern Canadian Passenger Association and the Southeastern Passenger Association have granted a rate of a fare and a third on the certificate plan for all points within their territories. The Central Passenger Association has granted a uniform rate of two cents a mile within its territory. The Western Passenger Association grants special one-way rates to its eastern terminals. The Southwestern Passenger Bureau grants reduced one-way rates to St. Louis.

Delegates coming from points in territory governed by the Trunk Line Association, New England Passenger Association, Eastern Canadian Passenger Association and the Southeastern Passenger Association can secure their tickets under the usual regulations which include buying a first-class ticket to Atlantic City not earlier than Oct. 10 and not later than Oct. 16, and securing a certificate. After this certificate is countersigned by the secretary of the association at Atlantic City, the return ticket can be secured at one-third fare.

In the district covered by the Central Passenger Association, special restrictions have been made by the railroads. The lowest rate granted will be two cents per mile in each direction from the starting point in the passenger association's territory to Buffalo, Pittsburg and other Central Passenger Association eastern gateways. From that point the one-and-one-third fare granted by the Eastern Passenger Association will be available. To secure the two-cent per mile rate in the Central Passenger Association territory, it will be necessary for persons purchasing tickets to be provided with card orders identifying them as delegates to the convention. These card orders are all numbered and the street railway association has to guarantee to the railroads that they will be used only by delegates to the convention. Representatives of railway companies can secure these card orders upon application by mail to Secretary Swenson of the association at 29 West Thirty-Ninth Street, New York. Representatives of the Manufacturers' Association can secure these orders upon application to Secretary Keegan, Park Row Building, New York. These card orders must be secured before the purchase of the ticket, so that all persons residing in the territory of the Central Passenger Association who expect to attend the convention and are desirous of securing the reduced rate should apply promptly to either Mr. Swenson or Mr. Keegan.

Delegates from the territories of the Western Passenger Association and the Southwestern Passenger Association can take advantage of the reduced one-way rates in effect to Chicago, Peoria and St. Louis. Delegates from Pacific Coast points should avail themselves of the daily nine months excursion rates between these points and St. Louis and Chicago. Upon arriving at these points, such delegates should purchase round-trip tickets to Atlantic City, and should follow the regulations applying to persons in the territory of the Central Passenger Association.

TRAINS FROM NEW YORK TO ATLANTIC CITY

To accommodate those attending the convention, the Central Railroad of New Jersey announces that it will arrange to provide special Pullman parlor cars on New York-Atlantic City trains leaving New York on Oct. 12, 13 and 14, from foot of West Twenty-Third Street at 9.50 a. m. daily (12.50 p. m. Saturday), 3.20 p. m. (except Sunday), 2.20 p. m. (Sunday only), and from foot of Liberty Street at 10 a. m. daily, 1 p. m. (Saturday only), 3.40 p. m. (except Sunday), and 2.30 p. m. (Sunday only). All of the above are through express trains running via Red Bank and Lakewood. If a considerable number advise of their intention to use any one train, a special train composed exclusively of Pullman parlor cars will be operated for their accommodation. The parlor car fare between New York and Atlantic City is $.75 in each direction. Passengers by this route have the privilege of stopping over at Lakewood and also of returning via Philadelphia.

The Pennsylvania Railroad will operate through fast express trains to Atlantic City, leaving New York, West Twenty-Third Street station at 9.55 a. m. and 2.55 p. m. week days and 7.55 a. m. Sundays only, with through Pullman cars. Special parlor cars will be reserved for the accommodation of the delegates and a special train will be operated if there is a sufficient number to justify it.

HOTELS

Convention Bulletin No. 4, just issued by Secretary Swenson, describes fully all these railroad arrangements and also refers to hotel matters. Those who have not yet secured hotel accommodations at Atlantic City and who expect to attend are urged to secure hotel accommodations promptly. As has already been announced, the American Association and the Manufacturers' Association have their headquarters at the Marlborough-Blenheim, the accountants will be at the Chalfonte, the engineers at the Dennis and the claim agents at the St. Charles.

The exhibition will be at the Steel Pier, and over 200 manufacturing companies have been assigned space. The total amount of floor space occupied will be considerably greater than at the 1906 convention at Columbus.

CONVENTION PROGRAM

The complete program of the four associations as announced in Convention Bulletin No. 3 was published in

The Street Railway Journal for Sept. 14. Since that bulletin was issued Wm. J. Clark, of New York City, has promised to present a paper on "Municipal Ownership in Great Britain and in the United States." It will be read at the meeting of the American Association on Friday morning. Changes in titles of three papers have also been made. They are:

American Association. Paper by P. P. Crafts, changed from "Package Express Business" to "Light Freight Handling by Electric Lines." Paper by H. H. Polk changed from "Freight Interchange with Steam Roads" to "Freight Service on Electric Railroads."

Engineering Association. Paper by J. R. Bibbins changed from "Double Flow Turbines" to "Recent Developments in Steam Turbine Power Station Work."

The secretary of the American Association calls special attention to the fact that the Committee on Standards of the Engineering Association will present its report to that association on Tuesday afternoon, Oct. 15. The report of the American Association Committee on Standardization will probably be short and will be based upon the work of the Engineering Association Committee. The attendance and participation of members of the American Association at the meeting of the Engineering Association will therefore be greatly appreciated by the officers of both associations.

ROLL CALL

It is expected that there will be a roll call at each session of the various conventions. Notices will be sent to the various companies immediately after the convention, informing them at what sessions their representatives were present. The official list of delegates will be used in connection with the roll call.

ENTERTAINMENT

President Beggs and the Executive Committee of the American Association have decided that there will be no annual banquet. The Entertainment Committee of the Manufacturers' Association has practically completed its plans for the convention week. On Thursday evening there will probably be a theater party to take the place of the banquet. Other events will be announced later.

EFFICIENCY TEST OF RETURN TUBULAR BOILER USING CRUDE OIL

In accordance with instructions from Chas. C. Moore & Co., engineers, of San Francisco, J. F. Borden, instructor in the University of California, made a test to ascertain the evaporative power of a return tubular boiler installed at the Alameda municipal electric plant with special regard to the economy of oil burned for a period of ten hours continuous running. The conditions of the test were as nearly constant as possible, and the rate of evaporation approached closely that of full load. Full load was taken as the evaporation of 2.65 lbs. of water (from and at 212 degs. F.) per sq. ft. of water heating surface per hour. This is the same as allowing 13 sq. ft. of heating surface per boiler horse power.

The boiler consists of one drum 72 ins. in diameter and 16 ft. long, containing 100 tubes, each 3½ ins. outside diameter and 16 ft. long. The boiler is one of a pair connected to the same stack, each having a separate furnace, and the entire boiler plant comprises two of these couples.

The feed water enters the drum through an open ended 1½-in. pipe. The water column is located on the left side of the front end of the drum, the gage glass being 16 ins. long and bottom valve of glass being 5 ins. above top row of tubes.

The furnace is of the common type used for coal burning with tubular boilers, only in this case the grate bars are replaced with fire-brick through which air is admitted to the burning oil from below. The furnace is 17 ft. x 4 ft. 10 ins., the bridge wall being 4 ft. 8 ins. from the front of the furnace. The distance of the furnace floor from the lowest point of the drum surface varies from 2 ft. 2½ ins. in front to 1 ft. 5 ins. in the back.

The total heating surface of the boiler is 1639.8 sq. ft.

One burner is used. It is of the internal mixing type and installed between the two front doors of the furnace. The flame is thrown backward into the combustion chamber, and the hot gases return through the tubes back to the front of the boiler and then up the stack. Air enters the setting through the regular ash pit door of the boiler.

The oil enters the burner through a ½-in. pipe at right angles to the flow of the steam. This oil pipe is surrounded by the shell of the burner, and gives up the oil through small holes made in its surface. Thus the oil mixes with the steam and is atomized on the inside of the burner within a few inches of the tip.

The fuel oil was taken from the regular oil heater of the plant, hot and under pressure. It was led into a tank weighed upon platform scales, and then run, by gravity, into a second tank. From this tank it was pumped by an independent fuel oil pump—3 ins. x 2 ins. x 3 ins.—to the burner.

The flame from the burner was carefully watched during the test through a peep hole in the front. The flame was generally well up near the shell and well spread. However, one could not but notice the inadaptability of the oil burner as generally used to this type of boiler, since only a small portion of the shell was actually in contact with the flame, while at the same time the tubes themselves were scarcely reached by the flame, the flame reaching only to the back of the boiler in the case of the particular load carried during the test.

Smoke observations were made frequently, but during the entire test no smoke was visible at the top of the stack

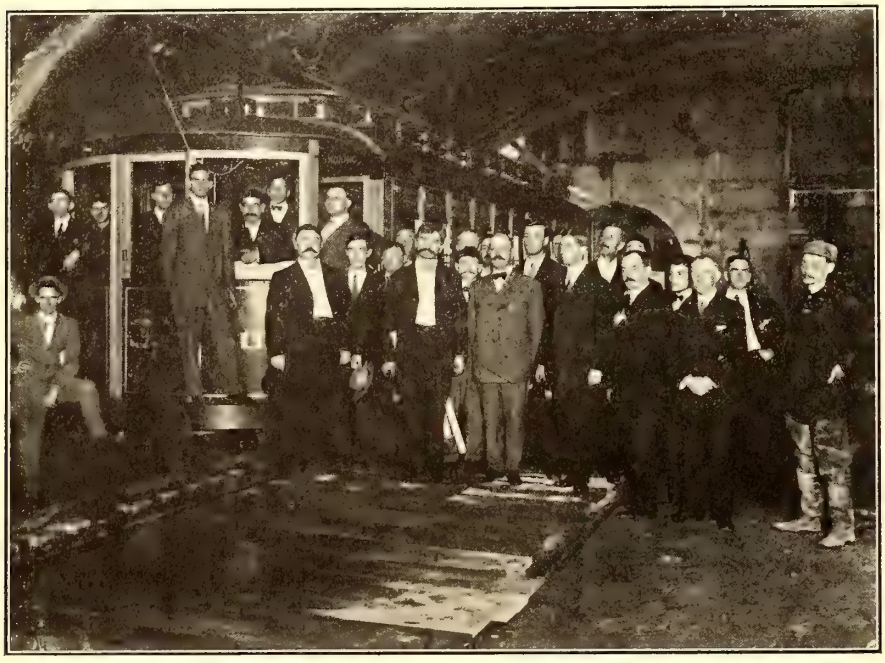
The following were the principal data found by the test:

Barometer—inches of mercury	29.87
Main steam pressure—gage	119.1
Main steam pressure—absolute	133.8
Temperature feed water—degrees F.	142.0
Quality of steam	99.5
Factor of evaporation	1.116
Temperature of oil—degrees F.	155.5
Temperature of flue—degrees F.	452.0
Temperature of boiler-room—degrees F.	78.0
Pressure of oil	65.0
Draft—inches of water	0.4
Water level before putting fires out	5.5
Water level after putting fires out—three minutes	5.25
Drop in water level—three minutes	.25
Average water level during test—	
Above bottom of glass	6.4
Above top row of tubes	
Total water actually evaporated—ten hours	39,046.0
Total water evaporated into dry steam	38,850.8
Total water evaporated from and at 212° F.	43,357.5
Water evaporated per hour from and at 212° F.	4,335.75
Steam used by burners—	
Pounds per hour	96.99
Per cent of steam generated	2.49
Per cent moisture in oil	None
Heat value of oil—B. T. U.'s	18,883.0
Total oil burned—ten hours	3,166.0
Water evaporated per square foot heating surface per hour from and at 212° F.	2.64

Horse power developed	125.6
Square feet water heating surface per horse power	13.0
Water evaporated per pound of oil—from and at 212° F. dry steam and dry oil	13.6
Efficiency of the boiler	69.5

INSPECTION TOUR THROUGH EAST RIVER TUNNEL

The first official trip through the Belmont tunnel under the East River at Forty-Second Street took place Tuesday, Sept. 24, about noon. Eventually, if the plans of its promotors succeed, this tunnel will be the connecting link between what are now really three entirely different systems: The Interborough-Metropolitan, in Manhattan, owning all subway and surface lines; the Queens County Railroad Company, owning many of the important surface lines running out of Long Island City; the Long Island Railroad Company, subsidiary company of the Pennsylvania Railroad, controlling all the railroad business on Long Island, and the New York & Long Island Traction Company, which controls many of the important surface lines in the interior of Long Island.



THE PARTY THAT MADE THE TUNNEL TRIP

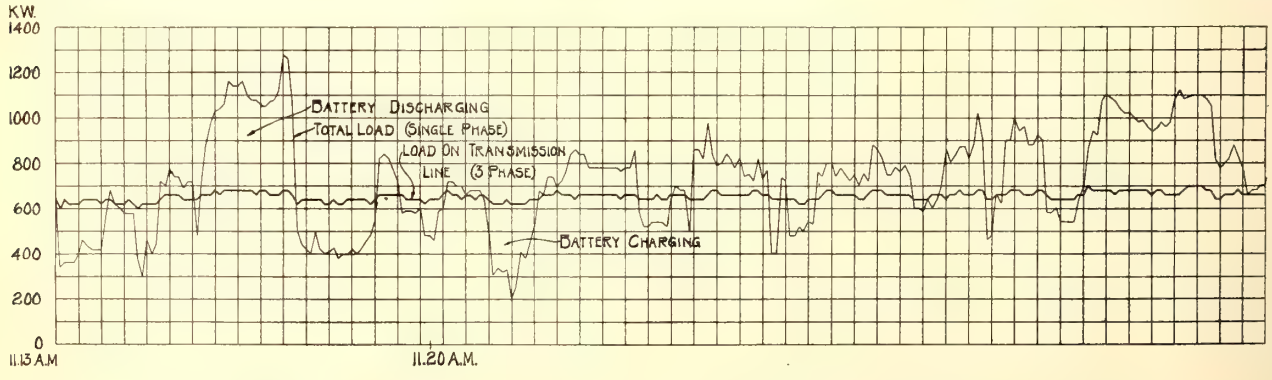
The Fort Wayne & Wabash Valley Traction Company has decided to establish a buffet service on its new limited cars which are to be put on between Fort Wayne and Lafayette on Oct. 1.

STORAGE BATTERIES APPLIED TO THE SINGLE PHASE SYSTEM OF THE SPOKANE & INLAND RAILWAY

The Electric Storage Battery Company has developed a number of systems for regulating fluctuating alternating current loads by storage batteries, thereby maintaining a practically constant demand upon the source of power irrespective of the variation in the load itself. The first application to electric railways of storage batteries for this purpose was at Spokane, Wash., where the Spokane & Inland Railway (now a part of the Inland Empire System) installed a storage battery for reducing the cost of the electric power purchased under a contract with the Washington Water Power Company. By the terms of this contract the cost of power is based upon the maximum demand during each month, and the closer the maximum demand can be kept to the average load the less is the cost of the current consumed.

The problem to be solved in this particular case was different from that ordinarily presented, in that the supply consisted of 4000-volt 3-phase 60-cycle alternating current, while the road was to be operated on 2200-volt single-phase 25-cycle current. This made the introduction of frequency changers necessary as well as voltage and phase transformers.

J. B. Ingersoll, general manager of the company, in consultation with the engineers of The Electric Storage Battery Company, conceived the idea of combining in one piece of apparatus an induction motor to operate from the power supply, a single-phase generator to deliver the required power to the road and a direct current machine to act either as a generator or a motor, according to whether the railway load is momentarily below or above its average value, the three machines being direct connected and mounted on a common bed plate. The d. c. machine gives power to or takes power from a battery of Chloride Accumulators connected across its terminals in series with a regulating booster controlled by battery company's carbon regulator. The latter is operated by the a. c. in the 60-cycle supply line, and insignificant changes of current in this line acting on the regulator cause the battery to charge from or discharge into the d. c. machine and relieve the line of the load fluctuations. The action of the combination is as follows:



INPUT AND OUTPUT CURVES OF THE SPOKANE & INLAND RAILWAY, SHOWING THE EFFECT OF STORAGE BATTERIES

The single-phase generator delivers current to the railway according to the demand, power for driving it being furnished by the 60-cycle 3-phase induction motor so long as the railway load is equal to the average. Under this condition the battery "floats" across the d. c. generator, neither charging nor discharging. As soon as the railway load falls off, however, the carbon regulator causes the d. c. machine to charge the battery and take the surplus power from the induction motor. On the other hand, when the railway load increases beyond the average, the d. c. machine immediately inverts and runs as a motor to assist the induction motor, drawing power from the battery, which, of course, is forced to discharge. The action of the carbon regulator in maintaining a constant load has been so often described that nothing need be said on this point here, except to add that by a proper design of its actuating solenoid it can be made to act as well on a. c. as on d. c. systems.

Mr. Ingersoll's ideas were put into practice and four of the special 3-unit sets were installed with suitable motor-driven exciters for the fields of the single-phase machines. Each set consists of a 1000-hp 4000-volt 60-cycle 3-phase induction motor, rated at 126 amps. per terminal, direct connected to a 1000-kw 2200-volt 25-cycle single-phase generator and also to a constant speed direct-current machine rated at 1100 amps. and 550 volts. The synchronous speed of the set is 500 r. p. m. These sets are all operated in conjunction with a battery of Chloride Accumulators with two boosters and a carbon regulator.

The battery consists of 275 cells of Type R-33 and each cell consists of 16 positive plates of the standard "Manchester" type and 17 negative plates of the "Box" type, contained in wood tanks, lined with sheet lead. The plates which are separated by wood diaphragm separators are lead burned to rolled lead bus-bars at either end of the cell. Lead covered copper bar is used to connect the ends of rows of cells and to connect the battery to the switchboard. The cells are mounted on wood stringers and are insulated from the floor and from each other by a double tier of glass insulators. The boosters are motor driven, and are of the shunt regulating type, operating in parallel in conjunction with one exciter and carbon regulator. The single-phase machines are excited from one or more of three exciter sets. Each set consists of a 400-volt 75-hp induction motor direct connected to a 125-volt 50-kw d. c. generator.

The power from the Washington Water Power Company is transmitted 2.2 miles over three 500,000 circ. mil cables at 4000 volts. It is fed directly to the induction motors without transformation through the usual disconnecting and automatic oil switches. Two busses are operated from the high-tension feeders, and any machine may be operated from either bus. The single-phase current is fed through five 1250-kw 2200-45,000-volt water cooled step-up transformers at 25 cycles for transmission to distant points. Three 375-kw 2200-6600-volt transformers feed the local section of the railway, while three 75-kw 60-cycle 4000-400-volt sets connected in delta on the 60-cycle supply line operate the exciter sets for the single phase generators.

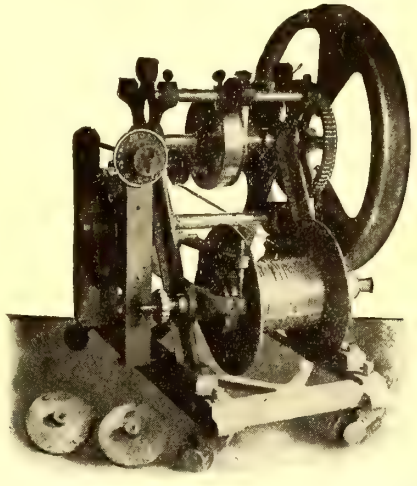
The cars operate over the city track on 600-volt direct current, and continue thus for two miles from the terminal station. There the change to 6600-volt a. c. is made.

On page 476 are shown in graphic form the input and output of the station. It is evident at a glance that all but a fractional part of the fluctuating load is cared for by the battery through the special transformer sets, leaving a practically constant load on the supply line. When it is borne in mind that current is paid for on the basis of maximum demand, it it seen at once how large is the saving effected.

BAND WIRE TENSION MACHINE

The Device Improvement Company, of Hanover, Pa., has designed a machine to fill the need of a precise device for acquiring an accurate and uniform tension in all sizes of armature band wire which can be regulated by means of a pointer on the index dial to produce any tension desired within wide practical limits. Furthermore, when the pointer is returned to the same index number the tension is exactly the same in all cases. As all the friction to produce the tension is absorbed by the external brake, the wire itself simply revolving around the tapered drum, the device will not heat or injure the wire. The machine is entirely self-contained. The cast-iron spool holding fifty to sixty pounds of band wire is mounted on the frame, winding centers being supplied to fill the spool in the lathe from a large wooden reel, which operation takes but a few minutes.

The machine may be used in connection with the Peerless banding machine or an ordinary lathe. It may be bolted to wall or as it is provided with casters may be quickly and easily placed in front of a banding machine or lathe for use, and then pushed under the work bench or any place



COMBINED TENSION AND BANDING MACHINE

in the barn where it is out of the way. The large drum which is used for the tension on the magnet wire in connection with the field-coil winding is applied to the machine with three cap screws, the same excellent feature applying as when used for band wire. The machine in brief, consists of two side frames mounted on angle-steel sills and casters. The lower shaft runs in babbitted bearings and one end carries the brake pulley. On the other end is a pinion which engages with the gear on the upper shaft, this ratio being 3 to 1. On the gear is mounted the large drum for insulated wire and on the shaft the tapered flanged band-wire drum. The taper is so designed that the tendency of the band wire to crawl up is neutralized by the tendency of the taper to slide down. Six or seven turns of the band wire on this drum will hold any tension desired. At the front end of the frame is mounted the cast-iron wire spool with the small retard brake as shown. The band wire passes off the spool to the grooved lead on pulley, thence to the drum, around the drum to the grooved lead-off pulley and thence to the armature. The tension index is plainly shown and has ten divisions, each division corresponding to different tension. The machine affords an accurate and reliable means of producing the right tension for banding armatures.

GOVERNING MECHANISMS OF THE CURTIS TURBINE

As very little has been published on the methods of governing steam turbines, engineers may find some interesting points in the following illustrated description of the Curtis turbine governor recently made available by the General Electric Company.

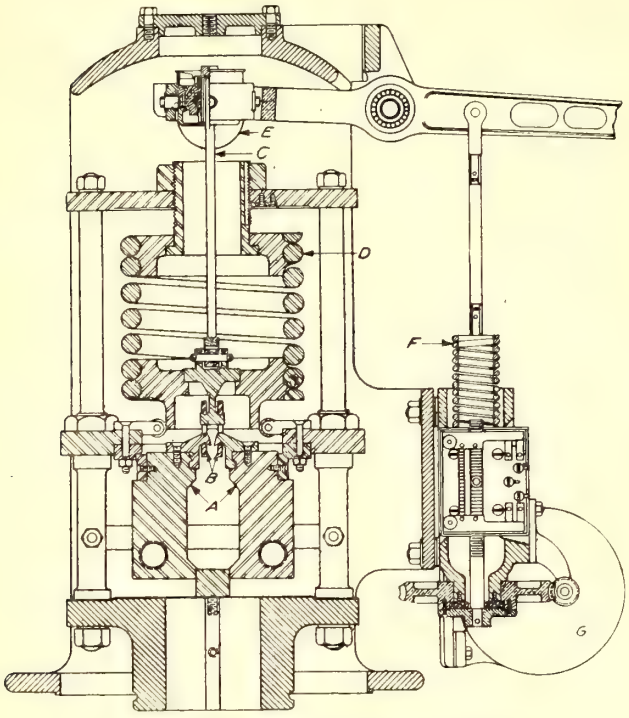


FIG. 1.—CROSS-SECTION OF GOVERNOR

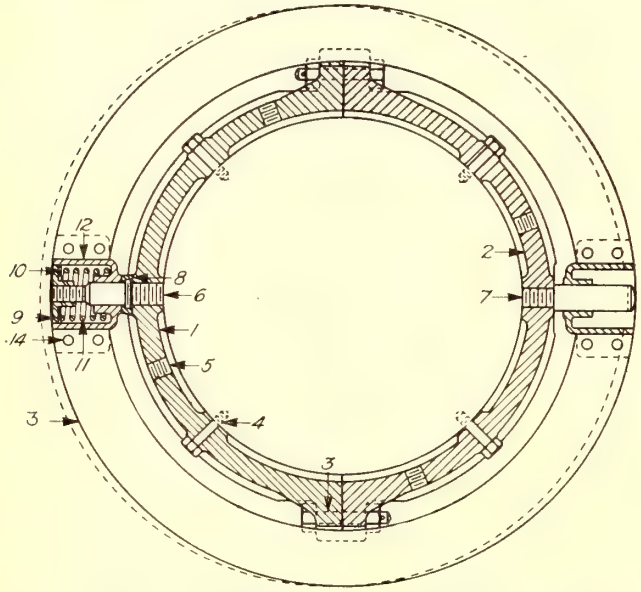


FIG. 2.—SECTION OF ECCENTRIC RING FORMING PART OF SPEED LIMIT DEVICE

The governor is of the centrifugal type and its action depends on the balance between the forces exerted by springs and the centrifugal effort of weights. In the accompanying sectional view Fig. 1, *A* is the moving weight which acts through the knife edges *B* to pull down the rod *C* against the action of the heavy spring *D*. At *E* a ball-bearing gimbal joint, thoroughly lubricated, forms a junction point between the revolving mass of the turbine and the stationary lever of the governor arm.

The governor is provided with an auxiliary spring *F* for varying the speed when synchronizing. In larger machines the adjustment of this spring can be made from the switchboard by the small motor *G*. The movement of the governor arm is transmitted through levers to the pilot valve of an oil cylinder containing the piston which operates the main arm. The latter transmits the motion either by a rack and pinion or by cranks to the rod carrying the cams. These cams act directly on the valves, opening and closing the number called for by the condition of the load.

An important advantage of this type of governor is that it is a slow moving mechanism and therefore not dependent on lubrication for successful service.

Since any steam turbine can accelerate rapidly and this increase in speed is not easily perceptible, it is important to have these machines equipped with simple speed limiting devices. The contrivance shown in Fig. 2 consists of a ring placed around the shaft between the turbine and the generator. This ring is placed in a slightly eccentric position and the centrifugal strain thus caused is counteracted by helical springs. When the speed increases the centrifugal effort overcomes the spring and the ring moves into a still more eccentric position. In this position it strikes a lever which trips the throttle valve through tension rod (Fig. 3). This rod, released by the emergency ring governor, is connected at the other end to crank *D* and the operating force is supplied by spring *S* which pulls up the gear and throws out hook *G*, which holds the valve suspended. The valve then descends with a very positive motion due to its own weight and the unbalanced area of the valve stem.

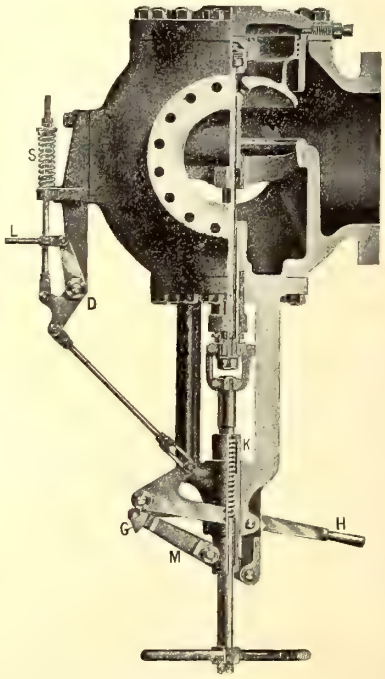


FIG. 3.—EMERGENCY STOP VALVE

This valve opens again very easily owing to the opening by the initial movement of the hand wheel of the by-pass with which it is fitted, the pressure thereby being equalized when the valve is closed.

Local street railway men and motormen and conductors on the Fort Wayne & Wabash Valley Company's line at Logansport, Ind., have completed the organization of a mutual benefit association to accumulate a fund to pay sick, accident and death benefits. There are 340 charter members in the organization.

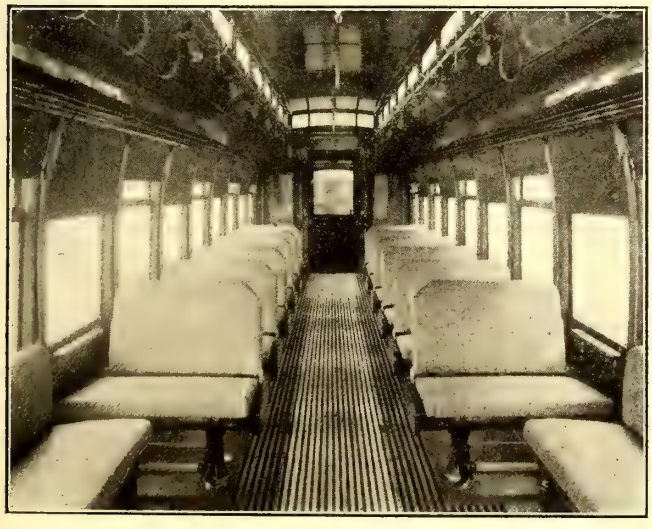
SEMI-CONVERTIBLE CARS FOR WESTERN NEW YORK

The Western New York Construction Company of Buffalo, which operates the electric railway lines in Erie, Pa., Dunkirk and Fredonia, N. Y., West Seneca and Hamburg, has adopted the Brill semi-convertible car as standard, and all these roads operate with a 28-ft. car of the type mentioned. The 28-ft. semi-convertible car shown in the engraving is one of nine turned out recently by the G. C. Kuhlman Car Company, which built the cars for the other cities mentioned. These nine cars will do service in Erie, Dunkirk, West Seneca and Hamburg. The Western New York Construction Company also has an order with the G. C. Kuhlman Car Company for six cars for suburban service, slightly longer than those mentioned and of the combination passenger and baggage type and each car will be equipped with four motors of 60-hp capacity each.



SEMI-CONVERTIBLE CAR FOR WESTERN NEW YORK

The service for which the cars are intended is both city and suburban and the seating arrangement includes longitudinal corner seats for four passengers each which increases the aisle space near the doors. The seating capacity of a car is forty. As the window sills of this type are extra low, namely 24⅝ ins. from the floor to top of sill, four-bar window guards are provided which are made in a single section. The bottom framing is made unusually substantial by the use of 15-in. x ⅜-in. sill plates which are on the inside of the sills and to which the bases of the posts are attached. The usual dimensions of sill plate for this length of car is 12 in. x ⅜ in. The outside platform timbers are reinforced by angle irons and the pair of angle irons which form the center knees extend well back of the body bolsters. The window curtains at the ends of the car are arranged to be operated in grooves with the same type of fixture as is used on the side curtains, instead of the ordinary type of curtain usually placed at end of car body and held down by a flap with fastener beneath the window. Other features of the cars are the same as usual in the semi-convertible type. The exterior illustration shows two of the window sashes opened at different heights, window stops being provided to permit the windows to be held at ¼, ½ or ¾ heights. The sash locks used with this window system are made with a steel core to prevent any chance of bending should the windows be dropped from one stop to another. The width over the sills, including the sheathing, is 8 ft. 1½ ins.; over posts at belt, 8 ft. 5 ins.; size of side sills, 4 ins. x 7¾ ins.; end sills, 5¼ ins. x 6¾ ins.; sill plates, 15 in. x ⅜ in. The builder's track scraper is installed on these cars and numerous specialties of the same builder are furnished, namely, angle-iron bumpers, gongs, signal bells, etc. Cherry forms the interior finish, but the ceilings are of poplar tinted Nile green. The trucks are of the 27-FEI type with 4-ft. 6-in. wheel base. Two 60-hp motors were installed on each car.



INTERIOR OF SEMI-CONVERTIBLE CAR

REINFORCED CONCRETE POLES

The American Concrete Pole Company, of Richmond, Ind., is preparing to construct and also to sell the right to construct reinforced concrete poles as designed by W. M. Bailey, its vice-president and general manager. A line of these poles has been installed across the Whitewater River at Richmond.

With the reinforcement of twisted rods and spiral binding wires properly distributed in the column of cement, the poles are not only substantial and durable, but are also said to be of remarkable elasticity. For instance, a pole 30 ft. long will permit a deflection of 30 ins. before the cement cracks. Even then the cracking of the cement does not impair the strength of the pole for after this takes place the reinforcement becomes active and takes the entire strain. As the rods are guaranteed to withstand a breaking strain of 50,000 lbs. per sq. in. it is easy to understand why this construction should be so safe and durable. In shape, the poles are square with the corners beveled off 2 ins. or 3 ins. so that the top of the pole is octagonal in shape. This gives it a pleasing form, leaves the corners substantial and avoids sharp edges that would be likely to chip off.

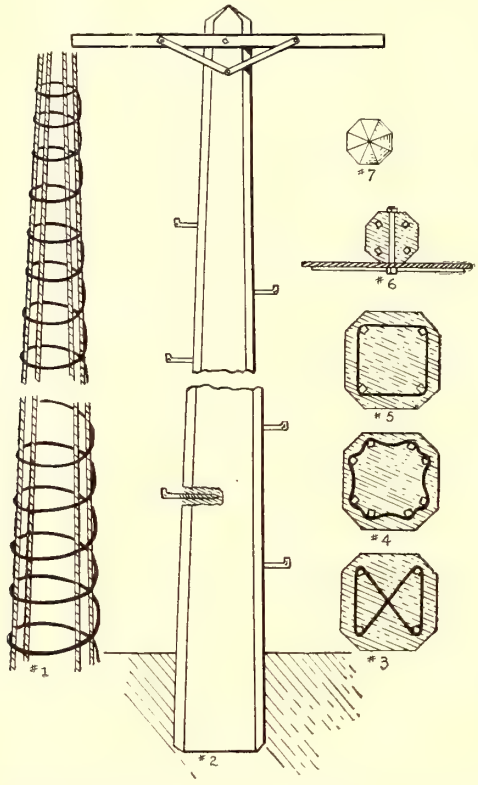
The rods are placed within ¾ in. of the surface of the cement at the corners and then bound by a spiral wire encircling the four rods from top to bottom. This serves to tie the rods together and prevents shearing of the cement, as the rods have a tendency to move outward when the pole is subject to a lateral strain. Another important function performed by the spiral-binding wire is that it ties the concrete and increases the flexibility of the entire body.

The smaller poles, up to and including 35 ft., are molded lying on the ground. The forms are laid with the butt near the hole and the reinforcement placed. Then the concrete is poured in and allowed to remain three to seven days, according to the weather. The forms are then removed, so that they can be used again and the pole is left to season. This process requires about three or four weeks and the poles are then ready to be set and used. All poles should be built on the ground upright in the hole in position to be set up, thus saving the cost of unnecessary handling. Poles 40 ft. and longer should be built standing, as this is most economical. First, the hole is dug and then the form is set in place directly over it, lined up perpendicular and temporarily guyed to hold it in position. The spiral binding wires are then put in place and the rods drawn up on the inside of the form and set. After the reinforcement has been properly secured, the side of the form left out to re-

ceive the steel work is put in place and the bands or ties around the outside secured. The equipment is then ready to receive the concrete.

There are several methods of placing this material. One is by using a large bucket with pulleys and a horse. With this method a 50-ft. pole can be filled in about two hours, including the mixing of the concrete. But the most economical plan is to have a wagon equipped for the purpose with a gasoline engine concrete mixer and grain elevator to handle the material as rapidly as it is mixed. The company is now building such wagons.

The accompanying cut marked with Figs. 1, 2, 3, 4, 5 and 6 gives the detail construction of pole and reinforcement as follows: Fig. 1 shows the four rods as they are placed in



DETAILS OF CONCRETE POLE REINFORCEMENT

the cement body with the spiral binding wires pulled in place. Fig. 2 shows the general view and shape of cement body as finished. The steps and other bolts and holes are very easily made while the concrete is plastic. Figs. 3, 4 and 5 show cross sections of pole with three different methods of bindings and also two different methods of reinforcement. The scheme represented in Fig. 4 is only intended for extremely heavy construction. Fig. 6 shows how cross arms are secured. A bolt or rod is placed in the form and removed within twenty-four hours after concrete has been placed. This becomes a clean hole through which the bolt that is intended to hold a cross-arm can be placed and the arm securely bolted. Fig. 7 represents the top of the pole which is easily put on after the pole is finished but is not necessary except for appearance. Mr. Bailey has also planned forms varying in sections from 5 ft. to 15 ft. each and divided to be easily handled.

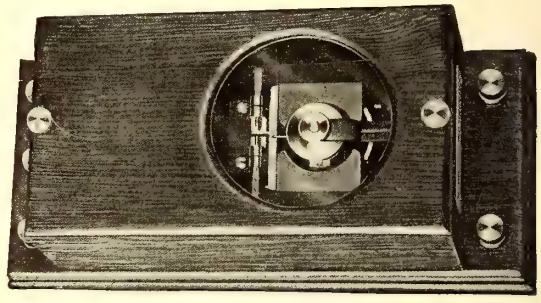
STANDARD T RAIL

The sub-committee of steam railroad managers and steel manufacturers who have been entrusted with the drawing up of recommendations for the manufacture of an improved railroad rail have submitted a report to George L. Peck, chairman of general railroad committee on steel rails.

The sub-committee consists of Joseph T. Richards, of the Pennsylvania; J. D. Isaacs, of the Southern Pacific; R. Montfort, of the Louisville & Nashville; P. H. Dudley, consulting engineer; F. W. Wood, of the Maryland Steel Company, W. A. Bostwick, of the Carnegie Steel Company; P. E. Carhart, of the Illinois Steel Company, and F. E. Abbott, of the Lackawanna Steel Company.

A NEW PORTABLE RELAY

In addition to its well-known line of voltmeters and ammeters for both portable and switchboard work, the American Instrument Company, of Newark, N. J., has recently developed an exceedingly sensitive, yet rugged and reliable portable relay. This instrument is built on the same principles as the regular type of "American" voltmeter, having a movable coil mounted in jewel bearings in such a way that it can turn between the poles of a powerful permanent magnet. Instead of the usual pointer, a short platinum contact arm is securely attached to the moving coil. On each side of this contact is mounted an adjustable platinum contact point, so that a local circuit may be closed when the moving arm is deflected to either one side or the other of its normal position. The instrument may be closely adjusted, so that, within reasonable limits, any desired movement of the contact arm can be provided for. The



PORTABLE RELAY

winding of the moving coil and the controlling spring can be adapted to give the best results under special conditions.

At maximum sensitiveness this relay requires .000,000,002 watt to actuate it, this being on .000,002 amp. and .001-volt potential difference. The resistance of the instrument usually supplied is approximately 500 ohms. Throughout, the workmanship is the best, special machinery having been designed for the manufacture of some of the parts. The instrument is suitably mounted in a polished wooden case as shown in cut. James G. Biddle, of Philadelphia, is general sales agent for the company.

The Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y., is issuing a thirty-two page booklet entitled "Lost Time," in which are described the various private branch exchange systems and equipments of the company. The publication is very artistic. It has a beautiful cover in four colors and bronze, stippled and roughed both sides, and should prove an excellent inquiry provoker. The inside pages are in three colors, the illustrations being for two colors with key plates in half-tone and auxiliary color in zinc tint plates. The main text is set in "MacFarland" type. All headings, index designs and initial letters are mainly of special design from engraved plates. The inside page stock is satin enamel. The binding is wire, saddle stitched. The book will be mailed free to all interested in P. B. X. systems. Regular customers of the company will receive the book without making application.

FINANCIAL INTELLIGENCE

WALL STREET, Sept. 25, 1907.

The Money Market

There has been no material change in the monetary situation during the past week. The dulness prevailing in the general securities market has resulted in a somewhat smaller demand for money on the part of stock commission houses, and the inquiry from corporations has also practically ceased. Money, however, continues in active demand at all of the principal Western and Southern points, not only for crop moving purposes, but for general business requirements as well. The demand at the interior was emphasized during the week by an advance in the rate of exchange on New York at Chicago to 50 cents per $1,000, and the indications are that the shipments of currency to the West and South this week will be somewhat larger than in the past. The relief measures put into effect by the Treasury Department are largely responsible for the present ease in the local market, and had it not been for the Government deposits in the interior banks, as well as in the local institutions, rates for money would doubtless be ruling much higher than those prevailing at this time. Notwithstanding the lack of demand for money here, the local institutions are not at all inclined to press their money upon the market, and the general belief is that rates will rule at about the present level for some time to come. Money on call was in plentiful supply at rates ranging from 4 to 2 per cent. Sixty-day money was obtainable at 5¼ per cent, as against 5½ per cent asked a week ago, while ninety day funds were offered at 5¾ per cent. Some demand was reported for four months' money at 6 per cent, which is considered a choice maturity, as it carries the borrower well into January, when rates for money are generally easy. Five and six months' money was offered at 6 per cent. The foreign exchange market has ruled somewhat firmer, but the impression in foreign exchange circles seemed to be that it is only a question of time when Europe will be compelled to buy liberally of our cotton and grain. The offerings of bills against such purchases thus far this season, have been comparatively small, and a more liberal export movement is looked for in the near future. The fact that the advances made by foreign bankers on cotton and grain this year have been extremely small, together with the high prices which our commodities are likely to realize will result in a larger import movement of gold this Autumn. The European money markets have been easy, especially at London, where private discounts have declined to below 3¾ per cent, or fully ¾ per cent below the official rate. It is not likely, however, that any reduction in the Bank of England rate will be made at this time, owing to the heavy demands for gold to finance the Egyptian cotton crop and for other purposes.

The bank statement, published last Saturday, made a satisfactory exhibit, inasmuch as the cash holdings of the banks were increased by $4,529,200. The reserve required, however, was $3,042,800 more than in the preceding week, thus increasing the surplus reserves by $1,486,400. The surplus now stands at $8,405,100, as against $11,315,925 in the corresponding week of last year, and $5,235,050 in 1905.

The Stock Market

One of the most encouraging developments in connection with the securities market that has occurred for a long time past transpired during the week just brought to a close, in the shape of a considerable increase in the demand for railway and other bonds, which was stimulated by the great success of the recent New York City bond sale, and the subsequent big inquiry for the new 4½ per cents at very decided advances over the prices at which they were awarded. This demand was not of sufficient magnitude to cause any great increase in the volume of business in the bond department, but it was of such proportions as to attract a good deal of attention, and to indicate an almost complete restoration of confidence on the part of investors. As a matter of fact, leading bond houses in Wall Street reported a larger demand for this class of securities than at any time for two years, and this was regarded as a very significant straw. As a result of this condition of affairs, bullish sentment in the stock market was further augmented, and during the fore part of the week prices for railway and industrial shares, alike scored additional advances, even though the buying came chiefly from the shorts. Renewed ease in the money markets here and abroad continued favorable, weather conditions in the crop growing sections of the South and West, with assurances that our farmers will receive for their harvests this year a sum largely in excess of any amount ever before secured by them, which naturally led to expectations of greater or less importations of gold from Europe later on materially assisted in the work of raising stock prices to a higher plane. Still another factor operating in the same direction was the report of the National banks of this country, showing in the year to Aug. 22 last an increase in their cash holdings of $77,000,000.

As the week drew to a close, however, there was a check to the upward movement, occasioned, in part, by prospects of a temporary hardening in the local money market consequent upon the Oct. 1 interest and dividend disbursements, but more directly traceable to the investigation being conducted into the affairs of the Standard Oil Company; the evidence of a recession in the iron and steel industry, and finally by a further cut in copper metal prices, and the announced determination of many of the larger producers to curtail their output even to a greater extent than was at first proposed, the intention now being to reduce production to 60 per cent of the normal, as against the 50 per cent restriction originally agreed upon. While in some quarters it was felt that these more or less drastic measures would bring about a settlement of the differences that have long existed between producers and consumers of the red metal, the prospect that they would eventuate in a reduction in dividends by some of the other copper mining companies, proved exceedingly distasteful to stockholders in all such corporations and induced considerable selling of these shares. The balance of the market was sympathetically affected and in the latter portion of the week much of the ground that had previously been gained in the direction of higher prices was lost. There were no signs of the demoralization that characterized the share speculation a few weeks since, and practically all the selling emanated from the bearish professional element, nevertheless the general list wore a rather unsettled aspect. Relatively speaking, the railway shares ruled firmer than the industrials, and there was an apparent disposition on the part of the former to cut loose from the depressing influence of the retrograde movement in the latter.

By far the most important development in the local traction situation during the week was the appointment of receivers for the New York City Railway Company, lessee of practically all of the traction properties in Manhattan and the Bronx. This action had been expected for some time, and had not the slightest effect upon the prices for the shares of the various traction properties. It is understood that the receivership proceedings are of a friendly nature, and in well-informed quarters they are considered to be the first step in the general reorganization of the local traction system. Prior to announcement of the appointment of receivers for the New York City Railway Company, fluctuations in price for the local traction stocks were quite general in keeping with those in other sections of the market, and after early substantial rallies all the shares in this class reacted. The same talk of a receivership for the Metropolitan Street Railway was again in evidence, but there were no developments of a tangible nature in that direction.

Philadelphia

There was a material falling off in the dealings in the local traction issues during the past week, and, while prices moved with more or less irregularity, the general trend of values was toward a higher level. Philadelphia Rapid Transit was comparatively quiet, nevertheless, it furnished the active feature of the group, and ended the week with a substantial gain. At the outset there was a disposition to sell the stock and the price eased off to 18⅞, but later on the price was advanced to 22¼. At the high figure profit-taking developed which carried the price off to 20⅞, but the final figure was 1⅜ above last week's closing price. About 4,500 shares of the stock changed hands, as against almost 35,000 shares in the preceding weeks. Union Traction also developed considerable strength, the stock advancing from 49 to 51¾, a net gain for the week of 2¼ points. Philadelphia Traction lost a point to 88, on light trading. Philadelphia Company common advanced 1½ to 40, but subsequently lost half of the gain. Other transactions included American Railways, at 47; United Companies of New Jersey at 240 and Consolidated Traction of New Jersey at 67¼@67.

Chicago

Very little interest was manifest in the local traction issues, and apart from the sale of a small amount of City Railway stock at 155, the trading was devoid of interest. South Side Elevated sold at 79, and Northwestern Elevated sold at 21½ @ 21.

Other Traction Securities

Dulness was the chief feature of the Baltimore traction market, trading being practically confined to United Railway issues, all of which showed weakness. The 4 per cent bonds declined a point to 14½, while the incomes lost ½ to 51¼. The funding 5s, after selling at 18⅛, dropped to 77¾, and closed at 78. United Railway stock lost ⅜ to 12⅛ on a single transaction involving 100 shares. Knoxville Traction 5s sold at 102½. At Boston the dealings were rather light, but the undertone was firm. Boston Elevated, after an advance to 130, reacted to 129. Boston & Worcester common was fractionally lower, 750 shares changing hands at from 18¾ to 18⅜. Massachusetts Electric common was strong, at 13¼, while the preferred rose from 49¾ to 51, on light purchases. Boston & Suburban advanced to 14. West End common brought 84½, and the preferred 100½ and 100.

Traction securities were not especially lively on the Cleveland Stock Exchange last week and the opening of the present week was not at all auspicious. Ten shares of Cleveland Electric sold at 50 on Wednesday, but on Thursday the same number went at 49. This week the bid price dropped to 47, but there was no stock for sale for less than 50. Northern Ohio Traction & Light has varied from 20½ to 21 and 22, with ten shares sold at the latter figure. The closing quotations were 21 bid and 25 asked. Twenty-five shares of Washington Baltimore & Annapolis pooling certificates sold on Friday at 11¾, but on Saturday an advance of ¼ was shown and 400 changed hands. This week opened with these securities at the same figure. Ten shares of Aurora, Elgin & Chicago sold at 33, while thirty-six shares of preferred went at 74.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Sept. 18	Sept. 25
American Railways	47¼	46½
Boston Elevated	129	129
Brooklyn Rapid Transit	45¼	46¾
Chicago City	150	150
Chicago Union Traction (common) certificates	—	2⅝
Chicago Union Traction (preferred) certificates	—	—
Cleveland Electric	—	50
Consolidated Traction of New Jersey	67	66
Detroit United	62	62¾
Interborough-Metropolitan	9	9¼
Interborough-Metropolitan (preferred)	25½	25½
International Traction (common)	—	—
International Traction (preferred) 4s	—	—
Manhattan Railway	114	118
Massachusetts Elec. Cos. (common)	12½	12½
Massachusetts Elec. Cos. (preferred)	a49½	—
Metropolitan Elevated, Chicago (common)	21	a20
Metropolitan Elevated, Chicago (preferred)	61	a60
Metropolitan Street	41	39
North American	59½	58½
North Jersey Street Railway	40	40
Philadelphia Company (common)	38½	39¼
Philadelphia Rapid Transit	19⅜	20¾
Philadelphia Traction	89	88
Public Service Corporation certificates	65	—
Public Service Corporation 5 per cent notes	92	92
South Side Elevated (Chicago)	80	79
Third Avenue	50	49
Twin City, Minneapolis (common)	91	95
Union Traction (Philadelphia)	49¼	51⅝

a Asked.

Iron and Steel

The "Iron Age" says that the heavy orders entered in the wire trade lately are considered significant, since that brand reflects better than any other the demand from a very wide range of sources, and from the agricultural community in particular. In the heavy lines business is undeniably dull, and a considerably lessened output during the winter months seems inevitable. The steel trade is steady and the rail trade is awaiting the results of the conference on the new specifications. The feeling is growing that copper has come down to a basis which pustifies at least moderate purchases. It is true, however, that electrolytic copper has sold this week at 14¾ cents.

LIMA & TOLEDO COMPANY SECURES RIGHTS IN TOLEDO

The Lima & Toledo Traction Company, now a part of the Ohio Electric Railway Company, has been granted a perpetual franchise to cross a number of streets in Toledo. For the present the company's tracks will be allowed to cross at grade,

CONSOLIDATING MAINE ROADS

The permanent organization of the Lewiston, Augusta & Waterville Electric Railway Company has been effected. The officers are: President, John R. Graham, Bangor; vice-president, H. L. Clark, Philadelphia; treasurer, D. S. Hahn, Lewiston; clerk, Herbert M. Heath, Augusta. Directors, John R. Graham, Bangor; John F. Hill, Thomas J. Lynch, Augusta; W. H. Newall, Lewiston; H. L. Clark, C. A. Pierson, Jr., Philadelphia; Frank Silliman, Scranton, Pa. This is the merger company, which was authorized by the recent legislature to acquire street railway properties in the counties of Androscoggin, Kennebec, Somerset, Waldo, Knox, Lincoln and Sagadahoc. It has acquired the Lewiston, Brunswick & Bath, with 58 miles of line in Auburn, Lewiston, Lisbon, Topsham, Brunswick, West Bath, Bath and Webster in Androscoggin, Cumberland and Sagadahoc counties; and the Augusta, Winthrop & Gardiner, with 27 miles in Augusta, Hallowell, Farmingdale, Manchester, Winthrop and Gardiner in Kennebec County. The road in Cumberland County is building 33 miles of line via Webster and Wales in Androscoggin County, and Monmouth, Litchfield, West Gardiner and Gardiner in Kennebec County; and 24 miles to connect Augusta with Vassalboro, Winslow and Waterville. Mr. Graham is the general manager for the Bangor Railway & Electric Company, with 59 miles of line in Bangor, Veazie, Orono, Old Town, Glenburn, Kenduskeag, Corinth, Charleston and Hampden, all in Penobscot County. Mr. Graham's backers are reported to be the Clarks of Philadelphia.

JOINT MEETING AND RECEPTION OF NEW YORK STREET RAILWAY AND GAS & ELECTRIC ASSOCIATIONS

In connection with the annual convention of the Empire State Gas & Electric Association,to be held in the auditorium of the New York Edison Company, on Wednesday, Oct. 2, a joint meeting and reception has been arranged to be held under the auspices of the Street Railway Association of the State of New York, and the Empire State Association, in the concert hall of Madison Square Garden, on the evening of Oct. 1. At this meeting addresses will be made as follows: Frank W. Stevens, chairman, Public Service Commission, Second District, "The Work of the Public Service Commission, Second District, and its Policies with Relation to the Corporations under its Supervision. Henry T. Pierce, president, International Railway Company, Buffalo, N. Y., "The Electric Railway Situation of To-Day." Dr. Alexander C. Humphreys, president, Stevens Institute of Technology, "Control of Gas Companies by State Commissions." Everett W. Burdett, chairman of Committee on Public Policy, National Electric Light Association, "Public Control from the Corporate Standpoint."

It is expected that the members of the Public Service Commissions of the First and Second Districts will be presnt and a cordial invitation is extended to everyone interested in public service corporations to attend the meeting and reception.

At the morning sessions of Empire Gas and Electric Association there will be presented the report of the executive committee and the reports of the various sub-committees which have been appointed during the year. There will also be an account of the publicity work done on behalf of the association. In the afternoon several very interesting papers will be presented and discussed. The subjects chosen will be of equal inteerts to representatives of gas or electric companies.

The electrical show will be in progress in Madison Square Garden from Sept. 30 to Oct. 5, and should prove an attraction to the representatives of the electric companies especially. An invitation has been extended to the association by the Consolidated Gas Company for delegates to the convention to visit the company's plant at Astoria on Wednesday morning, Oct. 5. Both associations extend a cordial invitation to the representitives of their respective interests to attend, and have arranged their program with the end in view of providing special entertainment for visitors.

TRACTION MATTERS IN NEW YORK—RECEIVER FOR NEW YORK CITY COMPANY

On Tuesday, Sept. 24, application was made before Judge Lacombe, in the United States Circuit Court, by the Pennsylvania Steel Company and the Degnon Contracting Company, creditors, for a receiver for the New York City Railway Company. The application was in the form of a bill in equity, asking that the court take charge of the affairs of the company and by the appointment of receivers provide for the liquidation of the company's indebtedness without its corporate disintegration. Adrian H. Joline and Douglas Robinson were appointed receivers, and they immediately qualified in the sum of $250,000 each.

On behalf of the Interborough-Metropolitan Company, August Belmont, chairman of the board of directors, made this statement:

The receivership of the New York City Railway in no way affects the solvency of the Interborough-Metropolitan or of the Interborough Rapid Transit Company, and it cannot be too positively stated that a receivership of either of those two companies has at no time been even considered. The Interborough-Metropolitan Company has no debt except its issue of 4½ per cent collateral trust bonds secured by Interborough Rapid Transit stock and about $8,000,000 of collateral notes representing advances made to the surface system under the agreements entered into last May, which then contemplated an advance aggregating $15,000,000. The Interborough-Metropolitan Company has over $6,000,000 cash in the bank.

The actual results of the operation of the surface lines in the last year and a half have disappointed all expectations, with the result that there has been such a large decline in the earnings of the New York City Railway that there is no immediate prospect of its being able to earn its fixed charges or to procure the very considerable sums of money which will be required for the improvement of its lines. Accordingly the board of directors of the Interborough-Metropolitan Company has determined that it is not wise for the Interborough-Metropolitan Company to make further advances to the surface system.

In the interest of the public, as well as of every one interested in the securities of the various companies, it is clear that a comprehensive readjustment should be effected promptly, in order that the essential improvements may be made as quickly as possible. The receivership is a long step in this direction.

The list of bond issues in the system recited by the bill of complaint is as follows:

METROPOLITAN BOND ISSUES

	Amount Outstanding.
Metropolitan Street Railway Company, general and collateral trust mortgage	$12,500,000
Metropolitan Crosstown Railway Company, first mortgage	600,000
Lexington Avenue & Pavonia Ferry Railroad Company, first mortgage	5,000,000
Columbus & Ninth Avenue Railroad Company, first mortgage	3,000,000
South Ferry Railroad Company, first mortgage	350,000
Broadway Surface Railroad Company, first mortgage	1,500,000
Metropolitan Street Railway Company, refunding mortgage	16,604,000
Second Avenue, first consolidated mortgage	5,631,000
Christopher Street & Tenth St. Railway, first mortgage	210,000
Fulton Street Railroad Company, first mortgage	500,000
Thirty-Fourth Street Crosstown Railroad Company, first mortgage	1,000,000
Twenty-Eighth & Twenty-Ninth Streets Crosstown Railroad Company, first mortgage	1,500,000
Union Railway Company of New York, first mortgage	2,000,000
Yonkers Railroad Company, first mortgage	1,000,000
Westchester Eectric Railroad Company, first mortgage	500,000
Tarrytown, White Plains & Mamaroneck Railway Company, first mortgage	300,000
Southern Boulevard Railroad Company	250,000
Dry Dock, East Broadway & Battery Railroad Company, general mortgage	950,000
Dry Dock, East Broadway & Battery Railroad Company, certificates of indebtedness	1,100,000
Forty-Second Street, Manhattanville & St. Nicholas Avenue Railway Company, first mortgage	1,200,000
Forty-Second Street, Manhattanville & St. Nicholas Avenue Railway Company, second mortgage income	160,000
Broadway & Seventh Avenue Railroad Company, second mortgage	500,000
Broadway & Seventh Avenue Railroad Company, first consolidated mortgage	7,750,000
Central Crosstown Railroad Company, first mortgage	250,000
Central Crosstown Railroad Company, first and consolidated mortgage (deposited with the Morton Trust Company as collateral security for the three-year-old notes of said railroad company to the face amount of $2,250,000)	2,490,000
Third Avenue Railroad Company, first mortgage	5,000,000
Third Avenue Railroad Company, first consolidated mortgage	37,560,000
Bleecker Street & Fulton Ferry Railroad Company, first mortgage	700,000
Second Avenue Railroad Company, first mortgage	1,280,000
Second Avenue Railroad Company, debenture bonds	89,000

The bill of complaint which contains the receivership petition recites the organization of the Pennsylvania Steel Company and the Degnon Contracting Company, and that of the New York City Railway as lessee of the Metropolitan Street Railway. The list of leased lines is next set forth, together with the mortgage indebtedness of the system already stated, and the fact that the Metropolitan Street Railway has outstanding $13,000,000 of its $20,000,000 capital stock. In connection with the mortgage indebtedness of the leased lines the petitioners state their belief that in default of payment of the interest in the various mortgages will operate as a default under the mortgages themselves, thus rendering the mortgages unenforceable and tending to break up the system. After reciting the administrative unity of the Metropolitan system in some detail, the bill names as the specific claims of the Pennsylvania Steel Company and the Degnon Contracting Company, two items of $36,831.38 and $11,173.27, respectively, one for rails and the other for construction work done. Beyond this, however, it is declared that the petitioners are informed and believe that the New York City Railway has spent on extensions and improvements on leased lines upward of $20,000,000, and has also spent large sums in electrification—all to the great advantage and betterment of the system, but in excess of the resources of the New York City Railway. Contracts entered into for electrification are also mentioned as being now in the course of performance which require $4,000,000 that the Metropolitan cannot pay, and that, as a result, electrification work must be suspended, notwithstanding the outlay already of large amounts whereby the defendant has incurred heavy liability. Prospective liabilities for new equipment which the defendant is under contract to buy are also recited, as well as several thousand damage suits in various courts which will entail a material expenditure under judgments to be obtained.

At the time of the appointment of the receiver for the New York City Company, the Interborough-Metropolitan Company and the Metropolitan Securities Company turned their books over to the Public Service Commission for use in the work which the commission is carrying on. As a result, there was an adjournment of the hearing until Thursday to give Mr. Ivins and the members of the commission an opportunity to go over the books. In connection with the receivership and its effect upon the work of the commission, Mr. Ivins said:

The appointment of the receivers by Judge Lacombe will have no effect whatever upon the conduct of the investigation, except in certain respects possibly to change its order. In such a case as the present there would have ultimately to be a judicial determination of the rights of the different parties among themselves not only, but a general judicial liquidation, which will undoubtedly result in a reorganization.

One of the effects of the application for the appointment of a receiver will be to relieve the Commission of the very burdensome work of determining the precise relations of the parties between themselves, but will not in any respect affect the inquiry as to the causes for the insolvency as growing out of agreements to pay rentals which could not be earned, and of overcapitalization, overbonding and overborrowing as well.

I do not believe it is the intention of the railroad companies to attempt to deprive the Commission of any jurisdiction in the premises, but rather to recognize the actual fact of the long-existing insolvency, and take steps which will permit of a reorganization that will ultimately tend to facilitate rather than to hinder the work of the Commission, first, because the work of the receivers will probably be done rapidly, in view of the necessity for maintaining and restoring the company's credit; second, because it will undoubtedly result in leaving the company in a position where it will be able financially to carry out the large general orders of the Commission, which it is certainly financially unable to do at the present time, and because, in respect of any reorganization, the Commission will have the final regulative voice as to the class, character and amount of new securities to be issued.

One of the things that the Commission is already prepared to go into is the investigation of the construction and equipment account of the subway, and the cost of the new tunnels, but that will now have to be deferred until a general survey has been made of the books of the two holding companies.

The session of the commission on Wednesday, Sept. 18, was devoted to the consideration of charts showing the comparative density of subway and elevated traffic on Aug. 21, 22 and 23 last. These charts were prepared on the basis of observations taken by clockers for the commission. They will be compared later with similar charts made up from observations by the company's men. It developed that the commission's charts

make a rather better showing for the subway and elevated than do those which the company has prepared. However, all the present charts show conditions at the time of lightest travel in mid-summer, as is evidenced by the deduction read into the record that on the three days in question there were "a few" standing passengers in the subway expresses leaving Brooklyn Bridge, northbound, between 5 and 6 o'clock in the evening. Another indication was that there was no great congestion on the downtown expresses in the morning. The observations discussed were taken at two or three points on the Second, Third, Sixth and Ninth Avenue lines and on the Subway, the points being so distributed as to take in most of the places where there is congestion.

The session on Thursday was devoted to the consideration of certain details of finance and to traffic statistics. Mr. Root, as vice-president and general manager of the New York City Railway Company, was the witness. He insisted that the car mileage was no criterion of the service rendered on the ground that weather conditions and the congestion of vehicular traffic varied the car mileage quite distinct from the number of cars operated. As an illustration, Mr. Root said that in December of last year the company increased the number of cars it ran by 3½ per cent, with a resultant increase of but one-third of 1 per cent in the car mileage. After the car-mileage subject had been dismissed, Mr. Ivins took up the subject of flat-wheels. Mr. Root said that things were a little worse than usual in this respect because of the destruction of the 146th street repair shops, but that in 1906 over 12,000 flat wheels were removed over the entire system. Mr. Root also spoke highly of the brake system in use on the Metropolitan and said that the only practicable fender for the traffic conditions that prevail in New York was one placed under the cars ahead of the trucks.

On Friday Mr. Root told the commission about the troubles of the manager of a surface traction system under the conditions existing in New York, and also discussed a set of proposed ordinances for the regulation of traffic sent to the commission by President Shonts of the Interborough-Metropolitan. In connection with these ordinances, for which the Metropolitan asks the support of the commission, there is the suggestion for the use of the "pay-as-you-enter" car. The traffic regulations propose, in the first place, that not only shall all vehicles keep to the right-hand curb, but that where a street is so narrow that there is only a single car track on it there shall be a diversion of vehicular traffic, so that only vehicles moving in the same direction that the cars are going shall be allowed on the street with the car tracks. It is proposed, also, that the city, in removing snow after a storm, shall open up at the earliest moment a street either north or south of any cross street where car tracks go through, so that teams will not jam in on the car tracks and tie up the operation to an indefinite extent, as is the case under present conditions. In connection with this same matter of snow removal, it is suggested that on streets having wide sidewalks, like Twenty-third street, instead of clearing all the snow off the sidewalks to the edges of the street, as the first step toward removal, and thus forcing the vehicular traffic upon the car tracks, some of the snow be allowed to remain on the outer edges of the sidewalks, so that the tracks may be kept, to a certain extent, free for the operation of cars.

The regulations contemplate, further, that no vehicle shall be allowed to stop on a crossing, and that on a street where there are car tracks no stop, other than an emergency stop, shall be allowed except to deliver goods or passengers. In case of such a stop in any way interfering with car operation, it is provided that the block shall not be allowed for more than five minutes at a time. More than this, the proposed ordinances stipulate that where a residence or business house fronting on a street where there are car tracks has also an entrance on a side street there shall be no stop to unload goods at the front entrance unless under a permit from the police department. The ordinances provide that all teams standing at the curb must face in the same direction in which the traffic is going on that side of the street, and may not stand within 100 feet of a street corner where there is a crossing of car tracks, nor within ten feet of the curb line of any corner. It is proposed to give all traffic going north and south the right of way over traffic going east and west, and to give cars the right of way, so far as that part of the street occupied by car tracks is concerned, over all traffic going at a less rate than ten miles an hour. There is a provision in this section that was believed by some who saw it yesterday to have been tucked in for its possible bearing in damage-suit claims. It added the word "persons" to the clause giving cars the right of way over vehicles being driven or standing on the car tracks. Additional restrictions for the pushcart men are contemplated. It is proposed not to allow them to stand within twenty-five feet of any corner or less than ten feet apart, and to keep them altogether off streets where surface cars are being operated. Coal trucks, which cause more trouble to surface cars than any other kind of vehicles, are, under the proposed ordinances, subjected to the London rule, which provides that between the hours of 7 a. m. and 7 p. m. they may not haul or deliver coal on any street where there are surface tracks without a permit from the police department for every such delivery. The last of the regulations proposes that on crosstown streets where surface cars are operated vehicles may be driven only when they are going to destinations in the block that they enter. The effect of such a move as this would be to throw east and west traffic off the cross streets where cars are operated into the next streets above and below until they approach the block in which their destination lies.

The receivers of the New York City Railway Company were in conference Wednesday with President Vreeland, General Manager Oren Root, General Solicitor Quackenbush and a member of Mr. Masten's firm. The only announcement following the meeting was the appointment of Mr. Masten and the fact that the receivers would proceed first to make up a definite statement of the assets and liabilities of the New York City Railway, which would be presented to the court as soon as it was ready.

The Interborough Rapid Transit Company on Thursday, Sept. 26, notified the Public Service Commission of its willingness to increase the elevated and Subway service at each end of the half-hour of greatest crush. In most instances the increases offered yesterday by the Interborough were less in amount than the 20 per cent general increase proposed some time ago for discussion at a later hearing, and the time within which the increased service is afforded is materially shorter than was proposed.

Mr. Hedley said that the first increase in the Subway service in the morning would be accomplished by running two additional trains from West Farms between 7 and 7:30 o'clock. Between 8:30 and 9 o'clock there will be one additional Subway train started from West Farms, and at the end of the day there will be an additional Subway West Farms express between 5 and 5:30 o'clock, and another between 6 and 6:45.

On the Second Avenue line, where an increase of 40 per cent is scheduled, two cars will be added to eight consecutive trains passing Forty-Second Street northbound shortly after 6 o'clock. Between 6:15 and 7 o'clock three additional trains will be started on the Second Avenue line from 129th Street and run to South Ferry; from 7 to 8:30 o'clock one additional South Ferry train will be started from 129th Street.

In the evening between 5 and 6:30, where a 4-per cent overcrowding was indicated by the commission's charts, one additional Second Avenue train is to be put on; from 6:30 to 7, two additional trains, and beginning with the third train passing Forty-Second Street after 7 o'clock when seven-car trains will be run instead of five cars for ten consecutive trains. Two cars will also be added to the five trains passing Forty-Second Street shortly after 8 o'clock in the evening.

On the Third Avenue line between 6 and 6:30 one additional train will be run down-town and two trains additional will be run between 6:30 and 7 o'clock. From 7:30 to 8 o'clock there will be four additional seven-car trains, and the same number additional from 8:30 to 9 o'clock. In the afternoon, beginning at 5 o'clock, there will be six additional trains in the first hour of the evening rush, some originating at 129th Street and some at 179th. Then there will be a break of half an hour with no trains additional, but at 6:30 the increase starts again with an additional seven-car train between that hour and 7 o'clock. Between 7 and 7:45 o'clock there will be additional Third Avenue trains, north bound, and shortly after 9 o'clock, instead of reducing the Bronx Park trains from seven to five cars, the seven-car trains will be continued for five intervals on the schedule.

On the Sixth Avenue line between 7:30 and 9 o'clock trains south bound are to run with seven cars instead of six, and the seventh car will be added to trains running north between 5 and 6:30 o'clock at night. On the Ninth Avenue line the only increase is to be between 5 and 6 o'clock at night, when three additional six-car trains will be run from Rector Street to 135th Street.

ANNUAL REPORT NORTHWESTERN ELEVATED RAILROAD COMPANY FOR THE YEAR ENDED JUNE 30, 1907

The report of the Northwestern Elevated Railroad Company for the year ended June 30, 1907, show that the gross earnings (including Loop net earnings), were $2,100,315.97, an increase of $151,588.69, or 7.7 per cent. The total expenses were $1,752,737.84, an increase of $84,508.57, or 5 per cent. The increase in expenses was due principally to increased taxes and increased Loop compensation to city, and to improved service requiring additional car miles, with a corresponding increase in pay roll and power accounts, to an increased rate of wages, and to additional insurance. The net income was $347,578.13, an increase of $67,080.12, or 23.9 per cent. The surplus at the close of the year was $1,649,013.01. The income account follows:

COMPARATIVE STATEMENT OF INCOME ACCOUNT

For the Years Ended June 30, 1906 and 1907

EARNINGS

	1906	1907
Passenger earnings	$1,456,454.01	$1,550,816.37
Other earnings (including loop net earnings)	492,273.27	549,499.60
Total earnings	$1,948,727.28	$2,100,315.97
OPERATING EXPENSES		
Maintenance of way and structure	$65,092.09	$50,681.25
Maintenance of equipment	147,387.13	141,738.23
Conducting transportation	415,555.80	458,773.64
General expenses	77,537.76	93,110.90
Total operating expenses	$705,572.78	$744,304.02
Net earnings	$1,243,154.50	$1,356,011.95
CHARGES		
†Taxes	$171,624.04	$217,311.32
Bond interest	783,466.53	791,122.50
Other interest	7,565.92	.....
Total charges	$962,656.49	$1,008,433.82
Surplus	$280,498.01	$347,578.13
Ratio of operating expenses (including maintenance reserves) to earnings (excluding loop net earnings)	46.62	46.38
Ratio of operating expenses, maintenance reserves, loop account and taxes to earnings (excluding loop net earnings)	62.72	64.36

†Includes compensation to city on account of loop. The above figures for 1907 include $35,054.07 set aside as a reserve for maintenance.

GENERAL BALANCE SHEET

(Including Loop Division)
June 30, 1907

ASSETS

Cost of road and equipment		$31,575,603.08
Land and buildings		442,022.42
Stocks and bonds		32,515.14
Cash and bills receivable		1,028,141.81
Accounts receivable		142,757.55
Materials and supplies on hand		3,805.17
Unadjusted accounts		415,766.59
		$33,640,611.76

LIABILITIES

Capital stock—preferred	$5,000,000.00	
Common stock	5,000,000.00	$10,000,000.00
Bonds	$22,624,000.00	
Less bonds owned	3,698,000.00	$18,926,000.00
Mortgages		122,350.00
Reserve for taxes		91,523.48
Accrued interest on bonds		248,611.68
Reserve for maintenance		250,000.00
Accounts and notes payable		2,322,338.33
Unadjusted accounts		30,775.26
Profit and loss		1,649,013.01
		$33,640,611.76

COMPARATIVE STATEMENT OF PASSENGER TRAFFIC

	Total Passengers.	Daily Average.
Year ended June 30, 1901	18,950,167	51,918
Year ended June 30, 1902	21,769,079	59,641
Year ended June 30, 1903	24,305,704	66,591
Year ended June 30, 1904	25,497,079	69,664
Year ended June 30, 1905	26,812,825	73,460
Year ended June 30, 1906	29,132,871	79,816
Year ended June 30, 1907	31,022,575	84,993

Average daily increase 1907 over 1906, 5177 passengers, or 6.48 per cent.

In presenting the report President M. B. Starring said in part:

The physical condition of the property has been maintained at a correct standard, and adequate reserves have been established to care for the future.

Thirty-four new combination motor cars were purchased, and their operation proved satisfactory; the wide door entrance space and the pneumatically operated door add much to the loading and unloading facilities of these cars, and will be adopted in future purchases.

The Wilson Avenue surface terminal station has been completed and now affords not only all possible convenience to the company's patrons, combined with satisfactory operative conditions, but also is an attractive addition to the neighborhood in which it is located.

A 2000-kw rotary converter was installed in an addition to the Chicago Avenue storage battery building, and placed in operation Feb. 6, 1907; current being purchased under a contract with the Commonwealth Electric Company, which contract will provide the electrical energy used in connection with the additional rotary converters hereafter mentioned.

An addition to the Fullerton Avenue power house is under construction for sub-station purposes, and two 2000-kw rotary converters will be installed therein; the first in September, 1907, and the second prior to Dec. 1, 1907; in addition to these the efficiency of the storage battery has been incrased over 40 per cent by additions made thereto, thus amply providing for the demands for electrical energy for the coming winter.

The Ravenswood extension, although not completed, was opened for business on May 18, 1907, and gives promise of developing all the traffic that had been expected of it. Its completion, including the surface extension, will be accomplished early in the autumn.

Acceptable ordinances have been passed by the City Councils of Chicago and Evanston, authorizing the Chicago, Milwaukee & St. Paul Railway Company and the Northwestern Elevated Railroad Company to operate the Evanston division of the St. Paul Company by means of electricity, which will result in the extending of this company's service to Evanston under an operating agreement with the Chicago, Milwaukee & St. Paul Railway Company, the terms of which have been substantially agreed upon.

Active steps were taken to obtain the frontage consents necessary for the passage of an ordinance for a stub terminal on North Water Street, to be introduced at the first fall session of the City Council.

The question of extending the Loop platforms so as to facilitate the operation of more cars per train than are at present operated, is being actively pushed before the Corporation Counsel of the city, and a decision is expected early in the fall.

The entire Loop situation is being carefully checked and examined by expert engineers, with a view to ascertaining in just what way changes in or additions thereto may be made so as to best accommodate the patrons of the lessees, and subserve all interests.

SAN FRANCISCO CAR STRIKE

The strike of the carmen which has been in force for over four months in San Francisco, has practically been called off, the boycott having been raised by the union leaders on Sept. 12. In addition the general strike committee has voted to allow all union men to ride on the street cars, but to consider the strike in force and effect and continue paying assessments until a settlement shall be effected bteween the carmen's union and the United Railroads.

Four killed and 252 known to have been wounded, is the record of the 131 days of the car strike period that began on May 5 and continued until the boycott was removed. In addition to the injury of 209 employees, the car company had 3529 car windows broken by rioters. It also had its Turk and Fillmore car house fence battered down; its high-tension electric wires short-circuited two different times; car rails greased and soaped dozens of times to cause runaway cars, and it ran over or found scores of torpedoes and other explosives on the rails, apprehended two dynamiting plots, found barriers of stone, of hardened cement, felled trees, and, in one instance, a small house placed across the track to block the progress of its cars.

The day before the strike was declared the United Railroads had 1700 platform men in its employ. It now has 1450 platform men at work, many of whom are deserters from the union.

The company not only has all the platform men it needs at present, but it is daily receiving from 50 to 75 applications for positions on the cars. Altogether, the company is in much better condition to handle traffic than it was before the strike. It has more cars and more new cars, and it has more lines open to traffic. The only present handicap is temporary shortage of power from the California Gas & Electric Corporation.

IMPORTANT RULING ON PETITIONS BY MASSACHUSETTS COMMISSIONERS

The railroad commissioners of Massachusetts on Wednesday, Sept. 18, issued their findings in the case of the four important interurban railway petitions before the board for certificates of exigency. Of the four the Boston & Providence, backed by the interests behind the Boston Elevated Railway, was the only successful road. The petitions of the Boston, Lowell & Lawrence and of the Boston & New York companies were dismissed, while that of the Boston & Eastern Company, which proposes to build to Lynn, Beverly and Salem, was held in abeyance in order that the company may file more satisfactory plans.

The petitions were all brought under the recent act of the Legislature which provides that a company which desires to build an electric railway must first secure a certificate that public necessity and convenience require its construction. In effect the statute declares that indiscriminate competition is undesirable, and that the resources of a monopoly, provided the management be efficient and progressive, may provide the largest and best public service; that established companies conducting their business in a proper manner are to be given a reasonable measure of protection, and that the extraordinary right of eminent domain is not to be exercised at the will of those who, professing public purposes, have in view merely private gain. An abstract follows of the report of the commissioners:

Though a road between Boston and Providence must openly compete with an excellent steam railroad service, it would offer equal speed with more frequent trains and with freedom from smoke and cinders. Physical conditions are favorable for an electric road of modern type, and as matters now stand it cannot be said that the adventure would be unprofitable. The question is simply which of the two companies that desire to build shall receive the necessary certificate, for it has been taken for granted from the first that there is room for only one.

The route of the Boston & Providence Interurban is the choice of experts who in the beginning had different lines in view. Their investigation has been exceptionally thorough and their plans have on the whole popular preference in the communities that would be served. The route of the New York & Boston Electric Railroad is of recent suggestion. While this project, as the name indicates, is more ambitious than that of the Boston & Providence Company, its future would be far more uncertain and speculative, success being dependent upon the ability of the company to prosecute the enterprise in other states where as yet nothing of a definite or tangible nature appears to have been accomplished. In our opinion a certificate ought to be issued to the Boston & Providence Interurban Electric Railroad Company as the company by comparison is in better position to make us of it for the public advantage.

The Boston, Lowell & Lawrence Electric Railroad as planned would pass through Charlestown, Somerville, Medford and Arlington, connecting with the Boston Elevated system in Charlestown. Residents of these cities and towns earnestly remonstrate against the building of this railroad. It cannot be gainsaid that the railroad which is proposed would interfere with important extensions of the Boston Elevated system which have long been awaited in these suburban towns. In general, it may be said that the method pursued in placing this project before the public at different times and in different places in the early days of its promotion was notable for indifference to law and conditions and to the possibility that promises made might call for performance. Then, too, the structure which the company proposes in Sullivan Square is undesirable and unsightly and the selection of that connection with the elevated system makes rapid transit improbable and aggravates conditions that already vex and menace the public at this terminal. Nor can the company build the structure which it has planned without special legislation, and such legislation has been expressly denied. The more careful the study and the closer the scrutiny of the history and character of this transportation scheme the less there is found in it to call for a certificate that public necessity and convenience require it.

It does not follow from what has been said that there is no call for an electric railroad in the territory which lies to the north of Boston, and a carefully studied plan for such a railroad has been presented by the Boston & Eastern Electric Railroad Company. Existing railroad and railway companies have argued that they are now giving all needed facilities in this territory, but the argument falls short of the mark. It is true that the Boston, Revere Beach & Lynn Railroad, within the limitations of a steam railroad hampered by ferry connection, is furnishing an admirable service to and from Lynn, and that much commendation is due the management of the Boston & Maine for a service along the North Shore that proves its interest in the comfort and convenience of patrons. But this is not the whole story. With all the railroad and railway lines that now serve it this densely populated territory, especially its rapidly growing cities, needs additional facilities both for immediate use and for the development of a commercial prosperity that might be realized were larger instrumentalities at hand. The plan of the Boston & Eastern Electric Railroad, though carefully studied, is not satisfactory in the way it provides for Lynn, and is fatally defective at the Boston end of the undertaking in proposing a connection with the Boston elevated railway at Sullivan Square. That feature of the enterprise is absolutely prohibitive. The travel which now comes to Sullivan Square as a connecting point between elevated and surface lines overloads the railway and the relief which is promised through changes soon to be completed cannot with our consent be endangered by conducting an additional tide of travel to this point.

In our opinion no electric railroad can successfully reach Boston from the north that does not secure an entrance to the city independent of the existing elevated structure in Charlestown. Without intending to define any exclusive route it may be suggested that the present tunnel or a second tunnel under the harbor might well be the connecting link.

Our conclusion is that, while public necessity and convenience call for enterprise in this field, the present route of the Boston & Eastern Electric Railroad does not meet the emergency. Its petition, however, is not dismissed, but held to await further study and development of plans by this or by any other public agency desirous of furnishing additional transportation facilities in this territory.

PROGRAM OF THE AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION

The program is announced of the eleventh annual convention of the American Street Railway & Interurban Accountants' Association, held at Atlantic City on Oct. 15, 16, and 17. The headquarters of the association will be at the Chalfonte Hotel, and the general headquarters the Marlborough-Blenheim. As the meetings will be held in the hotel, it is urged that members select the Chalfonte as their stopping place, for it will then be possible to have the meetings called promptly and insure a better attendance. The regulations as to securing reduced fare are published on another page of this issue. The Accountants' bulletin also suggests that as excursion tickets are available to the Jamestown Exposition from all parts of the country that allow stopovers at Philadelphia, advantage be taken of them. The program in detail follows:

PROGRAM.

TUESDAY, OCT. 15—10 A. M. TO 1.30 P. M

Convention called to order.

Address—Mr. John I. Beggs, President American Street & Interurban Railway Association.

Annual Address of President.

Annual Report of Executive Committee.

Annual Report of Secretary-Treasurer.

Paper—"Park Accounting," by Frank J. Pryor, Jr., Comptroller the American Railways Company.

Question Box—Frank R. Henry, Auditor, United Railways Company, of St. Louis, editor.

Appointment of Convention Committees and New Business.

Lunch and social afternoon, 2.00 P. M.

WEDNESDAY, OCT. 16—9.30 A. M. TO 1.00 P. M.

Joint Meeting with "American" Association (on Steel Pier).

WEDNESDAY, OCT. 16—3.00 P. M. TO 6.00 P. M.

Paper—"Mechanical Devices for Office Use," by F. E. Smith, Auditor, Chicago Union Traction Company.

Report of Committee on "Standard Classification of Accounts and Form of Report."

Report of Committee on "International Standard Form of Report."

THURSDAY, OCT. 17—10.00 A. M. TO 2.00 P. M.

Paper—"Where Maintenance Ends and Depreciation Begins," by J. H. Neal, Auditor of Disbursements, Boston Elevated Railway Company.

Reports of Convention Committees.

Election of Officers.

Installation of Officers.

PROGRESS ON THE WASHINGTON STREET TUNNEL, BOSTON

The Washington Street tunnel, in Boston, is now nearly completed as far as the tunnel proper is concerned, except for the roadbed and surfacing. With the exception of work near the west end of State Street, which does not admit of free passage, the tunnel is now clear between Castle Street and the North Station. Most of the stations are finished, and sample tiling has been done at the Temple Place and Lagrange Street stations. The tunnel will be more attractive in appearance than either the Tremont Street subway or the East Boston tunnel. The station tiling will be arranged to conceal all the overhead fixtures, including wires, pipes, rods and girders, producing a smooth, glossy surface in artistic designs. White tiling will cover the walls to a height of about 6 ft., after which colored ceramic mosaic work will be affixed up to the ceiling, and the narrow arches above will be finished with the same material. Different color schemes are to be used in the different stations, and the names will also be worked into the mosaic, as in the New York subway. The Boston Elevated Railway Company has suggested that the Boylston Street and Essex Street stations, which furnish access to both the north and southbound tracks at nearly the same spot, be finished in yellow; that the Temple Place, Winter Street, Summer and Franklin Street stations be finished in black; the Milk Street—old State House station—in gray; and the Union Street station in orange. Instead of using arc lights over the platforms the illumination will be by incandescents, placed in the ceiling about 10 ft. apart. The Castle Street connection with the elevated structure, and the track changes at the north station will keep men busy all winter.

THE CLEVELAND SITUATION

Tom L. Johnson has been renominated for Mayor of Cleveland by the Democrats to oppose Congressman Theodore E. Burton, who was chosen by the Republicans a few weeks ago. The platform says that the administration fostered the growth of a company devoted to building and operating street railways, wholly in the interests of the people, preserving the control of the highways by granting revokable franchises only, and that the grants on the West Side and on the Woodland and Kinsman Avenue routes, which will expire within five months, will be taken over by the new company and operated on the three-cent fare plan. Both sides are now engaged in organizing for the campaign, and while the fight will not be made on the street railway question alone by the Republicans, Mayor Johnson will probably make it his keynote.

In sustaining an objection made by attorneys for the Forest City Railway Company, in the trial of the injunction cases against it last week, Judge Lawrence ruled that a collateral attack cannot be made upon the original grant to the Forest City Railway Company, as the Circuit Court has already adjudicated the matter of franchise in favor of the company. The court refused to follow the findings of Judge Phillips, also of the Common Pleas Court, and stated that his decision was manifestly wrong. The decision of the Circuit Court, to which Judge Lawrence refers, was rendered, it seems, before Mayor Johnson's financial interest in the company became a factor in the litigation, but at the same time it is held that the decision must be respected, and that the grant cannot be attacked collaterally in this trial to support the contention of the Cleveland Electric Company's attorneys that the grants for extensions are illegal, because the original grant is illegal, in consideration of the Mayor's interest in the company. Attorney John G. White, for the Cleveland Electric, read a decision of the Supreme Court, in which he claimed that tribunal supported the course the attorneys desired to take, but this the court did not seriously consider.

A. B. Du Pont and H. J. Davies will possibly give the City Council the details of how they arrived at the amount to be paid the city for the use of Central Avenue and Quincy Street from January until April of this year. President Andrews said there was no profit on the business for the time the lines were operated on a three-cent fare. The company does not care to turn its books over to a committee again, since there is no obligation, and it is turning over the $84,000 voluntarily.

AFFAIRS IN CHICAGO.

The contract between the Northwestern Elevated Railroad and the St. Paul Railroad contemplates all switching north of Wilson avenue to be done with electric power as soon as the electrification of the line is completed. The purchase of electric locomotives is already under way, the plans and specifications having been completed and submitted to builders, who will file bids at once. The Northwestern Company has awarded the contract for all the overhead work in the electrification of the St. Paul tracks north of Wilson avenue to the Brennan Construction Company, the consideration being $100,000. The poles will be iron and the wire will be 21 feet above the bed of the track. The overhead trolley will be used until the tracks are elevated to Davis street, Evanston, when the third-rail system will be installed.

It is said that the Eastern bondholders of the Chicago traction companies plan another attempt to frustrate the issuance of rehabilitation bonds which would have priority over existing bonds, by applying for a motion before the United States Circuit Court for an injunction against the receiver of the companies, prohibiting the diversion by him of funds from the payment of the fixed charges of the company to the improvement of the property now in his hands. The injunction is desired in order to prevent default on the bonds of the companies as a result of which foreclosure proceedings might be begun, in the course of which the bondholders feel their interests would suffer.

CENSUS OF THE STREET CAR INDUSTRY SHOWS NUMBER OF ESTABLISHMENTS AND TOTAL PRODUCTS

A bulletin containing special reports on carriages and wagons and the steam and street railway car industry has just been issued by the Bureau of the Census. These reports were prepared under the supervision of William M. Steuart, chief statistician for manufactures, and present statistics relating to 4,956 establishments making carriages and wagons, and 1314 steam and street railroad car construction and repair shops as reported at the census of 1905.

The great development of street railroads since 1890 has caused an extraordinary growth in the industries engaged in the construction and repair of street railroad cars, and, according to the report, the value of products for these industries nearly quadrupled during the fifteen-year period from 1890 to 1905, increasing from $6,268,462 in the earlier year to $24,281,317 at the last census. The increase for the decade from 1890 to 1900 was $10,407,717, or 166 per cent, and that for the five years from 1900 to 1905 was $7,605,138, or 45.6 per cent. Street cars also are manufactured by two classes of shops, one being independent of the railroads and the other being operated by the street railway companies and doing repair work.

Of the 100 establishments engaged in the street car industries at the census of 1905, 86 were street railway repair shops. Notwithstanding the fact that there were six times as many repair shops as establishments engaged primarily in the manufacture of street railway cars, the latter represented an investment of $12,975,703, or 50.1 per cent of the capital employed in the combined industry, and manufactured a product valued at $10,844,196, or 44.7 per cent of the value of products for the two branches of the industry. The repair shops, however, employed 11,052 wage-earners and paid in wages $7,012,798, which constituted 70 and 71.2 per cent, respectively, of the totals for the combined industries. As in the case of steam cars, less than 5 per cent of the value of the products of the street railroad repair shops resulted from the manufacture of cars. With the car construction establishments, on the other hand, 76.6 per cent of the value represented the building of cars.

The number of street railway cars built during the year was 4694. These cars were valued at $9,902,310. Practically all of the cars were electric. No cable cars were reported and only 42 were cars for horse power. Of the electric cars built in the shops that were independent of the railroads 2621 were closed, 554 were open, and 502 were combination, and the remaining 251 were of other varieties.

Ohio was the leading State in the value of products of the independent shops, furnishing $1,828,326, or 16.9 per cent of the total value of products for such shops. New York ranked first in the value of products of the repair shops, with $3,879,933. The other states with products valued at more than $1,000,000 were Pennsylvania, $1,258,542; California, $1,228,443; Missouri, $1,210,961, and Illinois, $1,142,562.

ELECTRIC RAILWAY DEVELOPMENTS IN NEW MEXICO

In the description of the Las Vegas (N.M.) Railway & Power Company's syystem published in the Jan. 26 issue of the Street Railway Journal, brief reference was made to plans the company was formulating for tapping a rich agricultural territory for some 45 miles out of Las Vegas. These plans are now taking more definite shape and Las Vegas citizens have already subscribed for $40,000 of the bonds to be issued. The work of raising the funds is in the hands of Wm. A. Buddecke, president, and August Barthels, vice-president of the Las Vegas Railway & Power Company, with headquarters at East Las Vegas. It is figured that not more than $30,000 is required for additional power equipment, so that all the money to be still raised will be for track and overhead construction as well as rolling stock.

The population served by the extension would be about 25,000 and cover about 17 post offices. The chief value of the line, however, would be in the development of freight traffic, which is a large factor even on the present system.

The following information on the character of the territory to be exploited was furnished by Mr. Buddecke:

The line will pass through some very fertile valleys that have been cultivated for years, yielding enormous crops of wheat, oats, alfalfa, and sundry other farming products, which would, however, be very largely increased with better transportation facilities. The road will also tap very valuable timber districts and coal lands, from which it can get all the fuel necessaryy for its own use and sufficient more to supply the local demand. Aside from this, there are copper mines and other mining propositions that could be developed, which are not being worked now on account of the lack of transportation.

With the opening of this road into this territory there will be abundant opportunity for various enterprises, such as beet sugar refineries, tanneries, smelters, flour, paper and woolen mills, and canneries for peas, beans and other products.

In addition to the foregoing 45-mile extension, there is a 255-mile new railroad proposition to be had, all of which radiates from Las Vegas, making in all 300 miles of lines, crossing and connecting three separate steam systems, which the company hope to undertake after completing the first 45 miles. It would require close to $6,000,000 to build the two extensions and equip them, but when finished this line of 300 miles would form a link in a new transcontinental railroad, besides being in itself a feasible proposition.

A PECULIAR DAMAGE SUIT

The Evansville & Southern Indiana Traction Company is made defendant in a peculiar damage suit. The accident grew out of the recent street railway strike, and for this reason the company denies its liability under the peculiar circumstances. The company's answer to the complaint is in three paragraphs, in which a detailed history of the accident and events leading up to it are given. The company says it was in no way responsible for the accident in which the child was injured because it was operating cars according to the franchise. The accident, it says, was due to ineffectual appeals on its part to the city authorities to protect the company's property against the mob. It seems that soon after the car left the barns at the usual hour on the morning of May 17, a mob of 500 people was encountered arrayed against the company, with stones, clubs and other missiles, which were used to interfere with the operation of the car. The particular car was in charge of a competent and skilled crew, and while it was making its run on the Walnut Street line it was boarded by five of the mob, who pulled the motorman and conductor from their positions and took possession of the car. Increasing the speed they continued to run the car in reckless fashion until it left the track and ran into the house where the complainant was playing.

CONVENTION OF THE COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION

The Colorado Electric Light, Power & Railway Association held its fifth annual convention at Denver, Sept. 18, 19 and 20, at the Savoy Hotel. The first session was called to order about 11.30 Wednesday morning, Sept. 18, with George B. Tripp, of Colorado Springs, president, in the chair. The most interesting part of President Tripp's address was that relating to revolutionizing changes in the power situation in Colorado about to take place and due to cheap water power being developed by some of the large power companies soon to commence operation in different portions of the state. This cheap power would, he thought, make possible much mining development otherwise impossible. He predicted that in five years there would be a 50-per cent decrease in the amount of coal used by Colorado mines and mills due to the increase of the use of hydro-electric power, and that ultimately coal will mainly be confined to domestic uses.

There were no papers relating direct to railway operation, but several of them had to do with branches of street railway management. Among them was a paper by B. E. Buttles, of the Denver Gas & Electric Company entitled "Notes on Modern Boilers," which was presented Wednesday afternoon. He called attention first to the fact that boilers are not selected with the same care as engines with respect to refinements and suitability to the work in hand, and laid specific emphasis on ease of cleaning and repair, and the difference between test conditions with new boilers and operating conditions with old ones. Tests of boiler efficiencies are likely to be confused with furnace efficiencies. That boiler will probably be cleanest which is easiest to get at. He criticized points about various boilers which make both internal and external cleaning difficult. Soot and dust lodged in large quantities around a boiler are likely to cause damage as well as loss of efficiency.

Another feature of interest to street railway delegates was the discussion on Friday of "Lightning Protection in Colorado." Leonard Wilson, of the General Electric Company, opened this discussion with an address describing the kinds of arresters used in Colorado and their behavior, and various members then gave their experiences. It is the purpose of the association to print this as a symposium later, after those taking part in the discussions have furnished more complete data.

The secretary and treasurer's report showed five new active members gained during the year, two lost by consolidation, and two applicants at this convention. Expenses for the year were $199.50, the balance in the treasury being $1,076. The new officers elected were as follows: W. G. Matthews, of the Denver City Tramway Company, president; C. K. Durbin, of the United States Light & Traction Company, of Denver (controlling companies in several surrounding states), vice-president; Mr. J. F. Dostal, of the Denver Gas & Electric Company, secretary and treasurer; Geo. B. Tripp, W. T. Wallace and the officers, executive committee; John A. Beeler, W. J. Barker, J. F. Vail, I. J. Hale and J. J. Cooper, advisory committee; T. W. Cargo, E. P. Dillon, B. K. Sweeny, membership committee; V. A. Sickman, W. E. Robertson, Geo. H. Maxam, finance committee.

At the close of convention a special car was provided to take delegates to visit the plants of the Denver Gas & Electric Company and the Denver City Tramway Company. On Thursday afternoon the delegates took a special train to Lafayette, about 25 miles north of Denver, where the power station of the Northern Colorado Power Company is just being completed. This is a steam plant located at the coal mines for the purpose of supplying current to a number of towns in that part of the state and to operate the single-phase electric service which the Colorado & Southern (a steam road) is preparing to inaugurate. It is equipped with Parsons turbines and obtains condensing water from a lake. The transmission voltage is 44,000, and below the line, the entire length, is to be a 23,000-volt, three-phase circuit for supplying farmers along the line.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED SEPT. 17, 1907

866,085. Brake Shoe; Julius Stromeyer, Philadelphia, Pa., and William Morton, Camden, N. J. App. filed Oct. 15, 1906. A shoe of cast iron having its braking surface provided with a series of chambers having a filling consisting of a mixture of sand and hydraulic cement.

866,193. Trolley Guide; Frank G. Clark, San Francisco, Cal. App. filed Feb. 20, 1907. A pair of upwardly projecting arms mounted on the trolley pole below the wheel, the upper portions of which are adapted to yield rearwardly when passing an obstruction.

866,224. Trolley Pole; Alexander Ross, Rochester, N. Y. App. filed Feb. 5, 1906. The pole is made up of telescoping sections and has a rubber hood to keep rain out of the telescoping joints.

866,261. Railway Traffic Controlling System; Clarence W. Cleman, Westfield, N. J. App. filed Jan. 10, 1907. Relates to complete mechanical features and electrical circuits of a signal system having sectional track rails energized by a direct current and operating home and distance signals.

866,281. Railway Signal; William H. Jordan, Brooklyn, N. Y., and George T. Hanchett, Hackensack, N. J. App. filed June 14, 1905. A signal system in which the signals derive their power from the same source as that employed to propel the cars; has tappets adjacent the track rails instead of the usual sectional rail construction.

866,331. Railway Signal; Frederic B. Camors and Charles Pelletier, New Orleans, La. App. filed May 1, 1906. Relates to details of a signal system having special trolleys between the usual track rails and having depending brushes from the locomotive to establish signal circuits to the engine cab.

866,349. Trolley Pole Support; Hugh W. Fellows, Cahuenga, and Ira A. Cammett, Hollywood, Cal. App. filed Sept. 15, 1905. Means for holding the trolley wheel in contact with the wire and automatically releasing and dropping it when the wheel jumps from the wire, said means being set in action by the abrupt upward movement of the pole.

866,363. Trolley Wheel; Henry L. Humphrey, Monroe, Mich. App. filed Oct. 12, 1906. The trolley wheel axle has a globular enlargement at its middle.

866,380. Switch Operating Mechanism; George F. Mooney, Philadelphia, Pa. App. filed May 29, 1907. A pair of depressible shoes for throwing the switch when actuated by a lever on the car or train.

866,390. Track-Laying Machine; William M. Saxton, Peter J. Henselwood and Andrew A. Johnson, Portage La Prairie, Manitoba, Canada. App. filed May 29, 1907. Details of construction.

866,448. Pressure Governing Device for Pumps; Clyde C. Farmer, Chicago, Ill., and Walter V. Turner, Wilkinsburg, Pa. App. filed Jan. 14, 1904. Relates to pressure governing apparatus for air compressors which are driven by electric motors, such as are commonly employed on electric cars, and provides means whereby the pumps of a series of motor cars coupled in a train, and having their main reservoirs connected, may be automatically started and stopped simultaneously.

866,484. Alarm; Thomas R. Kinsella and Christopher W. Hodgetts, Hartwell, Ohio. App. filed March 21, 1907. The handle of the motor controller has a push button inset therein so that the motorman may operate an electric gong whenever desired in a convenient way.

866,521. Automatic Safety Apparatus for Railways; George E. Ryan, New York, N. Y. App. filed Sept. 27, 1906. An apparatus set by one train to cut off the steam in the locomotive of a too closely following train.

866,595. Self-Acting Safety Appliance for Street Cars; Lowell M. Maxham, Boston, Mass. App. filed May 14, 1907. Provides improved means for cushioning a street car buffer; for locating a drop fender beneath the overhanging end section of the car; for causing the fender to be dropped through the action of the body lying on the track in front of the car.

PERSONAL MENTION

MR. EDWARD DROYLES, of Bellefontaine, Ohio, has been appointed claim agent of the three divisions of the Ohio Electric Railway Company.

MR. H. C. KAERCHER has resigned as superintendent of the Juniata Valley Street Railway Company, of Huntingdon, Pa., to accept a position with the United Traction Company, of Albany, N. Y., as assistant to Mr. H. A. Benedict, mechanical and electrical engineer.

MR. I. H. McEWEN has been appointed assistant superintendent of the West Shore Railroad between Utica and Syracuse, in charge of the affairs of the Oneida Railway Company. Mr. McEwen has been identified for some time with the office of General Superintendent J. H. Hustis, of Syracuse, as general agent. At one time he served the R., W. & O. division as superintendent.

MR. F. E. DRAKE, the managing director of the Société Anonyme Westinghouse of France, has arrived in America and expects to remain until after the middle of October. Mr. Drake says his company is now doing the largest and best business in its history, with most favorable prospect for large increase in all branches of its trade.

MR. CHAS. E. FRITTS has been appointed chief electrical engineer of the Kansas City Railway & Light Company, of Kansas City, Mo., to succeed Mr. Charles. N. Black, who, as noted in the last issue of the STREET RAILWAY JOURNAL, has been appointed vice-president and general manager of the United Railways, of San Francisco. It is announced that no general manager will be appointed at present.

MR. J. A. EMERY, who recently resigned as vice-president and general manager of the Birmingham Railway, Light & Power Company, of Birmingham, Ala., is one of the organizers of the Emery Steel Company, of Birmingham, just incorporated, which will do a general business in castings and machinery. Associated with Mr. Emery in the company are Mr. R. C. Foster and Mr. J. H. Pritchard.

MR. O. R. STURGINGER has been appointed superintendent of the Toledo, Port Clinton & Lakeside Railway, to succeed Mr. H. C. Warren, who resigned recently to take a similar position on the Toledo & Indiana Company. Mr. Sturginger has been with the company for some time as master mechanic, and the appointment comes in the nature of a promotion. He has already entered upon his duties.

MR. J. T. BURKE, connected with the Southern Pacific Company, has been elected president of the Peninsular Electric Railway Company of San Jose, Cal., which is building the cut-off from Mayfield to Los Gatos, a distance of 20 miles. He has taken the place made vacant by the death of Mr. O. A. Hale, of San Jose, the former president. The Peninsular cut-off has all its grading done and track is laid from Mayfield southeastward four miles to Los Altos.

MR. JOHN I. BEGGS, of Milwaukee, president of the United Railways Company, of St. Louis, was the guest of honor one evening last week at a dinner at Hotel Jefferson commemorating his sixtieth birthday. A handsome silver loving cup was given President Beggs by his hosts, whose names were engraved thereon. Those present were Mr. and Mrs. Richard McCulloch, the latter, Mr. Beggs' daughter; Mr. and Mrs. Charles H. Huttig, Mr. and Mrs. Robert McCulloch, Miss Roberta McCulloch, and Miss Grace McCulloch.

MR. WM. E. MOORE, who will be succeeded on Nov. 1 as general manager of the West Penn Railways Company, of Connellsville, Pa., by Mr. Geo. R. Folds, as previously mentioned in THE STREET RAILWAY JOURNAL, will become associated as consulting engineer and adviser to the Kuhn interests of Pittsburg. Mr. L. H. Conklin will hold the title of general superintendent and J. W. Brown will continue in the capacity of superintendent of transportation. Mr. Moore has been in Connellsville four and one-half years, part of the time as general superintendent and part of the time as general manager.

MR. GEORGE R. FOLDS, who has recently resigned as general manager of the South Chicago City Railway Company, Chicago, was waited on by a committee of employees at the general offices of the company Saturday, Sept. 14, and presented with a pair of jeweled cuff links. Appreciation was expressed of Mr. Folds' personality and of his courteous attitude toward all the company's employees. Mr. Folds left for California Sept. 15, and will be married in that State Oct. 12. He will assume his new duties as general manager of the West Penn Railways Company, with headquarters at Connellsville, Pa., early in November.

MR. GEORGE STONE, who has been connected with the Public Service Corporation of New Jersey in Paterson for the past two years, and who for the past nine months has been superintendent of the Passaic County district succeeding Mr. W. B. Graham, has been made a division superintendent, and the Paterson district, of which he has charge, has been raised to a division. Instead of Mr. Stone's superintendency being confined to the county, he will have charge of all lines within the county and extending to the Delawanna and the Hackensack bridge, in Bergen County. Mr. Stone was for many years employed by the Twin City Rapid Transit Company, and for three years was with the Brooklyn Rapid Transit Company.

NEWS OF THE WEEK

CONSTRUCTION NOTES

Items in this department are classified geographically by States, with an alphabetical arrangement of cities under each State heading.

For the convenience of readers seeking information on particular subjects, the character of the individual item is indicated as follows:

* Proposed roads not previously reported.

o Additional information regarding new roads.

† Extensions and new equipment for operating roads.

Numerals preceding these signs indicate items referring to:

1. Track and roadway.
2. Cars, trucks and rolling stock equipment.
3. Power station sand sub-stations.
4. Car houses and repair shops.
5. Parks and amusement attractions.

1-3†HUNTSVILLE, ALA.—Manager Lawton, of the Huntsville Railway, Light & Power Company, states that plans have been drawn for the doubling of the capacity of the power house and for the extension of the street railway system. The Merrimack end of the line will be extended half a mile to Sanaqua wells, while the Dalls end will be looped around to the Meridianville pike and back into the city by way of the Southern depot.

*MONTGOMERY, ALA.—Richard Tullis, of Montgomery, has announced that he would soon begin the construction of an electric railway from Geneva to Dothan, Ala., to cost $500,000. It is his intention when this work is completed to extend the line to Union Springs, Troy, Eufaula, Clayton and Montgomery.

1†LOS ANGELES, CAL.—It has been announced that the Los Angeles Railway Company plans for immediate construction the following lines: The Main Street Garvanza line will be extended in two branches and the West Ninth Street line is already building west from its present terminus at Vermont Avenue and Tenth Street. It will run on Tenth Street west for a distance of something more than a mile to Gramercy Place.

1†LOS ANGELES, CAL.—A temporary franchise for a third rail on Sixteenth Street from Burlington Avenue to the city limits has been granted the Los Angeles-Pacific road. The company asked only for a temporary permit to lay a third-rail during such time as the work of broadening the gauge of the entire road is in progress.

1†LOS ANGELES, CAL.—It is believed that the formal transfer of the San Bernardino Traction Company to H. E. Huntington means the immediate construction of the Colton-Riverside electric line.

†LOS ANGELES, CAL.—Since the Los Angeles-Pacific Company was granted a permit to construct its subway from Temple Street to Sunset Boulevard, the company has changed its plans and now proposes to build a large subway. The old ordinance provided for a subway 26 ft. high and 22 ft. wide. Recently the City Council passed an ordinance providing for a subway 24 ft. high and 28 ft. wide. The Hill Street tunnel is to be large, and it is desired to make both bores correspond. It is the intention of the company to begin work on the subway at once. The difficulty of purchasing the property of the Red Men, arising out of the conditions of the title, will be overcome by condemnation proceedings. In the mean time the company has obtained permission from the City Council to maintain a grading track on Hill Street north of First Street, so as to start grading at once.

oNAPA, CAL.—The extension of the San Francisco, Vallejo & Napa Valley Electric Railway has been completed to Yountville and a regular service has been established. The construction crew is now concentrating its efforts toward pushing the line to St. Helena.

1†REDDING, CAL.—It is reported that the Northern Electric Company plans not only to extend its line to Red Bluff, but also to Redding and probably Kennett, just as soon as its Chico-to-Sacramento line is in good running order.

1†SAN DIEGO, CAL.—E. B. Webster, owner of the South Park & East Side Railroad, has filed petitions for the extension of his line on Fourth Street, through the northern and northeastern portion of the city. The line is to be about six miles long.

†SAN FRANCISCO, CAL.—The Northwestern Pacific Railway is to spend $150,000 in improving its North Shore electric branch from Sansalito to Marin County points, California. Improved electric generating equipment will be installed immediately at San Anselmo, and it is reported that the company will electrify the road to Point Reyes. At San Anselmo a substation equipped with two 500-kw motor-generators is to be installed, leaving room for four more motor-generators to provide for the future extension of the electric service to Point Reyes.

oSAN RAFAEL, CAL.—Work has commenced on the Bay Counties Electric Railroad by two construction gangs working each way from the Towne ranch, two miles out of San Rafael. Richard Hotaling is president of the road.

1†TRINIDAD, COL.—It is reported that extensive improvements to the street car system are contemplated by the Trinidad Electric Railway Company and within a year the company proposes to connect Cokedale, Sagundo, Hastings and interlying coal camps with Trinidad. One of the branches will extend west and the other north.

oAUGUSTA, GA.—It is reported that W. L. Hodges, of Hartwell, president of the Georgia-Carolina Railway Company, will soon award a contract to survey a route from Athens, Ga., to Anderson, S. C. The company will operate electric trains.

1†COLUMBUS, GA.—It is reported as very probable that the building of the new bridge across the Chattahoocee River at Dillingham Street will be followed by the extension of the Columbus Railway Company's line into lower Girard.

1†BOISE, IDA.—The Boise & Interurban Railway Company has decided to build a street railway line in Caldwell and to extend its present line from that city to the Canyon County fair grounds, which are located about a mile distant. Work on the fair ground extension is to be commenced within a few days and be pushed rapidly, so that it may be ready by the time the fair opens, the first week in October.

*SAND POINT, IDAHO.—An ordinance will soon be placed before the Council asking for a 25-year franchise granting right to Chas. R. Foss, John C. Cleary and Peter Johnson to build, maintain and operate a steam or electric railway on the streets of Sand Point. They offer to have the road in operation within a year, and state that they have the capital to put the project through.

oSPRINGFIELD, ILL.—A petition has been filed by the Mississippi Valley Electric Railway Company with the State Board of Railroad and Warehouse Commissioners asking for permission to cross at grade the Wabash Railroad at Carthage, Hancock County, and the Toledo, Peoria & Western Railroad at Elvaston, Hancock County. The railroad in question is to be constructed from Carthage west to Keokuk, Ia., and from Hamilton, opposite from Keokuk, Ia., through Nauvoo to Fort Madison, crossing the Santa Fe bridge at Fort Madison and the Keokuk & Hamilton bridge at Keokuk. R. R. Smith is the principal assistant engineer and is located at the Chicago office of the company, 1034 Rookery Building.

oCRAWFORDSVILLE, IND.—The commissioners of Montgomery County have granted a franchise to the Chicago & Western Indiana Traction Company, known as the "Educational Route," to construct and operate an electric railway through the county.

1†CRAWFORDSVILLE, IND.—C. C. Reynolds, general manager of the Indianapolis & Eastern Railway Company, announces that the contract for the construction of a branch line from Crawfordsville to Danville, Ill., will be let this year, work to begin early in the spring.

†EVANSVILLE, IND.—The first car was operated over the new Darmstadt-Evansville route of the Princeton Traction Company's line Sept. 16. Regular traffic over the line with an hourly service was begun Sept. 20.

oELKHART, IND.—A contract has been entered into between the Chicago, South Bend & Northern Indiana Railway Company and the St. Joseph Valley Traction Company for the exchange of track privileges in this city. Work on the Elkhart-Middlebury extension connecting the St. Joseph Valley Traction Company's line with the St. Joseph Valley Railway will be commenced at once to afford through service.

oINDIANAPOLIS, IND.—The City Park Board has granted to the Grand Central Traction Company a right of way across the western side of Garfield Park for an electric railway. This completes the company's right of way to the southern border line of the county.

1†PRINCETON, IND.—The Evansville & Southern Indiana Traction Company has awarded the contract for the construction of its extension from this city to Patoka to Jones Bros., of Columbus, Ohio. The distance or length of the extension is four and one-half miles, and includes five bridges, which will be erected by the Lafayette Engineering Company.

oSAPULPA, I. T.—It is reported that Ed. C. Reynolds and his associates have begun work on the Sepulpa electric street car lines. The franchise was granted on the condition that the line be completed within six months, and that it be extended as a motor line to the Midland Valley Railroad going through the Sapulpa oil fields.

oATLANTIC, IA.—The officials of the Atlantic Northern & Southern Railway Company announce that they have completed arrangements for the right of way for the entire distance between Atlantic and Kimballton. The work of grading has been started. It is expected that the first 5 miles of grading will be completed by the last of this month. The line will be in all about 20 miles in length and the company expects to have all the grading done by the first of December.

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DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

Of this issue of the Street Railway Journal 8200 copies are printed. Total circulation for 1907 to date 328,050 copies, an average of 8201 copies per week.

The Central Electric Railway Meeting

With the advent of cooler weather, the largest two sectional electric railway associations of the United States already have held meetings which are worthy introductions to those planned for Atlantic City within the next two weeks. The work of the Kingston meeting of the New York Association was reviewed in these columns last week, and it may now be in order to summarize the proceedings of the Central Electric Railway Association at Columbus on Sept. 26.

Like their New York confreres, the interurban railway managers of Ohio and Indiana have been wrestling with the problem of making a standard code of operating rules, but they have not bound themselves so definitely to their committee's report as did the New York organization. The different methods of the two bodies in handling precisely the same subject are worthy of some attention. The New York Association, on receiving the report of its rules committee discussed each section so thoroughly that the experience of every member present was brought into play and thus made possible the adoption of a code that will serve not merely as rule storehouse but as a live standard. The Central Electric Railway Association could not easily follow this practice because of its greater and more scattered membership. It therefore decided to adopt the method of the Master Car Builders' Association of sending a printed copy of the report to its members with the request that it be returned with any desired changes. At the next meeting, therefore, the committee will have a good idea of operating conditions on the individual roads and will undoubtedly find it possible to offer a code that can be adopted in the same fashion as the New York rule book.

The Central Association's report and discussion on express handling shows that with the Ohio-Indiana railways the question is not whether such business pays, but how it can be made to pay even better than at present by the organization of a co-operative interurban express company to make through routing easier. It is plain from this that the interurbans of the Central West are outgrowing the purely local express business and are seeking broader fields to conquer. Some guiding rules might be gleaned on this subject from an inquiry into the relations between steam railroads and the old-line express companies. It should not be difficult to secure such data if those who gave the information could be assured that the sources would be kept confidential.

The discussion on fire insurance was not unlike that on express handling, as the association is trying to learn whether it is better to insure with the old-line companies or in a co-operative concern. It is a sad truth that there are still many railways whose car houses are serious fire risks, some not deserving insurance of any kind. Hence no matter what type of insurance eventually is preferred, the rates will never be as low as they should until every important piece of electric railway property is rightly protected. The discussion on single-phase and high-tension d. c. systems while not lengthy showed that the members of this organization are anxious to keep in step with the latest developments. The questions asked about current collec-

tion proved also that the trolley wheel may not dominate the field of heavy interurban traction so completely as it is doing in lighter service in this country.

Last, but not least, was the good work of the standardization committee whose present achievements should make future master mechanics and manufacturers rise and call them blessed. The efforts of this body also have simplified the work of the Engineering Association's standardization committee by revealing the standpoint of the majority of interurban railways. In the past, some have feared that the work of the sectional organizations would detract from that of the parent body, but such instances as this demonstrate that such prophesies were ungrounded. To be sure, there are many railway problems of purely local nature, but there are plenty of so tough a nature that their predigestion by the smaller societies is a necessity.

The Interurban Decision in Massachusetts

The decision of the Massachusetts Railroad Commission in regard to the public necessity and convenience of new electric high speed interurban facilities between Boston and Providence, and between Boston and the northeastern suburbs of the city is of interest to every engineer who believes that the high-speed interurban road has a field of its own in the work of transportation. As printed in our columns two weeks ago, the order of the board approves the petition of the Boston & Providence Interurban Electric Railroad Company for the right to build a line of superior character between the foremost two cities of New England, and it also recognizes the need of additional facilities of an improved character at the north of the Hub.

Thus the so-called "transportation court" of Massachusetts commits itself to the far-reaching acknowledgment that neither the steam railroad nor the highway trolley line supply the same need as does the electric interurban road on a private right of way, and thereby encourages in a remarkably populous territory a new department of railway initiative. It is clear that the board believes that existing companies conducting their business in a proper manner will not be injured by the new facilities, and it remains now for the successful promoters to prove by actual operation how great an advantage has been made by electric railway engineers and manufacturers in rapid transit equipment and facilities since the earlier days of trolley construction on the highways for a house to house service. The interurban situation in the Middle West differs so much from that in Eastern New England that comparisons between the two will be of great interest and value as time goes on.

The point raised by the Commission that the Boston & Eastern Company's plan is defective in terminating its service at the Sullivan Square elevated terminal emphasizes an important principle in rapid transit. Through cars carried to the heart of the city of Boston by a high-speed route would provide a far better service than would be possible in the original plan of transferring passengers to the Boston Elevated at Charlestown and thus adding ten or fifteen minutes to their journey over a line already heavily charged with traffic. Of course, the cost of entering the heart of the city by a new tunnel would be a matter of considerable weight, but if the existing East Boston tunnel should be utilized, it is hard to see why the whole scheme would not be greatly advantaged. However the matter is settled, it is plain that a new era of electric railroading is at hand in Massachusetts. In some quarters there is apprehension expressed lest the new facilities will duplicate the electrified steam service expected within a few years, but a careful study of the possibilities on an electrified system inclines one to the belief that there will still be a field for each type of railroad. Economical handling of heavy freight and fast, through passenger service lies at the bottom of the heaviest railroading, and the probabilities are strong that the electric interurban of the future and the electrified steam road will supplement each other no less than do the trolley and the steam lines of to-day in the interchange of local and through business.

The High-Tension Insulator

The importance of the high-tension insulator in the successful transmission of power over long distances has been emphasized considerably of late, and the demands of new markets for power utilization in the general vicinity of large hydro-electric developments have stimulated insulator manufacturers to the most active efforts to extend the range of transmission through the use of voltages in excess of 60,000. At the recent meeting of the Canadian Electrical Association in Montreal, this aspect of the situation was discussed at length, the consideration of the topic having been introduced by C. E. Delafield, who presented a paper on "High-Tension Insulators from an Engineering and Commercial Standpoint." The author considered the intimate dependence of long distance transmission upon the insulator, outlined the type of insulator demanded by the exacting conditions of to-day, and emphasized the importance of correct manufacturing processes and careful tests prior to the acceptance of the product in commercial service.

There is room for considerable difference of opinion as to the best way of securing a satisfactory insulator for very high potentials. The canons of insulator design are so far from fixed that the engineer who specifies materials and shapes in great detail takes considerable responsibility upon his shoulders, and perhaps pays a good deal more in the end for his line construction, not to mention maintenance, than the one who asks the manufacturer for an insulator of the latter's design capable of withstanding a definite potential stress in continuous service of a specified nature. A short abstract of the paper was published in these columns recently in an account of the meeting, but the increasing use of high voltage transmission makes the topic so interesting that attention will be called to certain of the points brought out in the paper or discussion.

The author points out that an increase in voltage from 60,000 to 150,000 would make it possible to deliver Niagara power economically in New York, Boston or Philadelphia, and states that the insulator is the principal hindrance to this consummation. Without accepting this assertion in detail—for the commercially profitable sale of Niagara power in competition with coal on the Atlantic Coast involves many other factors than the voltage question—it serves to fix the central responsibility of the insulator in the transmission field. It needs little demonstration at the

present prices of copper and aluminum to show that by very high voltage only can the large powers now so successfully generated and safely handled in transformers and switching mechanism be distributed economically over very long distances.

The paper stated that wood can be safely accepted for insulator pins up to about 30,000 volts. Beyond this point, it seems advisable for mechanical reasons to use malleable iron, but the so-called pin type of insulator has reached such dimensions, in the endeavor to meet the requirements of higher voltages, that it appears to be the opinion of the leading high-tension engineers that this type of insulator has reached the limit of good line construction on account of its dimensions. It is a difficult matter, from a mechanical standpoint, to find a pin that will take the necessary stress incident to an insulator of very large size and weight, and the problem of manufacturers, from the standpoint of the pottery is one of great difficulty. It is probable, therefore, that a suspended form of insulator will be tried in the near future, as it is a comparatively simple matter mechanically to suspend any desired weight and, from an electrical standpoint, it seems possible to so design an insulator that it will be mechanically strong and a good dielectric as well.

The suspended type of insulator would have the advantage that ample arcing distance could be provided without making the insulator top-heavy and difficult to manufacture. It should be so designed, however, so that arcing cannot occur until the voltage is sufficient to rupture the air and cause the current to arc from end to end, this feature being of great importance in steel tower work. On high-tension lines where steel towers are used, the pin type of insulator for 100,000 volts or higher would seemingly be almost an impossibility owing to the size necessary to take care of surges and other line disturbances, and also because the earth potential is carried into the head of the insulator through the steel pin and towers. In proportion as the insulator accepted for a given transmission takes care of fogs, dust deposits and spray, is not handicapped by large still air spaces, exposes a large part of its surface to the wind and has a long leakage distance of small area, it is likely to be successful in the ultra high potential work of the future, and it has been pretty clearly shown that nothing but well vitrified porcelain should be used between points of opposite potential. Cemented parts should, if used, be under compression rather than tension. Insulators of the same electrical design but of different manufacture may vary greatly from one another. Thus, the one having the greatest electrolytic capacity and hence the greatest electrostatic field will be the first to suffer from brush discharge and arcing over. In another case the insulator possessing the greatest density in its body, and which is the most vitreous, will stand the more severe service.

The factor of safety which should be required in testing high-tension insulators has been the subject of much comment among engineers. Mr. Delafield urges that three times normal voltage be applied in the dry breakdown test between the insulator head inside and outside. This is a pretty strenuous requirement in the case of an insulator designed for operation at say 100,000 volts, and we question whether manufacturers are as yet willing to bid on a specification requiring their insulators to stand a 300,000-volt test. It is probable that a 200,000-volt test would not be prohibitive if the purchaser shows himself willing to pay the cost, and Mr. Delafield is clearly right in urging that economizing in high-tension insulators to save a few cents apiece in first cost is pretty poor policy. The operating engineer and the manufacturer are coming closer together on the insulator question, and both are beginning to realize that it is not the working voltage of a long, exposed line which demands the greatest precaution—the common enemy is an excessively high potential discharge, caused by lightning or resonance in the system. The latter factor will ultimately drive the breakdown test to the highest point consistent with manufacturing possibilities.

Utilizing Records of Delays to Equipment to Check Shop Work

When accurate records of detentions which result from defective car equipment are kept with the specific causes for these delays, a master mechanic has a definite means of determining the efficiency of the repair and inspection work done in his shop. It is to be regretted that more railway systems do not keep records of this kind for the benefit of the shop department. Such records can be used not only to enable the master mechanic or shop foreman to check from month to month the efficiency of the work, but with a little systematic work in the shop they can be employed to locate the men who are in the habit of doing careless or inferior work. This plan is now in service in several large shops and it could with almost equal facility be employed in smaller ones. It requires, particularly in the inspection of cars, that each man be given definite work to do on each car, and that he be compelled to sign his name to a permanent record kept for each car inspection. Then in case of breakdown, due to faulty work on his part, he can be identified as the one responsible for the trouble.

After such a system has been introduced in a shop and a few men have been censured severely for failure to do their work properly it is safe to say more attention will be given to the manner in which all details of the inspection and repair work are carried out. In fact, the men will feel more or less as though an invisible eye were watching them and the greater the extent to which they can be imbued with this feeling the better will be the work turned out. As a consequence a noticeable reduction should follow in the number of detentions of cars due to defective apparatus. There should also be a considerable decrease in the cost of maintenance.

The system will require the keeping of some records and will necessitate more office work, but the reduced expenses of maintenance alone will usually offset the additional expenses of clerk hire.

Where an attempt is made to keep records of delays and their causes some trouble may be occasioned by the fact that "defective equipment" may be offered as an excuse for delays, for which the transportation department or some other department may really be to blame. The equipment department, however, in cases of this kind may protect itself by having the motorman make detention reports entirely independent of similar reports made by the conductor or the representatives of other departments, and when the reports do not agree by having an inspection of the apparatus which is reported at fault.

NEW SHOPS AND CAR HOUSES AT KNOXVILLE—SHOP PRACTICE

During April, 1906, the car repair department of the Knoxville Railway & Light Company moved into new shops and car houses at the corner of Jasmine Street and South Fifth Avenue. Through the courtesy of C. H. Harvey, president and general manager of the system, it is possible to give the following details regarding these shops. The buildings are of modern fireproof construction in every detail, and the interior arrangement is particularly well suited for the maintenance of cars in cities of from 40,000 to 60,000 people.

The shops and the storage houses, between which there is a common wall, have a total frontage of 138 ft. The shop measures 99 ft. 4 ins. front, and 178 ft. 4 ins. depth. The houses are 399 ft. deep.

Both buildings are constructed of brick, on concrete foundations. The roofs are carried on steel framing. All openings are closed by Kinnear rolling steel doors, and the floors are generally of concrete.



FRONT VIEW OF KNOXVILLE REPAIR SHOPS AND STORAGE HOUSES

With regard to main construction, the repair shop consists of three bays; a central one containing pit tracks; one on the east, which serves as a carpenter and repair shop, and a bay on the opposite side utilized for blacksmith and machine shops, winding room, toilet room and storeroom. The roof over all three bays is of the saw-tooth type, that over the central one being considerably higher than the other two.

A brick fire wall separates the carpenter and paint shops from the repair tracks, and the bay containing these shops is further divided at a point midway of its length by a corrugated iron partition fitted with Kinnear rolling steel doors. Two tracks in the paint shop, which is in the front portion, continue only to the partition.

REPAIR TRACKS AND CRANES

The two tracks in the repair shop are each provided with concrete pits 4 ft. deep, which extend within about 8 ft. of the ends of the building. The method of supporting the rails is somewhat out of the ordinary. Supporting columns, consisting of 10-in. 15-lb. channel bars are placed under the rails and 7 ft. 6 ins. apart. These columns are built directly against abutments from the concrete pit walls, and are secured to the concrete work by anchor bolts. Flat plates are riveted to the channel bars at the top and bottom to serve for feet and supports for the rails. The rails which rest directly on the top plates are secured in place by angle-bolts, and also by anchor bolts, which extend into the concrete floor construction. Behind each rail and about ½ in. distance from it is placed a Z-bar, made up of a 4-in. x 3-in. and a 5-in. x 3-in. angle-bar bolted together. This Z-bar permits the rail to be removed and replaced without disturbing the concrete floor. The construction described is very well shown in the accompanying drawings and reproductions from photographs on pages 496 and 497.

The two repair tracks are served by two General Pneumatic Tool Company 8-ton electrically driven cranes, which are operated on a crane runway 16 ft. 4 ins. above the rails. Trolley wires for the cars are carried above the cranes in the usual manner, which necessitates the trolley pole being pulled down when the car passes under a crane. These traveling cranes are used almost exclusively in repair work, notwithstanding the fact that the shop is provided with two jib cranes between the tracks, as shown in one of the reproductions.

THE BLACKSMITH SHOP

The blacksmith shop occupies a space 23 ft. 6 ins. x 27 ft. It is separated from the machine shop by a corrugated-iron partition, but opens out directly on to the repair pits. The one forge in it is provided with an electrically operated blower. In the floor behind the forge is a brass furnace. The machine shop is equipped with a hydraulic wheel-press, a boring mill, lathes, and a shaper, all driven from a 10-hp motor.

WINDING ROOM

One of the illustrations on page 497 shows the interior of the winding room. A U-shaped beam overhead carries a traveler, provided with a hand-operated hoist. The beam extends over the armature racks, and above a 22-in. lathe used for banding armatures and terminates under the runway of the traveling cranes serving the repair tracks. In the winding room is installed quite an elaborate testing board. Load is carried by incandescent lamps installed in such a manner that small variations in load may be obtained by throwing knife switches. The board is used for both alternating and direct-current testing. The armature racks are so designed that the length may be varied to take any armature used on the system.

TOILET AND WASH ROOMS

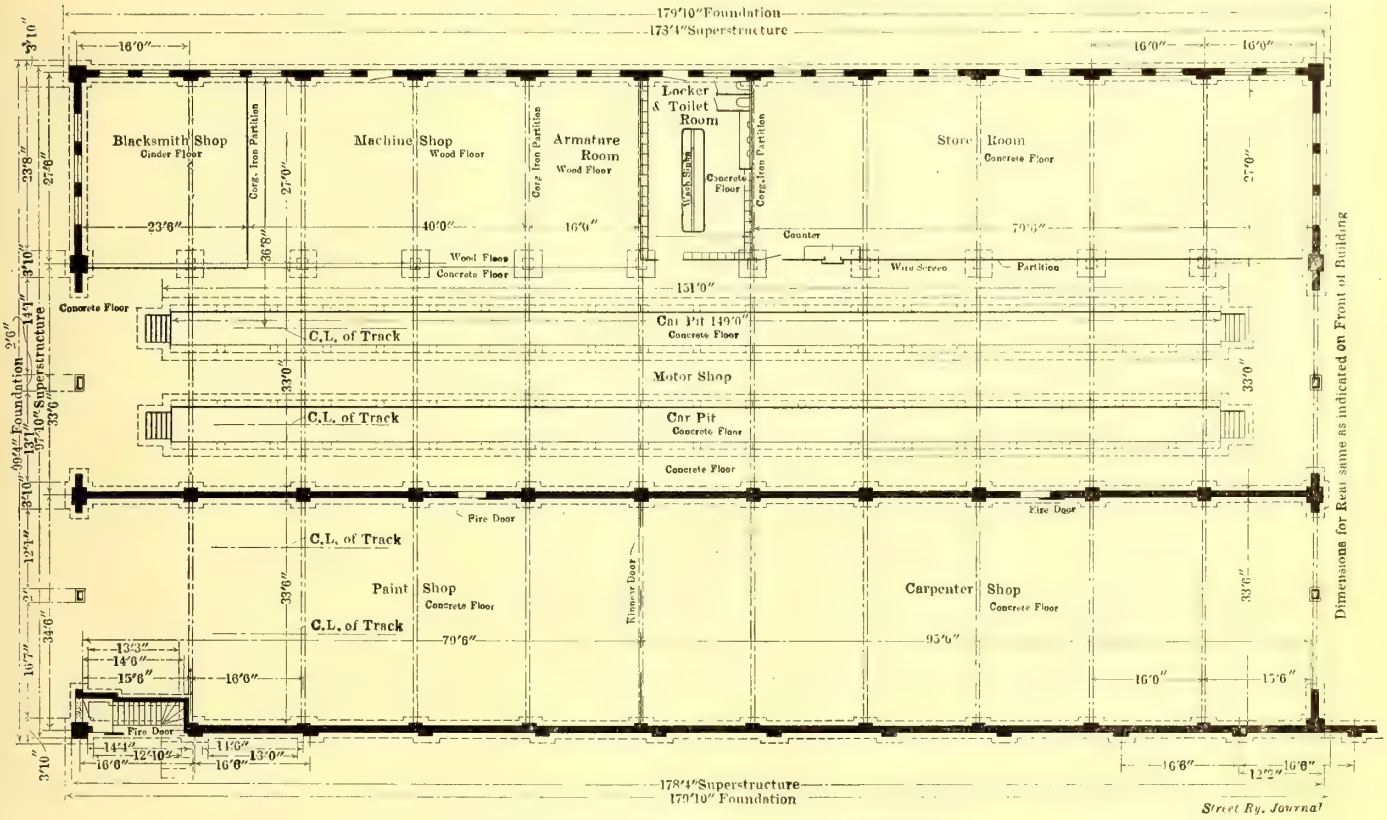
In designing the shops, particular attention was given to the comfort of the employees, and a space 16 ft. x 27 ft. was set aside for wash sinks, lockers and water closets. The lockers are of the expanded metal type. The sinks are of enameled steel and are provided with cold water connections. The toilet room is entirely enclosed by a corrugated-iron partition.

STOREROOM

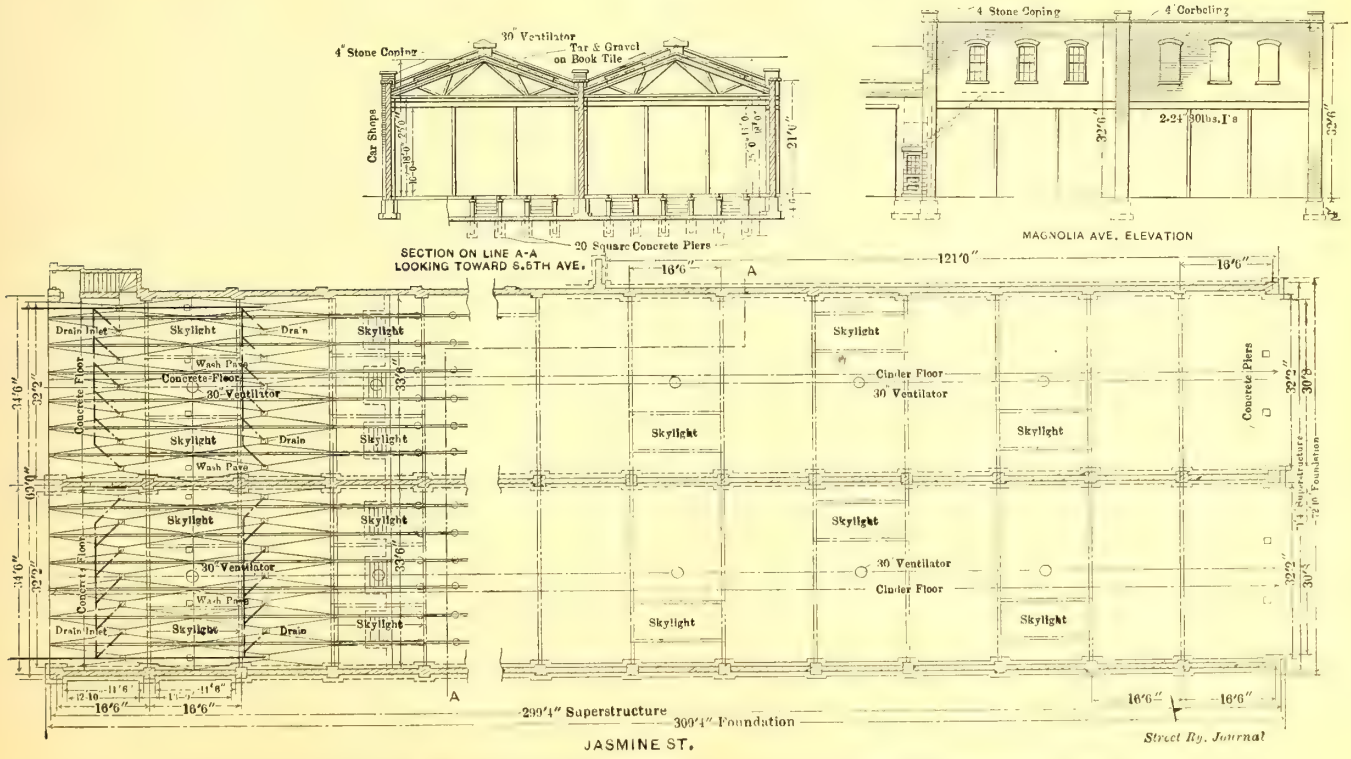
The store room occupies a space 79 ft. 6 ins. x 27 ft., partitioned off from the central bay by a wire screen. A small portion of this space at the south end is used as a storeroom office. The remainder is utilized for storing materials. Particular attention has been given to the design of shelving and racks for holding materials.

CAR-STORAGE HOUSES

The storage houses are of the same general construction as the shops already described. The two bays are separated by a fire wall and each bay has an independent gable



GENERAL PLAN OF KNOXVILLE CAR SHOPS



ROOF PLAN, SECTION AND ELEVATION OF KNOXVILLE TRACTION COMPANY'S CAR HOUSE

roof which is provided with skylights and ventilators.

The front of the building is two stories in height. The two rooms in the second story are used by the trainmen, one as a locker and toilet room and the other as a general reading and instruction room.

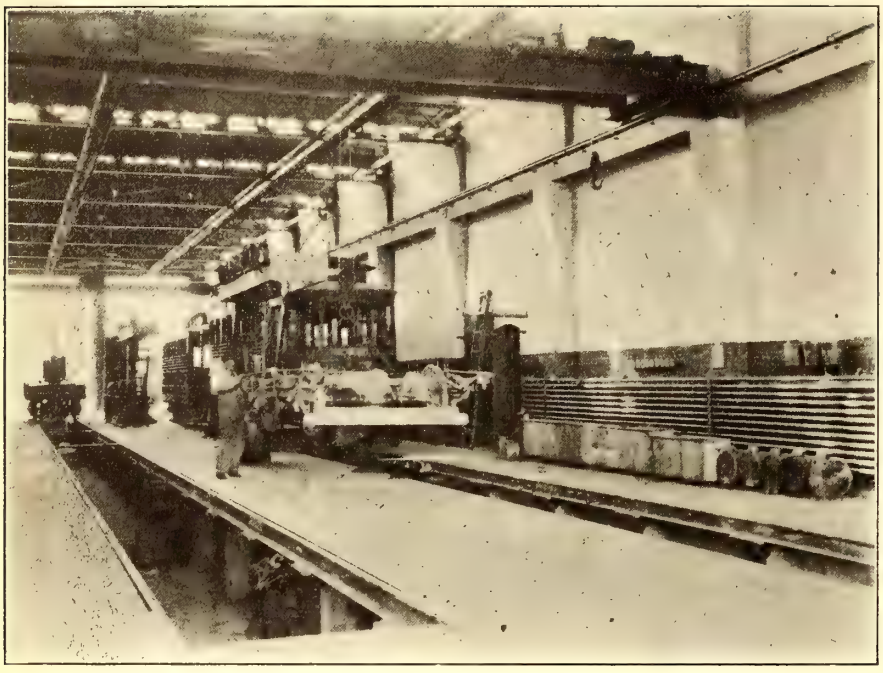
The ends of the building are closed by Kinnear rolling steel doors, one door being provided for each track. The door guides between the tracks are removable, and in mild weather these may be taken out and the whole front of the building opened up.

A concrete pit 90 ft. long extends the full width of each section of the car house. The tracks are supported over these pits by columns consisting of 6-in. wrought-iron pipe filled with concrete, placed 6 ft. apart. Over the space between the tracks is built a reinforced concrete platform. Tie-rods, provided with turn-buckles, extend under these platforms and tie the posts together, and at points midway between supports, adjacent rails, are connected by tie-rods.

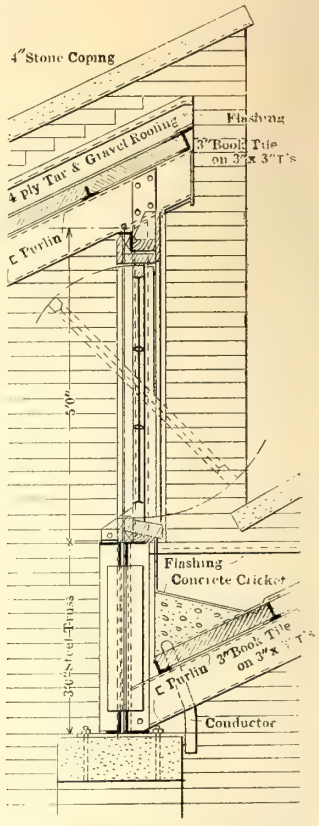
The pits begin at a point 50 ft. from the front of the building. Cars are washed over the intervening space which is provided with a concrete floor, and drains between the tracks having tile-pipe connections with the sewer to carry the water off.

General lighting of the shop is effected with enclosed arc lamps, and it is heated by an Evans Almiral hot-water heating system, with the radiating pipes installed on the walls near the floor.

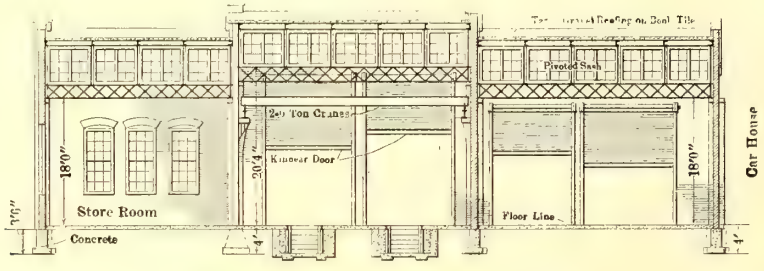
The boiler for the heating system is installed in a small brick structure west of the shop, which also contains the shop offices. The buildings were all designed and erected by Ford, Bacon & Davis. J. M. Kington, as master me-

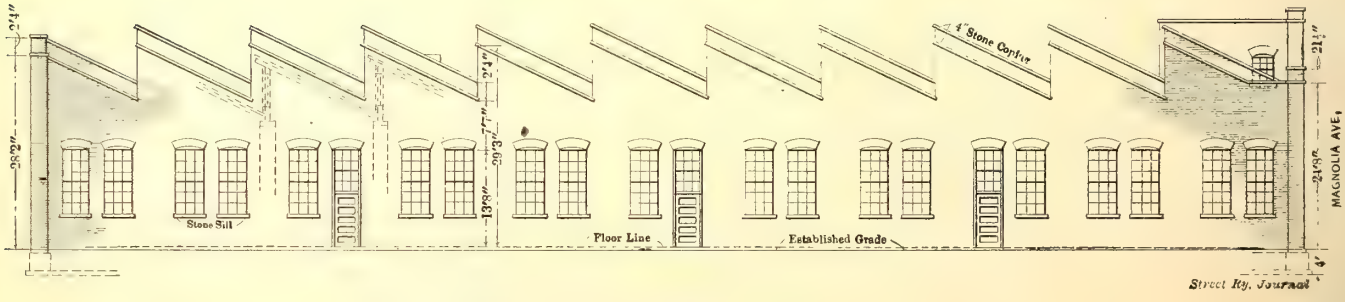


INTERIOR OF KNOXVILLE REPAIR SHOP, SHOWING 8-TON CRANE IN USE



SECTION TAKEN ABOVE STOREROOM



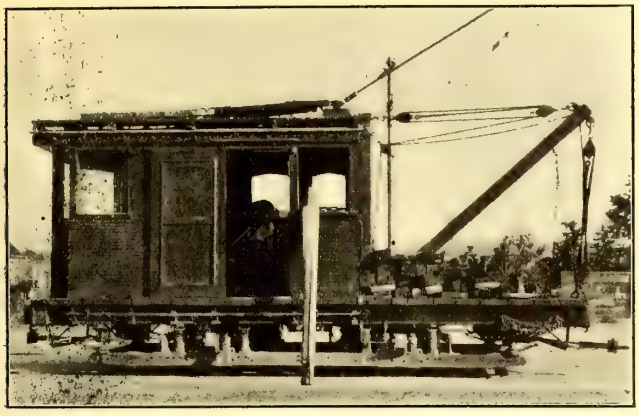


SIDE AND FRONT ELEVATION OF KNOXVILLE CAR HOUSE

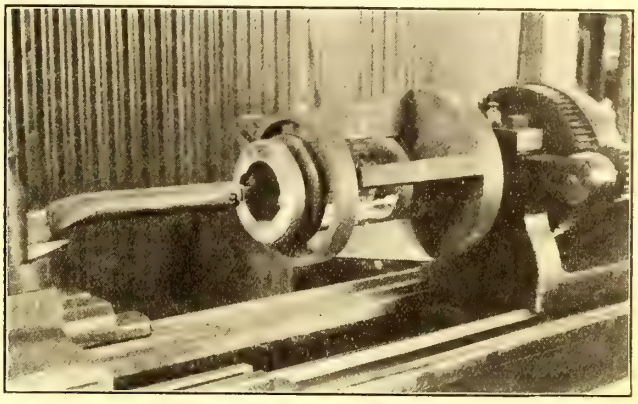
chanic of the system, is responsible for many of the details in their construction.

SHOP PRACTICE

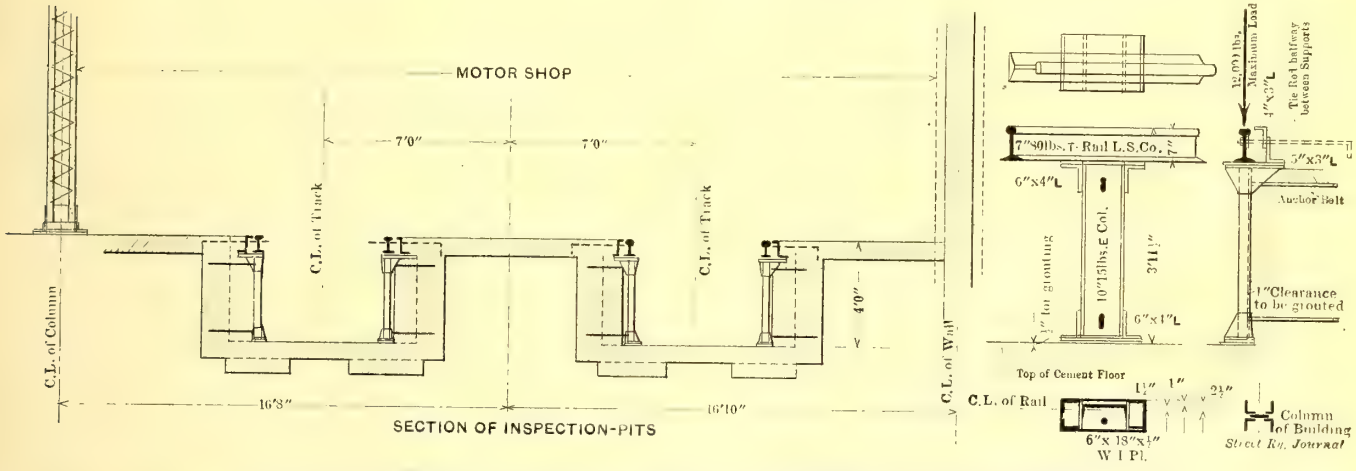
Trolley wheels, bearing shells, and practically all of the brass fittings required are manufactured in the shop. Brass casting, however, is largely confined to using up scrap metal. The reduced price obtained for scrap makes it very advantageous to use this up by turning it into castings, which would have to be purchased at the prevailing price for new brass and copper. One of the reproductions from a photograph shows a chuck used in turning trolley wheels. The wheel, after being bored, is centered on a lug projecting from one of the halves of the chuck. Pins extending from one of the halves project through between the spokes of the wheel and drive it.



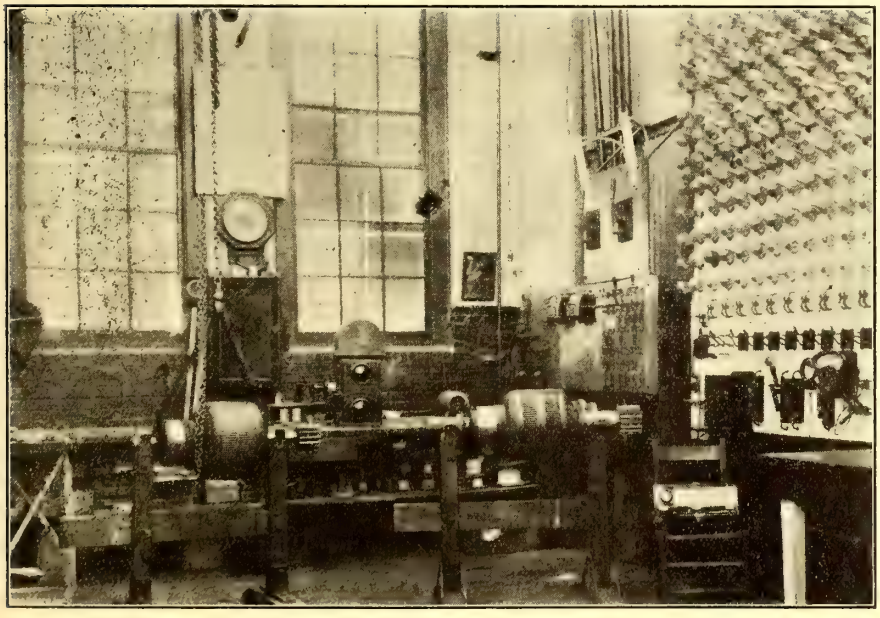
EMERGENCY CAR SUPPLIED WITH A MOTOR-OPERATED CRANE



METHOD OF BORING ARMATURE BEARINGS, SHOWING CHUCK FOR HOLDING THEM IN THE LATHE



SECTION OF INSPECTION PITS AND DETAIL OF CHANNEL COLUMN CARRYING T-RAIL



ADJUSTABLE ARMATURE STANDS AND TESTING BOARDS IN WINDING ROOM

Pins extending from one of the halves project through between the spokes of the wheel and drive it.

A tension of 24½ lbs. is carried on trolley wheels, as this tension is required to operate the automatic signals with which several of the lines are equipped.

Bearings are turned in a special chuck, as shown in a reproduction from a photograph, which assures of their proper alignment and centering at all times. The jaws of the chuck have flexibility sufficient to grip the bearing when the clamp shown is pulled down over the ends of the arms.

One of the illustrations shows a square brass grid, which is put over the end of the brake beam of Baltimore trucks to take up wear of the runway. The method of applying this grid is shown in the reproduction.

The use of grease for motor lubrication has been abandoned. Grease boxes have been fitted with oil cups, and the substitution of oil for grease has resulted in a great saving, both in lubrication and in maintenance due to defective lubrication. At present the cost of

lubrication is 90 cents per day for thirty cars, making an average mileage of 160 miles per day. This brings the cost of lubrication down to about 18 cents per thousand miles.

A rather neat rack for holding armatures which takes up very little floor space is shown in one of the illustrations.



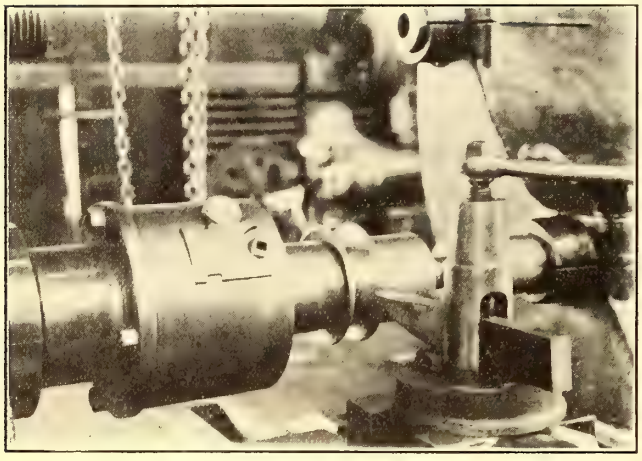
DOUBLE-JOINTED HAND RAIL ON KNOXVILLE SUMMER CAR

Several of the summer cars are equipped with a double-jointed arm rail which has advantages over the ordinary rail. As shown in the illustration, when the rail is down, the left short arm is vertical and the right one is horizontal. When up, the arms are reversed in position. Only one hook, and this is placed near the left arm, is required to hold the rail up.

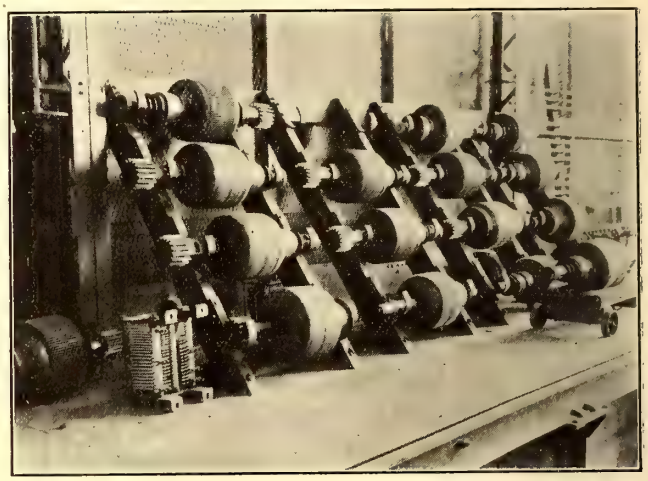
The shops are provided with a combination line-car, wrecking car and general utility car. The hoist is operated by a 2-hp motor. Ladders on top are provided to facilitate line repairs. The car is kept loaded with blocks, jacks, and other wrecking tools for emergencies. Stretchers are also provided.

TRACK BRAKE AT KNOXVILLE

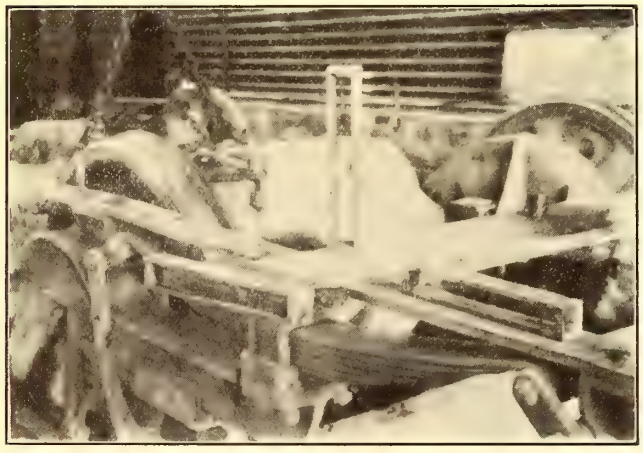
Knoxville, Tenn., is a rather hilly city and grades as high as 13 per cent are found on the electric railway lines. As an additional safeguard in the event of failure of the wheel brakes, track brakes of the type shown in the reproduction have been fitted to some of the cars. The brake is operated from a lever in the cab. It may be noted that the rock shaft is made of a square bar, and thus precludes the possibility of the levers slipping on it. The wood shoe is secured in a clamp in such a manner that it is held firmly, yet can be taken out and renewed without difficulty.



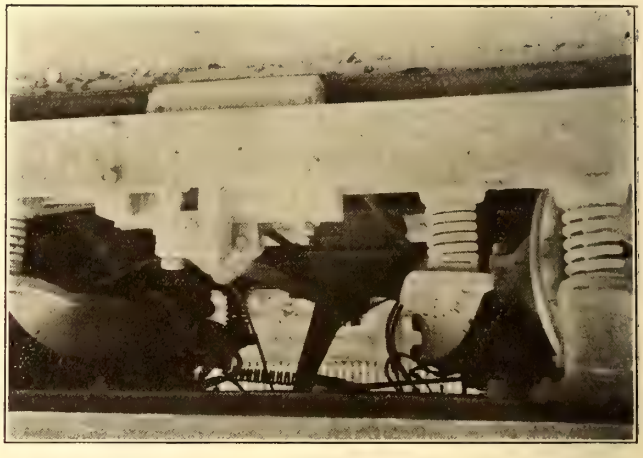
METHOD OF HOLDING THE TROLLEY WHEEL IN THE LATHE WHILE TURNING



ARMATURE RACK AND PADDED ARMATURE CAST, SHOWING ALSO WIRE NETTING PARTITIONS OF THE STOREROOM



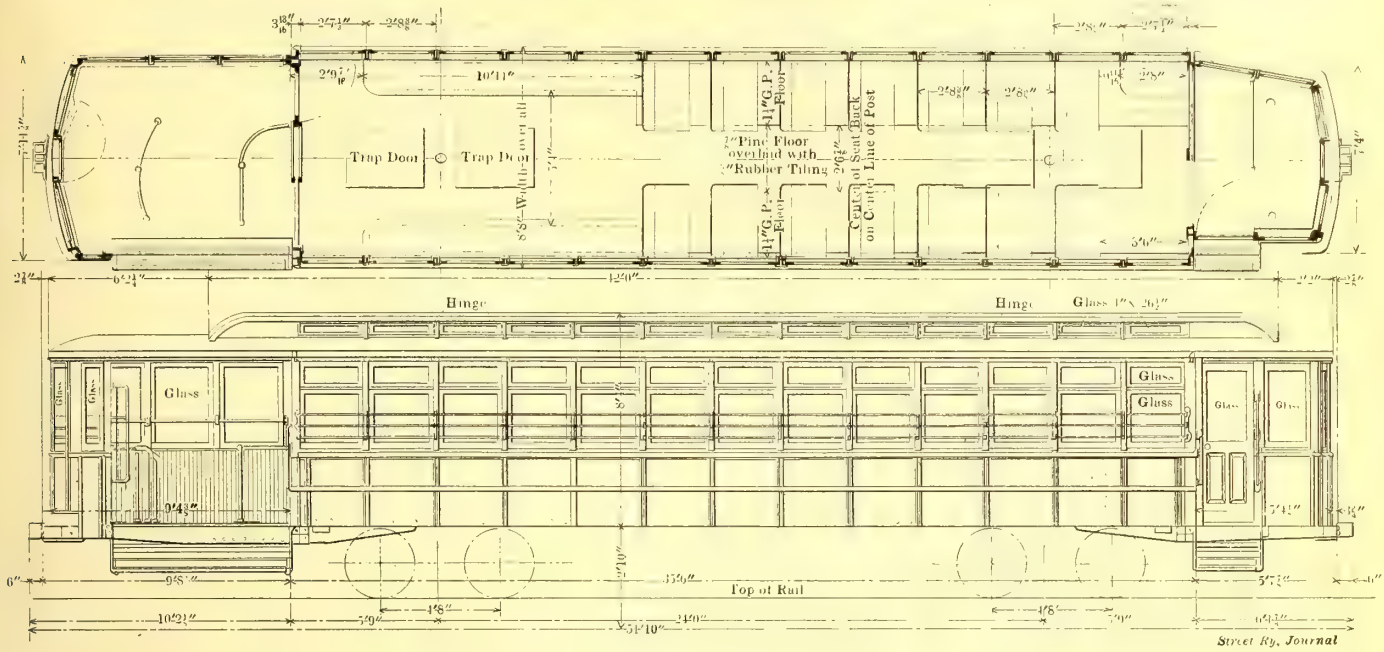
DEVICE TO TAKE UP WEAR IN THE BRAKE RIGGING OF BALTIMORE TRUCKS



TRACK BRAKE FOR KNOXVILLE'S HILLY LINES

PRESSED STEEL PAY-AS-YOU-ENTER CARS FOR MONTREAL

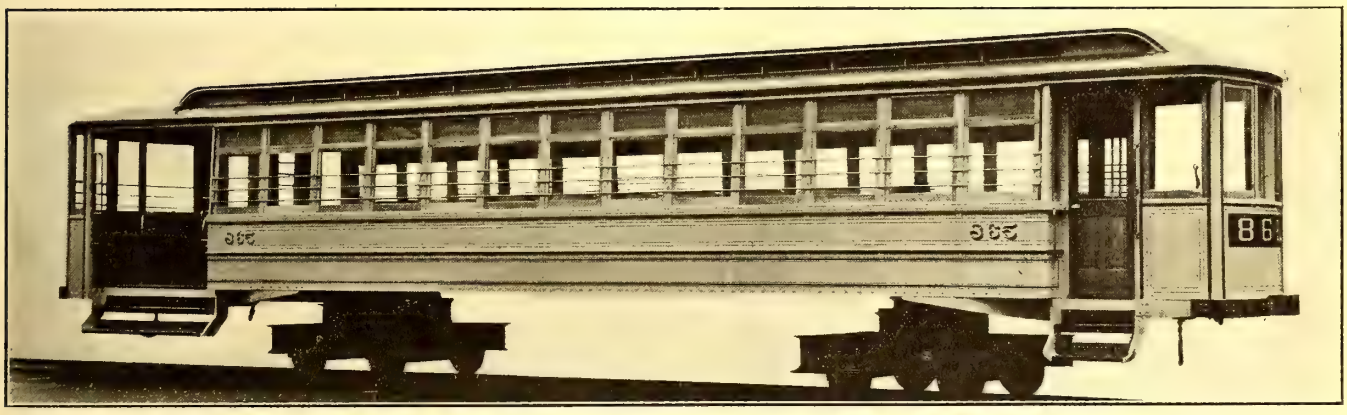
The recent delivery of ten pressed steel pay-as-you-enter cars to the Montreal Street Railway Company may be taken as an indication that this progressive railway refuses to be left behind others in trying out the very latest ideas in electric rolling stock. The cars were built at the Pittsburg works of the Pressed Steel Car Company, of New York, and resemble the wooden pay-as-you-enter car type so closely that it is doubtful whether the Montreal public will detect the difference. The general appearance of the car body and its interior are well shown in two of the accompanying half-tone illustrations.



PLAN AND ELEVATION OF MONTREAL PRESSED STEEL PAY-AS-YOU-ENTER CAR

The underframing of the car body proper consists of two longitudinal side sills and two center sills of rolled steel channel sections and angles. The center sills are spaced to allow for the four motor trap doors required. On each side between the center and side sills is a light sill which helps to carry the floor construction. The longitudinal members are tied by the two body bolsters and end sills of the channel section. The rest of the body underframe consists of four needle beams between the bolsters extending from side sill to side sill and shorter beams between the center sills for the trap doors. Each bolster is formed of special forged channel shapes with cover and bottom plates. It is 9½ ins. deep at the center bearing and 5 ins. deep at the side bearing. The channel shapes are attached to the side sills by a wrought bracket construction, the cover plates overlapping the channels. The center bearing consists of a casting riveted between the side channels, while the side bearings consist of castings shaped on a 2-ft. 5-in. radius bolted to the lower side of the bolster for easy removal.

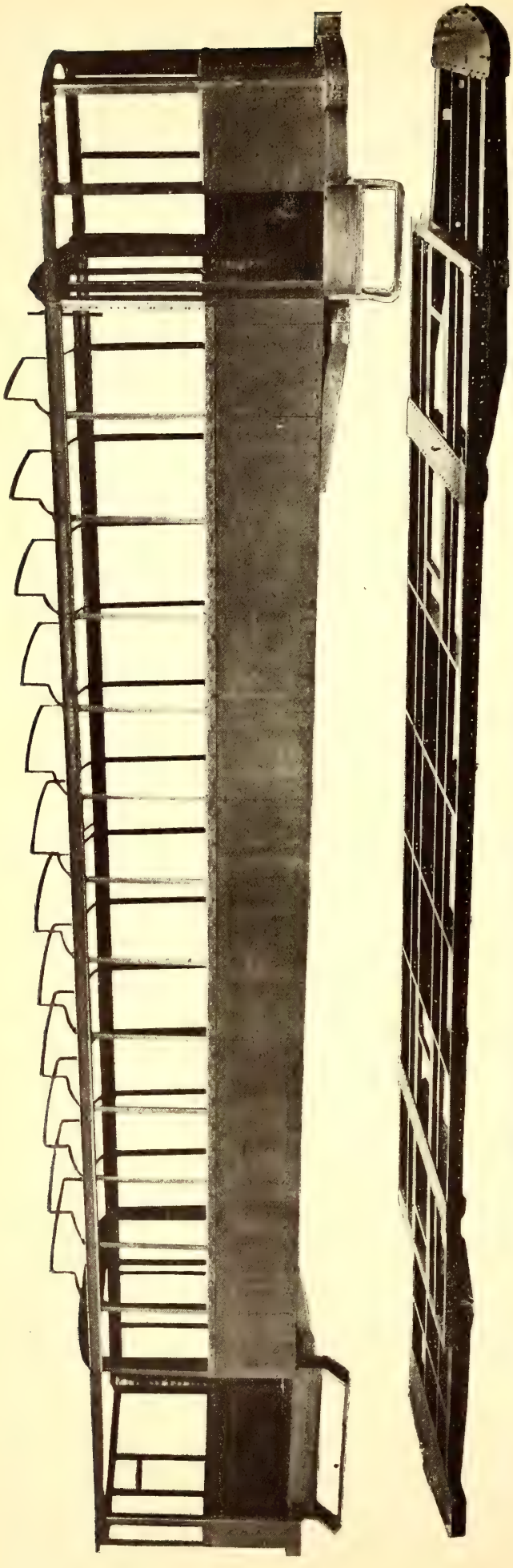
The platforms are built up of four channel members, which are bolted to the body underframe to facilitate their removal in case repairs are required. The corner posts



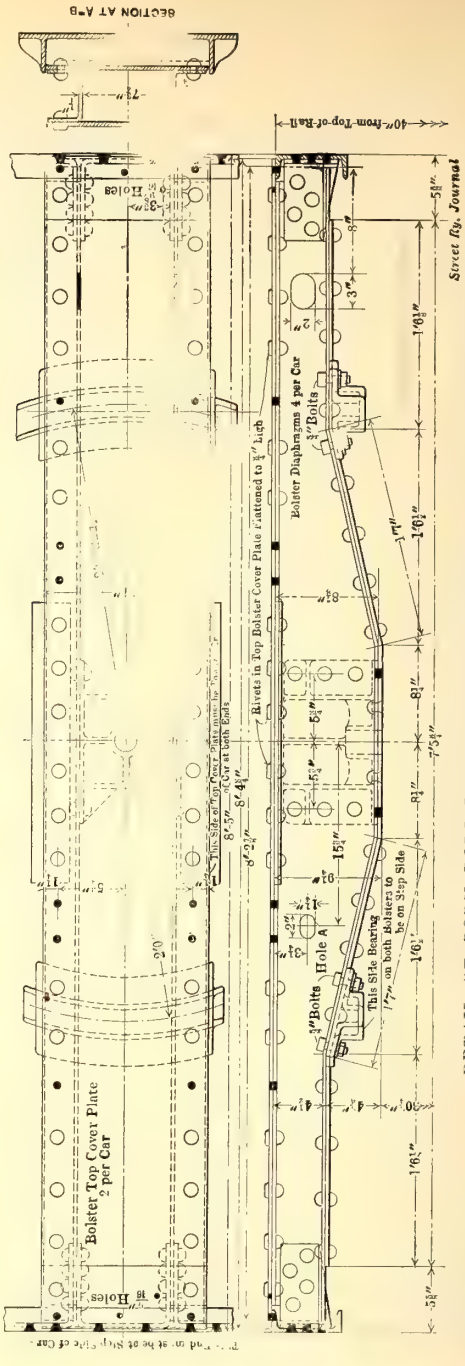
GENERAL VIEW OF STEEL PAY-AS-YOU-ENTER CAR BEFORE MOUNTING ON THE TRUCKS

are of pressed steel, the side posts of rolled tees and the top plates of steel angles. There are twelve wrought iron carlines. The vestibule framing and platform bearers are of steel throughout. The outside panels, which are 3/16-in. cold rolled steel, are riveted horizontally under the belt rail and vertically at each post to permit the removal of single damaged panels. All except the bottom line of rivets are covered with a steel molding to give the car the same appearance as the ordinary type. The roof consists of tongued and grooved white wood, painted with thick white lead and covered with No. 8 cotton duck, which is given three coats of white lead.

The car doors are made of oak. Those in the front are of the single half-glass sliding type. The front vestibule



UNDERFRAME AND GENERAL FRAMING OF MONTREAL STEEL PAY-AS-YOU-ENTER CAR



DETAIL OF BODY BOLSTER FOR PRESSED STEEL PAY-AS-YOU-ENTER CAR



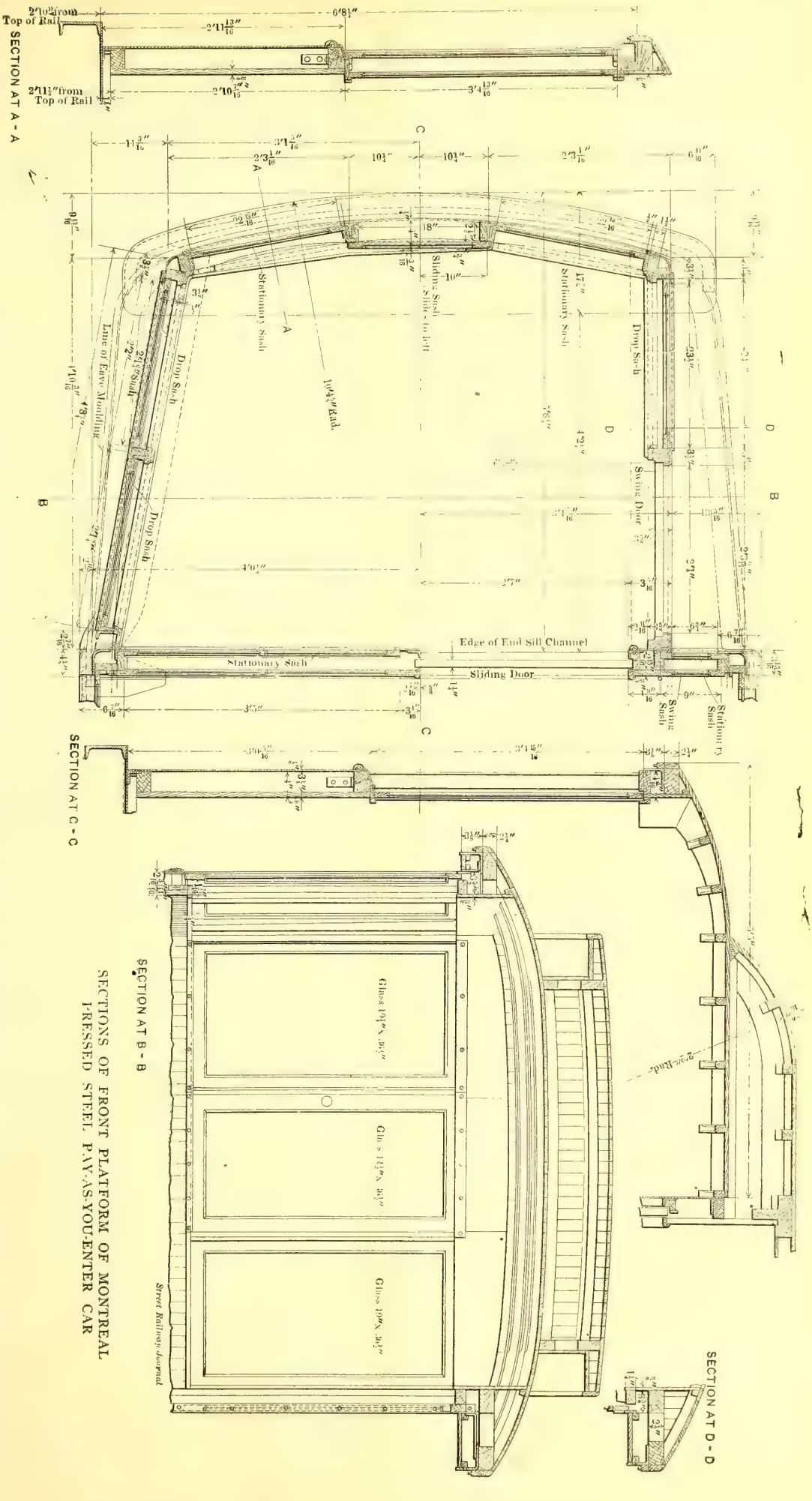
INTERIOR OF STEEL CAR SHOWING THE RUBBER TILING

door opens inwardly. The rear platform entrance door also opens inwardly, but the exit door is of the sliding type. All doors are glazed with ¼-in. plate glass. The steps are covered with Mason safety treads and provided with a back riser of malleable iron to close the step opening and thus prevent accidents to passengers by their feet slipping through.

There are thirteen square windows on each side with the upper part stationary and the lower dropping into pockets below the belt rail, as shown in the cross section. Pantasote spring roller curtains are used. Storm sash and guards are applied to each window. There are three ventilators at the front end and three at the back end on both sides of the car hinged at the ends and made to open outward by cranks and handles inside the cars. The remaining six on each side of the car are hinged.

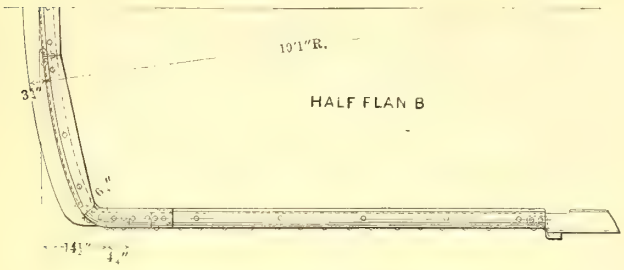
The top of the floor in the car is covered with the ⅜-in. interlocking blue and white rubber tiling which has been found so successful in the other cars. The first course of flooring laid on the underframe consists of 1/16-in. steel plate, upon which 13/16-in. long leaf yellow pine boards are placed. The interior finish of the car consists of oak linings and moldings for the doors, a white maple ceiling and polished brass trimmings.

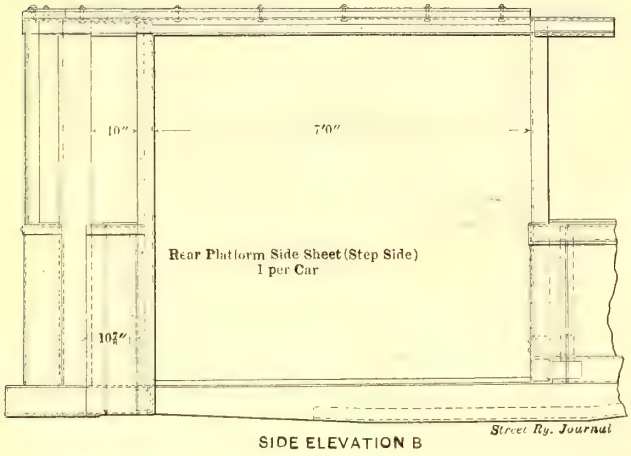
Each car is fitted with two longitudinal seats at the rear or entering end and one corner seat in the forward



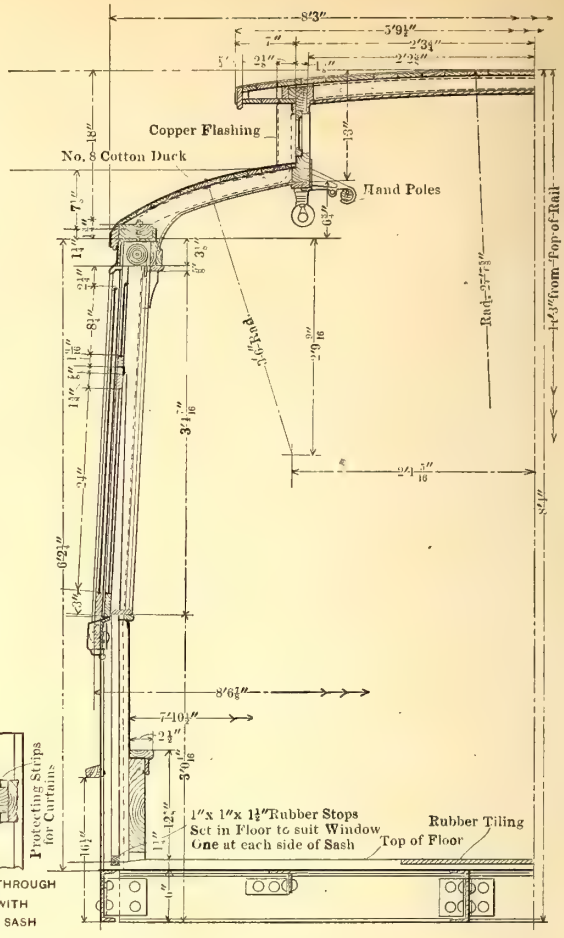
SECTIONS OF FRONT PLATFORM OF MONTREAL PRESSED STEEL PAY-AS-YOU-ENTER CAR

part of the car. These as well as the transverse seats are of the Haywood Brothers & Wakefield rattan type. The cross seats have grab handles, but there are straps in the rest of the car. The braking equipment consists of hand

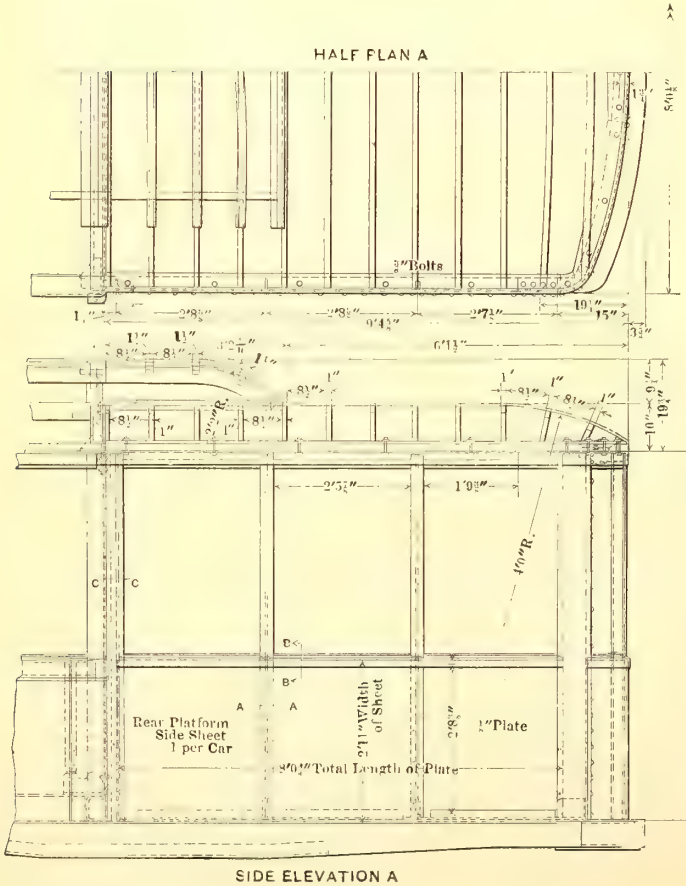




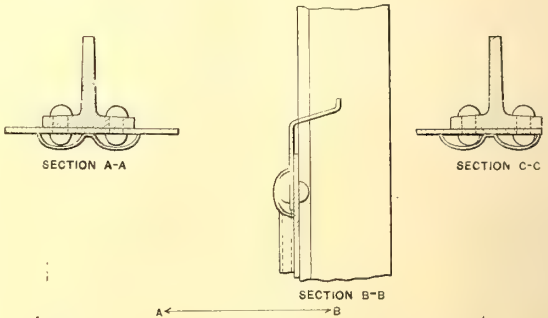
SIDE ELEVATION B

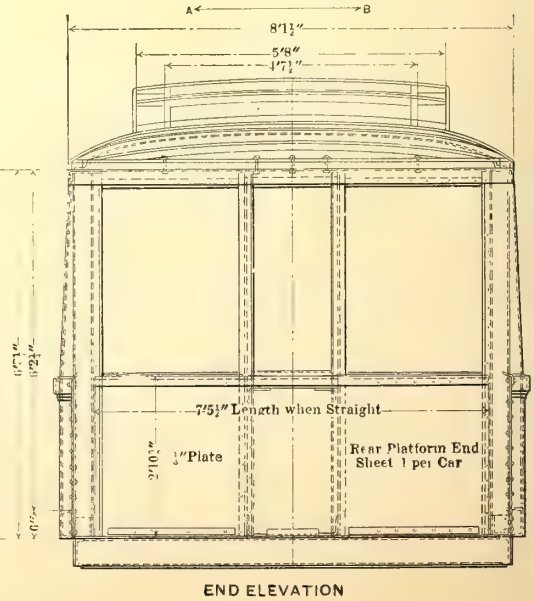


SECTION THROUGH POST WITH STORM SASH



SIDE ELEVATION A





END ELEVATION

SIDE AND END ELEVATIONS AND PART CROSS-SECTION OF MONTREAL PRESSED STEEL PAY-AS-YOU-ENTER CAR

brakes in addition to air brakes. The body is mounted on two Montreal trucks.

The following are the principal dimensions of the new cars: Length of car over bumper casting (over all), 51 ft. 10 ins.; length of car body over end sills, 35 ft. 6 ins.; length inside of car (end lining), 34 ft. 10⅜ ins.; distance from center to center of trucks, 24 ft. 0 in.; width of car outside of side sheets, 8 ft. 5⅜ ins.; width of car inside between truss planks, 7 ft. 7⅛ ins.; width of car over belt rails (over all), 8 ft. 8 ins.; width over eaves, upper deck, 5 ft. 9½ ins.; width over eaves, lower deck, 8 ft. 3 ins.; width of side window opening, 2 ft. 5⅞ ins.; height from rail to top of body floor, 3 ft. 5¼ ins.; height from rail to top of platform floor, 2 ft. 11¼ ins.; height from top of body floor to top of roof, 7 ft. 8¾ ins.; height from floor to ceiling, center, 7 ft. 6 1/16 ins.; height from rail to top of car, 11 ft. 2 ins.; height from rail to eaves, lower deck, 9 ft. 4 15/16 ins.

BOSTON ELEVATED EARNINGS

It is reported that the fiscal year of the Boston Elevated Railway will show an increase of about 3½ per cent in gross earnings over 1906. Earnings for the year ended Sept. 30, 1906, were $13,527,185, so that an increase of 3½ per cent in the last twelve months will bring gross receipts for the year up to approximately $14,000,000. During the 1906 fiscal year the company spent $500,000 in maintenance of way and equipment expenditures above the average of the preceding few years. For this reason the track and rolling stock are in such prime condition that the company has not been obliged to make the heavy charges against the earnings for maintenance which it did during the 1906 year. The saving thus realized has been utilized in meeting larger fixed charges and overcoming an increased operating ratio due to extremely adverse weather.

RIVERTON PARK, PORTLAND, MAINE

The ordinary electric railway park usually attracts business only during the warm months of the year and consequently the lines serving it must be sure of heavy summer business to make the venture profitable. This is especially true of territories like the northeastern coast of the United States, where a few weeks of raw weather in summer mean a great shrinkage in traffic receipts. In many cases, however, this disadvantage can be more than balanced by laying out a park that will be attractive in all seasons and thus be a steady money-maker.



A LINE OF CARS UNLOADING AT RIVERTON PARK, PORTLAND, MAINE

Riverton Park, Portland, Maine, which is operated by the Portland Railroad Company, is a conspicuous example of a perennial pleasure ground. It covers some 40 acres along the Presumpscot River in the Deering district about 6 miles from the business center of Portland, and therefore is readily accessible. The natural configuration of the landscape has been so artistically modified that the park may well claim it to be the prettiest in New England—and

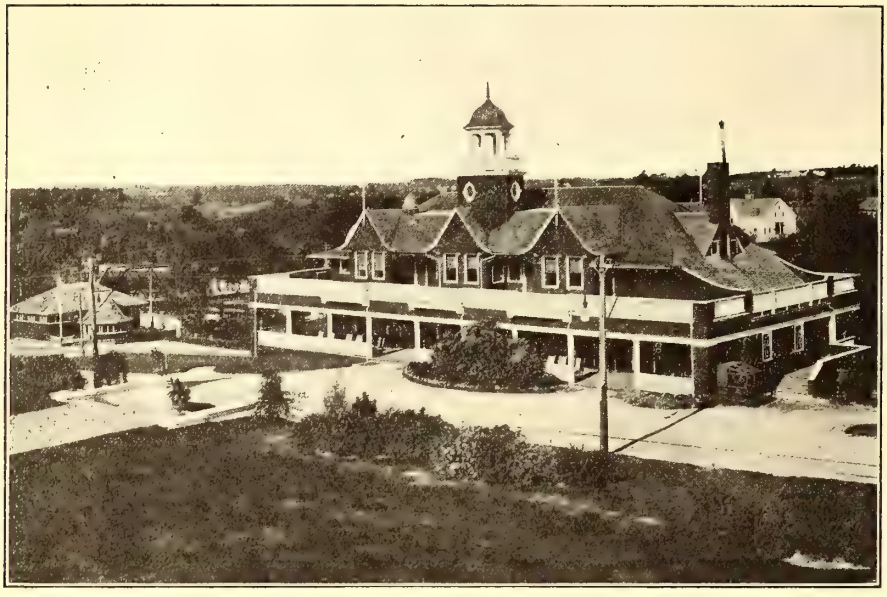


CAR ENTRANCE TO RIVERTON PARK, SHOWING THE PRESUMPSCOT RIVER BOAT HOUSE



THE ARTISTIC CAR ENTRANCE TO RIVERTON PARK. THE CASINO IN THE BACKGROUND

for that matter, in the United States. It is designed to appeal to people who can appreciate a playground of this kind and are willing to help keep everything on a high plane. When the car turns into the grounds, the visitor on glancing at the artistic stone gateway is inclined to imagine that he is entering the garden of some great mansion and not of a public park. The impression gained at the gate is strengthened upon inspecting the park itself, for the art



THE CASINO IN RIVERTON PARK

displayed in the different structures, walks and groves is not generally to be enjoyed so cheaply.

The main building in the park is a handsome casino, whose broad piazzas, commanding a view of the entire grounds, cozy parlors and attractive dining hall offer a never-failing attraction. In the dining room, visitors are served singly or in parties with light lunch or regular dinners. The reception or red room is elegantly furnished after the colonial type and its walls are ornamented with copies of famous pictures. A feature especially appreciated in inclement weather is the card room where conveniences are at hand for all the popular table games, including chess, checkers and dominoes. There is also a fine reading room furnished in Oriental style and having a well-stocked library. The dance hall, naturally enough, is one of the most popular features of the casino with the young folks. Recently the piazzas have been furnished with some slot machines of the different types so popular in penny arcades. On the whole, the casino's manifold attractions make it an excellent all-the-year resort, and it has become a favorite place for Portlanders to hold banquets and various cold-weather festivities.

The casino, souvenir house and one or two other structures in the open portions of the park are not built in the so-called rustic style, but the latter is applied with artistic effect to the open-air theater and other places where the woodland offers an appropriate background. The theater, which is situated on the river bank, has 2500 seats, of which only 250 are reserved, and for the nominal cost of 10 cents. Here refined vaudeville is given every afternoon and evening. In addition to the theatrical feature, there is an orchestra which plays daily either at the casino or the theater.

Canoeing on the river is one of the most popular recreations, and to encourage this pastime the company has built a fine canoe house where patrons may keep their own canoes or rent others. There is also an electric launch for those who want the ride on the river without effort. Among other features of the park are the fine menagerie with its elk, deer and other animals, the rustic arbors, bridges and benches and the numerous swings for the children.



OPEN-AIR THEATRE IN RIVERTON PARK



A RUSTIC BRIDGE IN RIVERTON PARK

The park is reached by cars of the Portland Railroad Company, which leave the heart of the city every 15 minutes during the periods of heavy travel. The round trip costs 20 cents, which includes admission to the grounds.

Taken all in all, Riverton Park is a splendid example of a railway park and while a part of its attractiveness is due to a location rarely found, the taste displayed in laying out the park and the ability in managing it could well be imitated by others in the same field.

TO THE INVENTOR OF ELECTRIC RAILWAY APPLIANCES

BY JOHN HOBBS.

A word to the inventor or the would-be inventor of electric railway apparatus may not be amiss. Their number is probably greater than in any other line of work, due partly to the substantial reward that is offered to those who are successful, partly to the fact that the deficiencies of much of the apparatus in use at present are very evident and partly because statistics show that trolley cars are used by a much larger proportion of the population of this country than any other electrical invention. To almost any one who is familiar with street railway apparatus, there appear numerous ways in which the device and methods in use in electric railway service could either be improved or be substituted by others, with the result that the cost of maintenance would be lessened, the safety of passengers would be increased, or operation would be facilitated in some other way.

These facts cause many who are not familiar with electric railway operation or the requirements of electric railway apparatus to attempt the role of inventors. Such people are greatly handicapped by a lack of knowledge of the actual requirements; on the other hand they have the advantage of looking at the question from the outside and with a free and untrammeled mind which is rarely possessed by those confined to one line of work. Their limited knowledge of operating conditions, however, usually causes them to waste the greater portion of their efforts by attempting to develop something which is impracticable or whose adoption after being perfected would probably introduce more difficulties than its use would avoid. On the other hand, the fact that they are not constantly thinking about one line of work often enables these outsiders to develop a really much needed article.

There is one device which is as alluring and which is seemingly as impossible to reach as the pot of gold at the end of the rainbow and the average inventor should regard it with caution. This is a self-replacing trolley wheel or a trolley wheel that will not jump the wire. The patent records will show that device after device, all supposed to be improvements on the present trolley, have been patented only to lie dormant. While employed in the shop of a large railway system the writer remembers that it was out of the ordinary if more than two or three weeks went by without some new trolley or trolley harp being offered for trial. The master mechanic of the railway system was one of those broad-minded men who are always willing to investigate and give any new piece of apparatus a trial if it shows possibilities of success or if such trial will rid the inventor's mind of delusions. But he regarded several of these trolley devices as too dangerous to overhead construction to be permitted on a car, even on trial. In fact once or twice, in testing some of them at very slow speed, trolley cars were caught and pulled from the span wires. Of all the devices submitted not one was suitable and the road, like practically all other direct current roads in the country, is to-day using the simple trolley wheel and harp.

Those who have devised apparatus which they consider great improvements often complain because the railway companies do not give them proper encouragement by allowing the apparatus to be tried or by offering facilities for its development. They do not realize to what trouble and expense the roads would be subjected if they offered encouragement to the many half-hatched schemes submitted. The writer is reminded of one or two instances which are typical. Permission was obtained by some alleged inventors to try a scheme of motor control without loss in resistances and the facilities of the shop were put at their disposal.

Under their directions all the controller reverse fingers in the storeroom were mounted on long boards and a car was also brought over the pit and the fields removed from the motors. In addition quite an amount of wire was cut into small pieces. After several days of inactivity orders were gotten to replace the fields in the car, the so-called inventors left the shop and the incident was closed. It afterward developed that the new "invention" consisted in weakening the fields by shunting them or by winding them in sections. Operations came to a stop because a point was reached where about one hundred and fifty dollars had to be expended and those responsible for the scheme either did not have the money or did not have enough faith in their idea to risk parting with this amount.

On another occasion after repeated solicitation a man from a small town of about 1000 people, through which an interurban line ran, was given permission to install an automatic track switch on condition that the company would not be inconvenienced or the street torn up. After the delivery of about two wagon loads of various materials, constituting the parts of one switch, and which included some timbers about ten or twelve inches square and a dozen feet long, the management decided to call a halt, and the inventor (?) considered he had not received fair treatment from the railway company.

Before bothering a railway company the inventor should feel certain that his device is a practical one and that he has gotten it in as advanced a state as is possible, until some of its defects are made evident by trial. But he should not assume that he can make repeated trials to the inconvenience of an accommodating railway company in order to perfect the apparatus. Every breakdown causes the master mechanic, the superintendent of track or of overhead or whoever permits the trial to lose confidence in both the apparatus and the inventor. Breakdown of experimental apparatus due to a single weak point has often caused the condemnation of an otherwise good article.

In developing an idea the inventor should keep simplicity uppermost in his mind. Simplicity carries with it the idea of being easily understood and of something not likely to get out of order. It must be remembered, too, that the apparatus will fall into the hands of men who are not as skilled and as careful as watchmakers and should consequently be built in such a manner that it will stand more than a reasonable amount of abuse. Street railway apparatus and appliances are in fact subjected to about as hard a treatment as any machinery devised and it is the lack of proper design and construction to withstand such treatment that causes many new devices to be thrown out.

But if the path of the inventor of street railway apparatus is a rather thorny one, the reward is equally commensurate. The electric railway fraternity is always ready to adopt a piece of apparatus that proves itself of worth and it is willing to pay well for it.

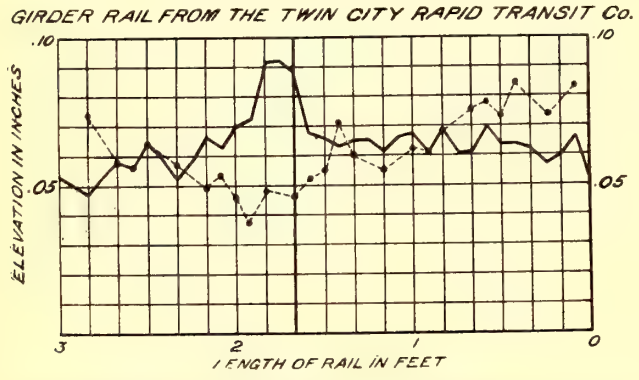
The writer remembers one casting that sold for about $9 which to all appearance could not have cost more than 50 cents. On much other apparatus the difference between the cost price and the price at which railways are willing to purchase is almost as great.

THE HARDNESS OF CORRUGATED RAILS

BY GEORGE L. FOWLER.

There has been much discussion regarding that annoying phenomenon of rail wear known as corrugation that apparently obeys no law and appears unexpectedly in all sorts of places. While manifesting itself at times on the rails of steam roads, its occurrence has been particularly frequent upon electric railways. Without stopping to discuss the various causes that have been assigned to this trouble, it will be sufficient to mention the one taken in especial consideration in this connection.

Among the theories that have been put forth to account for rail corrugation is the one that the hardness of the rail varies in spots and that the soft places are worn away by the action of the wheels, leaving the hard sections raised in relief. These alternate portions of hard and soft places are supposed to be caused by unequal action of the rolls in the manufacture of the rail, or by segregation of carbon or other elements. But all revert to the original proposition



RECORD MADE WITH TWIN CITY CORRUGATED RAIL

that spots of unequal density or hardness prevail in the head.

With the view of checking the accuracy or fallacy of this theory, it was decided to make an examination of a few rails that had become corrugated and ascertain their condition definitely. In order to do this, samples of such rails were obtained from the Boston Elevated, the Milwaukee Electric Railway & Light Company, and the Twin City Rapid Transit Company, of Minneapolis, Minn. The rails were accurately measured for their elevations at 1-in. intervals for their whole length, and the profile so obtained was plotted. The method of doing this was as follows: The rail was leveled on horses at a convenient working height and beside it a pair of angle-iron guides were placed parallel to it, but a little higher, and these were accurately leveled. A straight-edge was then fitted with a micrometer head reading to .0001 in. The straight-edge was laid across the guide and the micrometer brought down to a bearing on the rail. The readings thus obtained gave the profile with references to the guides and they have been plotted to show the contour of the rail in the accompanying diagram.

From this it will be seen that the T-rail from Milwaukee and rolled by the Lorain Steel Company was not truly corrugated as the term is generally understood. It was badly worn and had three distinct waves in its length of 15 ft. The fact that one end of the rail appears to be so much higher than the other is due to the fact that it was worn more at the lower end and the profile is plotted with reference to the bottom of the flange which was level. The crests of the waves thus formed were 4 ft. 5 ins. and 7 ft. 6 ins. apart, with some minor corrugations in between, noticeably between the 10 ft. and 14 ft. marks.

The girder rail from the Boston Elevated Railway showed a general crowning, extending throughout its whole length of 15 ft. 10 ins., with continual minor corrugations over the whole surface, with an average pitch from crest to crest of about 3 ins. The short length of girder rail from the Twin City Rapid Transit Company was a piece of truly corrugated rail, the pitch of whose corrugations varied from 2 ins. to 6 ins.

The test for hardness was made by means of a drop and worked out on the Martel scale. By way of explanation it may be stated that an elaborate investigation on the part of Lieutenant-Colonel Martel, of the French army, has shown that with a given form of punch, the amount of metal displaced by the indentation made by allowing this punch to fall through a given distance with a given weight is a measure of the hardness. That is to say, the hardness varies inversely with the amount of metal displaced. The fact thus developed has been given expression in the formula:

$$V = \frac{Wh}{D} \text{ or } D = \frac{Wh}{V}$$

in which

D = the hardness in degrees of the Martel scale,
W = weight of punch and head in kilograms,
h = height of fall in millimeters,
V = volume of material displaced.

This scale has been standardized by the French Government.

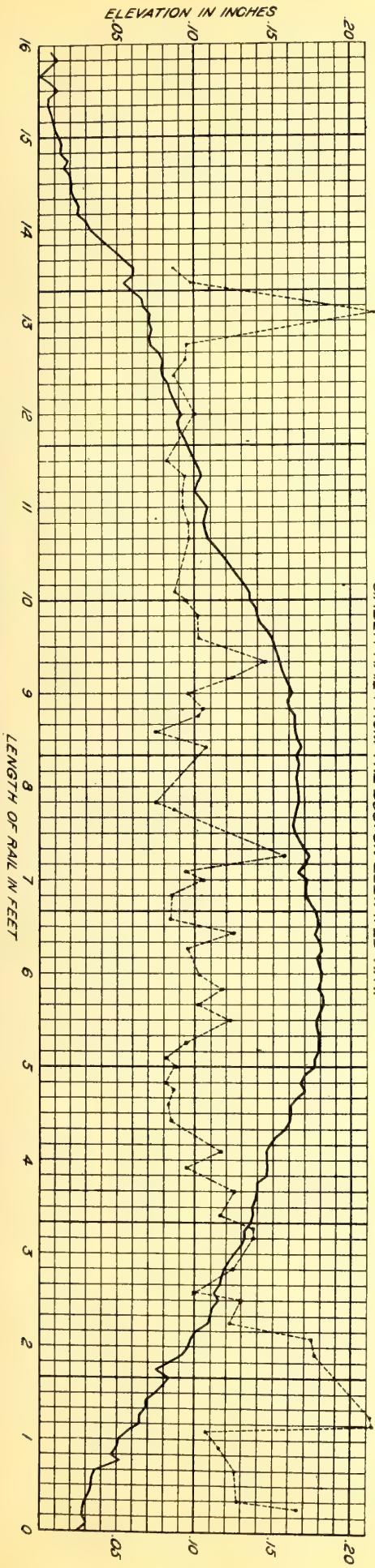
In this case the standard form of punch was used, which, with the head to which it was attached, weighed 3.522 kgs. The punch was a four-sided pyramid with two opposite edges, one pair making an angle of about 60 degrees with each other and the other two about 9 degrees.

By multiplying the cube of the length of the indentation that was made by the punch by a fixed factor the amount of metal displaced could be ascertained. It was evidently necessary to measure the length of these indentations very accurately and this was done by means of a microscope carrying cross-hairs and moved by a micrometer screw reading to .0001 in. The height of the drop used in making the test was 600 mms.

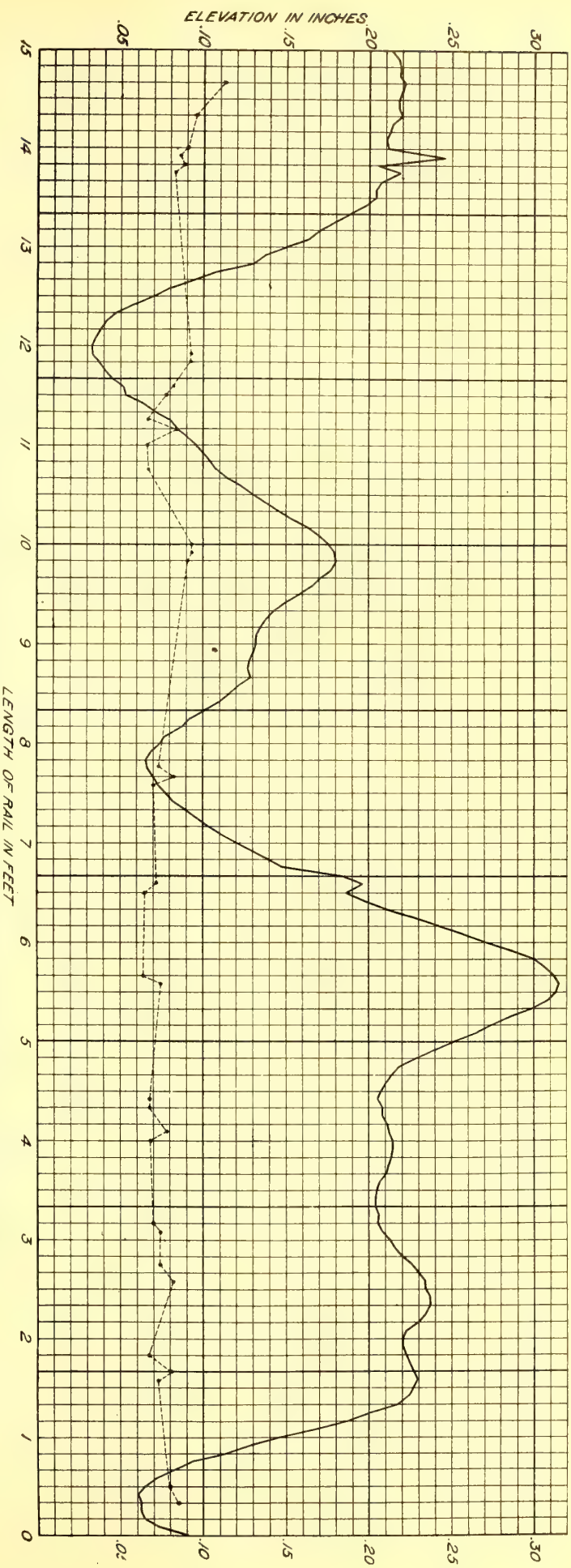
This explanation will serve to show that the methods employed in this determination were such as to secure accurate results.

It may be stated here that no disappointment was experienced at the results obtained, for the work was undertaken with the sole object of either eliminating or substantiating a theory of the cause of rail corrugation that is somewhat widely advocated though the possibility of proving it a valid one was rather remote. It does not seem that a careful consideration of the matter could lead one to think that the action of the rolls or the vagaries of the effects of segregation on the chemical composition of the rail could produce regular alternations of hardness and softness. As a matter of fact this investigation did not show that there was the slightest trace of any such action. While there was some variation in hardness, the variations that were manifested bore no relation whatever to the profile of the head of the rail.

To the diagrams showing the profile of the three rails there has been added a dotted line showing, on a greatly exaggerated scale, the variations in hardness. It will be seen that these do not rise and fall in any sort of harmony with the profiles. The variations were most pronounced in the girder rail from the Boston Elevated Railroad. But these variations appear mostly in the form of hard spots



CURVES OBTAINED FROM TEST ON GIRDER RAIL, FROM THE BOSTON ELEVATED RAILWAY



CURVES OBTAINED FROM TEST ON T RAIL, FROM MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY

that were probably developed in the rail by the service which it had been called upon to render, rather than by a defect inherent in the rail itself. With the T-rail from Milwaukee, rolled by the Lorain Steel Company, there is a practical uniformity of hardness throughout its whole extent.

While these tests might well be considered too meagre upon which to have based a positive statement that corrugations are caused by variations of hardness, it is quite evident that had such a cause existed it would have shown some evidence of it in one of the three rails that were tested. And as no such evidence did appear in any way, shape or manner, it seems quite reasonable to conclude that it does not exist, and that therefore we may eliminate this variation of hardness from among the possible causes of rail corrugation.

TEST OF A COMBINED RAILWAY AND LIGHTING PLANT

The economy of combined railway and lighting plants is of general interest on account of the division of the load between several classes of service and the opportunity which is afforded a careful management to utilize the machinery to the best advantage. In the Street Railway Journal of Dec. 29, 1906, a description was published of the new turbine plant of the Suburban Manufacturing Company at Waltham, Mass., which supplies central station service to Waltham and trolley current to the Newton and Waltham group of street railways. Below are given the results of a careful thesis test on the same plant, in March of this year, by Messrs. Macomber, McChesney, Packard and Nichols of the Masachusetts Institute of Technology.

The main generating equipment of the station consists of two 500-kw Westinghouse-Parsons turbo alternator sets, operating at 2300 volts, three phase, 60 cycles and 3600 r. p. m. Direct current power is obtained from a 432-kw Westinghouse, 2300-volt 60-cycle synchronous motor direct connected to a 400-kw 600-volt generator. This set supplies the railway power. Direct current is also obtained from a 175-hp induction motor-generator set, the motor being direct connected to a 120-kw 600-volt generator. Two 25-kw exciters of the engine-driven type are in service. Each turbine is provided with an Alberger surface condenser outfit. The boiler plant consists of two batteries of 4-375-hp Stirling boilers, the operating steam pressure being 175 lbs. Coal is handled by a Robins conveyer system, and the boilers are fired by hand.

Three tests were made: A 72-hour economy test of the whole plant; a series of tests under artificial load of one turbine; and a 10-hour economy test under commercial load, of the same turbine.

The data obtained in the 72-hour test were as follows:

Barometer	30.39 ins.
Boiler pressure	168.2 lbs.

TEST OF PLANT.

Temperature, outside air	51.16° F.
Temperature, inside air	68.18° F.
Temperature, feed-water before heater	47.30° F.
Temperature, feed-water after heater	189.1° F.
Quality of steam	.988
Kind of coal used	Orinda steam
Moisture in coal	0.85
Total water fed to boilers	846,738 gals.
Coal fired	94,391 lbs.
Ash and clinker	9,290 lbs.
Analysis of flue gases	
CO_2, 5.25 per cent; O, 14.54 per cent; CO, 0.35 per cent	
Temperature of flue gases	366.9° F.
Steam used by auxiliaries	200,474 lbs.
Drips	24,043 lbs.
Vacuum in condenser No. 1	29.06 ins.
Vacuum in condenser No. 2	27.43 ins.
Temperature condensation, No. 1	75.2° F.
Temperature condensation, No. 2	92.8° F.
Temperature cooling water at river	39.3° F.
Temperature cooling water after discharge, No. 1	47.9° F.
Temperature cooling water after discharge, No. 2	51.° F
Heat of combustion of coal	13,668 B. T. U.
Moisture in coal	0.85 per cent
Draft, normal 0.2 ins.—0.4 ins., maximum	0.8 ins.
Heating surface per boiler	3,540 sq. ft.
Grate surface per boiler	81 sq. ft.
Ratio, heating to grate surface	43.7
Dry coal burned	83,589 lbs.
Dry combustible coal burned	74,299 lbs.
Total ash in per cent dry coal	11.1 per cent
Total kw-hour output of turbines	23,945
Number of boilers used in test	2

RESULTS OF 72-HOUR TEST.

Total equivalent evaporation from and at 212° F.	901,445 lbs.
Equivalent evaporation from and at 212° per lb. of dry coal	10.78 lbs.
Equivalent evaporation from and at 212° per lb. combustible	12.13 lbs.
Equivalent evaporation from and at 212° per sq. ft. heating surface per hour	1.77 lbs.
Coal burned per sq. ft. of grate surface per hour	8.09 lbs.
Boiler horse-power developed, A. S. M. E. rating	362.9
Maximum possible error	1.37 per cent
Air per lb. of coal from analysis of flue gases	36.41 lbs.
Air per lb. of coal per formula $12\,C + 36\,(H - \frac{O}{8})$	10.56 lbs.
Excess air supplied per lb. coal	24.8 lbs.
Heat carried off by flue gases per lb. coal	2645 B.T. U.
Heat absorbed by water in boiler per lb. of coal fired	9224 B. T.U.
Heat radiated per lb. coal fired	1799 B. T. U.
Heat carried off by flue gases	19.36 per cent
Thermal efficiency of boiler plant	67.47 per cent
Heat lost by radiation	13.16 per cent
Cooling water over weir per hour	30,500 lbs.
Per cent total steam used by auxiliaries	23.67
Per cent total steam returned in drips	2.84
Total steam per kw-hour	33.93 lbs.
Total coal per kw-hour	3.78 lbs.

EFFICIENCY TESTS ON TURBINE NO. 1

The object of these tests was to determine the steam consumption per kw-h at various artificial loads. In order to maintain the load fairly constant at given values the generator was loaded by means of barrel rheostats. Large hogsheads were mounted on low platforms placed in a line about 12 ft. apart. The bottoms were then connected by a 4-in. iron pipe, the bottom of each hogshead being bolted to a flange at that end of the pipe and the middle hogshead being connected to the center of the pipe. By this means a flow of water was secured from one barrel to another and an even water level maintained in all. A small supply pipe was run from the city main along the wall parallel with the barrels, and a rubber hose tapped off into each barrel so that water could be run into the barrels when necessary. Each barrel was provided with two iron plates for electrodes. One plate was attached to the iron pipe at the bottom of each barrel, while the other was suspended in the barrel by means of ropes manipulated by pulleys. The iron connecting pipe between barrels was grounded. The arrangement was such that the barrels were connected in Y with the neutral point grounded.

On the a. c. switchboard of the plant are two sets of bus-bars, one of which is not used ordinarily. Rubber covered wires were run from these bus-bars to the water barrels, care being taken to keep the circuits out of the way of passers-by. By means of a double-throw switch on the generator panel the unit could be thrown on or off the artificial load as required. Salt was used in the water.

The steam consumption of the exciter was not directly measured, on account of the pipe layout. This was obtained by securing the curve of steam consumption of the particular set from the Westinghouse Machine Company for given electrical outputs.

The gland water is ordinarily supplied from the circulating system. During these tests the exact weight of gland water used was obtained as follows: A staging was built in the turbine room and on this a barrel placed high enough to give the required head. Still above this supply barrel was placed a small barrel on scales, which delivered into the supply barrel. This small barrel was filled by a hose from the boiler-room, and by bringing the level in the supply barrel to a certain mark when the test was started and stopped, the weight of water taken from the small barrel was known. The gland connection to the cooling system was broken, and was connected to the supply barrel on the staging, and the required pressure was obtained by throttling the supply with a valve at the turbine. The discharge from the wet pump was led over two weighing barrels which delivered the water after being weighed into a pit in the basement. Two tests were run to determine the condenser leakage. The circulating water was started, then the dry air pump, and the condenser pumped dry by the wet pump. By starting the leakage test at this point and keeping all pumps going, the data were obtained.

PLANT TEST WALTHAM

EFFICIENCY RUNS, TURBO UNIT NO. 1

	1	2	3	4	5
Duration hours	2	2	2	2	1
K.w.h. output	337.68	534.30	784.67	1019.67	654.45
Percent'ge of full load.	33.8	53.4	78.5	102.0	130.9
Barometer, inches	30.32	30.36	30.36	30.36	30.38
Barometer, lbs. per sq. in.	14.89	14.91	14.91	14.91	14.92
Steam pressure, lbs. per sq. in.	174.4	173.6	172.5	171.9	173.4
Calorimeter gage	9.3	9.2	9.1	9.0	9.1
Calorimeter temperature, °F	299.1	293.9	293.7	293.0	297.0
Condenser vacuum, inches	28.9	29.10	29.24	29.16	29.05
Turbine vacuum, inches.	28.7	29.	28.9	28.6	28.2
Temperature condensation, °F	83.3	77.8	75.7	80.8	87.1
Lbs. steam through condenser	9,018	11,830	16,597	20,780	13,167
Condenser leakage	.36	.36	.36	.36	.18
Gland water used	224	223	183	237	125
Gland water pressure	3	3	3	3	3
Steam used by exciter, lbs.	766	820	854	900	480
Net condensation, excluding exciter, lbs.	8,758	11,571	16,378	20.507	13,024
Net dry steam condensation, excluding exciter, lbs.	8,659	11,425	16,169	20,245	12,868
Lbs. steam for k.w.h., excluding exciter	25.64	21.79	20.61	19.85	19.66
Lbs. dry steam condensation, including exciter	9,416	12,234	17,012	21,144	13,342
Lbs. steam per k.w.h., including exciter	27.88	22.81	21.68	20.74	20.39
Thermal efficiency of unit, excluding exciter, per cent	9.23	13.61	14.40	14.97	15.20
Thermal efficiency of unit, including exciter, per cent	8.49	12.71	13.69	14.33	14.66

The above tests show that the unit more than fulfilled the guarantee of its manufacturers, it proving from 1.5 to 2 per cent better than the guaranteed consumption on various loads. The condenser leakage was practically negligible.

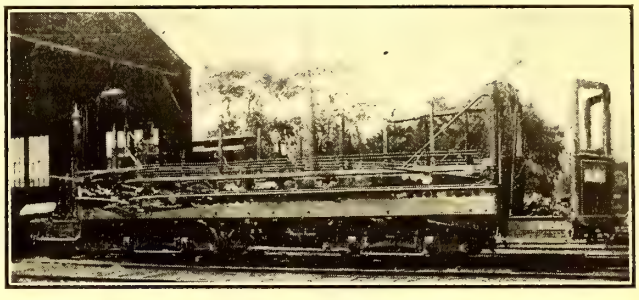
TEN-HOUR COMMERCIAL TEST TURBO UNIT NO. 1

The following data were obtained:

Kw-hour output	4,206
Average per cent of full load	84.1
Barometer	30.52 ins.
Steam pressure, lbs. per sq. in	172.4
Calorimeter gage, lbs	9.1
Calorimeter temperature, degs. F	296.4
Condenser, vacuum inches	29.3
Turbine, vacuum inches	28.9
Condensed steam temperature, degs. F	83.1
Lbs. steam through condenser	89,714
Condenser leakage, lbs	180
Gland water used, lbs	11.37
Gland water pressure, lbs	3
Steam used by exciter, lbs	4,770
Quality of steam	0.983
Net condensed steam, excluding exciter, lbs	88,397
Net condensed dry steam, excluding exciter, lbs.	87,630
Net dry steam condensed, including exciter, lbs.	92,073
Steam per kw-hour, output, lbs	20.77
Steam per kw-hour, including exciter, lbs	21.9
Thermal efficiency of unit	14.4 per cent
Flue gas analysis	
CO_2, 6.3 per cent; O, 13.7 per cent; CO, 0. per cent	
Temperature of flue gas	405° F.

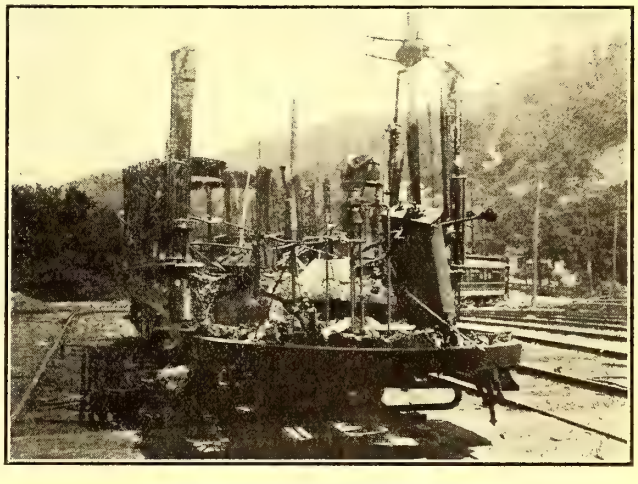
AN ODD ELECTRICAL ACCIDENT FROM A BROKEN TROLLEY WIRE

The accompanying illustrations show all that was left of one of the Wheeling Traction Company's cars after passing through a peculiar electrical accident a short time ago while en route between Moundsville and Wheeling. The line is single track and the trolley wire parted after the south bound car had passed. The north bound car ran into the break before the motorman saw it. One end of the wire wrapped around the expansion chamber of the hot water heater, which was located on top of the car.



SIDE VIEW OF DAMAGED CAR

This caused a short circuit between certain parts of the heating system and other metal parts of the car at several different places and caused a number of arcs which ignited the woodwork of the car. As the car was quite a distance from fire protection of any kind before a fire engine or chemicals could be had from the nearest town, it was almost entirely consumed. No passengers on the car were injured, as all had ample time to leave the car in safety.



END VIEW OF DAMAGED CAR

To prevent a recurrence of such accidents General Manager Nagle has ordered wood boxes to be placed over the expansion chambers of the heaters, a section of non-combustible non-conducting material inserted in the stove pipe (which also extends above the roof of the car) and an insulated joint inserted in the air whistle pipe located on the roof. With these improvements he believes the cars will be free from danger of another accident of this kind.

All parts of the car above the trucks were damaged to such an extent that they could not be again used, although the trucks, motors and apparatus under the car body, with the exception of the wiring, was not materially injured.

OPERATING RESULTS OF THE MONTREAL PAY-AS-YOU-ENTER CAR

Previous issues* of the Street Railway Journal have contained illustrated articles on the Montreal Street Railway Company's pay-as-you-enter car, but hitherto no operating statistics have been presented on the results achieved with this type. Such figures have now been made available by the Montreal company and they show that so far as Montreal is concerned the new car is an emphatic success in giving better schedules, practical elimination of platform accidents and increase in receipts. There are, of course, other advantageous features, but the three mentioned are surely enough to arouse any street railway man's attention.

The company did not begin its experiment with the pay-as-you-enter car on some quiet branch line, but placed the very first car in June, 1905, on St. Catherine Street, one of the busiest in the city. Thus the general public became familiar with it at once, thereby simplifying its later introduction on other lines. St. Catherine Street, Montreal, runs longitudinally and has over a dozen transfer points. It will be seen, therefore, that quick fare collection is a necessity on this line. The success of the first car led to the complete equipment of the St. Catherine line, on which thirty-seven pay-as-you-enter cars were required in March and April. The months mentioned were chosen for comparison with the same months of 1905 to show conditions when all the cars were of the old type, and also to show there is nothing in the contention that in cold or disagreeable weather passengers would not have their fare handy and therefore would block others from entering.

Referring now to the accompanying table, it will be noted that in 1907 the March receipts were $53,227.50, or 27.69 per cent greater than in 1905; similarly the April receipts were $52,626.67, or 31.23 per cent greater in 1905, notwithstanding that there were no additional cars put on this line during these months. The receipts per car-hour increased 52.87 per cent for March, and 50.28 per cent for April. The increase in the receipts per car mile were 38.92 per cent and 40.67 per cent. The average percentage increases per car hour and per car mile on the entire system was: per car hour 24.09 per cent March, 1907, compared with March, 1905, and 27.14 per cent April, 1907, compared with April, 1905, and per car mile—17.35 per cent March, 1907, compared with March, 1905, and 19.99 per cent April, 1907, compared with April, 1905.

The favorable influence of the new car on schedules is shown by the fact that the operating speed for March increased from 7.60 miles to 8.34 miles, and for April from 7.75 miles to 8.32 miles. The car hours were reduced from 23,938 in March, 1905, to 20,048 in March, 1907, or fully 16.25 per cent; the corresponding reduction for April was equal to 13.18 per cent.

The ordinary type of car used early in 1905 on the St. Catherine line seated the same number of passengers as the pay-as-you-enter car and had a platform of five feet, while the pay-as-you-enter car has a larger platform.

The decrease in platform accidents naturally has been very great, because the conductor is always stationed at the back of the car, where he can control the entrance of all and the exit of most of the passengers. Those leaving through the front door, of course, are observed by the motorman. During all of 1906 there were but two slight accidents on pay-as-you-enter cars.

The operation of this car has attracted a great deal of attention among street railway managers, a number of whom have either visited Montreal in person or sent experienced employees to study these cars in service. Orders for these cars have already been placed by the New York City Railway, the Chicago City Railway, and the International Railway Company, of Buffalo. In Montreal, a number of these cars are now also in use outside of the St. Catherine Street line, and additional ones are being put on as fast as the cars can be built.

MONTREAL STREET RAILWAY COMPANY
ST. CATHERINE LINE, WITH PAY-AS-YOU-ENTER CARS

	Receipts		Cars		Car Hours		Speed		Mileage		Receipts per Car Hour		Receipts per Car Mile	
	1907	1905	1907	1905	1907	1905	1907	1905	1907	1905	1907	1905	1907	1905
March	53,227.50	41,684.37	37	39	20,048	23,938	8.34	7.60	167,176	181,850	2.66	1.74	31.84	22.92
April	52,626.67	40,101.92	37	38	19,243	22,163	8.32	7.75	160,148	171,678	2.72	1.81	32.86	23.36
	PER CENT INCREASE													
March	27.69%				16.25%*				8.07%*		52.87%		38.92%	
April	31.23%				13.18%*				6.72%*		50.28%		40.67%	

*Decrease.

* See Jan. 27, 1906; June 3 and May 20, 1905, Street Railway Journal.

FIRST FALL MONTHLY MEETING OF AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The American Society of Mechanical Engineers will hold the first monthly meeting this fall on Tuesday evening, Oct. 8, at 7:45, in the main auditorium of the Engineering Societies Building at 29 West Thirty-Ninth Street, New York. The subject of this meeting is Industrial Education. The college technical courses and the student apprenticeship courses will be discussed at length by men who have been in charge of theoretical and practical institutions. Professor John Price Jackson has written a paper on the College Technical Courses and Apprenticeship Courses offered by manufacturing establishments. He gives data in the form of letters from several of the largest manufacturing establishments in America in which they outline the courses offered by the factories and explains the manner of conducting the same.

Dr. Henry S. Pritchett, president of the Carnegie Foundation and president of the Society for the Promotion of Industrial Education, and Professor Dugald C. Jackson, of Massachusetts Institute of Technology, and president of the Society for Promotion of Engineering Education, will deliver short addresses on the subjects allied to their societies. Other manufacturers have been invited to speak informally at the meeting of their experiences, and altogether it is expected that the meeting will prove interesting and instructive.

COLUMBUS MEETING OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

While the first fall meeting of the Central Electric Railway Association, held at Columbus last Thursday, was particularly interesting from every point of view, there was not the wealth of general discussion that has characterized some of the sessions in the past.

Messrs. Spring, Sloat and Ohmer, appointed by the president as a committee to prepare resolutions on the death of F. J. Stout, late general manager of the Lake Shore Electric, and A. W. Anderson, of Dayton, will make their report at the next meeting. Both of the deceased were members of the association and had taken an active part in its work. The esteem in which they were held was expressed feelingly by President Nicholl.

A special Pullman car has been secured for the use of the Ohio and Indiana men who will attend the annual convention of the American Street & Interurban Railway Association at Atlantic City. In addition to credentials from the Central Electrical Railway Association, it will be necessary to secure cards from the national association to take advantage of this service. A guarantee of eighteen passengers had to be made in order to secure the Pullman.

President Nicholl announced that, while the association is not wealthy, there is a balance of about $850 in the treasury. With expenses necessary in the future, all dues will be needed, however, and those who had neglected to remit were urged to do so, that the records might be kept clear and everything put in as good shape as possible. Four new members were admitted.

In presenting his report, F. D. Carpenter, chairman of the committee appointed some time ago to arrange and compile a set of standard train rules, said that the members had used every endeavor to familiarize themselves thoroughly with the rules of roads all over the country. To that end they secured copies of the rules of many roads, and from them selected only such as could be used to advantage by all interurban roads. Mr. Carpenter said that he is confident that they could be taken up and applied successfully upon all electric lines. Every precaution was taken to make the rules plain and accurate in language and convenient for the use of all who have to do with the train service.

Mr. Carpenter said that the rules take up about twenty-three pages of typewritten matter, and because of the time that would be required in reading them, they would be submitted without that formality. President Nicholl thought they should be adopted before the annual convention of the American Street & Interurban Railway Association, that the larger organization might have an opportunity to take them up in connection with its work along this line.

Objections were made to the adoption of rules that none of the members had heard read, especially since this association is considered the second most important of the kind in the United States. Argument was presented to the effect that the association would show a weakness in going before the national body with a set of rules that the members had little knowledge of and that they would be in a poor position to ask their adoption at Atlantic City. Mr. Norveil asked that they be read at once, even if the remainder of the day were consumed in the reading and discussion, as no more important subject could be brought before the association. Another member suggested that they be printed and sent to members for their consideration and that they be directed to communicate their approval or disapproval to the secretary before the date of the national meeting, the vote thus made to decide their adoption or rejection. This idea was seconded by another member, who said that rules meant to be standard should be thoroughly studied before any action is taken on them, whether they were in shape for presentation at the national meeting or not. President Nicholl stated that the rules, if adopted now, would be subject to amendment in the future when found necessary. Their adoption would not render them fixed and binding, if changes are found desirable at any time.

C. N. Wilcoxen stated that there seemed to be some confusion as to what the adoption of this set of rules means. The committee had tried to avoid all local fads, but had endeavored to make them broad and applicable to all roads. Their adoption will be in the nature of a recommendation of their use by members, but will bind no company. The report was simply offered as a complete set of rules, so that managers may revise their own rules in case they find the new ones an improvement. No one will be expected to use any of the rules that will affect his policy or work harm to his business. The committee has followed the example of steam road associations and the American Street & Interurban Railway Association in this matter. Both have recommended changes when necessary and will in the future. Following this talk, the question of adoption was put to a vote and was carried. On motion of Mr. Wilcoxen, Chairman F. D. Carpenter was instructed to have the rules printed and distributed among the members interested and to any others who desire them.

DISCUSSION ON CATENARY CONSTRUCTION

The paper read by G. D. Nicholl, electrical and mechanical engineer of the Indianapolis & Cincinnati Traction Company, on "Single Phase Catenary Line Construction," which is printed on page 516, called out a large number of inquiries. Mr. Nicholl, in answer to a question, said that sliding contact on the side and on top of the trolley had been discussed, but so far as he knew the side contact had never been used in this country. Answering a question by R. C. Taylor, the speaker said that there is little or no stagger in the trolley wire and that the wearing surface on the bows is from 8 ins. to 16 ins. About 15 lbs. tension is carried on the bow and has been found sufficient to keep it on the wire. The pressure is easily adjusted with springs, so that the bow will follow the trolley in a variation of from 16 to 22 ft. above the track. The collector consists of a bar of copper 16 ins. long and about 3 ins. wide, placed in the center of an oak strip 40 ins. long and ½ in. thick. As the sides are flanked with aluminum, the sliding surface is really 6 ins. wide. Two grooves on the top, ¼ in. wide, are filled with grease for lubrication. The bows are good for from 1500 to 2000 miles, although there is quite a little difference in them so far as their durability is concerned.

In answer to a question by F. J. J. Sloat as to whether the bow trolley could be applied to the usual d. c. lines and how it could stand the arcing, Mr. Nicholl said that with the contact wire in line, held parallel with the track by the messenger wires, he believed it would work out all right. One of the points about the Indianapolis & Cincinnati Traction Company's line is that the trolley wire has been kept practically parallel with the tracks, thus avoiding the troubles that come through the effort of the trolley to reach the wire at various heights. Mr. Nicholl thought that either a sliding or rolling type of trolley could be used with satisfaction.

Mr. Nicholl stated that he had experienced no trouble with the catenary construction due to changes of tempera-

ture. The trolley line is more slack in summer than in winter, but as yet he had not been compelled to take up slack on the straight lines. There has been no kinking due to the difference in contraction of the trolley and the messenger wires. On curves it has been necessary once or twice to give some attention to the wire, but this was due to the poles giving in the ground. No trouble has been experienced from the messenger wires falling against the bracket arm and burning off, although the arms are not insulated.

Wheel trolleys have been used on the line at times, when the bow trolleys have given out. The wheels sometimes pound on the hangers, but no trouble had been encountered from arcing. Little trouble has resulted from breaking of the trolley. Once or twice it slipped out of the sleeve and caused a little inconvenience, but there has never been trouble with the trolley and messenger wire at the same time. Owing to the unevenness of the trolley wire in some places, the current collector occasionally shows some wear on the edges, but as any kind of a trolley will show wear, this can not be made an objection. Replying to a question by W. H. Abbott, he said that his road uses no trolley catchers, and in the past six months there has not been a bow trolley off the line.

A vote of thanks was tendered Mr. Nicholl for his paper and a suggestion made that this subject be continued at future meetings, as the members all seem to be very greatly interested in it and there is a lack of information as to the actual operation of the single-phase system.

DISCUSSION ON FIRE INSURANCE

In discussing the report of the committee on insurance, which is published on page 513, C. D. Emmons said he understood the plan included the payment of 1 per cent of the gross earnings into the premium fund, and asked Mr. Staats, the chairman, if he was not wrong in stating the agents of the old-line companies receive a commission of from 20 to 25 per cent. Mr. Staats said that he referred particularly to Cleveland, Cincinnati, Chicago and some other large cities when he gave those figures, since agents in those cities receive more than in the smaller cities and towns over the country. Mr. Staats referred to the reduction of the rates on the properties of the Cleveland Electric Railway Company, from $1.50 to 15 cents per $100, but of course the properties had to be protected with sprinkler systems to secure that figure. Mr. Staats said it would not be necessary for railway companies to protect their properties with sprinklers to secure the benefit of the service of the American Railway Insurance Company, and that properties in small towns, where there is little or no fire protection, would be taken care of. The inspection bureau maintained at his office would fix an adequate rate in each case, and then at the end of the year the amount not used in paying losses would be returned to the owners of the properties. The intention is to protect all the properties at actual cost. If the old-line companies are carrying insurance on properties of any company under cost, then that company will be advised to let them carry it as long as they will. It is the province of the railway insurance companies to secure low rates for the railway companies and not to make money, so there is no incentive for the officers to advise a change as long as the insurance is being secured at or below cost. But the old-line companies can not continue to carry business at less than cost, and when they attempt to increase the rates to a point which is excessive, then the railway insurance companies will take the business and carry it on their plan.

J. C. Rotherty, of West Virginia, stated that last year the rate on their properties was $1.70, but this year it had been advanced to $2.45, although there had been no change in the risks and no reason for the action, except to get more money, which the companies claim they need to even up the losses on the San Francisco business. In this case the insurance amounted to about $125,000 and the advance made considerable difference. He believed the new plan should receive the support of the association, as the losses would then be paid promptly, while they are now evaded, if possible. He suggested that the report be printed, and made a motion to that effect, which was carried. Mr. Staats offered to bear the expense of printing and distributing the report.

ADOPTION OF STANDARDIZATION REPORT

R. C. Taylor, chairman of the standardization committee, in presenting the report printed on page 517, said it was an amendment to the one presented May 23. The standards recommended are practically the same as those approved by the committee of the American Street & Interurban Railway Engineering Association at its New York meeting, except that no provision is made for narrow tread wheels and an axle 7½ ins. in motor fit, with the same dimensions as the 7-in. axle of the Engineering Association, is recommended. The report was approved and adopted with practically no discussion.

DISCUSSION ON EXPRESS BUSINESS

The report by A. A. Anderson, chairman of the express committee, was read by J. F. Starkey, the writer being absent. An abstract of this report is printed on page 514.

C. D. Emmons, general manager of the Fort Wayne & Wabash Valley, stated that his company had a temporary arrangement with the United States Express Company, which had been forced to close its offices along the Lake Shore & Michigan Southern some time ago, and that the Wells-Fargo Express Company had been endeavoring to make a contract. He said that it is a question whether an express company operated by a small system would be profitable, unless connections could be made with the old-line companies at the larger towns and cities, so that through business might be cared for in that way. It seems to resolve itself into the question as to whether it is better to make individual contracts with the express companies than for all the railroad companies to get together and contract as a body.

Mr. Starkey said that he was afraid that an express arrangement with the old companies would flood the cars with express traffic to the detriment of the passenger service. The passenger business was the most important at this time and should receive first consideration. Mr. Kenworthy replied that all companies should provide themselves with sufficient equipment to take care of all business offered, providing the financial return makes it attractive.

F. J. J. Sloat related an interesting experience with an express company, in which he showed that electric railway companies may build up a good business of their own by hard work and the exercise of a little patience. His company at one time had a contract with the Wells-Fargo Express Company between Dayton and Hamilton. In July, 1899, the railroad company's portion of the receipts was $125. This contract was finally canceled and the company put on its own express car. For two years the business did not amount to as much as had been received that month from the Wells-Fargo people. Within five years, though, a business of $75,000 annually was built up. The rates of

the Southern Ohio Express Company, which was organized to take care of this business, are somewhat higher than the freight rates of the steam roads, yet low enough to attract the business from the other express companies. Rates on some classes of merchandise are too low, perhaps, but they may always be amended to suit the cost of hauling. The secret of success is hustling in the smaller as well as the larger towns and cities. In the small places especially the old companies make no effort to get business, but merely take what comes to them. By putting out wagons and solicitors in these places his company soon built up a good business and came to be recognized as a carrier. He believed that almost any road may build up a business for itself in that way.

The agreement of the Detroit United and allied roads with an old-line express company was explained to some extent, although the terms of the contract were not made known. A fixed guarantee contract has been made with the company, the business to be done on a tonnage basis. Regular freight cars are used for carrying the expressage. The increase in the business will necessitate additional equipment, perhaps, and the question with the carriers is whether the additional income will be in proportion to the cost thus incurred. In addition to the tonnage price, the express company pays a portion of the salaries of conductors, when they perform messenger service. Agents of the railroad company also act as agents of the express company at a number of points and are paid for the service by the company.

DISCUSSION ON 1200-VOLT MOTORS

The talk of E. H. Anderson of the General Electric Company on the 1200-volt system was based principally on the paper published in the STREET RAILWAY JOURNAL of June 29, 1907, and on one by W. J. Davis, Jr., published in the STREET RAILWAY JOURNAL of Sept. 7, and entitled "High Voltage, Direct Current and Alternating Current Systems for Interurban Railways." During his remarks he disclosed the fact that the 125-hp d. c. motors ordered by the Southern Pacific Railroad for its Oakland lines will be built for 1200 volts.

In answer to a question by W. H. Abbott, Mr. Anderson said that ventilation is important, but that the closed motors are being used largely to keep out brakeshoe dust. As to insulation, asbestos and mica were coming into more general use, but the former contains so much iron that compounds are necessary. It also powders when heated, thus making necessary the introduction of some other substance with it.

Mr. Anderson said that sub-station apparatus for the 1200-volt machines may be made by using two 600-volt rotaries in series or the regular sub-station sets made for them.

MISCELLANEOUS

C. N. Wilcoxen was appointed an additional member of the delegation from the association to the meeting of the national organization at Atlantic City, to give special attention to the action taken regarding train rules, and support the report made at this meeting on the subject. The other members of the committee are: F. D. Carpenter, chairman, Lima, Ohio; C. D. Emmons, Ft. Wayne, Ind.; C. A. Baldwin, Anderson, Ind., and F. J. J. Sloat, Dayton, Ohio.

It was also announced that the standardization committee would have a report on brake apparatus at the next meeting, which will be held in the Claypool Hotel, Indianapolis, on the fourth Thursday in November.

REPORT OF COMMITTEE ON FIRE INSURANCE*

We have organizations for co-operating along lines reaching out to every branch of the electric railway business, but one field that has not been cultivated and to a very large extent overlooked has been that of fire insurance. I am fully convinced that through unified action on the part of the Central Electric Railway Association, and by co-operation with other associations having risks of a similar character much good can be accomplished in reducing insurance to a minimum cost.

There is no important branch of the electric railway business that has received less attention and yet deserves greater consideration than the insurance of our valuable interests against loss by fire. We pay in the aggregate hundreds of thousands of dollars annually to insurance companies. So far as I have been able to learn only a small per cent of this money is returned to the policy holders in fire losses on electric railway properties. I am confident that from one-half to two-thirds of the money paid for insurance premiums by electric railway companies can be saved through co-operation with the American Railway Insurance Company.

After very careful consideration on the part of the executive officers of a number of the leading electric traction and electric light companies as to the best plan for producing the lowest cost of insurance, it was decided that it was not only feasible, but advisable, for said companies to perfect their own organization and to surround themselves with the best methods for safeguarding their properties against fire loss.

The American Railway Insurance Company has completed its organization with a capital and surplus of $500,000, subscribed by individuals connected with electric traction and electric light companies. The officers and directors represent thirty traction and lighting companies. An inspection and survey bureau has been established with offices in the Citizens Building, Cleveland, Ohio. Expert underwriters have been employed and the services of experienced engineers secured.

The amount of each subscription has been fixed on a basis of 1 per cent of the gross earnings of each separate traction and lighting company for the year 1906. For example, if the gross earnings are $1,000,000 your subscription will be $10,000. By this method each electric railway or electric light company adds to the capital and surplus of the organization, and through co-operation the fund will be increased to an amount that will warrant our companies in time to carry their own insurance in their own organization.

The Electric Mutual Insurance Company and the Traction Mutual Insurance Company have been incorporated under the laws of Ohio, and will co-operate with the American Railway Insurance Company in writing business. These companies, however, will be conducted on the plan of the Factory Mutual Insurance Companies, which has proven very successful during the past seventy years.

Electric traction companies and electric light companies of the United States have found that it has been impossible to secure from what is commonly known as old line or stock insurance companies satisfactory rates of insurance, and for the following reasons:

First. The stock companies are controlled by a limited

*Presented by Henry N. Staats, chairman, at the Columbus meeting of the Central Electric Railway Association on Sept. 26, 1907.

number of stockholders. Their desire is to make as large an amount of money on their investment as may be possible. Therefore, their prime object is to secure in every instance as high rate of insurance as can be obtained.

Second. The present method of stock insurance companies of paying from 20 per cent to 25 per cent of the entire premium as commission to agents is a wrong principle. This commission is a strong inducement for the agents to accept undesirable properties to obtain their commissions. Through these methods good properties are compelled to help pay losses on undesirable properties.

Third. There is no sufficient reason for placing electric railway and electric lighting insurance in the hands of strangers whose only object is to make the maximum amount of money out of their business.

Fourth. It is a part of wisdom for the traction companies and electric light and power companies to have their own insurance organization, that they may bring their insurance down to actual cost. This can be accomplished by the united action of the traction companies and electric lighting companies in following out correct principles of underwriting.

Two years ago H. J. Davies, secretary of the Cleveland Electric Railway Company, mailed to every street railway company in the United States and Canada, a letter requesting a report, showing the amount of money paid for fire insurance for the ten years from Jan. 1, 1895, to Jan. 1, 1905, the amount of losses sustained and the amount actually recovered from fire insurance companies. Reports were received from about 420 companies, and these show that there was paid for fire insurance premiums by said companies $6,049,641.45. There was recovered $1,673,336.27 from insurance companies by fire loss, leaving a balance of $4,376,305.18 to the credit of the insurance companies.

These figures prove beyond question that electric traction companies of the United States and Canada have been paying excessive rates of insurance, and some of the leading traction companies have felt the burden of this heavy taxation to such an extent that they have established a fund to carry their own insurance. This plan has not proven entirely satisfactory for the reason that the insurance fund in many instances has been drawn upon to promote other interests of the traction company.

There are a few companies, however, who have been eminently successful in carrying the major portion of their insurance under their own insurance fund. I refer to the United States Steel Corporation, the Pennsylvania Railroad Company and the Philadelphia Rapid Transit Company. The last named company has for years set aside sums for this purpose until its insurance funds amount to $1,600,000. The interest on this accumulation is sufficient to keep up this amount. No single loss can exhaust this fund, for the company has not $1,600,000 worth of property in any one location, unless it be at its power plants, which are substantially fire proof, or at least certainly not subject to a total loss. Not many electric light companies are able to do what the Philadelphia company has done. Several of them, however, may unite to carry their own insurance—and this is exactly what some of us are trying to do for the benefit of all of us.

The plan of organization and working of the American Railway Insurance Company, the Electric Mutual Insurance Company and the Traction Mutual Insurance Company has been approved and endorsed by the American Street & Interurban Railway Association and by the Central Electric Railway Association. The American Railway Insurance Company has recently been admitted to membership in the National Electric Light Association. W. H. Blood, insurance expert of the association, approves the plan.

If these great associations will co-operate in establishing an insurance organization composed of their members, confining lines of insurance to their own properties and kindred risks, employ expert underwriters and skilled engineers to conduct their business, we will in a comparatively short time compel the so-called old-line insurance companies to lower materially their basis rates of insurance; and, through our own organization we will be enabled to carry a goodly portion of our insurance at actual cost, and at the same time build up a power by which we can hold down the reduced rates that may be given by other insurance companies.

I would, therefore, strongly urge that each member of the Central Electric Railway Association co-operate in this very important movement to bring about reduction in rates of insurance on the properties of electric railway companies.

REPORT ON HANDLING EXPRESS BUSINESS ON INTERURBAN CARS*

Inquiries were sent to eighty interurban roads of Indiana, Ohio and neighboring states, including members and nonmembers of the association, to learn what roads have contracts with old-line companies. Opinions were asked as to the advisability of entering into contracts with old-line companies or of organizing an independent, interurban express company. Interurban companies having contracts, were asked for copies of same or detailed information as to the terms of their contracts and compensation. Information and suggestions were solicited and the purpose of the inquiry fully set forth.

Replies were received from twenty interurban railways, giving information with reference to twenty-three properties. Four of the companies operate under one contract. Replies were received from seventeen interurban companies that they have no contracts with the old-line companies.

Five interurban companies have received proposals for express contracts from old-line companies as follows: The Wells-Fargo Company, three; the Pacific Express Company, one, and one company, name not given. The proposal received from the Pacific Express Company was offered on a mileage basis but was rejected, as the interurban company was unwilling to enter into an agreement on that basis, the interurban company offering to go into an agreement on the basis of 50 per cent of the revenue derived from such business. The interurban company which rejected a proposal from an old-line express company preferred to act independently.

One of the interurban companies declined a contract with the Wells-Fargo Company, assigning as a reason that, inasmuch as practically express service is given to a considerable quantity of small freight, and for a rate scarcely higher than freight rates, but which seems to get for the traction lines more freight business than they could otherwise, it would be unwise to enter into an arrangement with the old-line express company, as it would interfere with their business if this express service for small freight was continued.

Another interurban company rejected a proposition from the Wells-Fargo Company, believing that the organization of an interurban express company would be better than to

*Abstract of report presented at the Columbus meeting of the Central Electric Railway Association on Sept. 26, 1907.

go in with any of the old lines, and thinks it best not to handle any express business, only such as is handled in the regular way, by their passenger combination cars and regular baggage cars and freight cars. The third interurban company was offered a contract by the Wells-Fargo Company on a tonnage basis, which was not satisfactory.

Seven of the interurban companies heard from, favor the organization of an independent interurban express company. One of the companies gives no reason for such conclusion. Another favors the organization of such a company because it has tried to make contracts with old-line express companies, which refused in every instance to enter into any arrangement. A manager of one of the seven interurban roads favoring the organization of an independent company, writes as follows:

"The writer has been in charge of this property since 1886, during which time for sixteen years the road was run as a steam road exclusively. We are now operating by electricity in the passenger business and steam for freight. Our experience with old line express companies was of short duration. We had the Adams Express on our road for three months, with poor results. This was in 1886. I then got our people to let me organize our own express at that time, and we called the Adams Express off the line. Since then the road has been very successful with this express business, and if you will look in *Bullinger's Guide* you will notice that the Cincinnati, Georgetown & Portsmouth Railroad appears there as one of the express companies. We have all our own blanks, which are independent from our freight department. We have our messengers on our express cars and our regular agents do all the billing. We handle C. O. D. business, bills and notes for collection. We handle cash packages from banks to banks and do a very large parcel business. Our experience is that any line having a mileage sufficient is justified in organizing its own express, thereby enjoying the entire revenues on same. We connect with and have the confidence of all the large express companies at Cincinnati, exchanging business with them daily. It must be remembered that the old line express companies retain, as I understand it, either 40 or 60 per cent of the gross earnings. Besides this, you have their messengers to haul, and another matter of great importance is the fact that you do not get to check up any of their business. You cannot state at any time what you are entitled to or what you are hauling, as you have no access to the billing, unless they have made new rules of which I know nothing. We have frequently had the old line express companies come around and endeavor to contract with us, but have always declined any advances and have never given them any encouragement."

A second writer says:

"At the present time we think it best not to handle any express except what is offered in a regular way in our passenger combination cars and regular baggage and freight cars. In the course of a year or so, after a lot of the missing links are built, we think an interurban express company can be operated successfully."

A third writer says:

"It seems to me that it would be preferable for interurban roads operating over any considerable stretch of territory to handle express matter through the organization of an independent express company, rather than to do so through the old line express companies. On the other hand, for properties operating interurban roads of comparatively short lengths, it would probably be better to have a contract with an old line express company, though if the business was of sufficient magnitude, an independent express company, which would practically be 'a wheel within a wheel,' would doubtless be a good source of revenue. Doubtless a contract with an old line express company would have to be on a tonnage basis, the express company getting most of the profit, and its shipments taking up space in the interurban cars, which might otherwise earn more per trip."

Five different interurban roads do not favor the organization of an interurban express company. Some of the reasons are as follows:

"I am not in favor of entering into an arrangement whereby interurban roads are to do their own express business, since we have an established freight business that equals anything in service that the old line express companies could offer, but at a lesser rate. I fear if the interurban lines should undertake to inaugurate a service of this kind at a high rate, it would demoralize the freight business. This may not be true with certain interurban lines, but with competition of steam roads, it would work out that way with us.

"My impression is that if a proper contract would be made with old line express companies which do not otherwise reach the territory traversed by the traction lines, that it would be a good thing to have such an agreement. It appears to me that a purely interurban express company would not, for years, be able to reach territory and obtain shipments that the old line companies would be able to obtain."

Five other interurban companies express themselves very decidedly in favor of contracting with old-line companies. Two of these companies are now operating under contracts and one of them assigns as a reason that the law in Indiana requires express companies to make delivery of express. By the handling of the business as freight, the interurban companies get away from the delivery obligation. Any matter handled as express, in connection with an old-line express company would put the delivery on the express company.

Replies were received from four different companies having contracts with old-line companies. Two of them operate contracts in connection with two other interurban roads. These are as follows: The Iowa & Illinois Railway Company of Clinton, Ia., which has a satisfactory tonnage contract with the American Express Company for carrying its express between Clinton, Davenport, Rock Island and Moline. The Evansville, Suburban & Newburgh Railway Company, operating between Evansville, Newburgh and Booneville, has a contract with the old-line companies. The Western Ohio Railway Company, the Dayton & Troy Electric Railway Company, the Springfield, Troy & Piqua Railway Company, and the Toledo, Urban & Interurban Company have a joint contract with the Pacific Express Company for a period of five years, the interurban companies receiving 50 per cent of the gross earnings. The Columbus, Delaware & Marion Railway Company has a contract with the Wells-Fargo Express Company, the Northern Ohio Traction Company has a contract with the American Express Company. The Lake Shore Electric Railway Company and Cleveland, South Western & Columbus Railway Company have a contract with the Wells-Fargo Company and the U. S. Express Company, all on a tonnage basis. The Ft. Wayne & Wabash Valley Traction Company has a temporary working contract with the United States Express Company on a percentage basis.

The conclusion of the committee is, that although little has been done along the line of contracting with old-line express companies, there seems to be a general opinion in favor of the same. For each company, or the few companies who operate connecting lines, to operate separate express companies, would make so many, that the work of auditing and getting at the proportion due the various companies would be immense. If an electric express company could be organized, and all the electric railroads become members of same, they to exchange business with the old line companies at points wherever convenient, some additional revenue might be derived.

As one manager puts it: "The matter is one which depends largely on local conditions as to the advisable course to pursue, and furthermore is one which requires careful investigation of costs and revenue to be derived from the service. It is a question of similar interest to that of the interchange of freight with steam roads, and into both must

necessarily enter a question of policy, which would naturally be governed by not only the resulting revenue from, and cost of the service, but also the effect it would have on interurban companies with the public, with the steam roads, and the laws bearing on both."

SINGLE-PHASE CATENARY LINE CONSTRUCTION *

The object of this paper is merely to promote a general discussion of the relative merits of catenary construction for the operation of high-voltage electric railways. While there are some high-voltage direct-current railways under construction, I believe none is in commercial operation at the present time, and these remarks will bear particularly on line construction for alternating-current railways.

The introduction of the single-phase alternating-current railway motor brought about the possibility of delivering energy to the car equipments at high voltages, and decreasing the investment necessary in copper for the distributing system.

It has also been a problem to collect the current for heavy equipments at high speeds with the ordinary type of wheel trolley, and considerable experimental work has been done to develop a current collector of the sliding type. There is a difference of opinion among engineers as to whether the current collector should be of the underrunning type or make contact with the conductor on the side or top. In this country, however, the general practice has been to use the underrunning type of current collector with the trolley wire over the center of the track. To operate the sliding current collector successfully at high speeds, it is necessary that the trolley wire have a practically smooth and even surface, free from kinks that might cause the sliding current collector to break contact.

Various types of catenary construction have been proposed for different classes of railway service. For trunk-line railroads having two or more tracks, the double catenary will undoubtedly be used, the messenger wires being supported from steel bridges spanning the tracks. This class of construction has two messenger wires spreading at the points of support and converging at the center of the span, the trolley wire being supported from both messenger wires by hangers of various lengths. A tie also is used between the messenger wires at each trolley support. This type of construction has been used by the New York, New Haven & Hartford Railroad on its electrified division near New York City. This class of construction is expensive, and its cost is not warranted for the average interurban line of the Middle West.

Single catenary consists of a single messenger wire with the trolley supported directly underneath by means of hangers of various lengths. The lines of the Indianapolis & Cincinnati Traction Company have single catenary construction. The line from Indianapolis to Rushville was built in the fall and winter of 1904-5, and was, I believe, the first single-phase alternating-current railway in commercial operation using the catenary trolley construction and the bow or sliding trolley. On the portion of the line from Indianapolis to Rushville, the trolley poles are spaced 100 ft. apart. From the experience gained on this portion of the line, it was decided to increase the distance between the trolley poles, so that on that portion of the line constructed during the year 1906, the spacing of the trolley poles was increased to 120 ft. on tangent track; the distance between poles on curves depending on the degree of curvature. The shortest curve being of three degrees radius, the poles are spaced 50 ft. apart. The center of the poles is located 7 ft. from the center of the track.

The trolley brackets are made of 2-in. x 2½-in. x ¼-in. angle iron. The outer end of the bracket is drawn into a loop to form a support for the messenger wire insulator. The loop in the trolley bracket is 16 ins. long, to allow an adjustment of 8 ins. each side of the center line of the track for staggering the messenger and trolley wires and for aligning the trolley wire, due to the unevenness of pole diameters and adjustment of messenger wire on curves. The inner or pole end of the bracket arm is bent at right angles to the arm and is fastened to the pole by two through bolts, and the outer end of the bracket arm is supported by a ⅝-in. brace rod.

The messenger wire is supported on an especially designed porcelain insulator, cemented into a cast-iron base, fastened to the bracket arm by four hook bolts. The messenger wire, which is composed of seven-strand steel cable, having a nominal outside diameter of 7/16-in., is supported in the groove of the porcelain insulator and tied to it by a steel tie wire.

The trolley wire, of No. 000 grooved section, is supported from the messenger wire by steel hangers spaced 10 ft. apart. Five different lengths of hangers are used, twelve hangers being used between two poles on a 120 ft. span, as follows: Two 11-in., two 9-in., two 7¾-in., two 6¾-in., and four 6-in. hangers. The hangers are fastened to the messenger wire by a "U" clamp and a through bolt, and to the trolley wire by a screwed clamp that fits into the groove. On curves the trolley wire is held directly under the messenger wire by treated hickory steady strains, one end of the steady strain being clamped to the bracket arm and the other end to the trolley wire.

The messenger wire is anchored every mile, a pole being set on the opposite side of the track from the trolley poles and well anchored. A 7/16-in. steel cable is stretched diagonally across the track and securely fastened to the messenger wire. Extra heavy wood-strain insulators are placed in this anchor wire to insulate it from the poles, and the ends made up into turnbuckles so the anchor cable can be easily adjusted.

Section insulators of treated hickory are installed about every 11 miles. Connection is made to the trolley wire at each end of these section insulators by a knife-blade switch. Normally, this switch is open, but in case of trouble it can be closed and two sections of the line fed from one transformer station.

In towns, span wire construction is used, extra heavy wood-break insulators being placed in the span wires. The messenger wire is fastened to the span wire by clamps, permitting easy adjustment for aligning the messenger wire with the track. The same style and length of hangers is used on span construction as on bracket arm construction. On private right of way the trolley wire is supported approximately 18 ft. from the top of the rails.

Lightning arresters are installed, three per mile, with ground connections to a galvanized iron pipe driven 10 ft. into the ground.

In building this line, both messenger and trolley wires were run out at the same time and both pulled to the same tension; an equalizer being used between the two wires.

With the length of hangers noted above the trolley wire is supported at an almost uniform distance above the track rails, as the successful use of the bow or sliding trolley at high speeds requires this type of construction. The operation of the bow trolley has proved very satisfactory. There

*Abstract of paper presented by G. D. Nicholl at the Columbus meeting of the Central Electric Railway Association, Sept. 26, 1907.

has been no difficulty in collecting current at speeds of 65 miles an hour.

The insulation of these lines was designed to operate at 3300 volts alternating current, and no trouble has been experienced with this viltage. On several occasions the lines have been covered with sleet and wet snow, but no trouble developed.

REPORT OF STANDARDIZATION COMMITTEE

The Standardization Committee appointed to investigate standards as applied to electric railway equipment presented to the association at the Indianapolis meeting, May 23, 1907, certain recommendations covering the subjects of brake shoes and brake-shoe head and key, axles, journal boxes, flange and head of wheels, and rail sections.

The details of these recommendations were published in pamphlet form and mailed to the members of the association so that ample time might be allowed for full investigation and consideration of these important subjects, and it is hoped that all of these matters will be given thorough and complete discussion at this meeting.

Your committee realized when it submitted its report on May 23, 1907, that a great many of the details (although fully considered and thoroughly discussed in committee) were absolutely arbitrary and would undoubtedly result in a spirited discussion by the members of this association. Your committee also realized that any recommendations affecting such important subjects must be of the most practical kind and commend themselves to the executive and operating officials of the electric railway properties comprising our association, and also commend themselves to the manufacturers of the apparatus which we are attempting to standardize. With these facts in mind each member of your committee has exerted every effort to obtain the most extensive information on the various subjects. The chairman of your committee, by virtue of his membership on the Standardization Committee of the American Street & Interurban Railway Engineering Association, had the privilege of discussing the proposed standards in detail on July 26, 27 and 28, at Cleveland, Ohio, with representatives of the General Electric Company, Westinghouse Electric & Manufacturing Company, Cast-Iron Car Wheel Manufacturers Association, Standard Steel Wheel Company, Schoen Steel Wheel Company, American Brake Shoe & Foundry Company, Columbia Brake Shoe Company, Symington Journal Box Company, J. G. Brill Car & Truck Company, Pennsylvania Steel Company, Lorain Steel Company, and William Wharton, Jr., & Company.

As a result of these investigations and discussions and as a result of the meeting of your committee, held at Columbus, Sept. 25, it is respectfully recommended that the following standards be adopted by this association:

AXLES

The four standard axles recommended are shown in the accompanying illustrations. They have been slightly modified from print No. 75 (Fig. 1) of the Central Electric Railway Association, dated May 7, 1907, to meet the requirements of the General Electric and Westinghouse companies, manufacturers of railway motors. Both of these companies agree that it is absolutely essential on the two largest axles to provide 50 ins. between wheel hubs to accommodate motors from 150 to 250 hp. Axle E. A. has a standard 3¾-in. x 7-in. journal. It is designed to carry a load of 15,000 lbs. per axle and accommodate motors up to 50 hp. Axle E. B. has a standard 4⅛-in. x 8-in. journal and is designed to carry 22,000 lbs. per axle and to accommodate motors of a 100 hp. Axle E. C. has a standard 5-in. x 9-in. journal and is designed to carry 31,000 lbs. per axle and may accommodate a motor of 150 hp. Axle E. D. has a standard 5½-in. x 10-in. journal and is designed to carry 38,000 lbs. and may accommodate motors of 250-hp capacity.

Special attention is directed to all the dimensions of these axles, which were carefully considered by the committee and

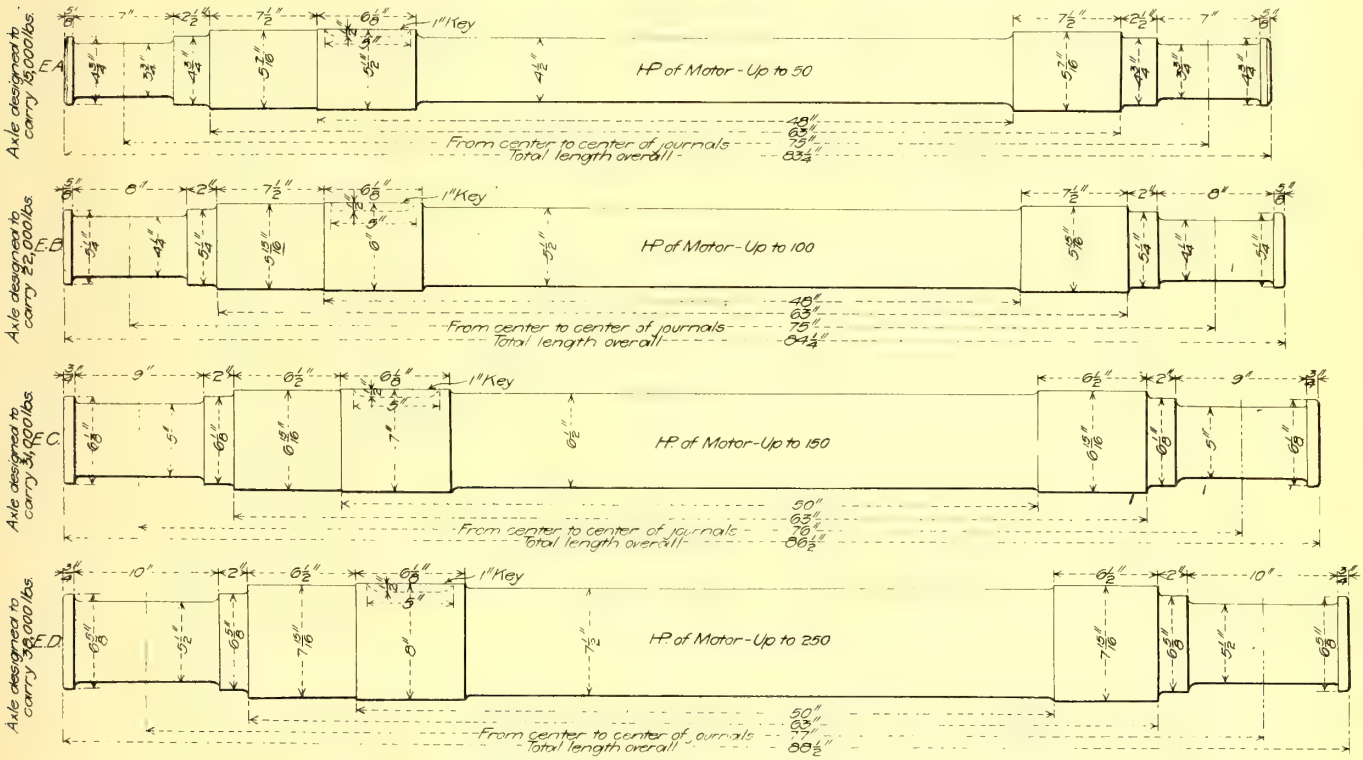


FIG. 1.—STANDARD MOTOR AXLES RECOMMENDED BY THE CENTRAL ELECTRIC RAILWAY ASSOCIATION.

recommended only after a full discussion with each other and with the manufacturers whose product is affected by the dimensions. The dimensions observed standardize at once the diameter and length of journals; diameter and length of wheel fits; diameter and length of gear fits; diameter and length of motor fits, and length, width and depth of gear keys. These dimensions are consistent with the best practice of successful installations and if adopted will result in commendable uniformity of everything connected with an electric motor axle.

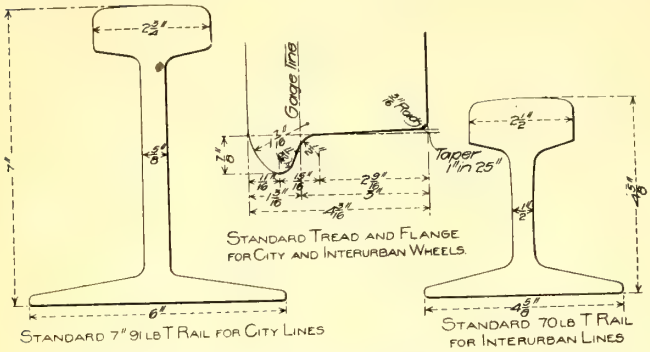


FIG. 2.—SECTION OF STANDARD CITY AND INTERURBAN WHEEL AND SECTIONS OF STANDARD 4⅝ IN. AND 7 IN. RAILS FOR CITY AND INTERURBAN SERVICE

BRAKE SHOES, BRAKE-SHOE HEAD AND KEY

Drawing No. 76 (Fig. 3) of the Central Electric Railway Association, dated May 7, 1907, shows in detail the recommendation of the committee on brake shoes, brake-shoe head and key. Two shoes are recommended, one with a flange to be used in situations where it is impossible to use a brake beam; the other a shoe without a flange which should be used wherever it is possible to do so. The design of the shoe head and key is identical so far as its attachment to the shoe is concerned with the M. C. B. standard. Either one of the shoes will fit this head. The flange shoe may be reversed by changing to the other wheel on the same axle. The flangeless shoe may be reversed on any wheel. The sketches show a pair of shoes designed for 33-in. wheels, but the radius and width of the rubbing surface may be modified for any diameter and tread of wheel used generally on electric roads. As the brake shoes are an expensive item of maintenance on all railways the recommended standards of this part of the equipment should find ready adoption and result in both mechanical and financial advantages.

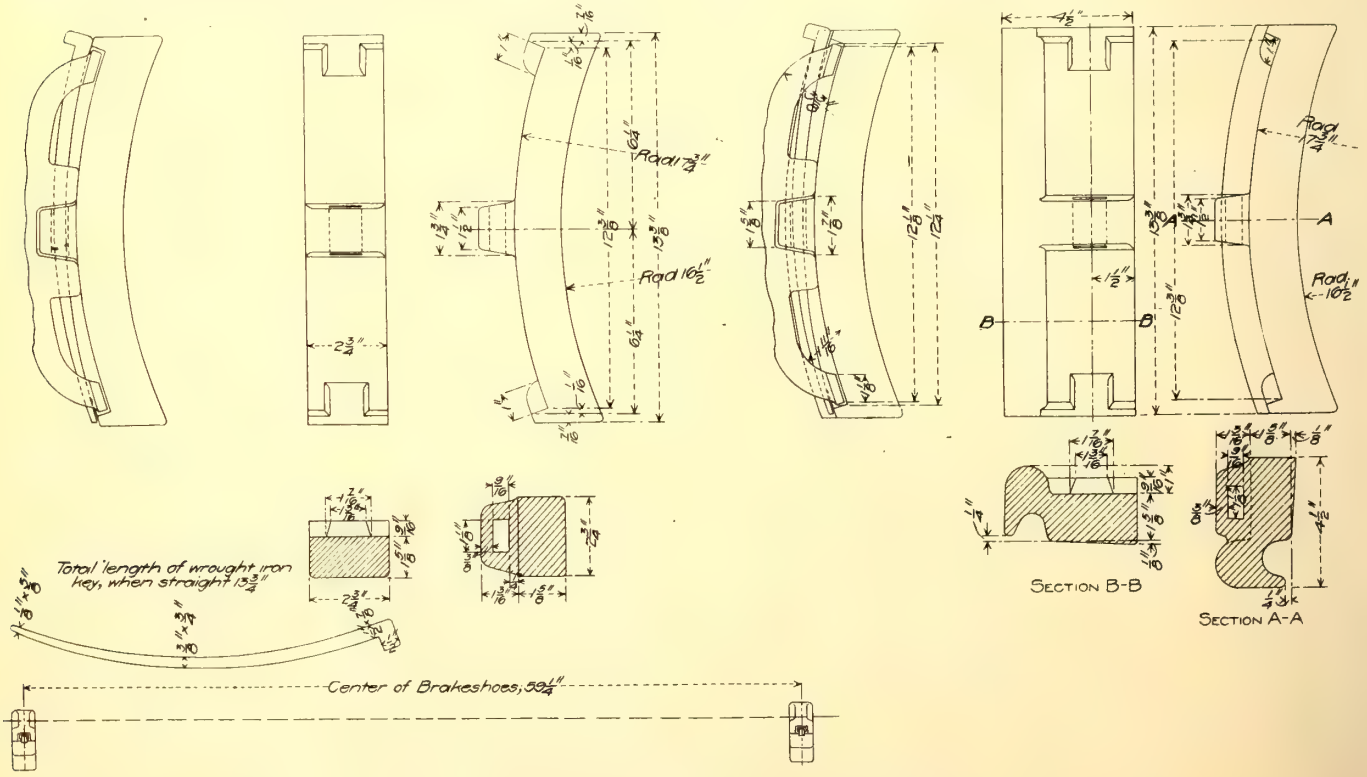


FIG. 3.—STANDARD BRAKE SHOES, BRAKE SHOE HEAD AND KEY

JOURNAL BOXES

Drawing No. 78 of the Central Electric Railway Association, dated May 9, 1907, showing pedestal-fit dimensions, was submitted as your committee's recommendation. After conferring with the manufacturers of M. C. B. boxes your committee desires to substitute in place of drawing 78 a series of sheets Nos. 79, 80, 81 and 82 (Figs. 4, 5, 6 and 7) of the accompanying illustration. These dimensions were worked out by Mr. Weston of the Symington Journal Box Company, and are a modification of the M. C. B. box to electric trucks. It will be observed that these drawings standardize the exterior as well as the interior dimensions and if adopted should result in decided commercial benefits to operating companies.

SECTION OF FLANGE AND TREAD OF WHEEL

Drawing No. 77, Central Electric Railway Association, dated May 8, 1907, shows details of recommended flange and thread 1 in. in 25 ins. instead of 1 in. in 32 ins., as previously new wheels and worn wheels were examined by your committee and it is believed the flange shown for T-rail construction will prove quite acceptable. Your committee after further consideration has decided to recommend a taper of thread 1 in. in 25 ins. instead of 1 in. in 32 ins. as previously recommended. It is believed that this taper will have a tendency to save flange wear.

RAIL SECTIONS

These recommendations are also shown on drawing No. 77 (Fig. 2). It will be noted that both sections are T-rail 7 ins. 91 lbs. for city streets and 70 lbs. American Society C. E. for interurban lines. Your committee is aware that due to municipal restrictions in many cities T-rail might not be

permitted and it is doubtful whether it would be possible to recommend a standard that would cover such cases. We have, therefore, recommended what is considered best practice and has been successfully used in a great many of our largest cities.

WHEEL HUBS AND GEARS

Drawing 83 (Fig. 8), Central Electric Railway Association, dated Sept. 20, 1907, shows the committee's recommendation on gears, gear hugs and wheel hubs. This supplements the committee's previous report, as it seems quite proper and

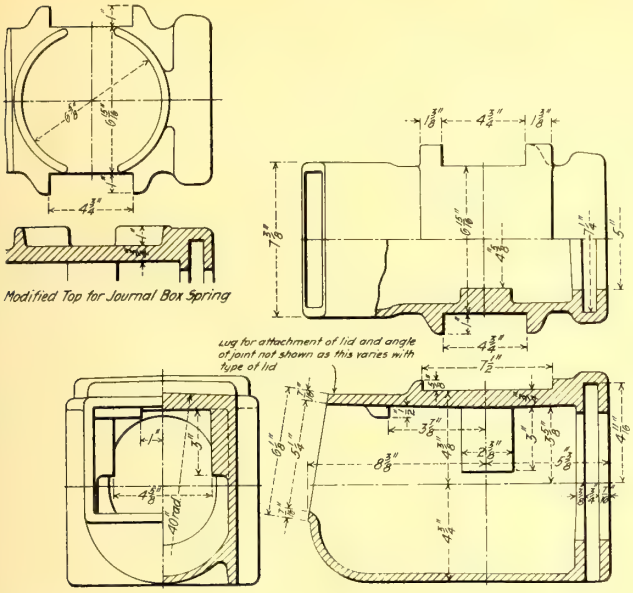


FIG. 4.—PROPOSED STANDARD, 3¾ IN. X 7 IN., JOURNAL BOX

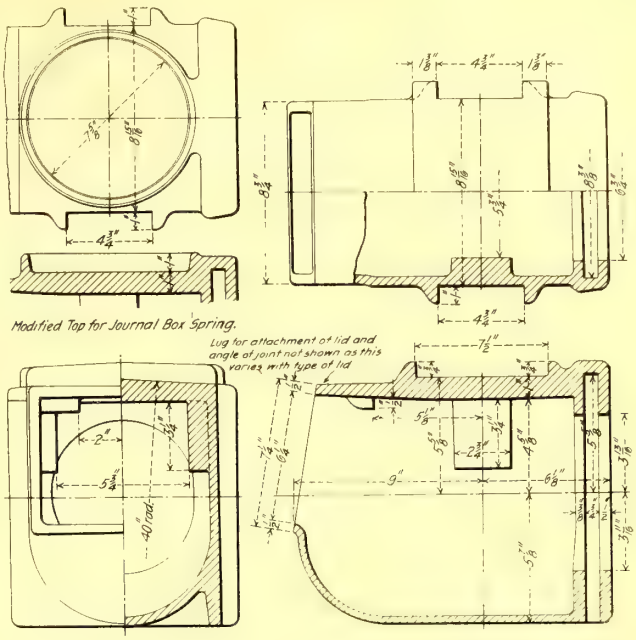


FIG. 6.—PROPOSED STANDARD, 5 IN. X 9 IN., JOURNAL BOX

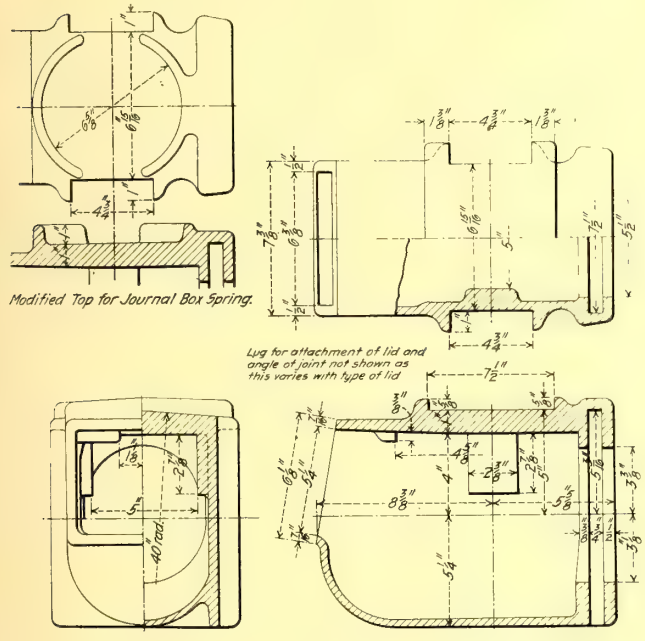


FIG. 5.—PROPOSED STANDARD, 4¼ IN. X 8 IN., JOURNAL BOX

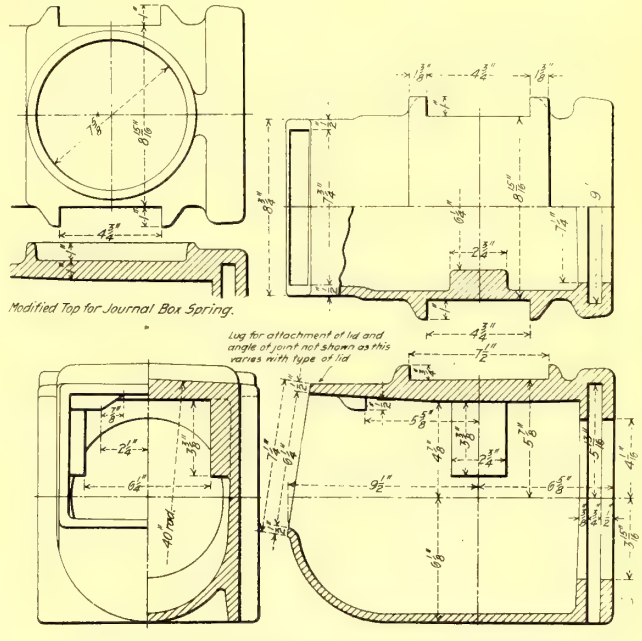


FIG. 7.—PROPOSED STANDARD, 5½ IN. X 10 IN., JOURNAL BOX

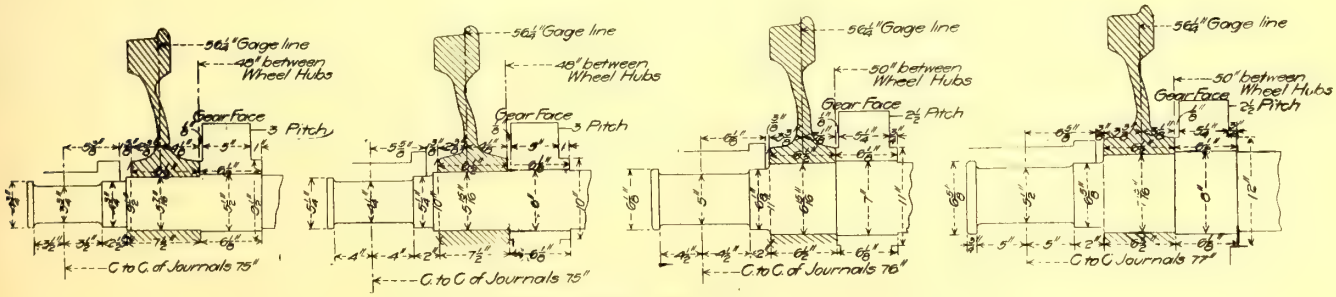


FIG. 8.—PROPOSED GEAR AND WHEEL HUB STANDARDS

E. A., 3¾ in. x 7 in. Journal; E. B., 4¼ in. x 8 in. Journal; E. C., 5 in. x 9 in. Journal; E. D., 5½ in. x 10 in. Journal.

desirable that these dimensions should also be standardized. Special attention is directed to the fact that all wheel hubs are the same length and the distance from the gage line to back of the hub fixed for all standard axles, the diameter of the wheel hub has been designed to give 2 ins. of metal all around the wheel fit this design, having special reference to steel centers or rolled steel wheels which at present seems to be the preferred practice on heavy passenger equipment.

Referring to gear-hub dimensions: These have been made 6⅛ ins. long for all axles. Our axles drawing shows 1-in. key 5 ins. long for all gears. The design of gear key seems to be undergoing at present a process of evolution and both of the motor manufacturers have signified their willingness to agree on the key dimensions. The committee, however, is unanimous in the opinion that with solid gears properly designed the gear key may be dispensed with entirely and with this fact in mind his proposed diameter of gear hub, allowing in each case 2 ins. thickness of metal around gear hub, so the gear may be pressed on with sufficient pressure to do the work without a key.

In making these recommendations your committee has been greatly assisted in reaching its conclusion by many of the members of this association as well as the representatives of the leading manufacturers of the country. It takes this opportunity of thanking all who have rendered their services for their invaluable co-operation in the work.

The committee also earnestly urges that final action may be taken on its recommendations by the association at this meeting, so the progress of its work in the future may not be impeded by uncertainty or indecision. There is still much work to be done by the standardization committee and its sub-committees and each member is encouraged to continue the work in the hope that as a result of this work some definite standards may be adopted which will give the very best results to the companies comprising this association.

ELECTRIC SERVICE ON THE DENVER & SOUTH PLATTE RAILWAY

The Denver & South Platte Railway Company, of Denver, Col., has started a half-hour service on the portion of its electric line which is completed from Englewood south. The new electric railway is not part of the Denver city tramway system, but it makes connections with every third Englewood car, and carries passengers to the first trestle on the Santa Fe line this side of Littleton. The line relegates to the background the old white horse which has been immortalized in story and picture, because he rides from Cherrylyn to Englewood on the rear platform of his car, after pulling it up the hill in the other direction. The Denver & South Platte road will be completed on south to Roxborough Park this winter, if the company's plans mature satisfactorily, and it is anticipated that the entire region lying south of Englewood will be materially benefited by being thus put in direct communication with Denver.

ANNUAL REPORT OF THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD

The annual report of the New York, New Haven & Hartford Railroad Company for the fiscal year ending June 30, shows gross earnings from operation of $55,601,936, as compared with $52,984,322 for the previous year; operating expenses, $37,850,081, as compared with $36,222,586, and net earnings from operation, $17,751,854, as compared with $17,761,735. The net income this year applicable to dividends is $8,803,041, as compared with $10,185,377 last year. The surplus after dividends is $1,988,053, as compared with $3,718,285 last year. President Mellen says that while the gross earnings show an increase of about 5 per cent, the operating expenses increased about 7 per cent. In regard to the Boston & Maine merger, President Mellen says: "If the Boston & Maine can be acquired with the good will of the public it now serves it should prove a profitable business venture, but if there is to be only unfavorable criticism, misrepresentation and disparagement, it may be well to proceed no further." The reduction in the passenger rate to two cents a mile on the whole system resulted in a gain of passenger receipts, where a considerable loss was anticipated.

JOINT MEETING OF NEW YORK ELECTRIC RAILWAY, GAS AND ELECTRIC MEN

On Tuesday evening, Oct. 1, the Street Railway Association of the State of New York held a joint meeting with the Empire Gas and Electric Association in the Concert Hall of Madison Square Garden. Before this meeting President Wilson entertained the members of the Street Railway Association's executive committee at luncheon in the Waldorf-Astoria, after which there was a conference on business matters.

Addresses were delivered by Hon. Frank W. Stevens, chairman of the Public Service Commission of the Second District; Henry J. Pierce, president of the International Railway Company, of Buffalo; Dr. Alexander C. Humphreys, president of Stevens Institute of Technology, and E. W. Burdette, chairman of the Public Policy Committee of the National Electric Light Association.

ABSTRACT OF MR. STEVENS' ADDRESS

Mr. Stevens, who as the first speaker was scheduled to speak on the work and policy of the Public Service Commission for his district, said that he did not want it understood that his remarks should be taken as an expression of the opinions of the entire board. He was glad that the meeting of the evening had been arranged because the representatives of public service corporations were certainly entitled to a full enunciation of their views on a law that is so thorough reaching, and they also had the right to know the attitude of the commission. No man could honorably accept the office of commissioner unless he was thoroughly imbued with the spirit and purpose of the new law and impressed with the existence of evils which that law seeks to correct. His first duty should be to subject himself to a critical examination as to his attitude toward the corporations placed under his control and supervision. No commissioner should forget that the public service corporations are absolutely indispensable to the public, and he should bear in mind that any attempt to cripple them means a corresponding injury to the public. Even if the evils complained of are true it does not mean that the commission should disregard the rights of the corporations. It would not do to right one wrong by committing another. The great function of the commission should be to promote the efficiency of the public service corporations. He felt that the commission was entitled to the hearty support of the corporations; first of all, because it is the law of the state. He was glad that up to this time there had been no indication on the part of any of the public service companies in the Second District that they did not intend to obey the law.

There were many things, of course, which the commission was being called upon to examine, but there were several to

which he desired to call particular attention. The subject of accidents was one, for human life seemed to be held too cheaply. Investigations made by him only since the first of July had shown that five deaths in the state were directly attributable to the lack of proper care and attention to the rules on he part of the railways concerned. The second important work of the commission was the control of stock issues, bonds and other obligations. This was not so simple a duty as it would seem. It is true that in many cases it is easy to distinguish between just and fictitious capitalization, but there are plenty of instances where it is very hard to draw the line. The third duty of the commission was to find how much truth there was in the complaints of the public regarding poor freight and passenger service. Certainly there is some ground for such complaints, at least on steam railroads, as he knew from personal experience. The commission was determined to know how these evils could be corrected, and if the delays in freight handling were due to the fact that business had grown faster than the capacity of the railroads to handle it, it would be well to know it.

After the conclusion of Mr. Stevens' talk, Henry J. Pierce, president of the International Railway Company, made an address on the electric railway situation of to-day. The address follows in slightly abbreviated form:

THE ELECTRIC RAILWAY SITUATION OF TO-DAY

Nearly every public utility company in the state is represented here to-night. This gathering in open council and friendly spirit between the commissioners, in whose hands such great power has been placed, and representatives of the corporations, whose affairs they will in future control, should mark an era in business life.

It would be well for the country, for the welfare of its financial institutions, for its business prosperity, for the stability of the investments of people, both rich and poor, if, when those high in authority speak, they should not judge all corporations by the few who have done wrong, but also should bear in mind that the great majority of corporations are conducting their affairs honestly and in the interests of the people whom they serve.

Justice in public utterance is as essential as justice in private act. Fairness in official conduct is as necessary as honesty in daily business. In this practical age nothing should be done in the shadow of secrecy that cannot bear the light of day, and nothing should be done in the glare of publicity that cannot bear the close impartial scrutiny of honest private analysis.

The dual duty of a public utility corporation is to provide good service to the people from whom its franchise was obtained, and to return to its stockholders a reasonable profit on their investment. The electric street railway may not increase its fare, yet wages have increased, and the cost of material has advanced over 40 per cent in three years. The public are ever expecting greater facilities, which require heavier track, larger cars, increased power, more car houses, more efficient, and therefore, higher priced trainmen, better and more frequent renewal of pavements, extension of tracks into sparsely settled neighborhoods, while the state and municipalities are constantly increasing taxation.

Under this combination of circumstances, one of four things must inevitably occur:

Poorer service; price of labor and material reduced; rates of fare increased; taxation reduced.

The manufacturer or the private corporation may close their plant for a time when business is not profitable, or need not maintain their plant at a high state of efficiency; but the public service corporation is always in the public eye—it must keep on, it must keep up the quality of its service to highest standard.

The business of an electric railway in fast growing communities is increasing to be sure, but not nearly in the ratio of increase of expense of operation, maintenance and necessary betterments. Of course, poorer service cannot be permitted under any circumstances; in fact, it should be constantly improved. No street railway man favors lower wages. I certainly do not. Labor earns its wage. Our men work faithfully, and their families are entitled to the comforts won by their toil. No thoughtful man favors reducing the price of materials at the expense of the prosperity of the country, for good prices for materials mean good prices for the makers of materials—the manufacturers and the men who work for them. The comfort and happiness of our people are more closely allied with prosperity than is realized by some. Adversity means idleness, poverty, and distress. Comforts are then no longer obtainable; necessities even are difficult to obtain; for when a workman's labor ceases, his income stops, and when money is lacking, misery takes its place with those who depend for the necessities of life upon the earning of their daily wage. Where there is no daily wage, there is apt to be no daily bread. Prosperity, therefore, is in itself the first necessity.

A proposal to increase the rate of fare is not practicable.

Real estate may be developed and a building left for years without improvement, addition or even a coat of paint on its woodwork. Not so with a street railway. The public, not unnaturally, insists on the newest type of cars, on more cars, on better and still better service, on greater comfort, on perfect hygienic conditions. An unpainted or old-time battered car would no more dare to run on a modern city street railway system than a caravel of Columbus would dare venture to cross the bows of the "Lusitania" in defiance of the new queen of the seven seas. In Buffalo there are buildings on the foremost streets which are three and four and even five and more times as old as the oldest type of street cars in the entire system. And Buffalo is no eyesore in this respect—not at all. The same is true in other cities. The public is more exacting with street railways than with any other form of business.

Public officials reflect the attitude of the public in this regard. Municipalities yearly require more and more from street railways. Re-paving, re-tracking and new paving, new tracks, new cars, care of streets and other items, constantly increasing in number, heavily swell the total of expenditures. Added thereto are taxes; and all these requirements causing increased expenditures to the street railway are in turn used as a basis for increase in taxes. Here we find the one feasible and valid method of relieving the existing situation. The municipality or state can lighten the burden. In view of the heavy expenditure yearly required and the tremendous cost of operation and maintenance, resulting in greater conveniences and facilities to the public, and materially benefiting the municipality as a whole as well as each individual citizen thereof, this added load of taxes could or should be greatly lessened or removed. The street railway then could better fulfill the public demands and could turn to its owners for authority for further improvements, at the same time permitting a reasonable income on genuine investment.

When the Public Service Commission act was in process of passage, I opposed it for two fundamental reasons—the

bestowal of such vast powers for the regulation of the business affairs of corporate citizens, and because it denied the foundation principle of our Republic that every citizen should have the unrestricted right of appeal to the courts. But the Public Service Commission act has now become a law, and while in the hands of unjust or arbitrary commissioners it would bring hardship and perhaps ruin upon the corporations affected, yet the wise choice of commissioners by Governor Hughes insures that while the interests of the people will be looked after, the corporations, which are citizens of the state, will undoubtedly be treated fairly and no unjust demand be made upon them. I am confident that in requiring that betterments and changes be made in the plants of the corporations over which they have supervision, the Commission will take into consideration that it is almost impossible to raise money at this time, a condition largely brought about by unwise, cruel and sometimes unwarranted attacks made upon public utility corporations.

I believe that my fellow-members of the Street Railway Association of the State of New York will take the same position for their companies as I do, when I say for the corporations which I represent, that now the Public Service Commission act is law, we cheerfully obey it; that we will open our books to the commissioners, and will promptly furnish them with all information that they ask which it is in our power to give. If we have made mistakes, let us know it and correct them. If conditions can be bettered, let us co-operate to the utmost with the commissioners to make them so. I am certain that investigation will in some instances result to our benefit; that the commissioners will find the burdenes of taxation placed upon us are too great to permit of our rendering the service to the people that we desire and which the commission would like to request of us.

Most street railways are no more over-capitalized than real estate is over-capitalized. I believe every fair and informed student of conditions will corroborate this. Whether it be a trolley line or a ten or twenty-story building, the method and proportionate extent of capitalization are the same. But there the similarity ceases, for after capitalization the building goes its way serenely, the initial cost being the final cost as well; but the street railway through the long period of construction encounters difficulties on every hand, not only labor but questions of consents and adjustments, and through each succeeding year the demands in service and maintenance and operation increase and multiply.

Capital requires and is entitled to a fair return on investment. It is estimated that fully 80 per cent of the street railways of the United States are not paying dividends. Capital invested in street railways finds the electric railway situation of to-day a problem requiring the most serious consideration. Any who would blindly heap further burdens of expense on the electric railways of the country either know little of or care less for the best interests of the people at large.

I am not croaking. This is no caw of a black crow. It is no sandwich-man placard reading "Pity us! Pity us!" I feel that every man present here who is familiar, fully familiar, with the electric railway situation of to-day realizes the truth of what I have said. It is no rumble to foretell disaster. It is no calamity cry. I have endeavored briefly to outline conditions as we who are in the street railway business know them to be. I believe that to-day, considered from the business standpoint as between the electric railway and the "value received" which they give to the people in return for their fare, in most communities the people have the best of it; that it is the electric railways that are in need of the most help from their father (the state), their mother (the municipality); that they require the "first aid for the injured" from their doctors (The Public Service Commission) to keep them out of the ravenous clutches of their "uncle" (the money lender). The electric railway cannot sell its bonds, and the only money it can secure is what it can beg from its stockholders, borrow from the banks or coax from its conductors.

The future? Show me a man who does not believe in the future, and I will show you a man who has not believed in the past and who is not apt to be believed in the present. Ours is a busineses whose growth and success depend upon fair and broad-minded management from within, and upon fair and broad-minded treatment from without. It is a great business, devoted to the service and convenience of the people, to the everyday necessity of the public, to the development of outlying sections and open country; to the growth of cities, and to the knitting together of communities; it is a business where the investor and the patron, capital and the customer alike, can be faithfully served, and where the results achieved redound to the benefit of the entire State.

We have progressed steadily. From the bygone days of the horse-cars we have advanced in tremenedous development to the commodious electric cars of to-day. Distances once requiring an hour, now are traversed in ten minutes. Country that was desolate, is populous and quick of access. Cities that were sprawled in remote sections are compactly united, with no neighborhood inaccessible. We have done it under difficulties. We have met obstacles seemingly unsurmountable; they have been overcome and the advance has gone on. We are entitled to help and not to hindrance. A vast work lies ahead of the electric railways—a work requiring official co-operation, a work requiring the confidence of investors and the support of capital.

The electric railway situation of to-day, summed up, shows existing systems beset by tremendous expenses, which make relief from heavy burdens of taxation imperative. It shows the great need for extension of electric railways, with capital hesitant to enter where the risks are so numerous and the financial burdens so heavy, and the dividend returns on the investment practically nothing. It shows the whole nation eager for the closer communication of localities. Where trolleys were fought bitterly a decade ago, the opening of new lines to-day is the occasion for a holiday and celebration, with congratulatory speeches, blowing of whistles, ringing of bells, music and cheers of welcome.

It is well for the community; it is well for the passenger; it is well for the employee. In all fairneses, should it not be made well also for the man whose money makes all this possible? Is he also not entitled to a fair return on his investment—a fair return, a moderate dividend? The government of a state or city or town can far better afford to throw off the burden of taxation in such an instance as this of the electric railways. In the country the farmer is allowed to work out his road tax, and why not let the street railway perform its full duty to the state and municipality through furnishing every reasonable facility for the comfortable, rapid transit of all the people, instead of compelling it to cripple its resources by paying money into the public treasury for the benefit of other taxpayers who do not represent one-tenth of those who daily utilize the street cars, and whose constant comfort would be thus vastly improved. There is a prosperity of greater possibilities and importance than for the taxable purposes of the moment.

The broader and richer develeopment, the greater growth, the revelation of larger commercial and social resources, all of which are allied with the existence and extension of electric railways, make it not only possible but proper for government to say, "We throw off the burden of taxation—you are of too much service to the state to be hampered by tithes in this time of vast demands and colossal requirements, when you are called upon to do more than is asked of any other form of private business or public service in the whole world."

When we look over this vast nation and see what has been accomplished by the pioneers in electric railway building, the men who have established transportation facilities surpassing those of any other land, we feel a thrill of pride and see the hand of enterprise bidding us on to greater things. Far out ahead looms the banner of the nation's need in electric railway transportation. It is not for us to cry, "Bring back that banner to the line of what has already been accomplished." Rather it is for us to hail it with acclaim and cry, "Let us bring up the line of our achievements to the banner of the nation's need."

We can picture the future day—the day of accomplished deeds, the day of satisfied needs—when that which waited to be done waits no longer. Between now and then lies an era of tremendous endeavor, of ceaseless labor—and through it all we will have no time for needless turmoil, we want no seneseless strife. We do want earnest, honest co-operation, not alone with the private investor, but also with the public official—and the day of complete success will come when the investor, builder, operator and official, all act in harmony and unison, based on a common confidence that all are working together for the common good.

REMARKS OF MESSRS. HUMPHREYS AND BURDETTE.

The third speaker, Dr. Humphreys, reviewed the causes of recent agitation, investigation and legislation directed at corporations with such indiscriminate zeal, and expressed his belief that real reforms would be secured, although both labor and capital were likely to suffer from the loss of credit and confidence. He then spoke about the relations between the public service commission and the gas companies of the state.

The last speaker, E. W. Burdette, read a paper on public control from the corporate standpoint, under three heads, past, present and future. He showed how eager the public had been to foster modern corporation utilities until they had become adjuncts of daily life. It seemed natural and proper to suggest that one of the most important functions of the new public service commission of the State of New York should be to determine what a reasonable return is on capital invested in the public service corporations under their control. He hoped that the future attitude of corporations toward public supervision and control would be friendly and not hostile. If he were in charge of a large corporation in New York he would not if he could repeal the existing law, though he confessed he should favor some radical amendment. The greatest objection to it was that everything depended upon the men who administered it. It does not announce the principles upon which they shall act nor undertake to outline the policy which they shall adopt. The fears of disastrous results are dissipated, however, if one entertains a conviction, as he had no doubt the body of the commissioners did, that the true interests of both the corporations and the public are substantially alike. It is not for the interest of the public that the corporations should be crippled in their activities or unreasonably limited in their progress. On the other hand, it is not in the interests of the corporations that the public should be subjected to exorbitant rates, poor service or contemptuous treatment. He hoped in the end there would be applied a device which, while successful abroad, has not yet had much attention in this country—namely, the so-called "sliding scale," under which, when a proper relation has once been established between a company and its customers, the profits of one are made directly dependent upon the economies to the other.

ENTERTAINMENTS AT ATLANTIC CITY AND OTHER INFORMATION

A. L. Whipple, chairman of the entertainment committee of the American Street & Interurban Railway Manufacturers' Association, has announced the following particulars in connection with the entertainment features of the Atlantic City Convention:

Roller chairs will be furnished to all delegates and guests of the convention wearing official badges for service between the hours of 8:30 a. m. and 9 p. m. from the following stations, to be maintained from Oct. 14 to 18, inclusive: Main entrance of Steel Pier and Marlborough-Blenheim Hotel. Additional stations will be established if found necessary. Arrangement also has been made whereby a special rate of 25 cents per person will be charged delegates and guests, wearing official badges, from any Shill or Reed roller chair station and direct to destination only. If any stop is made the regular rate will be charged. This service and rate will apply from 9 p. m. and up to midnight only. Private chairs at reduced rates can be secured through the committee upon application.

Bathing arrangements have been made with Adams' Baths (Boardwalk above Virginia Avenue), whereby all delegates and guests of the convention wearing official badges will be supplied with strictly first-class accommodations at a special price of twenty-five (25) cents each. This price includes all extras, such as ladies' stockings, rubber caps, straw hats, etc.

On Monday evening, Oct. 14, at 9 o'clock, Miss Kitty Cheatham will entertain for one hour at the Solarium in the Marlborough-Blenheim Hotel. This will be followed by informal dancing. Admission will be by official badge only.

For Tuesday afternoon, Oct. 15, at 2:30 o'clock, the committee will endeavor to arrange a roller chair parade for the ladies.

On Tuesday evening, at 9 o'clock, the annual reception in honor of the presidents and other officers of the associations with their ladies will be held in the Solarium of the Marlborough-Blenheim Hotel. At this reception there will be an orchestra, soloists and refreshments. Dancing will follow the reception.

On Wednesday between 2:30 and 5 p. m. there will be a Ladies' Afternoon at the Country Club of Atlantic City, where golf and tennis can be played. There will be music and an afternoon tea. Attention is called to the ladies' clock golf contest for which prizes will be given. Sightseeing automobiles will leave the Marlborough-Blenheim Hotel at 2 o'clock sharp, stopping at the Chalfonte en route, and, if necessary, special trolley cars will leave from Boardwalk and Virginia Avenue at 2:30 p. m. sharp. Through the courtesy of the Country Club of Atlantic City, the official badge will secure all the privileges of the beautiful club and grounds, excepting the use of the links, for which the customary fee will be charged. A limited number of golf

clubs may be obtained from the steward, but if convenient the ladies should bring their own "putters."

The third annual Supply Men's amateur vaudeville and theatrical performance will be given at Young's Pier Theater Wednesday, 8:30 p. m. Admission will be by official badge only. The performance will be followed by informal dancing from 11 to 12:30 p. m. in the ballroom of the Marlborough-Blenheim Hotel.

On Thursday afternoon at 2:30 a trolley trip to Ocean City via Shore Fast Line, has been arranged for the ladies of the convention. Special cars will leave Board Walk and Virginia Avenue at 2:30 p. m. sharp, returning about 5:30 p. m.

For Thursday evening a theater party has been arranged for Young's Pier Theater and Savoy Theater. The committee has secured the entire house at both of the theaters, and there should be ample room for all who wish to attend. There will be no reserved seats (excepting for the officers of the Railway Association, who will occupy the boxes). Admission by theater ticket. Choice of seat secured by tender upon surrendering ticket at door. The committee will distribute the theater tickets for both the above attractions from the box office on Steel Pier, on Thursday from 11 a. m. to 1 p. m. The official badge must be presented to secure a theater ticket. If anyone wishes to obtain tickets for ladies or friends, in attendance at the convention, please present the official badge of such persons in each case. Informal dancing will follow, 11 to 12:30 p. m., in the ballroom, Marlborough-Blenheim Hotel.

On Friday afternoon a men's golf tournament will be held at the Country Club of Atlantic City, and on Friday evening an entertainment in the Solarium of the Marlborough-Blenheim Hotel at 9 o'clock by informal dancing.

The County Club of Atlantic City has kindly extended the privilege of its club house to all delegates and guests during their stay, and admission to the grounds will be by official badge. It also extends the privilege of its links for a charge of $1 a day. Tickets may be obtained from the steward at the club. The club is located at Northfield, and may be reached by the Shore Fast Line electric cars, leaving from Board Walk and Virginia Avenue on the hour and half-hour, returning leave Northfield Station at twenty (20) and fifty (50) minutes past the hour, also by the Atlantic City & Suburban Traction Company's cars leaving from Florida Avenue and Board Walk at 15 and 45 minutes past the hour, returning leave Northfield 10 and 40 minutes past the hour. The running time is about twenty (20) minutes. Those who intend to play may find it well to bring their own golf sticks.

POSTAL, TELEGRAPH, TELEPHONE, EXPRESS AND OTHER FACILITIES

The postal authorities have established a branch post-office in the entrance hall of the Steel Pier (at general information bureau), and all mail addressed to exhibitors on the Steel Pier, addressed in care of the convention, will be distributed. The Western Union and Postal Telegraph companies maintain a branch station on the Board Walk, directly across from the entrance to the Steel Pier (up stairs). This station is open from 9 a. m. to 7 p. m. Both the above companies will have messengers at the general information bureau and patroling the Steel Pier, and their services may be obtained by telephone.

Through the courtesy of the Delaware & Atlantic Telephone Company, the Bell Telephone Company of Philadelphia, and the American Telephone & Telegraph Company free local exchange service will be given (day and night) from all stations on Steel Pier only, and free toll line and long distance service, before 9 a. m. and after 6 p. m., to all the delegates and guests upon presentation of the various official badges to the attending operator at the following stations only, from Oct. 14 to 19, inclusive: Marlborough-Blenheim Hotel and Atlantic City Steel Pier.

Arrangements have been made with the Eldredge Express Company, of Atlantic City, to handle the exhibits at the following rates: For taking machinery, castings and cases weighing over 300 lbs. from the railroad station to the exhibit space on the Steel Pier and return, $5 per ton. For taking consignments weighing less than 300 lbs. each as above described, $1 per case for the round trip, or 50 cents for one way.

A number of exhibitors have installed private telephones in their booths, and may be reached through the local exchange station on Steel Pier.

The committee has arranged with Miss L. H. Marvel to maintain a stenography and typewriting office, for the convenience of the members of the convention. Her office is on the Board Walk, directly across from the Steel Pier (up stairs), and entrance through the drug store.

SPECIAL NOTICE CONCERNING RAILROAD RATES TO THE ATLANTIC CITY CONVENTION

As stated in Bulletin No. 4 of the American Street & Interurban Railway Association, and also in last week's issue of the Street Railway Journal, those who desire to go to the convention from the Central Passenger Association territory or from western or southwestern points, must avail themselves of Central Passenger Association card orders if they desire to obtain the reduced rates from points in that territory.

To facilitate the distribution of these card orders among the street railway delegates who wish to avail themselves of the reduced rates, a limited number of these card orders have been sent to Robert McCulloch, general manager of the United Railways Company of St. Louis, St. Louis, Mo.; the Chicago office of the Street Railway Journal, 590 Old Colony Building, Chicago; the Cleveland office of the Street Railway Journal, Schofield Building, Cleveland; The Wilson Company, Publishers, 160 Harrison Street, Chicago, Ill.; the Electric Traction Weekly, Cleveland, Ohio, and H. A. Nicholl, president Central Electric Railway Association, Anderson, Ind. All of these card orders are numbered and the association has guaranteed that these orders shall only be used by convention delegates.

Card orders for street and interurban railway company representatives may be obtained upon application to Bernard V. Swenson, secretary, 29 West Thirty-Ninth Street, New York City. Representatives of manufacturing companies may obtain card orders upon application to George Keegan, secretary of the Manufacturers' Association, Park Row Building, New York City.

The Roberts & Abbott Company, engineer for the Washington, Baltimore & Annapolis Railway, states that it has been decided not to ground the brackets supporting the single-phase catenary construction, as illustrated on page 360 of the issue of this paper for Sept. 7. This plan was originally considered, but has since been abandoned. In addition to the overhead equipment mentioned in that article as being supplied by the Ohio Brass Company, the General Electric Company is furnishing the rest of the strain insulators, all of the bracket insulators, the messenger hangers and the section insulators.

THE MONTREAL STREET RAILWAY COMPANY'S FIRE DEPARTMENT

The policy of the Montreal Street Railway Company is to carry its own fire insurance, which is done by laying aside annually an amount equal to what the insurance premiums would be. This money is invested in interest bearing securities and now amounts to over $341,000. Of course, the success of this practice depends upon an efficient fire department. This has evidently been secured in Montreal, for since the organization of the department in 1902 there has been no fire damage, although there were some 300 instances when the lack of a fire department might have resulted seriously.

The fire department consists of both night and day companies in all power houses, car houses, shops and other buildings of the company. The men are divided into detachments, each under a captain and a nozzle man, who is second in command. In general there are six to eight men in such a company and three to five detachments at any one place according to the size of the structure. To each of these detachments is consigned the care of one line of hose and one reel. Axes and fire ladders are used only when the men receive instructions. In addition to the usual hose and hydrants, the buildings are furnished with chemical extinguishers and fire pails. The hose connections are so arranged that three or four streams can be played immediately on a fire at any point, and if more are required double the number can be played in three or four minutes. The accompanying cut is a fac-simile of a specimen 13-in. x 14-in. poster placed in the St. Denis Street car house and bearing information with regard to alarm calls, hydrants and general rules in case of fire.

Each shop is also protected by a watchman to guard against fire and theft. The buildings thus guarded are equipped with Acme time detectors, each having ten stations which are punched at five-minute intervals. These stations are placed so the watchman will pass diagonally through the shop several times an hour. Thus a man punches his first box on the hour, his second box five minutes past the hour and so on until the tenth box is reached at forty-five minutes past the hour. This leaves him fifteen minutes in which to examine cars for overheated resistances, burning insulation or other evidences of fire, and to see that all fire appliances are in good order. He then returns to the first station on the hour and begins his rounds again, remaining on duty from 7 p. m. to 7 a. m. Watchmen must know how to give all fire alarms, make themselves familiar with fire drills and all points whence fire calls can be sent in. In all cases of fire, either on the company's property or nearby property, the fire marshal must be telephoned at once.

The fire department as a whole is under the direction of one fire marshal, who is directly responsible to the manager. He has charge of all fire drills, which, as a rule, are held weekly, but oftener if the regular tests are unsatisfactory. Besides these schedule drills, the fire marshal is likely to call unexpectedly day or night to test the efficiency of different detachments. The fire marshal must see that all fire appliances throughout the system, such as hose reels, hydrants, fire extinguishers, fire pails, etc., are kept in good order for immediate application; that all electric wires and connections are properly insulated, and protected in accordance with the Fire Underwriters' specifications; and that all buildings and yards are properly cleaned and no inflammable material exposed in dangerous places.

The watchmen are also directly under the charge of the fire marshal and it is his duty to see that they obey the rules laid down for protecting the buildings from all possibility of fire.

MONTREAL STREET RAILWAY COMPANY.

CITY FIRE ALARM BOX.

ST. DENIS STREET, at the South end of the Subway, or Telephone Main 141.

PRIVATE CALLS.

ONE Ring front of Shop. TWO Rings rear of Shop. THREE Rings Office
FOUR Rings Blacksmith. CONTINUOUS RINGING, Storage Shed.

HYDRANTS.

No. 1 Hydrant is at the front of the shop on the east wall.
No. 2 Hydrant is at the front of the shop on the west wall.
No. 3 Hydrant is at the rear of the shop on the east wall.
No. 4 Hydrant is at the rear of the shop on the west wall.
No. 5 Hydrant is on the centre of the east wall.
No. 6 Hydrant is on the centre of the west wall.
No. 7 Hydrant is on the Office.

The position of men for fire drills will be the same as at present. When it becomes necessary to make changes notices will be posted for your information.

SPECIAL INSTRUCTIONS FOR FIRE DEPARTMENT.

Every employee of the Company in any car shop, work shop, or power house, will attend to fire drills and interest themselves in the Company by doing all in their power to guard against fire. The men will form up for fire drills under instructions from the Fire Marshall or from their Engineer or Foreman in charge.

In guarding against fire, the most dangerous things around the shops or cars are cotton waste and paper, especially if there is any animal oil or lard on them. Never place these in a concealed place or allow any to be left in the pockets of your over-alls when work is over. Painters using boiled linseed oil and turpentine thereon should not forget that it is liable to create spontaneous combustion if left in any place where there is heat,—where the direct rays of the sun strike, or around heated pipes. Paper with new printer's ink thereon is dangerous as regards fire. Sweepings of a machine shop should never be placed over iron or steel shavings; this mass of disintegrated iron is enough to incite heat and combustion. Iron and steel planings and turnings when mixed with oil are also dangerous.

Men handling fire apparatus must be careful not to damage the same, and remember not to strike the brass couplings or nozzle against any hard substance such as shop uprights or rails when crossing pits, car wheels, etc. When it is necessary to pass hose under or around cars great care must be taken to prevent cutting the hose against the wheels. In using fire extinguishers, I would call your attention to the small nozzle which is very easily broken. Do not allow any weight or undue strain to be placed on the weak point. Engineers or watchmen will call the attention of the Fire Marshal to any part of the appliance which is out of order, or has been used in case of fire in order that he may examine the same. If extinguishers are used, they will require re-charging. It will be the duty of any employee who discovers fire to first ring in an alarm at the Company's private fire bell and afterwards from the street box or by telephone to call the City Brigade. Any employee not attending to this will show unpardonable carelessness and lack of interest in the Company's affairs and may expect to be treated accordingly.

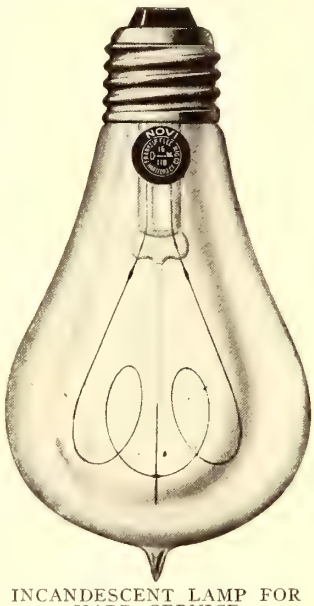
W. G. ROSS, *Managing Director.* J. KERR, *Fire Marshal.* D. McDONALD, *Manager.*

SPECIMEN OF THE POSTER USED BY THE MONTREAL STREET RAILWAY COMPANY'S FIRE DEPARTMENT, GIVING INFORMATION ON THE POSITION OF FIRE BOXES, HYDRANTS, ETC., TOGETHER WITH SPECIAL INSTRUCTIONS

The Continental Tunnel Company has been organized by the Denver, Northwestern & Pacific Railroad to build a tunnel through James Peak.

AN INCANDESCENT LAMP DESIGNED TO WITHSTAND HARD USAGE

An incandescent lamp designed and constructed to meet the demand for an incandescent lamp that will withstand more than the ordinary amount of hard usage is offered for street railway use by the Franklin Electric Manufacturing Company, of Hartford, Conn., under the name Novi. Owing to the shape of the filament utilized in this light the end-on or tip candle power is considerably in excess of that developed by the regular type of lamp containing the ordinary oval form of filament. As will be seen from the illustration, an efficient filament support is obtained with but one anchor, insuring a uniform product of high quality. This support is formed by a small glass column, extending from the platinum seal to a point a little below and between the upper portions of the filament coils, and from this point a metal wire extends to a similar distance below the lower portion of the center coil. Through this improved method of construction a maximum distance between the leading-in wires and the point of support is secured and the greatest rogidity obtained. It is impossible for the filament to droop and touch the glass or for the coils to become entangled and short-circuit it. It is said that the vibration always present in street cars which proves so injurious to the life of the ordinary incandescent lamp has absolutely no effect on the Novi street railway type. The company proposes to exhibit the lamp at the convention of the American Street & Interurban Railway Association at Atlantic City by means of a vibration machine.

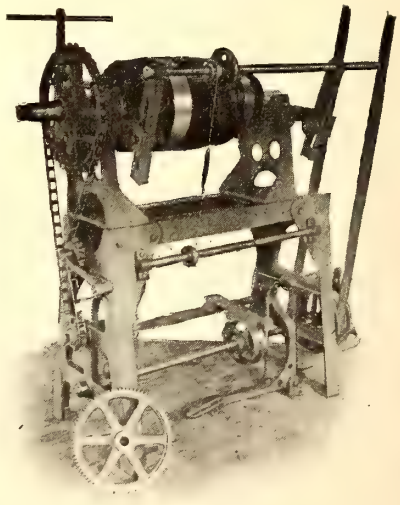


INCANDESCENT LAMP FOR HARD SERVICE

A NEW MACHINE FOR BANDING ARMATURES AND WINDING FIELD AND ARMATURE COILS

A machine designed along new lines for the exclusive purpose of banding armature and winding field and armature coils, which is easy to control, occupies a small amount of floor space and operates at high speed, is being built for railway use by the Device Improvement Company, of Hanover, Pa. The machine consists of two substantial cast-iron legs bolted to a steel bed, the legs containing the babbitted bearings for the shafts and belt shifter. The left hand head is bolted to the bed, but the right hand is adjustable to accommmodate armatures of different length. The armature shaft revolves in each head on two soft brass rollers of wide face, thus preventing injury to the armature bearings. The outer bearing on each head is adjustable to accommodate the various diameters of shafts. Each head carries an inwardly projecting arm to which are fastened the slotted strips carrying the steel feed rod. The rod can thus be adjusted to the proper position to suit the operator for any diameter of armature. The feed rod is of steel one inch in diameter, threaded its entire length to receive the feed wheel which on its hub carries the independently revolving grooved wheel for guiding the band wire. The armature is driven by the clutch sprocket wheel and a detachable link chain. The clutch jaws are self-centering on the shaft in one direction and the shaft need be only approximately centered by the eye in the other, as any discrepancy due to the sprocket not being centered is taken up by the slack in the chain and the idler. The jaws are brass lined, preventing any possible injury to the armature shaft in case sprocket should slip if not properly tightened. The faces of the jaws are wide and if properly set down on the shaft the sprocket will not slip on armatures of the largest diameter.

Power is transmitted to the machine direct from the line shaft by a 2¼-in. belt running over light and loose 10-in. pulleys. It is therefore not necessary to put up a countershaft, and the machine can easily be adapted for individual motor drive. A yoke bolted to the legs supplies the outboard bearing for the shaft, and as a support for the belt shifter rod on the opposite end of this shaft are two pinions of different diameters. Meshing with these pinions are the corresponding gears, the two ratios being 4 to 1 and 2 1/3 to 1. The speed of the armature may be increased or reduced by changing the speed of the driving shaft to suit the convenience of the operator. This speed change can be made in about a minute by removing one gear and putting on the other. On the outside of the shaft carrying the gears is pinned the small sprocket, which in turn transmits the power to the clutch sprocket through the chain, the adjustable idler keeping the chain always tight. The stopping and starting of the machine is entirely controlled by the foot lever, which when depressed applies the brake, locks the driving shaft and shifts the belt to the loose pulley. To start the machine the foot lever is disengaged from the dog, which is screwed to the floor, and the spring on the outside of belt shifting rod automatically pulls the belt to the tight pulley and releases the brake. This method of control is quick, positive and sensitive, it being possible to move the armature one-half inch or less. It also leaves the hands of the operator free to perform the operation of banding, putting in clips and soldering, etc. The banding and winding machine may be used with the company's band wire tension machine, in which case it forms the combined machine. It may also be used with any other tension device. A simple attachment is furnished extra with this machine for field coil winding, which can be put on in a few minutes.



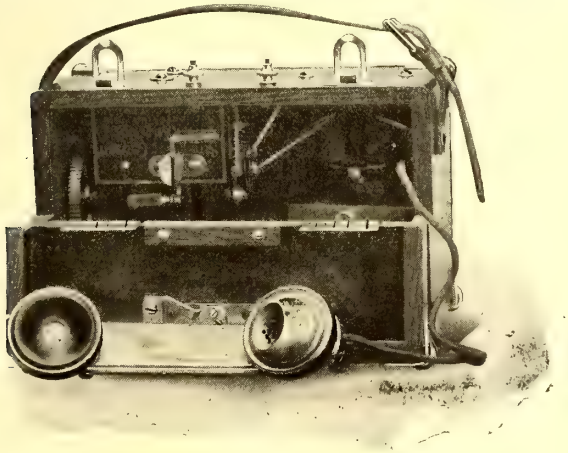
ARMATURE BANDING AND WINDING MACHINE

A COMPACT TELEPHONE TESTING SET FOR USE UNDER HIGH POTENTIAL INFLUENCES

The necessity for developing a durable and compact testing telephone for the use of linemen which was created by the practice of installing telephone circuits parallel to high tension power circuits has resulted in the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y., designing a testing set possessing several unusual mechanical features. As shown in the accompanying illustration, the apparatus is arranged in a well constructed heavy oak box, reinforced and protected at each of the eight exterior corners by heavy cast brass knobs. All hinges and snap catches are especially designed for this instrument, and a heavy carrying strap of sole leather supports the test set evenly.

The apparatus in the talking and signalling circuit is thoroughly insulated and well protected from injury. One of the special features is a one-half micro-farad condenser in the receiver circuit, to eliminate a switch hook on the box, for the purpose of breaking the line circuit. With this arrangement the instrument may be rung any time when on the line. The ringer is not across the line when ringing out. The generator shunt cuts out the bell, putting the full voltage of the generator on the line when ringing with the generator, thus giving the greatest power.

The all-metal combination telephone shown in the view of the open set embodies many features which make it an especially good instrument for use as a lineman's testing telephone. Like the complete telephone cabinet, it is designed to withstand rough handling, and the manufacturers claim that it has no parts which are perishable. The frame is made of seamless brass tubing especially drawn. The regular solid back transmitter electrodes are enclosed in a



GENERAL VIEW OF TESTING SET

case consisting of three pieces mounted directly on the frame by large screws. Perforated cast-brass mouthpiece and clamping ring hold the diaphragm and diaphragm spring in place.

The receiver is the regular operator's type in a specially designed case, having all exterior sides and edges made of metal in order to prevent breaking the ear cap, which is enclosed as much as is practicable. The microphone is provided with a battery push button that cuts in the battery when necessary or only when talking. This button also prevents the annoyance of side tones taken up by the transmitter when listening in on the line in a noisy place. Both transmitter and receiver interior parts are accessible by unscrewing the clamping rings. This form of complete testing telephone, known as No. 841 3-bar, No. 842 4-bar and No. 843 5-bar generator call linemen's test set, has been given a severe test by some of the leading high-tension power companies operating telephone lines, and has proved entirely satisfactory for unusually hard service.

SEMI-CONVERTIBLE CARS FOR TEXARKANA, ARK.

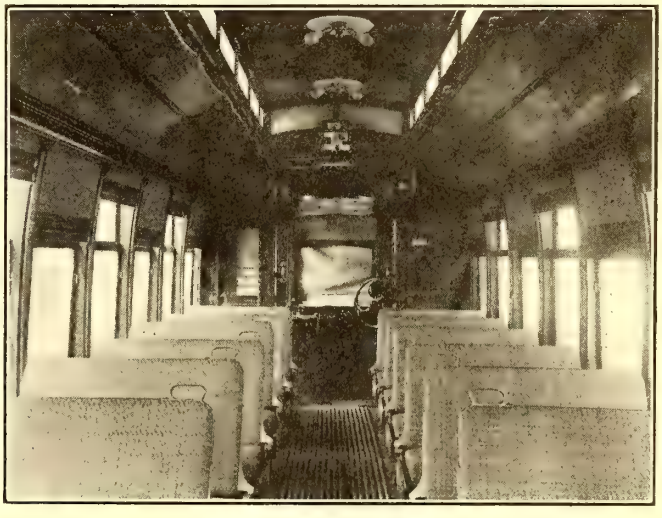
One of the many roads to adopt the semi-convertible car last summer was the Texarkana Gas & Electric Company, successor to the Texarkana Light & Traction Company, which absorbed the Texarkana Traction Company, of Texarkana, Ark. The cars were built by the American Car Company and it was found expedient to order them of dif-



EXTERIOR OF TEXARKANA CAR

ferent lengths, those measuring 20 ft. 8 ins. over the bodies (one of which is illustrated) being intended for service in the city proper and the larger car—28 ft. over the body—for park and suburban service.

The semi-convertible car illustrated is generally similar to other cars of the type illustrated in these pages, and the suitability of the window system for excursion service especially has been touched upon in these columns. The smaller cars are mounted on the No. 21-E single truck with 7 ft. 6 ins. wheel base; the larger cars take the No. 27-G1, with 4 ft. 6 ins. wheel base. The chief dimensions of the

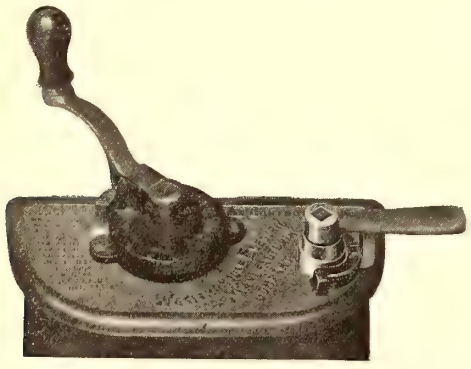


INTERIOR OF TEXARKANA CAR

single-truck cars follow: Length over end panels, 20 ft. 8 ins.; over crown pieces, 30 ft. 1 in.; width over sills, including panels, 7 ft. 9½ ins.; over posts at belt, 8 ft.; height from floor to ceiling, 8 ft. 4¾ ins.; from track to under side of sills, 26⅝ ins.; size of side sills, 5 ins. x 3⅜ ins.; end sills, 3½ ins. x 6⅝ ins. All the cars are finished in cherry, with birch veneer ceilings. The single-truck cars are each equipped with two 25-hp motors and the double-truck cars with four.

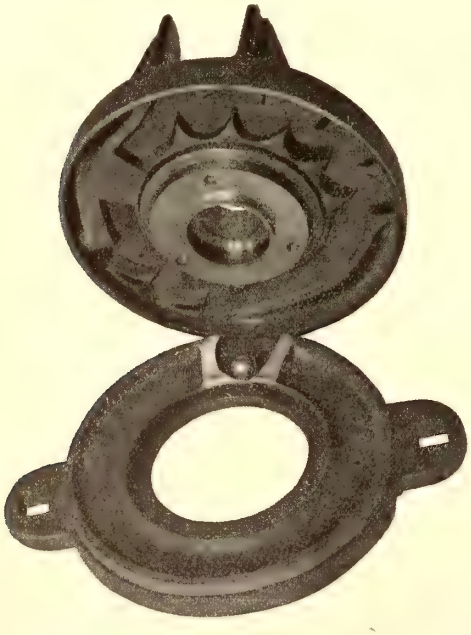
A SIMPLE REGULATOR OF FEED.

The Durkin Controller Handle Company, of Philadelphia, has recently still further simplified its controller regulator, a fact that warrants the recording at this time of the details of the apparatus. Essentially the device consists of a circular box with a stationary base bolted to the controller and a revolving top. Between the two is a chilled steel ball confined in a cup which allows it a limited movement. As the cover is turned the ball follows the irregularities of



CONTROLLER REGULATOR ATTACHED TO CONTROLLER

the route laid out for it on the inside of the lid and, no matter how slowly or how quickly the handle is turned, there is a full stop at each feeding point. This stop is not prolonged, however, for the ball drops at once and moves freely to the next point. The power can be turned off from any point instantly without hindrance. The accompanying illustration shows plainly the manner in which the ball is penned up and does its work. The complete regulator leaves the factory permanently riveted together, and the



VIEW OF REGULATOR SHOWING HOW BALL IS PENNED UP

entire box is simply bolted to the dial of the controller with two bolts and is then ready for use, no change being required in the controller. The ordinary handle is used in connection with the regulator, slipping on and off as required. The wear on the steel ball inside is trifling as the bearing on which the cover turns is brass against iron.

Some figures giving results of exhaustive tests of the regulator—tests which led to large installations of the device—show how great the saving is in the single item of armatures. The official who made the test prepared a statement showing a remarkable saving in the first year over the cost of equipping the cars. In the same barn, with the same mileage and general conditions, twenty cars fitted with regulators were compared during four months with twenty cars not so equipped. At the end of the test the cars without regulators had lost twenty-nine armatures; those with regulators had lost seven armatures. The expense for armatures for the cars not equipped was $1.160, a cost per car per year of $174. The expense for armatures for the cars controlled by the regulator was $280, a cost per car per year of $42. Adding the cost of the regulator, $12.50, gives $54.50 per car against $174, showing a saving on each car per year of $119.50.

Besides the usefulness of the regulator in the avoidance of electrical troubles due to fast and irregular feeding and reversing, it saves current at starting, avoids costly "peaks" in the power load, and increases the comfort and safety of passengers. Details of the results obtained in actual running, as well as of prolonged tests, of the regulator can be obtained by corresponding with the company direct.

NEW CARBON BRUSHES

The Speer Carbon Company, of St. Marys, Pa., whose carbon brushes for different classes of service have long been in use, has designed a reinforced brush in three grades which retains all the essentials that have made for the success of the company's other carbon brush products. The different grades are known No. 1 R, No. 2 R and No. 27 R, and each possesses some virtue peculiarly its own. No. 1 R, for instance, is a medium hard, fine, close-grained carbon and wears slowly and uniformly. It has given entire satisfaction both as regards efficiency and in preservation of the commutator. Grade No. 2 R is what the company calls its "high grade" re-enforced brush. It possesses all the properties which have made the "high grade" so much appreciated, and like the latter it can be used for current densities greatly in excess of those permissible with ordinary carbon. It presents a very soft frictional surface. Grade No. 27 R presents from an electrical point of view very remarkable properties, its average conductivety being three or four times greater than that of the ordinary carbon. This carbon acquires a very dense and uniform texture and is of low resistance. It is specially adapted for single-phase work.

The directors of the New Orleans Railway & Light Company, after considering the questions of transfers and half-fares for school children, have decided to recommend the inauguration by the various companies making up the New Orleans railways of a system of transfers for cash fares between certain lines. The board, however, could not see its way to granting half-fares. A consideration controlling the board is that the trust deed securing the 4½ per cent bonds of the company binds the company to preserve in their integrity franchises of the various companies whose stocks it controls, and deprives it of the power of agreeing to the reduction of the 5-cent franchise fare, even if it could otherwise see its way to making such a recommendation.

LONDON LETTER.

(*From Our Regular Correspondent.*)

Some interesting reading matter has been published during the past month regarding the various tube railways operated by the Underground Electric Railways Company, as the half-yearly meetings of three of those tubes were held during the past month. At the meeting of the Bakerloo Tube, the chairman stated that this was the second half-year of full working since the opening of the line, and that the number of passengers carried was 9,936,955, the passenger receipts amounting to £61,501, and the operating expenses to £42,128. The net result of the half-year's working was a credit balance of £6,744, which had been carried forward. He also stated that during the year two new stations had been opened, the one at the Great Central Railway Station, and the other at Edgware Road, but that it had been decided for the present not to extend the tube as far as Paddington. No doubt this extension would be an advantage, so that connection could be made with the Great Western Railway Company, but, for various reasons, it was thought better to postpone the work for the present, and as their powers did not expire until 1911, there was plenty of time. At the meeting of the Piccadilly & Brompton Tube they had now had the experience of a full half-year's working. They had carried 11,953,795 passengers, and the passenger receipts had been £102,836, the operating expenses amounting to £75,794, and, after paying the necessary interest on the Debentures, etc., the result showed a deficit of £5,270. The directors considered this very satisfactory, as the best results could not be expected immediately, and the opening of the Hampstead Tube would undoubtedly bring them further business. At the meeting of the Hampstead & Highgate Tube, there was little to say, as this tube had been opened so recently, and no figures were available except those of capital account, and the figure for this tube amounted to £5,539,446. The work, however, was now completed and it represented the very latest improvements in tube construction. While there is yet room for a great improvement in the traffics upon these tubes, the whole tone of the meetings was one of optimism, as the directors seem to think there is no doubt that they will do much better in a year or two when Londoners get better educated as to the advantages to be derived by traveling on these tubes and more familiar with their ramifications and the facilities offered for inter-communication.

The London County Council are face to face with the prospects of a severe struggle with their men, who are up in arms against them for different reasons. As was intimated in this column a month or two ago, the men have objected very seriously to the medical examination, but since organizing and holding many meetings they have developed a series of complaints, all of which will have to be settled sooner or later. One of the chief demands made by the men is the appointment of a board of conciliation to consider any disputes or differences which may arise, and the men are also extremely anxious to get a working day of eight hours and slight increases of wages. The whole matter will probably come before the Highways Committee at its first meeting in October. Meanwhile the work of electrification in different portions of London is being actively carried on. The electrification on the conduit system of the route from Highbury to the Archway Tavern at Highgate is now almost completed, and the whole of the intricate work of the Highgate terminus is ready for traffic. The work of electrification of the system between Vauxhall, Brixton, Loughborough Junction, Camberwell and Tulse Hill is also proceeding apace, and this section ought to be ready for immediate service. A service of trams will then be run between Stratham and Victoria, via Brixton Road, Stockwell, Clapham and Vauxhall, crossing the new Vauxhall Bridge. The electrification of the tramways which have for years started at Holborn and gone by way of Gray's Inn Road to King's Cross, and then northward by way of Pentonville Road, York Road and Caledonian Road, has brought up an interesting and important question, which will require decision in the near future, as to a great improvement which is possible in the vicinity of King's Cross Station of the Metropolitan Railway. As the route of tramways is at present, the cars have to go round the end of Pentonville Road, turning a very sharp corner, and coming back towards the foot of Caledonian Road. This means that the whole of this traffic has to go round a very sharp peninsular made by the King's Cross Station and the Metropolitan Railway, and it is now suggested that if a bridge were built through the station and across the tracks of the Metropolitan Railway Company this sharp angle would be prevented. No doubt the building of a new bridge would be a vast improvement to the vicinity, as there is a great congestion of traffic at this point. The question of expense, however, is one that would have to be settled between the County Council and the Borough of St. Pancras, and compensation would also have to be given to the railway company. The bridge, however, would undoubtedly improve the property in the vicinity, and little difficulty would be incurred from the property holders if the Council and Borough of St. Pancras could come to some agreement.

The contract which the London County Council awarded to Dick, Kerr & Company for the electrification of the tramways on Bow Road by means of the G. B. surface contact system has led to altercation between the County Council and the Boroughs of Stepney, West Ham and Leyton, and it would look as if the arbitration of the Board of Trade would have to be resorted to. The situation has, of course, arisen on account of the hostility of the Borough of Stepney to have overhead wires which the London County Council were desirous of using on this system. As Stepney would not give way in this matter and as the ordinary underground system, not only being extremely expensive but impracticable in the Bow Road, owing to the underground railway, the G. B. surface contact system was adopted. As it is intended, however, to have through running trams from West Ham and Leyton and as these routes are equipped on the overhead system it is pointed out now by these boroughs that the complications which would ensue would be preventative of all satisfactory working, as it would be necessary for the West Ham cars to be equipped not only with trolleys for their own system but with the necessary skates for the G. B. surface contact system, and also with plows so as to traverse a conduit section of the tramways near Aldgate. Such complications are necessarily undesirable as well as expensive, and the whole question is one which could easily be avoided if the Borough of Stepney would only take a reasonable view of the situation and allow the construction of overhead wires along Bow Road, the beauty of which could not possibly be spoiled in the opinion of anyone with even the most vivid imagination.

There has just been opened at Olympia in London, by Sir Alexander Kennedy, an Engineering and Machinery Exhibition. A similar exhibition was held last year or the year before and was a great success, and this year's exhibition promises to be even more successful. There are exhibits to the value of about £100,000 and weighing between 2500 and 3000 tons. Most of the exhibits show labor-saving devices in machinery and are operated electrically.

The Municipal Tramways Association held its Sixth Annual Conference during the past month in the Town Hall, Manchester. In the usual way the delegates were received by the Lord Mayor and the Chairman and Members of the Manchester Tramways Cimmittee, after which J. M. McElroy, president of the association and general manager of the Manchester Corporation Tramways, read his presidential address. R. L. Acland followed with a paper on "Long Wheel-Base Trucks," and afterwards A. Baker, general manager of the Birmingham Corporation Tramways, gave a paper on "Employees' Hours of Labor, Rates of Pay and Methods of Computing Same." Luncheon was served at the Town Hall at the invitation of the Manchester Tramways Committee, after which special cars were provided for the ladies of the party who were conveyed to Heaton Park, where tea was provided. The delegates were furnished with special cars which took them to the Hyde Road car repair works and the Stuart Street generating station. In the evening there was a reception by the Lord Mayor at the Town Hall which was well attended by the delegates and their ladies. The following day, after the business of the association, a paper was delivered by J. Dalrymple, general manager of the Glasgow Corporation Tramways, on "Staff Organization," after which luncheon was provided at the Town Hall, Pendleton, at the invitation of the Salford Tramways Committee. In the evening a dinner was extended to the delegates by J. Calvin Brown, managing director of the "White City," special tickets of admission to the various side shows being provided for everyone attending. On the following day, a paper was given by A. L. C. Fell, chief officer of the London County Council Tramways, on "Rail Corrugations," and communications from F. Spencer, general manager of the West Ham Corporation Tramways, on the subject of the statutory obligation to maintain the pavement between the rails and for 18 ins. on the outer side of the tramway tracks. In the afternoon, an excursion was aranged to Tatton Park.

Knutsford, special cars leaving the vicinity of the Midland Hotel for Altrincham. From Altrincham the party was conveyed by motor 'buses to Knutsford, where, by the kind permission of the Earl of Egerton, it was conducted through the grounds and gardens of Tatton Park. Tea was provided at the Royal George Hotel, Knutsford, and the party arrived back in Manchester shortly after 7 o'clock in the evening.

The London United Tramways, Ltd., has incurred the severe displeasure of many districts through which its tramways run, on account of the noise accompanying the operation of its cars. In certain portions this noise has gradually got to be an intolerable nuisance, caused largely by the rail corrugations, but, according to various authorities, also owing to the defective condition of the machinery and trucks connected with the cars. The districts of Hammersmith, Twickenham, Ealing, Hampton Wick, Hanwell and Teddington have now determined to apply for an injunction to restrain the company from running cars, unless it complies with a request to make some effort to abate this nuisance. Teddington is taking the lead in the matter at present, as it estimates that it has lost in depreciation of house property at least the sum of £30,000 and another £30,000 for loss on empty houses.

A year's working has now been completed by the Wemyss Tramway Company, and all concerned are to be congratulated on the success of the undertaking. Sellon, C. E., estimated that the population would be carried thirty-three times over, a modest estimate, exceeded in reality by about half, seeing that 2,000,000 passengers have been booked. Starting with nine cars, the company has now thirteen and a claim on four large workmen's cars A new shed is in course of completion, new offices are to be built shortly, and tramway tea-rooms and shelter are being erected.

Sir Colin Scott Moncrieff has made his award to the Accrington Steam Tramway Company in the suit with the Haslingden and Rawtenstall corporations. For so much of its undertaking as belonged to the borough the company asked from Haslingden £24,203. It has ben awarded £14,203, which includes the depot and its land. From Rawtenstall the company asked £7,375. It is awarded £4,252. The corporations bear the costs. Haslingden is aranging with the company to continue its running of the cars until the end of the year. It proposes to commence electrifying the system as early after Christmas as the weather permits, and meanwhile is negotiating with Accrington and Rawtenstall corporations as to through running powers.

Leeds Corporation has submitted a draft agreement to Pudsey, in which it agrees to take over the tramway powers of the Pudsey Corporation, and proposes to construct a line from their terminus at Stanningley to Chapeltown, Dudsey. Leeds agrees to pay Pudsey the expenses of obtaining the Order, and agrees, upon the expiration of thirty-five years, or upon the expiration of any subsequent five years, to Pudsey purchasing from it the tramways, upon paying a sum equivalent to the fair market value of the cars, etc., and permanent way; but without anv allowance for goodwill or loss of profits.

We recently made a remark in this column that at the last annual meeting of the British Electric Traction Company, Sir Charles Rivers Wilson made the statement that tramway fares all over the country were too low and would have to be raised, and that in their particular case, in connection with their various enterprises, an early attempt would be made to do so. This attempt has been made, but, as far as is visible at present, not entirely successfully. In the vicinity of Birmingham, when the fares were raised, a large number of people who used to employ the tramway in question found other methods of transportation, some even preferring to walk rather than submit to the increased fare. The Yorkshire Electric Tramway Company has also endeavored to increase its fares in Dewsbury, and has been met with a boycott of its system by the workpeople in the district, many of whom are now to be seen walking long distances to and from their work. Increase of fares, therefore, is not such a simple operation as one would imagine, and it would appear that some other method would have to be adopted for increasing profits.

Few of the electrical construction companies have such a satisfactory record as Dick Kerr & Company, whose annual report appeared a few days ago. The company has managed to maintain for the past eight years an excellent average level of profit, and it has never paid less than 10 per cent on its ordinary capital. The total issued share and mortgage capital is divided into £305,000 6 per cent preference shares, £260,000 ordinary shares and £276,900 4½ per cent debenture stock. The gross profit has averaged £84,100 per annum and the net profit, which is struck after allowing for debenture and all other charges, £74,400 per annum. In 1907, the gross profits were £80,476 and the net profits £67,364. The ordinary or common stock received 10 per cent. dividends.

The company has carried out many contracts of importance in all parts of the world. It electrified the Liverpool and Southport section of the Lancashire & Yorkshire Railway, has been responsible for much of the equipment of the London County Council's tramway system and has conducted successful electrical installations in Hong Kong, Burmah, Japan, the Straits Settlements, Siam, New South Wales, India and other countries. It holds the lease of the Edinburgh Corporation tramways, which it has sublet to the Edinburgh & District Tramways Company. A. C. S.

CONVENTION OF SIGNAL APPLIANCE ASSOCIATION

Arrangements have been completed for the exhibits and entertainment at the convention of the Signal Appliance Ass'n, to be held in Milwaukee Oct. 8, 9, 10, the scheme of arrangements being very similar to that which was carried out so satisfactorily last year at Washington. A draft is appended of the programme contemplated, which will be adhered to as closely as possible.

PROGRAMME "BUSINESS."

Tuesday, October 8, 10 a. m. to 1 p. m.—Meeting
2 p. m. to 4:30 p. m.—Meeting.
Wednesday, October 9, 9 a. m. to 12 noon.—Meeting.
1 p. m. to 3 p. m.—Meeting.
3 p. m. to 5 p. m.—View Exhibits.
Thursday, October 10, 10 a. m. to 1 p. m.—Meeting.
2 p. m. and thereafter.—Indefinite.

Tuesday, 1 p. m. to 2 p. m., and Wednesday, 12 noon to 1 p. m., luncheon will be served at the place of meetings.

PROGRAMME "ENTERTAINMENT."

Tuesday, October 8, 2 p. m.—Ladies, Trolley Ride to Waukesha.
8 p. m.—Theater Party.
Wednesday, October 9, 10 a. m.—Ladies, Art Gallery and Museum.
2 p. m.—Auto Ride to Whitefish Bay or Tally Ho (optional).
7:20 p. m.—Banquet.

The speakers at Banquet will be as follows:

C. R. Peck, General Counsel, Chicago, Minneapolis and Saint Paul Railway Company, "Attitude of Railroads to Safe Transportation of Persons and Freight."

W. R. Gardner, Vice-President, Chicago & Northwestern Railway, "Relation of Signaling to Railway Operation."

John I. Beggs, General Manager, Milwaukee Electric Railway & Light Company, "Signaling for Trolley Lines."

E. Morse, President, Simplex Electric Company (for the Signal Appliance Association), "Relation of the People to the Railroads."

Azel Ames, Signal Engineer, New York Central & Hudson River Railroad (for the Railway Signal Association), "What the Signal Engineer Is Doing."

MUSIC.

Thursday, 10 a. m.—Indefinite.

Hotel Pfister will be headquarters of the association, the meetings being held in the Public Service Building. Room No. 435 of this building has been assigned for exhibition purposes. The treasurer of the association is H. M. Sperry, resident manager of the General Railway Signal Company, New York.

The association is only a little more than a year old, but has prospered in that short time beyond expectation. It numbers among its members some fifty signal companies and others along lines closely identied with signaling, and the meeting in Washington last year was very successful. Mr. Sperry's report as treasurer of the association was made simultaneously with the announcement of the coming meeting, and serves as a good index to what the association has already done in the line of organization. A list of both members and associate members in attendance at Washington is given, also the constitution and by-laws.

The financial report shows gross receipts of $2,573 and a balance of $1,052, after deducting Washington expenses and the expenses for the year.

EIGHTH ANNUAL REPORT OF THE AMERICAN RAILWAYS COMPANY

The report of the American Railways Company for the year ended June 30, 1907, has just been made public. The gross earnings of the subsidiary companies were $2,855,320.48, showing an increase over 1906 of $245,043.16, or 9.4 per cent. The total number of passengers carried was 67, 624, 731, showing an increase of 6,517,323, or 10.66 per cent. After paying all fixed charges, interest and taxes, the net income is $384,558.63. There was paid in dividends to stockholders of the American Railways Company $304,392, showing an increase over the amount paid in the previous year of $53,007 (due to the increase of the capital stock during the previous year), leaving a balance to the credit of surplus account $80,166.63, which, after adjustments hereinafter noted, leaves a balance to the credit of surplus on June 30, 1907, of $478,273.72. There has been charged off during the year against surplus account the sum of $8,981.21, being the final settlement of the old claims of the Economy Light & Power Company, of Joliet, Ill.

In presenting the report J. J. Sullivan, president of the company, said in part: While the growth of the different companies owned and operated has been eminently satisfactory to us, the increased cost of operating and maintaining the properties at the high standard that we have established has amounted to almost .18 per cent. This increased cost was caused by the increase of the very high prices of electrical machinery and all other supplies required in the maintenance and operation of the properties of the company and the advance of the wages of conductors, motormen and other employees.

In December, 1906, we paid $975,000 with interest, being the balance remaining unpaid when we bought the Scranton Railway Company in December, 1905. We borrowed the money on time to enable us to make this payment and close the transaction, which has turned out to the best interests of this company. The result of the operation of the company so far gives ample evidence of the wisdom shown by the board of directors in making the purchase. In April, 1907, we arranged to issue a collateral trust loan of $2,500,000, at 5 per cent interest, running for ten years, redeemable at any interest period at 102½ per cent and interest. We pledged 39,500 shares of the common stock of the Scranton Railway Company, and 29,500 shares of the stock of the Altoona & Logan Valley Electric Railway Company as collateral for that purpose. These bonds are now being sold, and will provide the funds to enable us to pay off the floating debt referred to above, also to build three large car barns, make some extensions and purchase additional cars and equipments. During the year we bought and paid for in Scranton, Pa., nine acres of land costing $31,500, on which we will erect a fire-proof car barn. In Joliet, Ill., we bought and paid for land for storing cars. In Tyrone, Pa., we bought and paid for a tract of land having a valuable water supply running through the property. At Tipton, Pa., we bought 4.45 acres for right of way, having in view the straightening of our tracks at some future time.

During the year the fire insurance fund of the company has been continued with success. This fund shows an increase for the year of $16,068.75, and the par value of the securities held for fire protection on June 30, 1907, is $146,500.

We have spent during the year for new construction and equipment and also in the purchase of real estate needed on account of the continual growth and development of the different properties the sum of $918,913.96, divided among the different properties as follows:

Altoona & Logan Valley Electric Railway Company	$200,465.50
Chicago & Joliet System	95,114.84
The Peoples Railway Company	88,395.53
The Springfield Railway Company	60,145.65
Bridgeton & Millville Traction Company	5,576.06
Bridgeton Electric Company	19,724.76
Home Electric Light & Steam Heating Company	13,327.46
Franklin Real Estate Company	41,264.52
Dellwood Park Company	154,123.29
Scranton Railway Company	240,776.95
Total	$918,913.96

TREASURER'S REPORT FOR FISCAL YEAR, ENDING JUNE 30, 1907

INCOME

Income from sub-companies	$502,758.35	
Miscellaneous income	24,304.17	
Gross income		$527,062.52

DEDUCTIONS FROM INCOME

General expenses	$930.69	
Printing and registration of stocks and bonds	3,651.22	
Legal expense	1,615.00	
Taxes	13,000.00	
Interest on funded debt	122,535.42	
Depreciation of office furniture and of engineering department instruments	771.56	
Total deductions from income		142,503.89
Net income		$384,558.63
Dividends paid		304,392.00
Surplus		$80,166.63
Surplus June 30, 1906	$407,088.30	
Adjustment of the Economy Light & Power Company's disputed accounts for the year 1902-1903, against the Chicago & Joliet Electric Railway Company and Chicago & Desplaines Valley Electric Railway Company	8,981.21	
		398,107.09
Surplus June 30, 1907		$478,273.72

WALTER W. PERKINS,
Treasurer.

E. & O. E.

GENERAL BALANCE SHEET FOR FISCAL YEAR ENDING JUNE 30, 1907

ASSETS

	Total issue.	Owned by The A. R. Co.	Value on A. R. Co. Books.
The Springfield Railway Company 1st mortgage bonds; 6 per cent	$500,000.00	$500,000.00	$500,000.00
The Springfield Railway Company capital stock	1,000,000.00	994,400.00	39,959.16
Bridgeton Electric Company capital stock	25,000.00	25,000.00	17,279.44
Bridgeton & Milville Traction Company capital stock	200,000.00	200,000.00	159,364.32
The Peoples Railway Company capital stock	1,100,000.00	1,100,000.00	1,334,228.50
The Springfield Light & Power Company capital stock	700.00	700.00	700.00
Altoona & Logan Valley Electric Railway Company capital stock	1,500,000.00	1,500,000.00	403,750.00
Du Page Construction Company capital stock	25,000.00	25,000.00	25,000.00
Dellwood Park Company capital stock	150,000.00	150,000.00	150,000.00
The Franklin Real Estate Company capital stock	10,000.00	10,000.00	10,000.00
Chicago Union Traction Company capital stock (Preferred / Common)			75,000.00
Scranton Railway Company capital stock, preferred	1,500,000.00	1,499,100.00	1,499,090.50
Scranton Railway Company capital stock, common	2,000,000.00	1,997,500.00	2,001,025.13
Total cost of stocks and bonds			$6,215,388.05
*Bills receivable, accounts receivable, etc			$4,847,480.94
Office furniture and fixtures			5,901.93
Engineering department instruments			1,043.02
Fire Insurance Fund investments			142,548.75
Interest on bonds owned, accrued but not due			15,251.03
Cash on hand			148,065.42
Collateral Trust Gold 5 per cent. Bonds, 1917, in treasury			2,185,000.00
			$13,560,678.24

*Chiefly advances to Subsidiary Companies.

LIABILITIES

Capital stock	$5,095,100.00
Collateral Trust Convertible Gold 5 per cent bonds, due 1911	2,435,500.00
Collateral Trust Gold 5 per cent bonds, due 1917	2,500,000.00
New York Trust Company, trustee Scranton Railway Company preferred stock	1,499,000.00
Bills payable	1,265,000.00
Vouchers payable	73,874.78
Bills audited, but not paid	5,548.31
Accident insurance fund	25,495.17
Fire insurance fund	146,074.59
Taxes accrued, but not due	22,726.26
Interest accrued, but not due on funded debt	14,085.41
Profit and loss, surplus as per operating report	478,273.72
	$13,560,678.24

Par Value.

FIRE INSURANCE FUND INVESTMENT ACCOUNT OF THE AMERICAN RAILWAYS COMPANY, JUNE 30, 1907

Altoona & Logan Valley Electric Railway Company Consolidated Mortgage Gold 4½s	$94,000.00
Bridgeton & Millville Traction Company 1st Mortgage Gold 5s	16,000.00
Scranton Railway preferred stock 5 per cent Gold Trust certificates	24,000.00
Philadelphia Electric Company 4 per cent Gold Trust Certificates	5,000.00
Union Traction Company of Philadelphia, 150 shares	7,500.00
	$146,500.00

THE CLEVELAND SITUATION

Judge Lawrence refused to dismiss the suits of the Cleveland Electric as a taxpayer and as a property owner against the Low Fare Railway Company, which was included as a defendant in the attack made on the curative ordinance. The decision to hold the company was made because of its occupancy of East Fourteenth Street. The attorneys for the Forest City Railway Company undertook, by motion, to induce the court to find for the Low Fare Company before the evidence was all in, in order that it might be released from any responsibility in the matter.

Harry Rickey, editor of the Scripps-McRea string of newspapers, told on the stand what he knew of the Cleveland *Press* guaranteeing that stock of the Forest City Railway Company, sold through it, would receive a dividend of 6 per cent, and of the connection of Mayor Johnson with the plan. He and E. W. Scripps signed an agreement that made the *Press* safe in making the guarantee, but Mr. Rickey said that all but four of these guarantees have been taken up and exchanged for others, with which the mayor had nothing to do.

The deposition of Ben T. Cable, one of the men to whom Johnson claims to have delivered stock he received from Secretary Alber, showed that he had exchanged securities for the shares which he received, with the understanding that the mayor would convert them into cash when the company needed the money. He claimed that he had not been influenced to purchase the stock and that he had received no guarantees. This transaction, the Forest City Company's attorneys claim, disposes of the mystery surrounding the $80,000 which the mayor is supposed to have furnished the company.

The first payment made by C. M. Bates was $6,100, given shortly after John B. Hoefgen withdrew from the proposition. He said that he went into the company because he believed that it would pay. Further, he said the mayor had told him that he thought the company would secure a franchise.

Mayor Johnson's testimony was to the effect that he promised, when first a candidate for office, to sign no street railway franchises for a higher rate of fare than three cents and universal transfers, and further that he had promised to secure the formation of a company, or companies, that would operate on those conditions. He said that he induced John B. Hoefgen to go to work on the proposition, but that he withdrew when his franchises were declared worthless by the courts. At that time Hoefgen had spent about $6,000, but he paid him no money. When Hoefgen left, he said he induced C. M. Bates, his former secretary, to come and take his place. Mr. Bates put in $6,200 and took up the vouchers of Mr. Hoefgen. Mr. Johnson told of taking the securities given him by Mr. Cable and converting them into money, for which he secured stock certificates and turned them over to Mr. Cable. He said he never expected to make any money out of the enterprise. None of the debts of the Forest City Railway Company have been paid by him, he said, although he admitted taking up the note given by Mr. Schwab and Mr. Salen, but this had been done with the money received from Mr. Cable, he said.

President Horace E. Andrews, of the Cleveland Electric, has written Congressman Burton a letter, denying that a profit of 6 per cent was made on a valuation of $79,000 a mile on the Quincy Street and Central Avenue lines while they were being operated on a fare of three cents, as has been asserted by A. B. DuPont, who endeavored to prove that this rate of fare would pay by the figures of the Cleveland Electric itself. Mr. Andrews said that Mr. DuPont had taken the time of operation at that fare as Feb. 1 to Apr. 23, when as a matter of fact it was from Jan. 12 to Apr. 23. He further stated that the figures used were evidently taken from a partial examination made of the books by Peter Witt and not from the complete records which could have been secured if desired. Mr. Andrews said that these lines had attracted business from other nearby and parallel lines until they showed a loss of $15,190,000, which, deducted from the gross receipts of the Central Avenue route, $70,261.82, make the earnings $58,341.38. Deducting operating expenses, $60,607.89, and a deficit of $2,266.51 would be shown. These figures have been revised since this statement was made, showing a much larger deficit than here stated. Mr. Andrews states that the company made no money operating at three cents, although a willingness had been shown to pay the city for the use of the streets for the time, as the supreme court had declared the franchises on this route had expired and the council failed to renew them at the offer the company made.

REORGANIZATION OF THE WINNEBAGO TRACTION

The Winnebago Traction Company, which some time ago went into the hands of a receiver, has taken steps for a reorganization. This plan contemplates improvements in Oshkosh and vicinity amounting to $300,000. The company is sending to each bondholder and stockholder a proposed agreement which will result in the formation of an organization committee. This committee will agree to carry out the proposed plan inside of a year. It is proposed to spend $100,000 on the Oshkosh plant and on cars, and $200,000 will be spent in building an extension to Berlin of the Oshkosh-Omro Interurban Line. In order to make these improvements, the company, upon reorganizing, will sell bonds and will place a first mortgage on its property of not less than $1,250,000, and a new second mortgage of not over $400,000.

GRANTING FREIGHT RIGHTS IN THE BERKSHIRES

In granting local freight and express rights for the Berkshire Street Railway, selectmen of the town of Great Barrington, Mass., have undertaken to impose novel conditions as to transportation of parcels and baggage, and although the company, in routine procedure under Massachusetts law, has petitioned the Railroad Commission for approval of the local grants, it is possible that the commissioners may see fit to strike out the novel features. The commission has heretofore negatived numerous attempts on the part of small towns and cities to impose onerous conditions when the companies found themselves obliged to ask rights for trolley express service.

Great Barrington's demands include what amounts to a 5-cent rate for all parcels of express or baggage weighing less than 25 lbs., carried within the limits of the town. The selectmen also reserve the right, on complaint of ten different shippers, after due notice and public hearing, to regulate the company's charges. This last would certainly be negatived by the state board if it were not put in with a saving clause, "provided these are approved by the Railroad Commission." The town's stipulation as to baggage is as follows: "The company shall receive and convey on all its passenger cars that are equipped for carrying baggage, trunks and other baggage of passengers actually riding and traveling on the cars, at all points along the line of the tracks within said town, where passengers owning such trunks or baggage are taken on for transportation; and such trunks and other baggage shall be transported and delivered to the same point where the passenger owning or having charge of such trunks or baggage leaves the car, or to any intermediate point to which the passenger shall desire to have the same transported. Until combination cars for express and passengers are used, express cars shall stop at any white pole where signalled, and deliver baggage to persons presenting check."

The town of Lee, adjoining Great Barrington, has also granted freight and express rights to the Berkshire Company, for which the company now asks the Railroad Commission's approval. Lee stipulates that only closed cars shall be used for this new service, that they shall be fitted with "safety brakes," that cars shall always be in charge of "trained" employees, and that not more than two cars shall be run "together or in connection" without a special permit from the town. Both towns require that no freight or express cars shall be operated between midnight and 5 a. m.

The Berkshire Street Railway is one of the New York, New Haven & Hartford Railroad's properties, operating in Pittsfield, Mass., and the towns south of there. It has just filed a petition with the Railroad Commission that indicates an intent to go ahead with the long-contemplated connection with the Western Massachusetts Street Railway, another New Haven property. It asks for approval of a location through the town of Lee to the boundary between Lee and Becket, a location formerly obtained by the Western Massachusetts, but never built upon. If this location is granted, it would be necessary only to get a continuance of the line through Becket and Chester in order to join the completed line of the Western Massachusetts, over which cars from the Berkshire might be run easterly through Huntington, Russell and Westfield, and so over the old Woronoco Street Railway line into Springfield. All the properties concerned are controlled by New Haven interests, which would thus become possessed of a trunk line joining their groups in the Springfield and Pittsfield districts.

THE TRANSIT INQUIRY IN NEW YORK

Judge Lacombe, of the United States Circuit Court, who appointed receivers for the New York City Railway last week, has directed Adrian H. Joline and Douglas Robinson, the receivers, not to seek an appearance before the Public Service Commission in its investigation of street railway affairs, but to leave the presentation of the company's side of the case in the hands of the "owners," to use the term applied by the court. Incidentally Judge Lacombe remarked that the receivership presumably would not extend for operation beyond a year and might end before that.

Judge Lacombe's opinion says:

"Application is made by the receivers for instructions of the court as to whether they should appear and participate in the investigation now being conducted by the Public Service Commission touching improvements to be made on the property and in the methods of its operation. It would seem unnecessary for them to do so. Their occupancy of the leased property is but temporary; presumably it will not extend—at least for operation—beyond a year, and it is to be hoped that it may be ended sooner.

"They are not practical street railroad men, have had only a few days' experience with this property, and could contribute nothing to the solution of the problem before the Commission. The former operators and owners of the roads are the persons from whom the information as to existing conditions and the probable results of proposed changes is to be obtained.

"All books in the custody of the receivers and all persons in their employ, who may be called as witnesses, will of course be at the service of the Commission, and it is to be supposed that the owners will continue to be represented at the hearing and to conduct their side of the investigation, because, to whatever extent the income of the property may enable the receivers to carry out the improvements called for by the Commission, the ultimate burden of them all will fall upon the property."

William M. Ivins, in response to a question by Chairman Willcox, read at the hearing on Wednesday, Oct. 2, a letter he had written to the receivers of the Metropolitan & New York City Railway expressing his dissatisfaction with the explanations advanced by Secretary-Treasurer Moorehead as to the disposition of the books and certain other papers of the company and asking the receivers to act under the circumstances. Other matters under consideration related to the use made of certain moneys entered as construction account which properly should have been charged to certain other service.

A Wall Street committee of the holders of the refunding 4 per cent bonds of the Metropolitan Street Railroad was announced Wednesday, Oct. 2, as being prepared to act for the protection of investors in this class of traction securities. At the same time a similar committee of Third Avenue bondholders was announced. The committee for the Metropolitan bonds consists of E. S. Marston, president of the Farmers' Loan & Trust Company, chairman; E. M. Bulkley, of Spencer Trask & Company; Dumont Clarke, president of the American Exchange National Bank; E. Y. Hebden, of the Bank of Montreal, and Otto H. Kahn, of Kuhn, Loeb & Company. The committee for the Third Avenue bonds consists of J. N. Wallace, president of the Central Trust Company, who is chairman; Adrian Iselin, Jr., of Iselin & Company; E. D. Randolph, treasurer of the New York Life Insurance Company; Mortimer L. Schiff, of Kuhn, Loeb & Company; James Timpson, vice-president of the Mutual Life Insurance Company, and H. Winterfeldt, of Hallgarten & Company.

By a resolution passed at its open meeting Wednesday, Oct. 2, the Public Service Commission made the Brooklyn Subway a certainty. The vote on the resolution stood three to two for adoption. Those who voted against the resolution were Commissiners Bassett and Maltbie, the former of Brooklyn, the latter of Manhattan. Both issued statements as to the reasons for their action, as did the other members of the commission who voted the other way. In a statement which he made in casting the deciding vote, Chairman Willcox said that it seemed to him that the whole matter had been duly passed upon, and that the action taken by these two boards (Estimate and Rapid Transit), if not legally, is morally binding upon the commission. While it is doubtless true that this commission could refuse to proceed with the advertising of contracts now before it, he was of the opinion that such a step should not be taken, except for the most weighty reasons and for causes which were not properly considered by the Board of Rapid Transit Commissioners and the Board of Estimate and Apportionment. The action of the board winds up the matter so far as the preliminaries are concerned. The work will be done by sections as quickly as possible. Advertisements for bids will probably appear next week and the contract will be awarded some time next month. Then work will begin within sixty days. The route of the line is from the Manhattan terminal of the Manhattan Bridge, over the Bridge and under the extension of Flatbush Avenue, thence under Fourth Avenue to Fortieth Street. This is the part that will be contracted for almost immediately, the line to be four tracked. Eventually two tracks will be extended from Fortieth Street to Fort Hamilton, and the other two tracks will be carried from Fortieth Street to Coney Island.

DECISION IN FAVOR OF MEMPHIS STREET RAILWAY COMPANY

The Tennessee Supreme Court has rendered a decision declaring the ordinance passed by the Council of the City of Memphis, attempting to reduce the fares of the Memphis Street Railway Company, invalid and unconstitutional. This decision reverses the opinion of Judge Pittman, of the State Circuit Court, who had decided that such an ordinance was valid.

OHIO FIXES RAILWAY VALUATIONS

The Ohio state board of equalization has fixed the valuation of interurban roads in that state at $12,685,896, an increase of $1,021,755 over last year. Reductions from the appraisements made by the board of county auditors have been made on the followng roads:

Scioto Valley	$46,214
Lake Shore	36,122
Northern Ohio Traction & Light	50,064
Indiana, Columbus & Eastern (Dayton-Columbus Division)	40,035
Columbus, Urbana & Western	28,925
Total	$201,360

Valuations were increased on the followng roads over the figures fixed by the county auditors:

Cincinnati, Dayton & Toledo	$33,713
Mahoning Valley Electric	36,060
Fort Wayne, Van Wert & Lima	9,863
Lima & Toledo	23,984
Lake Erie, Bowling Green & Napoleon	5,550
Steubenville & East Liverpool Traction	10,315
Wheeling Traction	23,390
Youngstown & Sharon and Sharon & Newcastle	7,408
East Liverpool Traction & Light	18,600
Steubenville & Wheeling	5,850
Ohio River Electric	3,005
Cambridge Power & Light	6,877
Camden Interstate	7,269
Youngstown Park & Falls	5,097
Victory Park	1,100
Mansfield Railway, Light & Power	3,375
Total	$201,456

AFFAIRS IN CHICAGO

Attorney Calhoun says that the cross bill filed by the West and North Chicago companies in the Guaranty Trust Company suit will not seriously affect the traction settlement. He says that they want the properties sold as a unit. The defendants to these suits must answer within twenty days after service. The petitioners ask that all assets and equities of the Union Traction Company and its subsidiaries be ascertained and established.

The Chicago City Railway Company's report for the six months ended July 31, 1907, compares with the years ended Dec. 31, 1906, 1905, and 1904, as follows:

	Six Months 1907.	Year 1906.
Gross receipts	$4,057,336	$7,871,126
Operating expenses	2,840,135	6,146,304
Net earnings	$1,217,201	$1,724,822
Fixed charges	713,635	1,620,000
Surplus	$503,566	$104,822
Paid to city	278,218	.....
Surplus	$225,348	.....

The share of the city of Chicago in the net profits of the Chicago City Railway Company for the first six months ending July 31 will be $278,218. This is according to the official statement of the financial results of the operation of the traction settlement ordinance, made by President T. E. Mitten, of the railway company. The report shows the total net profit for the period is $503,550, and the company's share is $225,348.

These figures are based on the city getting 55 per cent and the company getting 45 per cent of the net profits, as provided in the ordinance.

A new plan of reorganization for the Chicago Union Traction properties offered by Messrs. Burry & Beitler represents merely the views of counsel acting for one trustee, the Fidelity Insurance, Trust & Safe Deposit Company of Philadelphia. It is not understood that any other trustees have concurred therein. It is not an official plan and stands solely on its merits as a suggestion.

There is not likely to be any important development in the Chicago Traction situation for ten or fifteen days, or until the receiver makes a move to default on the underlying bonds, as he has threatened to do. The trustees of the mortgage on which interests will next come due and on which an attempt will be made to default, will take steps to thwart that design, and then, it is hoped, all the trustees may be able to come together and agree upon a plan satisfactory alike to themselves and the bondholders.

STEAM AND ELECTRIC ROADS IN INDIANA MUST INTERCHANGE TRAFFIC

That steam and electric roads in Indiana must interchange traffic is the substance of a ruling by the Indiana Railroad Commission in disposing of the case of the Farmland Stone Company vs. the Chicago, Cincinnati, Cleveland & St. Louis Railroad and the Indiana Union Traction Company to compel an interchange of coal traffic at Winchester, Ind. The petition alleges that the traction company has for same time past been unable to deliver cars of coal to the stone company, which is located in Farmland, six miles from Winchester, whereas formerly the steam lines brought the coal to Winchester and delivered it to the traction company in car-load lots and the traction company hauled it to Farmland and delivered it to the stone company. It was set out that notwithstanding the traction company has been ready and willing to deliver the coal in car-load lots to the stone company for some time past, the railroad company has refused to deliver the cars to the traction lines. The petition asks that the steam lines be compelled to resume the interchange of the said coal traffic. The attorneys for the steam lines attacked the constitutionality of the law passed by the last Legislature, giving the commission jurisdiction in cases of this kind, and insisted that the stone company was not entitled to the relief demanded and that the railroad commission had no jurisdiction in the matter. Upon the evidence being heard the commission ordered that the interchange of the traffic be resumed not later than Oct. 20, 1907. The commission held that both the steam and electric roads were common carriers, belonging to the same class and amenable to the same general rules and regulations. However, the commission said that this ruling was applicable only to the present case and that all cases would have to be determined on their merits after considering the physical condition and capacity of the traction line successfully to carry out interchange of traffic in car-load lots. As to the constitutionality of the statutes the commission leaves the question open to the courts.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED SEPT. 24, 1907

866,646. Contact Device; Clarence J. Harter, Ilion, N. Y. App. filed Dec. 3, 1906. Patentee provides special attachments to the trolley wire at intervals thereon with depending shoes to engage contact devices on the car for operating sign indicators, etc.

866,659. Amusement Apparatus; Carl V. Johnson, Goldfield, Nev. App. filed March 14, 1907. An amusement apparatus of a character somewhat analogous to the ordinary "Loop-the-Loop" device except that the track swings into a different form after the car has passed partly through the loop.

866,675. Car Brake; William Q. Olden, Chicago, Ill. App. filed Dec. 12, 1906. Construction of lever system for operating the brakes of a railway car from a single air cylinder on the upper side of the car floor.

866,680. Amusement Apparatus; Albert L. Plotner, Dorchester, Mass. App. filed June 1, 1907. Amusement device of the class in which passengers slide down an inclined track in a tub or bucket having gear teeth on its periphery to impart a rotary movement.

866,729. Trolley; William Moeckel, Jersey City, N. J. App. filed June 12, 1907. The trolley harp has rigid U-shaped extensions projecting upward therefrom which carry grooved rollers on vertical axes to engage the trolley conductor laterally on both sides thereof.

866,743. Metal and Concrete Railway Tie and Rail Fastening; Moses Stoner, Warsaw, Ind. App. filed March 20, 1907. Means for securing the rails upon the ties comprising plates having overhanging lips or flanges and movable endwise with a wedging movement upon the rail.

866,780. Snow Plow; John W. Flynn, Bordentown, N. J. App. filed May 23, 1907. A snow plow adapted for use on locomotives having a plurality of vanes or blades by which the snow is guided against an interior inclined plane.

866,781. Trolley; George R. Forster, Fithian, Ill. App. filed April 27, 1907. The trolley pole has a spring impelled piston in a pneumatic cylinder for normally raising it, and means for admitting air to the cylinder to retrieve the pole.

866,846. Electric Locomotive Controller; Charles O. Dayton, Washington, Ia. App. filed Oct. 8, 1906. A block signal system for single track trolley roads having turnouts. Provides step-by-step actuated devices for registering and indicating the number of cars which enter a block in either direction.

866,945. Electric Signaling on Railways; William J. MacKenzie, Dunmurry, Ireland. App. filed Dec. 13, 1905. A device for signaling between trains including special trolleys between the usual track rails and which are engaged by grooved rollers depending from the locomotives.

866,983. Railway Switch; Guy M. Thompson, Seattle, Wash. App. filed Nov. 26, 1906. Details of construction of an electrical track switch. The switch point has rigid curved extensions therefrom to the ends of which are fastened the cores of separate solenoid magnets which respectively impel the switch point in opposite directions.

866,998. Switch Structure; Victor Angerer, Ridley Park, Pa. App. filed March 19, 1907. A bearing for the pivoted end of a switch point including curved surfaces which are held in engagement by force closure, supplied by tension springs.

867,007. System of Railroads and Appliances Pertaining Thereto; William H. Boyes and Erwin F. VonWilmowsky, New York, N. Y. App. filed July 23, 1900. In a railroad car consisting of short sections having a length of about 9 ft., elastic linking means between sections, oblique section ends joined by a flexible material for enabling the car to round the curves of the track.

867,021. Electric Contact Rail and Shoe; George Drawert, Chicago, Ill. App. filed May 14, 1906. The contact rail is specially constructed with a groove on its under side having underhanging lips, and the collector shoe runs in this groove so as to be positively guided against displacement in all directions.

867,085. Fare Register Attachment; John R. Scott, Oakland, Cal. App. filed Dec. 12, 1906. In place of the usual bell, patentee has an arrangement by which the lights are momentarily extinguished in a car to indicate the register of the fares.

867,125. Trolley Wheel Support; George W. Grisdale, Jr., Philadelphia, Pa. App. filed March 5, 1906. The trolley harp is swiveled on a vertical axis at the end of the trolley pole and is further yieldable rearwardly by an independent swinging movement.

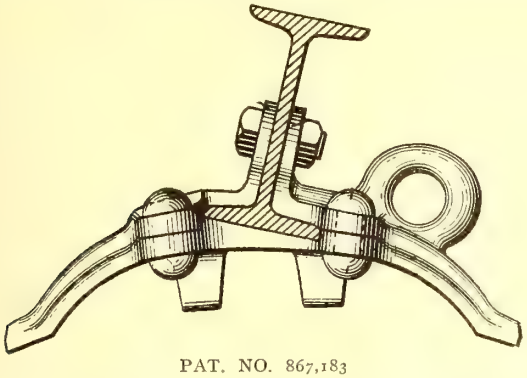
867,147. Rail Magnetic Brake; Victor L. Ochoa, New York, N. Y. App. filed Jan. 5, 1907. A large triangular magnet is hung by links between the wheels of the truck so as to act upon their peripheries and also on the track rail.

867,150. Railway Signaling Apparatus; Vincent L. Raven, Darlington, Eng. App. filed April 18, 1907. A complete system for permitting locomotives to communicate in foggy weather, including spaced contact plates between track rails engaged by brushes depending from the locomotive cab or cabs.

867,151. Railway Signaling Apparatus; Vincent L. Raven, Darlington, Eng. App. filed April 23, 1907. Relates to modifications of the above.

867,152. Railway Signaling Apparatus; Vincent L. Raven, Darlington, Eng. App. filed April 23, 1907. Covers additional modifications.

867,183. Brake Shoe Head; James H. Baker, Allegheny, Pa. App. filed Nov. 12, 1906. A construction of brake head having an open or frame-like body consisting of spaced side rails,



PAT. NO. 867,183

angular strips extending across the space or opening between the side rails and forming ears or lugs for holding the shoes and brake beam lugs or ears on the rear of the head.

867,197. Block Signal System for Electric Railways; Clayton W. Hamm, York, Pa. App. filed Dec. 19, 1906. Details of recording or registering mechanism for single-track trolley roads having turn-outs, including a pair of adjacent ratchet wheels with oppositely directed teeth and mechanism acting thereon to move a contact disc in opposite directions for the cars entering the single-track section from opposite sides.

WASHINGTON STREET SUBWAY WORK IN BOSTON

The Boston Transit Commission will receive bids for the widening of the Tremont Street subway near Haymarket Square, on Oct. 4. The merging of the Washington Street tunnel and the subway at this point will make it necessary to spread the mouth of the subway sufficiently to take care of the six tracks which will ascend the incline, and the first work to be done will be the construction of 270 ft. of wall from 10 to 30 ft. outside of and intended to take the place of the present westerly wall of the subway beneath the square. The bids will be required to cover the construction of the wall, excavation and the roofing of the intervening space. About 50 ft. of sewer will be built in connection with the new wall.

The Commission will shortly be obliged to decide how to build the new Riverbank subway, under the new Charles River embankment on the water side of Beacon Street. Some time ago the Charles River Basin Commission, which is building the embankment, located the marginal conduit in the middle of the embankment. This conduit is to be used for sewage purposes. If the subway is located on the land side of the conduit, the subway level must be high enough to carry it over the cross sewers, and this will mean 4 or 5 ft. of subway above ground, or at best covered by an artificial ridge of grass and flowers. Property owners object to this method and an alternative solution is to locate the subway on the water side of the conduit, in which case it would be wholly below the level of the embankment, with a filling of earth and masonry and a concrete sea wall between it and the water of the river. A public hearing will probably be held soon for the purpose of securing public sentiment as to the best place for the westerly portal to be brougnt forth.

NEW PUBLICATIONS

MODERN STEAM ENGINEERING IN THEORY AND PRACTICE, by Gardner D. Hiscock. New York, Norman W. Henley Publishing Company, 487 pages, illust. Price $3.

The author is a well known writer on technical subjects. His latest work has a broad field, taking up as it does much of the apparatus and many of the appliances used in steam engineering. The book contains several chapters on electrical engineering contributed by Newton Harrison.

THE ENGINEERING INDEX ANNUAL FOR 1906. New York, *The Engineering Magazine*. 412 pages. Price $2.

This annual finds a regular place in the library of those engineers who require to be kept in touch with the achievements of all fields of engineering.

PERSONAL MENTION

MR. A. C. HARRINGTON having resigned as the resident engineer of the Buffalo, Lockport & Rochester Railway Company, has been appointed chief engineer of the American Engineering Company, of Indianapolis, Ind.

MR. FRANK BURTON, who for many years was connected with the Yonkers lines of the Union Railway Company, of New York, has been appointed superintendent of transportation of the Montgomery Traction Company under General Superintendent Royster.

MR. ALBERT CARR has resigned his position as Chief Engineer of the United Railroads of San Francisco, to take the position of Superintendent of Construction on the water power developments of the Central Colorado Power Company. His new headquarters will be Colorado Springs.

MR. J. C. HUFFMAN, who recently resigned from the position of electrical engineer of the Oneonta & Mohawk Valley Railroad, has accepted a sales position with the Canadian Westinghouse Company, Limited, with the Winnipeg office. He will travel out of Calgary, having the territory of Alberta, Saskatchewan and Eastern British Columbia.

MR. W. H. FORSE, JR., secretary and treasurer of the Indiana Union Traction Company, with headquarters at Anderson, Ind., has been appointed by the president of the American Street & Interurban Railway Accountants' Association one of a committee to represent the association at the convention of the National Association of Railway Commissioners, to be held in Washington in October.

MR. C. P. ORTH has been appointed master mechanic in charge of the city and interurban lines of the Galesburg & Kewanee Electric Railway Company, as well as the overhead work of that company. Mr. Orth has been connected with the electric railway business for several years, his original connection in this field having been with the old Brush Electric Company, of Cleveland. Since that time he has been identified with the Cleveland Electric Railway Company, the Lorain Street Railway Company and the New York & Long Island Traction Company.

MR. BENJAMIN J. WEEKS, for the past seventeen months general manager of the Pacific Traction Company, of Tacoma, Wash., has resigned from the company. Mr. Weeks states that this step is the result of his determination to devote his entire attention to private interests. Mr. Weeks has been engaged in street railway enterprises in Washington for the past six years. During the first two and one-half years of this period he was general superintendent of the Tacoma Railway & Power Company's lines. A portion of this time the lines were the property of the General Electric Company and shortly before Mr. Weeks severed his connection with the road they were purchased by Stone & Webster, of Boston. From the time he left the Tacoma Railway & Power Company until seventeen months ago, when he entered the service of the Pacific Traction Company, Mr. Weeks was general manager of the Spokane Electric Company. It is understood that no successor to Mr. Weeks will be selected at present, and that the duties of the general manager of the Pacific Traction Company will be temporarily attended to by Mr. E. J. Felt, vice-president of the company.

MR. ELMER H. LITTLEFIELD, superintendent of the ninth division of the Boston Elevated Railway Company, is dead. He was fifty-nine years old and had been identified with the street railway business nearly forty years. Mr. Littlefield was born in Georgetown, and spent the larger portion of his early life in Salem, where his parents moved when he was but three years old. In 1870 he came to Boston, and in the same year began his street railway career as a conductor on the Union Street Railway under the administration of Supt. Richard Hapgood. For a number of years he filled the positions of driver and conductor on the Union & Cambridge Street Railways, and was later placed in charge of the River Street stables. This position he held until the present head of the elevated company, General Bancroft, became superintendent of the road, when Mr. Littlefield was appointed assistant superintendent. In 1888 Mr. Littlefield resigned and went to Topeka, Kan., where he became superintendent of a street railway company. In 1898, after living in Oklahoma for several years, he came back to Boston and entered the service of the West End Company, and in 1899 was appointed as superintendent of division 9. This position he held until his death.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement, "American Street Railway Investments" which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. ‡ Including Rapid Railway system, Sandwich, Windsor & Amherstburg Railway, and Detroit, Monroe & Toledo Short Line Railway.

Company.	Period.	Total Gross Earnings.	Operating Expenses.	Net Earnings.	Deductions From Income.	Net Income. Amount Available for Dividends.
AKRON, O. Northern Ohio Tr. & Light Co.	1m., Aug. '07	216,146	112,860	103,286	43,522	59,764
	1 " " '06	194,379	96,181	98,198	40,589	57,609
	8 " " '07	1,274,443	736,414	538,029	339,881	198,148
	8 " " '06	1,130,064	677,206	452,858	321,002	131,856
CHAMPAIGN ILL. Illinois Traction Co.	1m., July, '07	329,601	*183,318	146,283	.....	.....
	1 " " '06	262,725	*136,708	126,017	.....	.....
	7 " " '07	2,035,918	*1,158,200	877,718	.....	.....
	7 " " '06	1,625,595	*913,151	712,444	.....	.....
CHARLESTON, S. C. Charleston Consolidated Ry., Gas and Elec. Co.	1m., July, '07	67,298	38,619	28,679	13,517	15,162
	1 " " '06	61,727	34,564	27,163	13,017	14,147
	5 " " '07	302,942	185,667	117,274	67,583	49,691
	5 " " '06	272,214	162,708	109,506	64,933	44,573
CHICAGO, ILL. Aurora Elgin & Chicago Ry. Co.	1m., July, '07	152,252	74,909	77,344	27,508	49,835
	1 " " '06	135,798	64,971	70,826	24,939	45,887
Chicago & Milwaukee Elec. R. R. Co.	1m., Aug. '07	122,679	45,732	76,947	.....	.....
	1 " " '06	107,089	35,615	71,474	.....	.....
	8 " " '07	674,284	282,646	391,638	.....	.....
	8 " " '06	536,387	212,894	232,493	.....	.....
CLEVELAND, O. Cleveland, Painesville & Eastern R.R. Co.	1m., July, '07	34,401	*15,893	18,508	6,796	11,712
	1 " " '06	32,631	*15,774	16,856	7,108	9,748
	7 " " '07	157,587	*84,225	73,362	50,072	23,290
	7 " " '06	146,518	*81,876	64,642	48,314	16,328
COLUMBUS, GA. Columbus Elec. Co.	1m., July '07	30,845	*20,468	10,377	10,150	227
	1 " " '06	24,594	*13,280	11,314	8,762	2,551
	12 " " '07	340,955	*195,167	145,788	113,894	31,894
DALLAS, TEX. Dallas Elec. Corp'n	1m., July, '07	91,861	*64,485	27,375	18,940	8,436
	1 " " '06	83,598	*51,422	32,176	15,125	17,051
	12 " " '07	1,070,319	*793,408	276,910	202,287	74,624
	12 " " '06	1,010,910	*627,418	383,492	183,129	200,363
DETROIT, MICH. Detroit, Jackson & Chicago Ry.	1m., Aug. '07	41,834	*30,882	10,952	16,575	†5,623
	7 " " '07	245,047	*192,168	52,879	106,650	†53,771
‡Detroit United Ry. Co.	1m., Aug. '07	690,213	*396,885	293,328	116,537	176,791
	1 " " '06	618,386	*349,617	268,769	106,850	161,919
	8 " " '07	4,481,466	*2,726,651	1,754,815	912,549	842,266
	8 " " '06	3,999,447	*2,365,263	1,634,184	817,056	817,128
DULUTH, MINN. Duluth St. Ry. Co.	1m., July, '07	83,921	36,073	47,847	17,991	29,857
	1 " " '06	75,470	32,990	42,480	17,876	24,603
	7 " " '07	470,042	237,126	232,916	123,922	108,993
	7 " " '06	431,708	224,466	207,242	122,930	84,313
EAST. LOUIS, ILL. East St. Louis & Suburban Co.	1m., July, '07	186,101	97,865	88,235	.....	.....
	1 " " '06	173,676	78,795	94,880	.....	.....
	7 " " '07	1,183,918	640,817	543,100	.....	.....
	7 " " '06	1,069,833	536,246	533,586	.....	.....
EL PASO, TEX. El Paso Cos.	1m., July, '07	41,637	*32,073	9,564	5,035	4,529
	1 " " '06	31,002	*22,116	8,886	3,911	4,975
	12 " " '07	455,142	*349,085	106,056	54,392	51,664
	12 " " '06	339,917	*228,476	111,441	45,541	65,900
FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co.	1m., July, '07	117,494	67,985	49,509	.....	.....
	1 " " '06	101,074	61,286	39,788	.....	.....
	7 " " '07	686,772	416,981	269,791	.....	.....
	7 " " '06	592,960	368,377	224,583	.....	.....
FT. WORTH, TEX. Northern Texas Tr. Co.	1m., July, '07	96,933	*54,207	42,726	11,001	31,725
	1 " " '06	81,758	*48,210	33,549	9,942	23,607
	12 " " '07	982,280	*613,523	368,757	123,079	245,677
	12 " " '06	757,620	*467,450	290,170	119,279	170,891
GALVESTON, TEX. Galveston Elec. Co.	1m., July, '07	38,818	*20,032	18,786	4,166	14,620
	1 " " '06	33,441	*17,473	15,968	4,166	11,802
	12 " " '07	351,356	*208,572	142,784	50,000	92,748
	12 " " '06	292,389	*181,820	110,569	50,000	60,569
GLENS FALLS, N.Y. Hudson Valley Ry.	12m., June, '07	618,614	415,641	202,973	202,248	725
	12 " " '06	570,689	327,354	243,335	265,975	†22,640
HOUGHTON, MICH. Houghton County St. Ry. Co.	1m., July, '07	26,330	*13,146	13,184	3,972	9,212
	1 " " '06	22,901	*12,913	9,988	3,909	6,078
	12 " " '07	246,749	*151,354	95,395	47,231	48,164
	12 " " '06	212,707	*144,455	68,252	46,123	22,129
HOUSTON, TEX. Houston Electric Co.	1m., July, '07	59,950	*36,559	23,391	11,043	12,347
	1 " " '06	51,166	*32,489	18,677	10,066	8,611
	12 " " '07	643,305	*417,300	226,005	127,959	98,046
	12 " " '06	561,563	*352,312	209,251	127,759	81,492
KANSAS CITY, MO. Kansas City Ry. & Lt. Co.	1m., July, '07	513,445	265,512	247,933	154,599	93,334
	1 " " '06	469,973	233,562	236,414	143,460	92,953
	2 " " '07	1,029,261	546,787	482,474	307,828	174,646
	2 " " '06	927,763	478,664	449,099	285,486	163,613
LEXINGTON, KY. Lexington & Interurban Rys. Co.	1m., July, '07	52,807	32,742	20,064	.....	.....
	1 " " '06	50.186	30,931	19,254	.....	.....
	7 " " '07	302,502	202,271	100,231	.....	.....
	7 " " '06	281,588	194,144	87,444	.....	.....
MILWAUKEE, WIS. Milwaukee Elec. Ry. & Lt. Co.	1m., July, '07	337,649	166,125	171,524	103,158	68,366
	1 " " '06	305,681	146,817	158,864	90,191	68,673
	7 " " '07	2,199,576	1,102,428	1,097,148	671,851	425,297
	7 " " '06	1,977,341	987,029	990,312	604,596	385,716
Milwaukee Lt., Ht. & Tr. Co.	1m., July, '07	97,179	35,488	61,692	60,020	1,672
	1 " " '06	81,679	26,784	54,895	30,709	24,186
	7 " " '07	441,715	194,199	247,516	269,942	†22,425
	7 " " '06	374,920	149,830	225,090	176,671	48,419
MINNEAPOLIS, MINN. Twin City R. T. Co.	1m., July, '07	571,986	271,236	300,749	115,142	185,607
	1 " " '06	522,950	236,118	286,832	114,619	172,213
	7 " " '07	3,420,600	1,668,378	1,752,221	806,458	945,763
	7 " " '06	3,077,558	1,450,500	1,627,059	774,636	852,422
MONTREAL, CAN. Montreal St. Ry. Co.	1m., Aug. '07	329,755	184,844	144,911	67,208	77,703
	1 " " '06	300,278	158,415	141,863	59,430	82,433
	11 " " '07	3,164,399	1,946,389	1,218,010	524,555	693,455
	11 " " '06	2,794,948	1,686,679	1,108,179	434,240	673,939
NEW ORLEANS, LA. New Orleans Ry. & Lt. Co.	1m., July, '07	443,831	264,685	179,146	161,450	17,696
	1 " " '06	466,748	287,710	179,038	169,909	9,129
	7 " " '07	3,342,920	1,805,153	1,537,767	1,077,736	460,030
	7 " " '06	3,532,903	1,864,881	1,668,022	1,170,472	497,551
NORFOLK, VA. Norfolk & Portsmouth Tr. Co.	1m., July, '07	274,018	166,722	107,296	.....	.....
	1 " " '06	162,586	108,394	54,192	.....	.....
	7 " " '07	1,374,198	867,204	506,994	.....	.....
	7 " " '06	957,573	633,692	323,881	.....	.....
PEEKSKILL, N. Y. Peekskill Lt. & R. R. Co.	1m., Aug. '07	16,760	*7,800	8,960	.....	.....
	1 " " '06	14,831	*6,612	8,219	.....	.....
	8 " " '07	108,973	*59,228	49,745	.....	.....
	8 " " '06	95,265	*49,324	45,941	.....	.....
PHIL., PA. American Rys. Co.	1m., Aug. '07	294,037	.....	.....	.....	.....
	1 " " '06	274,167	.....	.....	.....	.....
	2 " " '07	596,191	.....	.....	.....	.....
	2 " " '06	550,441	.....	.....	.....	.....
PLYMOUTH, MASS. Brockton & Plymouth St. Ry. Co.	1m., July, '07	17,451	*8,358	9,093	1,731	7,363
	1 " " '06	15,477	*7,013	8,464	1,797	6,667
	12 " " '07	118,393	*76,377	42,016	21,574	20,442
	12 " " '06	104,869	*71,005	33,864	21,641	12,223
ROCHESTER, N. Y. Rochester & Eastern Rapid Ry.	12m., June, '07	258,982	168,963	90,019	120,114	†30,095
	12 " " '06	237,903	144,946	92,057	85,009	7,048
ST. LOUIS, MO. United Railways Co. of St. Louis	1m., Aug. '07	956,240	*610,161	346,079	232,506	113,573
	1 " " '06	897,651	*568,400	329,251	231,732	97,519
	8 " " '07	7,185,731	*4,710,133	2,475,598	1,851,327	624,271
	8 " " '06	6,748,837	*4,254,758	2,494,079	1,854,345	639,734
SAVANNAH, GA. Savannah Electric Co	1m., July, '07	55,452	*36,601	18,851	12,024	6,826
	1 " " '06	60,528	*33,678	26,850	11,523	15,527
	12 " " '07	585,767	*387,907	197,860	139,537	58,323
	12 " " '06	618,897	*373,330	245,567	131,311	114,256
SCHENECTADY, N. Y. Schenectady Ry.	3m., June, '07	270,041	174,756	95,285	32,449	62,839
	3 " " '06	192,802	140,925	51,877	55,056	†3,176
TACOMA, WASH. Puget Sound El. Ry. Co.	1m., July, '07	171,146	*101,549	69,597	32,735	36,862
	1 " " '06	138,152	*84,407	53,745	25,585	28,159
	12 " " '07	1,553,902	*1,008,396	545,506	352,711	192,795
	12 " " '06	1,249,329	*835,574	413,755	274,358	139,397

STREET RAILWAY JOURNAL

THE CONVENTION CITY.

Atlantic City is unique among the pleasure resorts of this country in that it receives and entertains guests during the entire year. Annually between 6,000,000 and 8,000,000 people visit Atlantic City expecting to be amused or to find benefit in the climate. The city has no factories or no shipping and none of the large industrial enterprises to which other communities lay claim. It tries to forget the existence of those institutions in which men toil and labor. In doing so it the more successfully succeeds in affording relief to those who wish to escape business cares and worry.

But Atlantic City does boast of its hotels, and it may rightfully do so, both as to number and quality. Of the hotels there are twenty-two that have a capacity of more than 500 people each, and these, together with the 900 other licensed hotels and boarding houses, have a total capacity for about 300,000 guests. Few cities can boast of better accommodations than they afford.

But the hotels and even Atlantic City itself are incidental to the Boardwalk. This cosmopolitan thoroughfare, which varies in width from 20 ft. to 60 ft. and which stretches for five miles along the beach, has an inexplicable fascination for and leaves an indelible impression on every visitor to Atlantic City. Probably the explanation lies in the fact that the proximity of so many others, all on pleasure bent, the large shop windows in which everything is enticingly arranged to attract the attention of the purchaser, and the wide expanse overhead, and eastward in the direction of the ocean, combine to turn one's thoughts from himself and drive dull care away.

The roller chair is a feature of the boardwalk to the same extent that the walk itself is a feature of Atlantic City. These chairs are always in readiness for those who have spent too much of their energies in battling with the waves while in bathing or in keeping their place for several hours in the continuous promenade along the ocean. There are more than 1300 roller chairs licensed by the city, and to the observer it appears that the entire number passes him during an evening promenade. The boardwalk, it may be added, was constructed by the municipality at a cost of $300,000.

One cannot help but reflect on the amount of money left in Atlantic City annually by the horde of visitors. An official estimate places it at $110,000,000. Assuming that there are 6,000,000 visitors annually, this would allow of each visitor spending about $18. The estimate has every appearance of being a conservative one. The amount in the aggregate seems a prodigous sum, but no doubt it would be much less than the money value of the benefits derived by the visitors could a price be placed on improved health, clearer brains and rested nerves.

Atlantic City of course owes its existence to the ocean and to the gradually descending beach which causes the surf to roll in a manner which is peculiarly fascinating to the observer. Almost every visitor during the summer season comes with firm resolution to spend at least a portion of the time each day in the water, and usually does so. During the height of the season there are often as many as 40,000 people on the beach in bathing suits at one time. A few bathers may be found in the water during the early morning hours and some venture into the ocean after dark, but the throng begins to appear about 10 o'clock in the morning. From this time on the beach is crowded until evening, when all return to their hotels, to sally forth soon afterward on the boardwalk or to patronize some of the many amusement features which are to be found on the several steel piers.

Those who care to stray from the influences of the beach, the boardwalk and the piers will find many other pleasant and wholesome ways of spending their time.

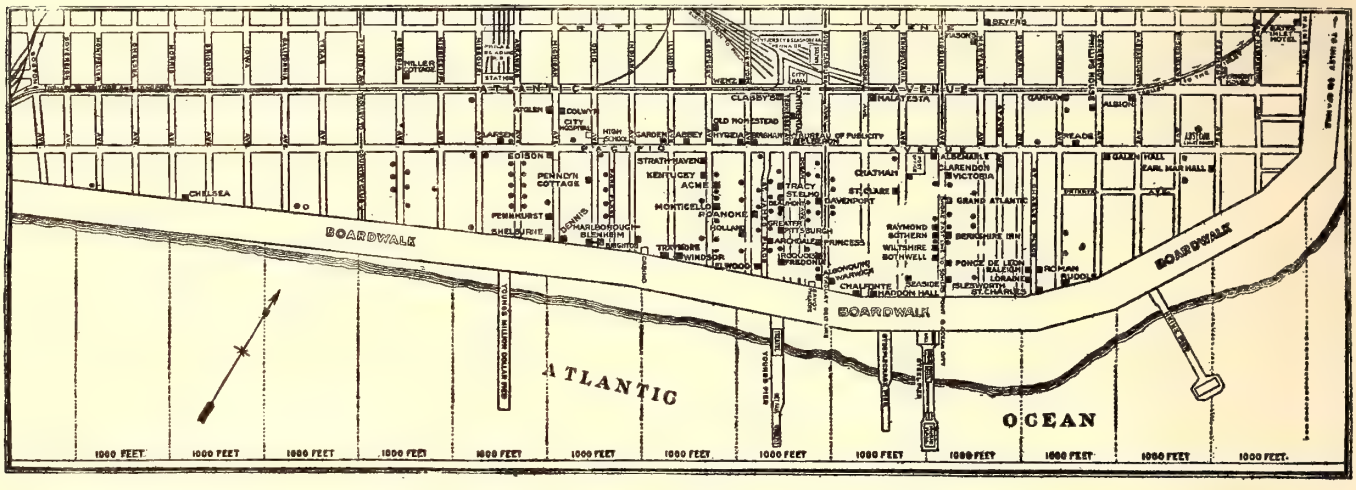
In the inlet at the northern terminus of the boardwalk are small steamboats, sailboats and tugs which can be engaged for excursions along the shore or for fishing trips out into the ocean, while those who are too timid for either of these pastimes may enjoy a sail over the waters of the Thoroughfare, which divides the island on which Atlantic City is located from the mainland. Still others prefer to drive on the Speedway, which continues seven miles from Albany Avenue to Seaview, or on the several highways which extend to Longport, South Atlantic City, Lighthouse and other nearby points of interest.

A very pleasant trolley trip may be had by taking the electric cars which traverse the ocean front and extend from the Inlet at the northern end of the island through Chelsea, Ventor and South Atlantic City to Longport, where the trolley is met by a steamboat on which the trip may be continued across an inlet to Ocean City. Another trolley trip may be taken across the Thoroughfare to Pleasantville and to Somers Point on the mainland, and thence to Ocean City over a long trestle which has recently been completed. The Country Club, located at Northfield seven miles away, affords every opportu-

nity for golf and other outdoor sports at all seasons and can be reached by trolley at any hour.

Many visitors undoubtedly leave Atlantic City under the impression that it consists wholly of the boardwalk, the beach, the hotels, the bathing pavilions and souvenir stores. But such is not the case. Behind what can be seen from the shore there is in fact a well planned and carefully built city with 40,000 permanent inhabitants who have their work and their business institutions just as do residents of other cities.

The city has five national banks and three trust companies with aggregate deposits of $8,500,000. There are ten public school buildings with about 150 teachers and 5800 pupils. Of churches of all denominations there are thirty. The police department consists of 100 members, the fire department of 140 men and the city beach patrol or life saving corps is composed of 55 guards.



MAP OF THE HOTEL DISTRICT, ATLANTIC CITY

The city's water supply is obtained partly from fifteen artesian wells, which supply 4,000,000 gallons of water per day, and partly from a cedar-grown protected watershed on the main land. In August the daily consumption is over 10,000,000 gallons, exclusive of that of many of the larger hotels, which obtain their water from private artesian wells.

Sixty miles of sewer pipes carry sewage to a common station, from which it is pumped up into the Thoroughfare several miles back of the city. By this method the water of the bathing beach is kept pure, as has been proven by repeated analyses.

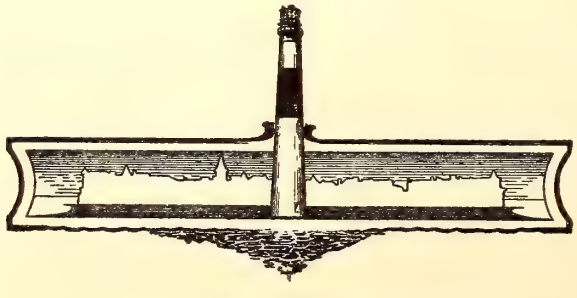
ELECTRIC RAILWAYS

Exclusive of the West Jersey & Seashore Railroad, which is owned by the Pennsylvania Railroad Company, there are three electric railway systems in and about Atlantic City.

The Atlantic City Electric Railway extends the full length of the island on which Atlantic City is located, from the inlet on the north to the landing opposite Ocean City on the south. It is owned and operated by the Pennsylvania Railroad. There are seventeen miles of track and the passenger equipment consists of twenty semi-convertible and thirty-five open cars. The repair shops are at Main and Arctic Avenues.

The Atlantic City & Shore Railroad extends from Virginia and South Carolina Avenues across the Thoroughfare to Pleasantville and thence to Somers Point. An extension under the name of the Atlantic City & Ocean City Railroad is being built across Egg Harbor to Ocean City. For a portion of the distance between Pleasantville and Atlantic City the cars are operated over the tracks of the West Jersey & Seashore Railroad, and for this reason the cars are equipped with third-rail shoes. On the mainland catenary construction overhead is used. Current for operating the line is purchased from the West Jersey & Seashore Railroad. The high tension lines from the power station at Westville are carried to a rotary converter sub-station belonging to the Atlantic City & Shore Railroad at Somers Point. The run between Atlantic City and Somers Point, a distance of fourteen miles, is made in thirty minutes.

The Atlantic City & Suburban Traction Company also operates between Atlantic City, Pleasantville and Somers Point. The road has seventeen miles of track and twenty-two cars. The power station and shops are at Pleasantville.





THE BOARD WALK AS SEEN FROM THE MARLBOROUGH-BLENHEIM



EASTER SUNDAY AT ATLANTIC CITY



THE BATHING HOUR AT ATLANTIC CITY



THE STEEL PIER AND STEEPLECHASE PIER













VIEWS IN AND AROUND ATLANTIC CITY



THE INLET, THE STARTING-POINT FOR BOATING TRIPS



TERMINAL AT VIRGINIA AVENUE AND BOARDWALK OF THE ATLANTIC CITY & SHORE RAILROAD

THE SCOPE OF THIS ISSUE

It seems a far cry from the Richmond road of 1888, with its two 7½-hp motors per car hung on the underframing, to the powerful electric locomotives which are now hauling trains of twelve or more heavy Pullman sleepers out of the Grand Central Station in New York—to the high-speed motor trains which are carrying more passengers between Camden and Atlantic City and on the electrified portions of the Long Island Railroad than were ever transported by their steam predecessors—to the single-phase leviathans of the New Haven and Pennsylvania railroads, and to the latest developments in electric traction locomotives in England and on the continent of Europe. The past nineteen years, which have been crowded with developments in other branches of engineering, have consituated practically the entire history of the modern electric road. Starting almost as a toy at an exposition it soon developed into the street railway as we know it now, then into the suburban extension of the city system, then by almost insensible gradations into the interurban road which is familiar to readers of this paper. From this point the advance to heavy electric traction was a rapid one.

Practically all of the electrified steam railroads in this country have been described in the technical press at the time or soon after they were placed in operation. A list of the most important of these articles which have appeared in the Street Railway Journal is presented below. In this table the elevated railways which have been converted from steam to electricity, like those in Brooklyn and New York, have been omitted.

Name of Company.	Present Length of Route.	Present Length of Track.	Reference to Street Railway Journal.
TRUNK LINE RAILWAYS FOR TRUNK LINE CONDITIONS			
N. Y. Central (N. Y. Zone)	17	85	Vol. 26, 336, 609, 837, 872, 920.
N. Y., N. H. & H.....	22	100	Vol. 27, 558; Vol. 30, 242, 278, 308.
Baltimore & O. (Belt Line)	4	8	Vol. 21, 398, and earlier issues.
Long Island Railroad.....	42	97	Vol. 27, 323, 536, 896, 936, 968.
TRUNK LINE RAILWAYS FOR BRANCH LINE CONDITIONS			
Pennsylvania Railroad— West Jersey & Seashore.	74	150	Vol. 28, 928.
N. Y., N. H. & H.— New Canaan Division....	8	8	Vol 14, 540.
Providence-Warren-Bristol	24	44	Vol. 19, 225.
Middletown-Berlin	17	17	Vol. 30, 412.
Erie R. R.—Port Morris Br.	34	34	Vol. 28, 1091.
West Shore R. R.— Utica-Syracuse	44	105	Vol. 29, 996.
Boston & Maine— Concord & Manchester...	16½	16½	Vol. 20, 921.
INDEPENDENT LINES, OPERATED BY STEAM OR ELECTRIC RAILWAY COMPANIES			
Albany & Hudson.....	37	37	Vol. 17, 141.
Cincin., Geo'twn & Portsm'th	53	56b	Vol. 21, 286.
Evansville, Sub. & Newburg.	28	28	Vol. 29, 446.
North Shore, California...	12	24	Vol. 23, 4, 56.
Lockport Line—International Railway, of Buffalo...	13½	13½	Vol. 14, 535.

b, partly operated by steam.

These articles, as well as most of those which have appeared elsewhere in the technical press, have described the engineering features of the roads as they were when completed and turned over to the operating department of the railroad company. There has been a dearth of information, however, as to the practical operation of these roads. It is as if the constructional features only are of interest to the engineer and manager and that the question of operation is a minor detail.

This is very far from the fact and it is the intention of this paper to supply this omission so far as the most conspicuous examples of the recent changes from steam to electric traction are concerned.

For this reason a careful study has been made of the electrical engineering operating practice of the New York Central & Hudson River Railroad, the Long Island Railroad, the West Jersey & Seashore Railroad and the West Shore Railroad. As the New York, New Haven & Hartford Railroad was described so recently in these columns no attempt has been made to take up the electric operating practice of this company so completely as in the case of the other roads mentioned, but the use of single-phase locomotives adds such an interest to the practice of this company that it has been deemed wise to take up this matter in considerable detail. Additional information is also presented of the electrified division of the Erie Railroad between Rochester and Corning to supplement the article on this subject in the second section of this issue, and of the Interborough Rapid Transit Company in its power station department. It is thought that this account will be of interest in this connection because of the similarity between its conditions and those of the electrified steam railroads already mentioned.

Finally an article from the pen of Philip Dawson discusses the progress being made abroad in heavy electric traction, particularly in the field of single-phase motors. As will be seen from Mr. Dawson's review of the subject, European engineers and managers are fully alive to the possibilities of electric power on their steam roads. Probably the most ambitious plans at present being formulated in this direction are those of the Swedish Government, whose extensive trial of electric power receive ample discussion in Mr. Dawson's paper. Germany, Switzerland, Italy and England, however, are not far in the rear of their Northern neighbor and are engaged in electric traction work of the greatest importance.

In many respects it is believed that this compilation will be of great value not only to the steam railroads which are contemplating or have contracted for electrical equipment but also to the electric railway companies of the country. The managements of the latter have worked out their problems along certain lines, but as the high-speed electric road is the outgrowth of the city line it is not surprising that the conclusions reached should have been different from those obtained when the same question is taken up from the steam railroad standpoint, and when the electric road in question is operated as a part of a large trunk line system.

The editors and publishers of this paper take this occasion to express their sincere thanks for the courtesy and co-operation of the engineers and managements of the different lines whose practice is described, in the preparation of these articles and the compilation of the data contained in this issue.

GENERAL FEATURES OF THE NEW YORK CENTRAL ELECTRIFICATION

The New York Central & Hudson River Railroad Company's terminal electrification at New York City, including the northern suburban zone tributary to the metropolis, involved the solution of engineering and operating problems of unprecedented magnitude before commercial electric train service could become a reality. The far-reaching scope of the changes required in the physical equipment of the road has already been outlined by the design and construction articles printed from time to time in the columns of the Street Railway Journal. Nothing less than the complete reconstruction of the Grand Central terminal as a whole is required, with the building of a new double-level station for the reception and dispatch of trains; the construction of new streets over depressed electrified tracks; the installation of a complete system of power plants, transmission lines and sub-stations arranged for reliable and flexible operation, and the placing in service of a third-rail distribution system capable of meeting the demand for continuous service under all conditions and emergencies which can be anticipated. The substitution of the electric motor for the steam locomotive in the local and through train service of the road demands the solution of numerous problems in rolling stock design, operation and maintenance—problems which in many instances can be settled only by the test of service. The fundamental necessity in the construction period has been to carry out the momentous changes at issue with a minimum interference with traffic, and the essential requirement in the present period of initial operation is to give as good service, if not better, than was given with steam locomotives, leaving the accomplishment of minor economies to be worked out in a gradual way as each month goes by.

Although at this writing the electric train service of the New York Central extends only as far as High Bridge on the Hudson River Division and to Wakefield on the Harlem Division, the general operating features of the electrical zone are well determined. The organization has been built up with the idea of giving safe, reliable service under all possible anticipated conditions. The ample provisions made for emergencies can be followed through every root and branch of the system. While some of these provisions are doubtless of a tentative nature, the magnitude of the traffic demands a fixing of responsibility in the operating organization, a definite apprehension of limits of authority, and a crystallized knowledge of the proper course in emergencies and in routine duties which would be entirely out of place in a small system.

It must be borne in mind by the reader that the operating methods described in the following articles are not necessarily final in themselves. The temporary terminal facilities now in use at the Grand Central Station and at Lexington Avenue cannot be selected as a basis for estimates of the operating situation in the permanent terminal station, but from the standpoint of the electric railway engineer, the temporary solutions of such problems are as interesting as the final ones.

Construction and train operation in the electrical zone, which will ultimately extend from the Grand Central Station to Peekskill on the Hudson River Division and to North White Plains on the Harlem Division, are in charge of the Electrical and Operating Departments of the company. In so far as the operating routine comes under the head of train movements and service, it falls under the immediate jurisdiction of the operating department; and in so far as the operating routine concerns the provision of adequate power and the maintenance of electrical rolling stock in proper condition for service, it falls within the jurisdiction of the Electrical Department.

ORGANIZATION OF ELECTRICAL DEPARTMENT

The chart published on the opposite page shows the general organization of the Electrical Department as developed by Mr. William J. Wilgus. A Vice-President of the company is in charge of the work of the Department and next in command is the Chief Engineer of Electric Traction. Four heads of departments report directly to the Chief Engineer of Electric Traction, namely, the Electrical Engineer, the Engineer of Power Stations, the Superintendent of Power and the Superintendent of Electrical Equipment. The work of the Electrical Engineer is largely of a designing and constructional nature, as can be seen by the make-up of his subordinate force. The Engineer of Power Station's duties in a similar manner cover the field of power station design and construction. The Superintendent of Power is responsible for the supply of electricity to the third-rail and his jurisdiction begins at the coal pile and ends with the delivery of power to the rolling stock at the third-rail. The Superintendent of Power has charge of operating matters rather than construction work. The Superintendent of Electrical Equipment is responsible for the maintenance of electric rolling stock and operation of repair shops and inspection sheds. The employees reporting to him include an Assistant Superintendent and a clerical force in addition to men on the road and in the shops.

The chart published on page 542 illustrates the organization of the force at each power station. Reporting to the superintendent of the station are a small clerical force and three watch engineers. The functions of the different subordinate employees are clearly shown in the diagram.

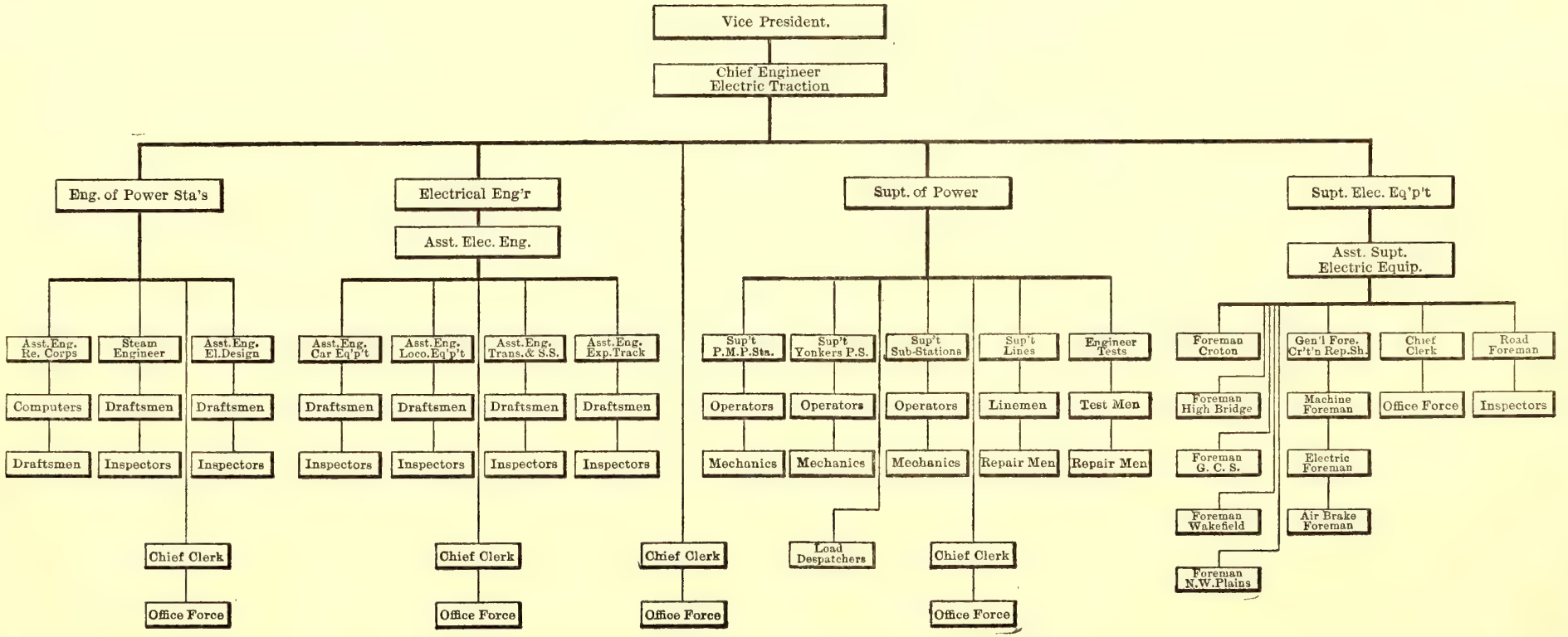
Detail organization sheets covering each subdivision of the electrical department have been prepared to enable the Chief Engineer of Electric Traction and the other heads of departments to keep a continuous and simple record of the status of their working force. Three of these are shown on page 543 and one other is reproduced later in this issue in connection with the discussion of "Maintenance of Rolling Stock." An important feature of these detail organization sheets is a tabulation made up each month, summarizing the force on the pay rolls as compared with the force of the previous month and showing the authorized number of employees, their total salaries and the number of employees who are estimated as necessary for the month to follow. This method is described in detail in the chapter on maintenance of rolling stock.

November 1, 1906.

N. Y. C. & H. R. R. R.

ELECTRICAL DEPARTMENT.

ORGANIZATION SHEET.



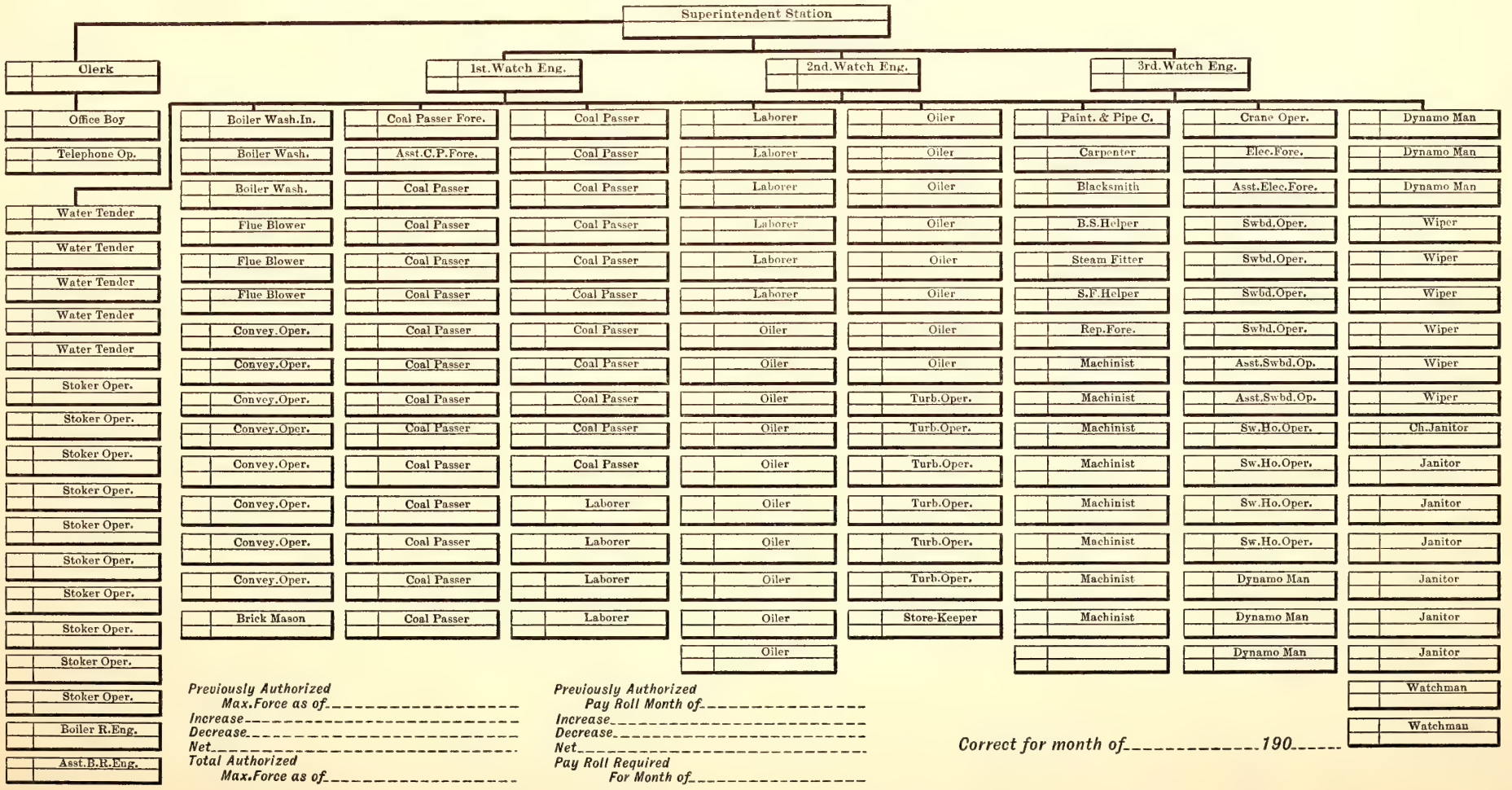
Street Ry. Journal

Sheet No. 1.

ORGANIZATION CHART OF THE ELECTRICAL DEPARTMENT OF THE NEW YORK CENTRAL RAILROAD

November 1, 1906.

N. Y. C. & H. R. R. R.
ELECTRICAL DEPARTMENT.
OFFICE OF THE SUPERINTENDENT OF POWER
_____ POWER STATION



Previously Authorized
*Max.Force as of*_____
*Increase*_____
*Decrease*_____
*Net*_____
Total Authorized
*Max.Force as of*_____

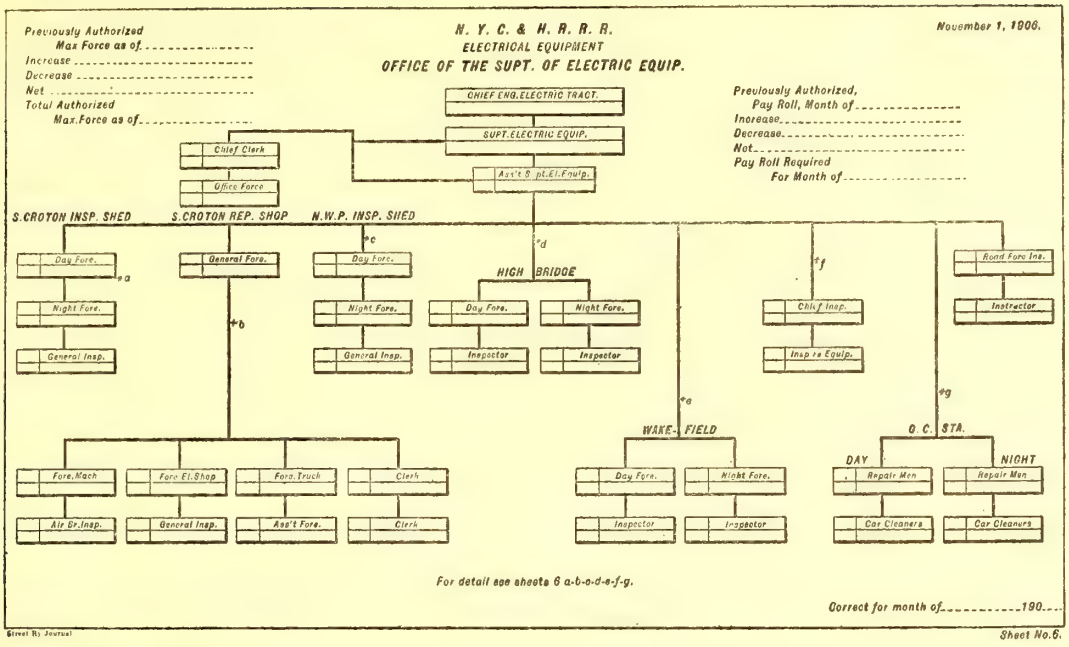
Previously Authorized
*Pay Roll Month of*_____
*Increase*_____
*Decrease*_____
*Net*_____
Pay Roll Required
*For Month of*_____

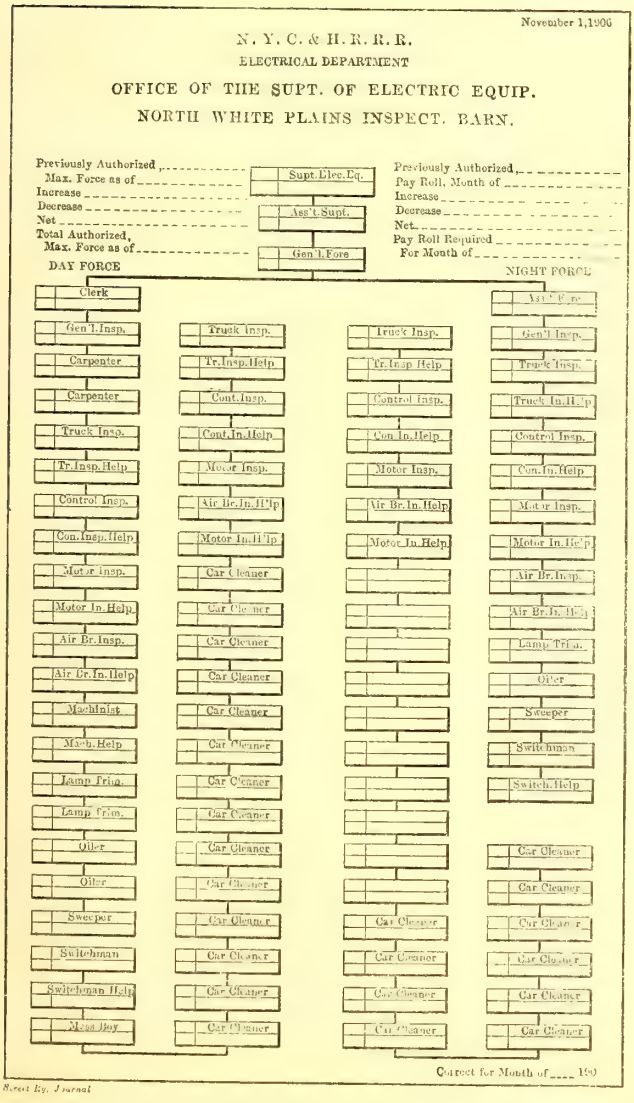
*Correct for month of*_____*190*_____

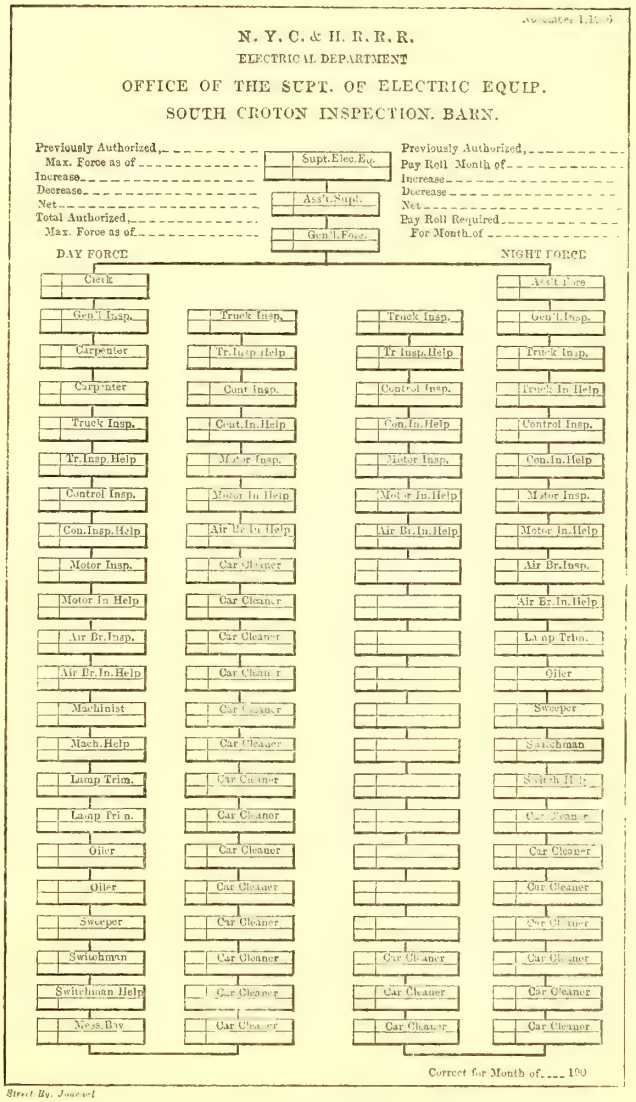
Street Ry.Journal

Sheet No.5(__)

ORGANIZATION OF OFFICE OF THE SUPERINTENDENT OF POWER AND FORCE AT EACH POWER STATION







TYPICAL ORGANIZATION CHARTS OF DIFFERENT DEPARTMENTS OF THE NEW YORK CENTRAL RAILROAD

POWER STATION PRACTICE OF THE NEW YORK CENTRAL

Two power plants have been built to furnish current to the electrical zone of the New York Central, one being located at Port Morris and the other at Yonkers. In salient features these stations are duplicates, each having an ultimate capacity of 30,000 kw normal output at full rating. The Port Morris and Yonkers stations were described in the Street Railway Journal of Nov. 11, 1905, and Nov. 3, 1906. The operating organization of each plant provides for an elastic service capable of current supply separately or in multiple to the various transmission lines and rotary converter substations, meeting routine and emergency conditions with positive assurance of successful cooperation. The distribution of power and to some extent the operation of the main generating plants are supervised by a highly developed load despatching system, described under the caption "Distribution System." This feature of the work and the scientific methods of analysis practiced in the power plant production processes are of peculiar interest in connection with the general reliability and economy of the power supply. So far as the generation of power is concerned the station routine follows practice accepted in the heaviest central station work, but at every stage the question of continuous service is paramount.

The Port Morris power station was started in May, 1906, and it has thus far supplied all the current necessary for train service, both preparatory and commercial. The first trial train was operated in July, 1906, and the first regular electric train was run into the Grand Central Station on Dec. 11, 1906. Since July 1, 1907, all the New York Central trains have been electrically operated into and out of the Grand Central Station and the Lexington Avenue temporary terminal. The Yonkers station is practically in readiness for operation.

Sixteen 625-hp boilers have now been installed at Port Morris, the ultimate capacity of the station being twenty-four boilers of this size. Four 5000-kw turbines have been installed, each machine consisting of a Curtis-General Electric five-stage, three-phase, 25-cycle, 11,000-volt unit of the revolving field type. Six turbines constitute the ultimate station equipment at each plant. The Port Morris station is 237 ft. long, 167 ft. wide and 105 ft. high. It has the Custodis stacks, each 250 ft. high above the grates and 15 ft. 6 ins. in diameter. The turbine room at Port Morris is 231 ft. 8 ins. long by 69 ft. wide, the boiler room being 88 ft. wide. All high-tension switching at each power station is effected in a separate switch house. This building is 100 ft. long by 50 ft. 10 ins. wide at Port Morris, and at Yonkers, on account of the fact that it is combined with a rotary converter substation, the switch house is 255 ft. 4 ins. by 37 ft. 4 ins.

COAL HANDLING

The coal burned at Port Morris is of the semi-bituminous variety from Clearfield County, Pa. A typical analysis is presented under the caption "Work of the Engineer of Tests." This coal is delivered at the power station by water, although in case of necessity it can be delivered by rail, and the same conditions apply at Yonkers. The capacity of the coal barges which deliver at Port Morris varies from 400 to 700 tons each. Aside from the hoist for unloading coal from the boats, which is handled by steam, the coal handling apparatus is all driven by electric motors. The conveyors are driven by 220 volt three-phase induction motors varying in capacity from 7½ hp for the ash conveyor to 40 hp for the coal crusher and conveyors.

Coal delivered by boat is elevated by means of a hoisting tower to a hopper over the car tracks, whence it is delivered to the crushers. From the crushers the coal is fed to an elevating conveyor of the bucket type which carries it to a point above the bunkers, whence it is distributed by four scraper conveyors acting independently. From the coal bunkers the coal is discharged to the hoppers of the stokers through cast iron chutes and distributing aprons. The ashes fall from the grates to hoppers below, which discharge into hand push-cars of one ton capacity. These dump their load into conveyor hoppers in the basement underneath the boiler room and the ashes are carried up by malleable iron bucket conveyors to storage bins over the trestle where they are loaded into cars. A gang of ten men is busy looking after the coal and ashes all the time. The coal conveying system is run about 10 per cent of the time.

There are three coal bunkers above the boilers, the capacity being 4800 tons, and in addition there is ample yard room for storage in case it is needed. About 2500 tons are usually kept in the bunkers. In case of fire in a bunker the coal is used from that bunker as quickly as possible and, if necessary, the coal is run out of the bunker, wet down and returned to the bunker; however, there has been but little trouble from bunker fires.

Calorimeter tests and chemical analyses are made in the testing department laboratory of the fuel used, four or five samples being taken from each barge load. A Parr calorimeter is employed, and both proximate and ultimate analyses are made if necessary.

STACK AND FUEL GASES

Each of the two chimneys is of the Custodis radial brick type, and is 250 ft. high above the grates and 15 ft. 6 ins. in diameter. Twelve boilers are operated on one stack and four on the other. The draft averages about ¾ in. An automatic CO_2 recorder is used in the boiler room; frequent analyses of flue gas are also made with the Orsat apparatus.

BOILERS

Each of the sixteen boilers at the Port Morris station has 6250 sq. ft. of heating surface and 112 sq. ft. of grate surface, with a total superheating surface of 1230 sq. ft. The boilers are equipped with Roney stokers and each stoker engine operates four stokers in normal operation, but eight can be run per engine in case of emergency. The boilers have an overload capacity of 50 per cent for 24 hours and 175 lbs. per square inch pressure is used in regular operation. Superheated steam is employed for the turbines and all the auxiliaries, the average superheat being about 150 degs. F.

The boilers are usually operated on a common header, but if desired, when the load increases the station can be operated on the unit system. To take care of the latter procedure the apparatus in the station is divided into groups. Each group consists of four boilers, one feed pump and feed water heater and a complete condensing plant.

The maximum load of the plant so far is carried on six boilers. Only one turbine is operated at present, except at times of peak load, when two machines are in service. Twelve hundred and fifty kw per boiler can be carried on the turbine continuously.

FEED WATER

The feed water enters the boilers at a temperature of 212 degs. F. Croton water is used for boiler feed and very little scale forms. The boiler drums are cleaned about twice a year and the tubes once in three months; a turbine cleaner is used for cleaning the tubes. No oil is allowed to enter the water supplied the boilers.

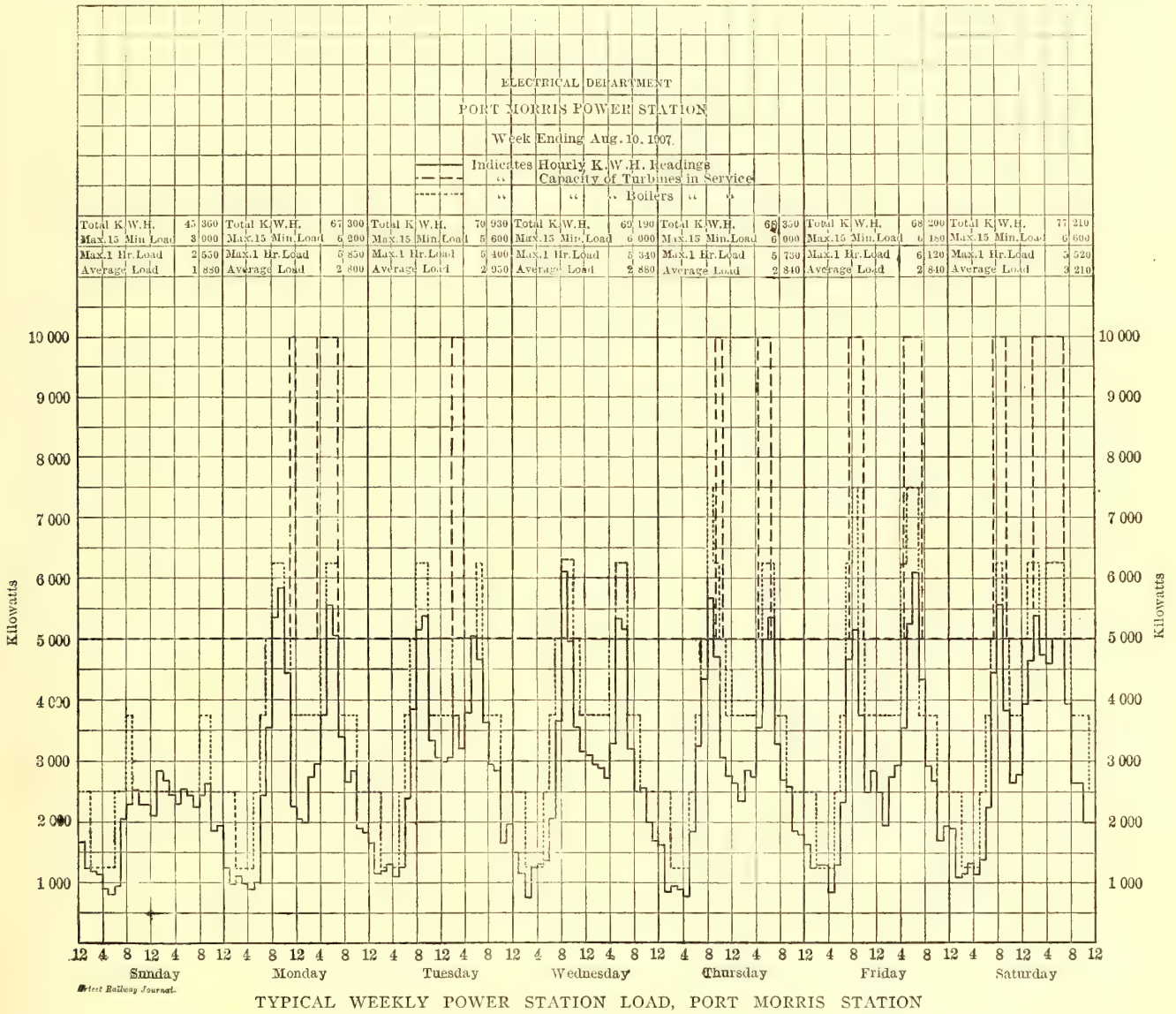
COAL AND WATER CONSUMPTION

The usual rate of combustion varies from 28 to 29 lbs. of coal per square foot of grate surface per hour at times of heavy load. The monthly coal consumption under present load conditions averages 2.9 lbs. per kw-hour. About 100 tons of coal are burned daily at present, the amount of ashes averaging about 15 per cent to 20 per cent in weight.

The load factor of the station in July, 1907, averaged 44.4 per cent on a 15-minute peak assumption. At time of writing this article the load on the plant was increasing on account of the addition of electric trains on the New York, New Haven & Hartford Railroad.

TURBINE AUXILIARIES

The concrete intake line for the circulating water of the condensing system is protected by a double screen at the outer end. No trouble was experienced with ice at this point last winter. The intake racks are cleaned once daily and the screens three times a week. In starting the centrifugal pumps which supply the circulating water to the condensers the pumps are primed from the dry air pump. The circulating and dry air pumps are steam driven, but the hot well pumps are



TYPICAL WEEKLY POWER STATION LOAD, PORT MORRIS STATION

The water consumption of the plant averages about 8 lbs. per kw-hour. This includes the water required for auxiliary and general uses, exclusive of lavatories. It is estimated that from four to five pounds of water per kw-hour are required for make-up in connection with the turbine operation, when the condensing system is tight.

OUTPUTS

The total kw-hour output of the Port Morris plant from March, 1907, to July, 1907, was as follows:

March	1,687,730
April	1,693,950
May	1,790,990
June	1,717,020
July	1,936,960

motor driven. Practically the only head against which the circulating pumps work is that due to the pipe friction, as the discharge is below the water level. The capacity of each pump is 18,000 gals. per minute against a head of 20 ft. at 250 r. p. m. The minimum temperature of the circulating water during last winter was from 30 to 31 degs. F. and the maximum summer temperature is about 65 degs. F. The average temperature of the discharge is from 6 to 9 degs. higher than that of the intake.

OIL

Three grades of oil are used in the plant; first, a high temperature cylinder oil adapted to operation at 175 lbs. steam

pressure and 200 degs. superheat. This is used in reciprocating engine cylinders; second, ordinary engine oil used generally in the bearings, and third, crank case oil used in the stoker engines. The oil consumption in July, 1907, was 216 gals. of cylinder oil, 101 gals. of engine oil and 10 gals. of crank-case oil. A gravity oiling system is in use, two storage tanks being located at the roof level. Each machine is separately piped for both cylinder oil and engine oil. The oil is cooled mainly by circulation through the power house and is filtered by two Turner oil filters which both strain and wash it.

TURBINE OPERATION

The turbines are warmed up previously to starting if there is time. About fifteen minutes are required for this work. In case of emergency a turbine can be brought up to speed in two minutes from the cold state and placed in service in three minutes, all told.

In starting a turbine, the switchboard operator notifies the watch engineer in charge of the shift when another unit is needed. An emergency machine is kept standing ready all the time with water circulating through the condenser at half speed in the pump. One short blast on the turbine room whistle calls the turbine operator's attention to the switchboard, and by means of a speaking tube, which connects the operating gallery with the main floor of the power station, he learns what is wanted. The turbine operator is then ordered to bring the machine up to speed, by the watch engineer, and this is done by opening the throttle to 10 or 15 lbs. pressure, as indicated by the first gauge.

In addition to the speaking tube and whistle, pilot lamps are provided for connection between the switchboard gallery and the operating gallery of the turbines, a bell calling the attention of the attendant at either end, to the lamps. The whistle signals are as follows:

One short blast	Calls turbine operator
One long blast	Calls watch engineer
Two short blasts	Indicate machine phased in or out
Three short blasts	Call dynamo man
One short and one long blast	Call electrical operator
Two short and one long blast	Call boiler-room foreman
Four short blasts	Call all hands for emergency

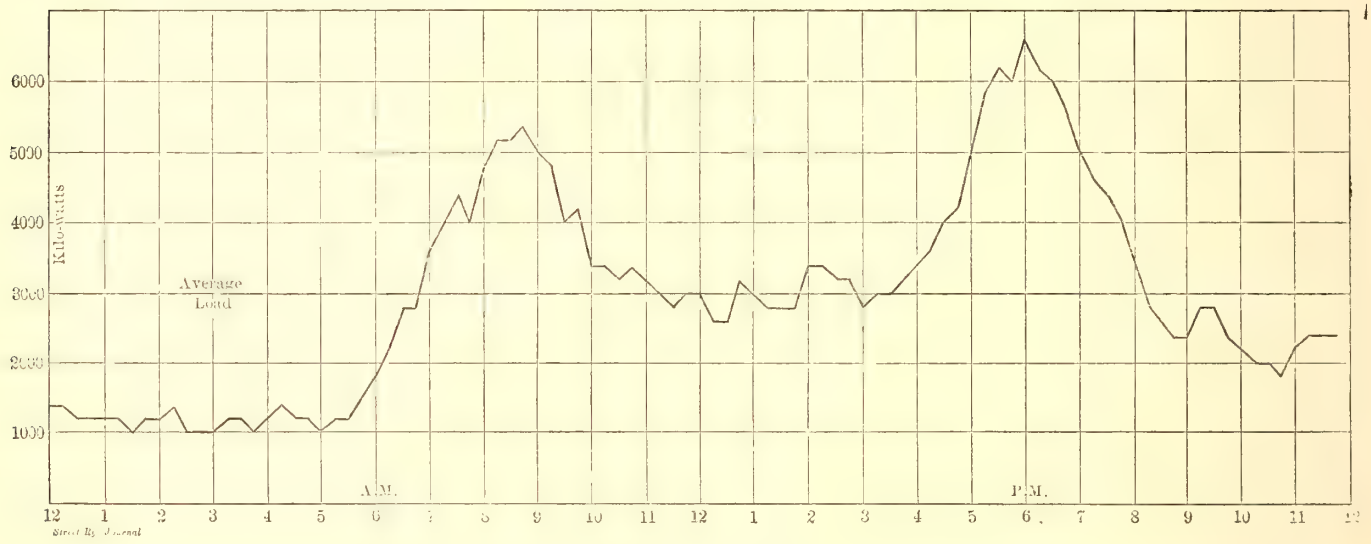
The machine, after being started, is synchronized at the switchboard and placed in service. Two whistles are then blown, notifying the turbine operator that the machines are tied together, and immediately the throttle is opened wide, the new turbine taking its share of the load. Normal excitation is used in starting.

In shutting down, one whistle calls the attention of the watch engineer or the turbine operator. The number of the machine to be withdrawn from service is struck on the bells at the turbines from the switchboard. The throttle is partially closed and at the same time the switchboard operator lowers the load by means of the field rheostat and also by the motor-controlled governor. When the throttle is nearly closed the turbine operator signals the switchboard operator and the generator switch is opened.

When the load is above 5000 kw for one hour, a second turbine is cut into service and the same thing is done after the load is above 6000 kw for a few minutes. The maximum sustained overload usually permitted is about 20 per cent for one hour.

The turbine step bearings each require from 8 to 10 gals. of water per minute for lubrication. It takes about three-quarters of an hour for a turbine to come to rest after steam is cut off, with full field on and two hours without the field.

The repairs of the turbines as compared with reciprocating engines have been very much lower. None has been required to the wheels or wheel casing; the bearings also have given little trouble. Spare armature coils, valve fittings, governor parts, field-ring brushes and similar small supplies for the turbines are carried in storage against emergencies.



TYPICAL WEEK-DAY LOAD, PORT MORRIS POWER STATION

EXCITER SYSTEM

The exciter system operates at 125 volts, power being furnished from two 150-kw Curtis turbines and one 150-kw motor generator. In addition to these a battery having a capacity of 1200 amps. at the one-hour rate is provided. The exciter turbines are of the horizontal type, two-stage, 2000 r. p. m., and operate non-condensing, the exhaust from them being used for heating the feed water. Two direct-current bus-bars are provided so that the crane motors and any other direct-current load can, when desired, be operated on a separate machine from that used for field excitation. A 200-hp, 220-volt, three-phase induction motor is used for driving the motor generator set. The exciter battery consists of seventy-four cells, each containing 21 type "R" plates and has a capacity of 1200 amps. for one hour. It will furnish sufficient current for exciting the fields of four 5000-kw generators for about four hours.

SWITCHBOARD

The entire electrical equipment in the station is controlled from the switchboard gallery on one side of the generator

room. Enclosed in a glass booth in the center of the gallery is the main operating board, on either side of which are separate boards for controlling the exciters. The lamp and motor circuits in the station are controlled from smaller switchboards situated at either end of the operating gallery and the field panels are located outside the operating booth on each side.

In the switch house two sets of high-tension bus-bars are provided, one being divided into two and one into three sections by tie switches. The high-tension bus-bars are connected to the generators through a main switch and selector switches. Each feeder is provided with two selector switches which connect to the two respective high-tension bus-bars below them. Overload relays are connected with the feeder circuits and the generator circuits have reverse current relays connected to indicator lamps. The switchboard equipment in the switch house is such that the main operating board in the station may be out of service for cleaning or repairs and the equipment could be then controlled from the switch house. With a few exceptions, all the incandescent lamps in the station, about 1000 in number, are fed with alternating current, although the lamp circuits are arranged so that they can be thrown on the exciter bus-bars should occasion require.

Form E. D 12—WHCCo.—7-06—750

New York Central & Hudson River R. R. Co.

ELECTRIC DIVISION

Port Morris Power Station

DAILY REPORT Turbine No. 2 Date, Aug. 10 1907

	STARTED WARMING UP TURBINE		
	AUX. MACHINERY STARTED		
	TURBINE ON LOAD		
	TURBINE OFF LOAD	10[46]	
	FEED PUMP ON #3		

TIME	Temp. Steam at Throttle	Press. Steam at Throttle	Press. 1st Stage Turbine	Tem. Cir. Inlet	Temp. Cir. Outlet	Abso-lute Gauge	Vac-uum Gauge	Temp. Conden-sation	Temp. City Water	Temp. Hot Well	Temp. Feed Water	Barom-eter	Feed Pump Revo-lutions	Step Pump Revo-lutions	Initials of Operator
12:00 MID.		[illegible]													
1:00 "	480	180	0	67	72		28½	87		108	212	30.98	5	2	[illegible]
2:00 "			-6		71			85		104					
3:00 "			0		72			86		112					
4:00 "			-10	66	70					100					
5:00 "	475		-10		70					106					

UPPER PART OF TURBINE RECORD

motors; two ½-hp motors driving battery end cell switches; forty-five motors of .9 hp each for operating oil switches; and four motors of ¼ hp, each for operating generator field rheostats. All of these motors are 125-volt direct-current machines.

AUXILIARY MOTORS

A large number of small motors is in use in the Port Morris plant for auxiliary purposes. These include one 15-hp elevator motor; four crane motors of 25, 50, 7½, 25 hp; four condenser hot well-pump motors, 10 hp, each run on the exciter-bus as a provision against shutdowns; four 1/6-hp governor motors; two ½-hp motors driving battery end cell switches; forty-five motors of .9 hp each for operating oil switches; and four motors of ¼ hp, each for operating generator field rheostats. All of these motors are 125-volt direct-current machines.

The alternating current motors in the plant are wound for 220 volts and are all of the three-phase induction type; these consist of two 30-hp coal crusher motors, one 15-hp and two 20-hp motors driving scraper conveyors, and one 7½-hp ash conveyor motor; one 15-hp motor for driving winch used in hauling cars along coal trestle, one 40-hp and one 7½-hp motor driving air compressors; four 1-hp driving sump pumps; one 3-hp driving house pump, and one 7½-hp motor driving

E D 12—WHCCo.—2-07—750

NEW YORK CENTRAL & HUDSON RIVER R. R. CO.

In Service ..... × Banked Fires ..... — Cold ..... ○

Daily Boiler Room Report Port Morris Power Station.

Date Aug. 10 1907

Hours	Unit—No. 1 Boilers 1 2 3 4	K. W. Load	Unit—No. 2 Boilers 5 6 7 8	K. W. Load	Unit—No. 3 Boilers 9 10 11 12	K. W. Load	Unit—No. 4 Boilers 13 14 15 16	K. W. Load	Total K. W. Load	Total Boilers in Service	Steam Pressure 1 2 3 4	Feed 1	Temperature 2 3 4
1 A. M.	○ ○ × ×		○ — — —	1920	○ ○ ○ —		○ ○ ○ ○		1920	2	180		212
2 "				1140					1140	2			
3 "			× — —	1170	— — —				1170	1			
4 "			— — ×	1380					1380	1			
5 "			— — —	1170					1170	1			
6 "			× × —	1380					1380	2			
7 "			× — —	2250					2250	3			
8 "			× — ×	2205					2205	4			
9 "			× — ×	1760					1760	5			
10 "			× — ×	1920					1920	4			
11 "			× — —	2670					2670	3			
12 NOON			× — —	2990					2990	3			
1 P. M.			× × —	3930					3930	4			
2 "			× × ×	4680					4680	5			200
3 "			× × ×	2700					2700	5			207
4 "			× × —	2370					2370	4			212
5 "			× × ×	2295					2295	5			
6 "			× × ×	2505					2505	5			
7 "			× × ×	2550					2550	5			
8 "			× × —	3960					3960	4			210
9 "			— × —	2670					2670	3			
10 "			× ○ —	2670					2670	3			
11 "			— ○ —	2040					2040	2			
12 MID.	○ ○ × ×		○ — ○ —		○ ○ ○ —		○ ○ ○ ○	2048	2040	2			

REMARKS.....

Supt. of Station.

DAILY BOILER-ROOM REPORT

fan in connection with heating and ventilating of the switch house, also several small fan motors.

MACHINE SHOP

The Port Morris power station is equipped with a first-class machine shop located on the north gallery of the turbine room below the main operating switchboard. All the machine tools in this shop are driven by direct connected motors. The shop is well lighted by north windows and is accessible from the main traveling crane of the station. The equipment consists of one 48-in. Prentiss radial drill driven by a 5-hp 125-volt motor; one 24-in. Gould & Eberhardt shaper, driven by an 8-hp motor; one Blount emery wheel, and one 24-in. Davis drill, driven by a 2-hp motor; one 30-in. Lodge & Shipley lathe, driven by a 10-hp motor; one 16-in. Lodge & Shipley lathe, driven by a 4-hp motor; and one National bolt cutter, driven by a 3-hp motor. Speed controls are provided for each machine on the machine frame and the lathes are provided with controls on the carriages. On the north side of the shop is a bench where hand work is carried on. Three regular machinists devote their time to the work of the shop in the day time. At night one man is on duty in case emergency repairs are necessary. This shop has been of considerable value in making the final adjustments and slight changes required in the plant during the construction period, and in the early months of regular operation.

STORE ROOM

On the gallery near the shop is a store room where pipe fittings, valves, packing, gaskets, nuts, bolts, cutters and tools are kept. Each machinist is provided with several numbered brass checks which he exchanges for tools when he wishes to draw them out of the store room for use. At a conspicuous place in the store room is a check board fitted with numbered hooks, each number representing a specific tool. In borrowing a tool from the store room the machinist leaves his brass check on the corresponding hook. By this arrangement the total number of tools out at any one time, the number of tools of the same kind which are out, and the numbers of the men who are using them, can be observed at a glance. There is also another store room on the turbine-room gallery which contains electrical supplies, including lamps, fuses, carbon, brushes, and wiring fittings, compactly disposed in tiers of labeled compartments. Beneath the boiler room is a storage compartment for heavy spare parts and supplies.

Form E. D. 5—WHCCo—2-07—600

New York Central & Hudson River R. R. Co.

ELECTRIC DIVISION.

Daily Report Port Morris Power Station. Aug. 10 1907

	No. 1	No. 2	No. 3	No. 4
Hours each turbine is in service		14.45		45.45
Max. load carried		5400		3480
Ave. temp. steam at throttle		513		518
Ave gauge pressure at throttle		180		180
Ave vacuum in inches		28.5		28.5
Ave temp condensing water, Inlet		67		67
" " " " , Outlet		75		75
" " air pump suction		84		82
" " hot well		98		94
" " feed water		212		212

Max. no. boilers in service 5 Boilers banked but not up to pressure 1

Total no. of boiler hours 73

Ave. temp city water —

Water passed city meter—lbs. 1,071,580 Water passed house meter—lbs. 1,027,850

Amt. water in storage tanks—lbs. North tank Very full South tank Very full

Ave. temp. flue gas in uptakes

" per cent. C. O. 2 in flue gas

" barometer reading 30.10

Tons coal in bunker No. 1 683 No. 2 1123 No. 3 180 Total 1986

Tons coal in cars In barges Total coal on hand 1986

Tons ashes removed 25 4 men on coal and ash gang 9 days 4 nights

Machines down for repairs

No. of men working 110

Remarks

Night Foreman. Third Coaler Asst

76470
740
665
Total 77,210
1,425
Net 75,785

Supt. [illegible]

DAILY REPORT OF BOILER AND TURBINE OPERATION

†Form E. D. 25—2-07—600

PORT MORRIS POWER STATION

N. Y. C. & H. R. R. CO.

WATER METER READINGS

TIME_____ DATE_____ 190__

METERS NO.	YESTERDAY'S READING	TO-DAY'S READING	CUBIC FEET USED	CUBIC FT USED YESTERDAY	DIFFERENCE	MORE OR LESS
Boulevard S. 278546						
Boulevard N. 278545						
Power House W. 276246						
Power House E. 278247						
House Tank 263704						

Total Cubic Feet Passed Boulevard Meters		Boulevard Meters	Lbs.
Total Cubic Feet Passed Power House Meters		Power House	Lbs.
Total Cubic Feet Passed House Tank Meters		House Tank	Lbs.
Total Cubic Feet Passed Power House and House Tank Meters		Filling Yard Tank	Lbs.
Total Cubic Feet Passed Filling Yard Tank		Not Accounted	Lbs.
Total Cubic Feet Passed Not Accounted For			

Water in N. Yard Tank	Ft.	Lbs.	
Water in S. Yard Tank	Ft.	Lbs.	

REMARKS

Signed,_____

WATER METER RECORD

New York Central & Hudson River R. R. Co.

DAILY COAL AND ASH REPORT _____ POWER STATION

DATE,_____

Coal in Bunker No. 1.—Tons	
Coal in Bunker No. 2.—Tons	
Coal in Bunker No. 3.—Tons	
TOTAL	
Coal on Cars in Yard	
Coal on Boat in Slip	
Coal Unloaded Today	
Ashes Removed Today	

No. of Men on Coal and Ash Handling: DAY_____ NIGHT_____

Signed_____

DAILY COAL AND ASH REPORT

Form E. D 16—WHCCo.—2-07—1200

BOILERS IN SERVICE ×
BOILERS BANKED
BOILERS COLD O

New York Central & Hudson River R. R.

ELECTRIC DIVISION Port Morris POWER STATION

DAILY BOILER REPORT

Watch No._____ Date Aug. 10 1907

TIME	UNIT No. 1 BOILERS 1	2	3	4	UNIT No. 2 BOILERS 5	6	7	8	UNIT No. 3 BOILERS 9	10	11	12	UNIT No. 4 BOILERS 13	14	15	16	REMARKS

Signed_____
WATER TENDER

DAILY BOILER REPORT

LOAD CURVES

A typical weekly load curve of the Port Morris plant for the seven days ending Aug. 10, 1907, is given on page 545, together with capacities of generators and boilers in service.

The full line indicates the hourly load, the dotted line the boiler capacity and the dashed line the generator capacity. By examination of these curves it will be seen that there are two prominent peaks upon each week day, with prominent depressions at noon, and in the small hours of the morning. The maximum load during the week was about 6100 kw. The minimum load upon the station occurred between 4 and 5 o'clock a. m. on Thursday, being 750 kw. The maximum output of the station during any single day of the week was 77,210 kw-hours, on Saturday, Aug. 10. The Sunday load was light in the early morning, and extremely regular during the day. The load variations on Monday, Tuesday, Wednesday, Thursday and Friday resemble each other quite closely, but on Saturday a large and sustained afternoon and evening load reflects the conditions of the weekly half-holiday. The minimum output of the station during the week was 45,360 kw-hours, which occurred on Sunday. The turbine capacity in service reached 10,000 kw nine times during the week. The boiler capacity in service follows the fluctuations of the load quite closely.

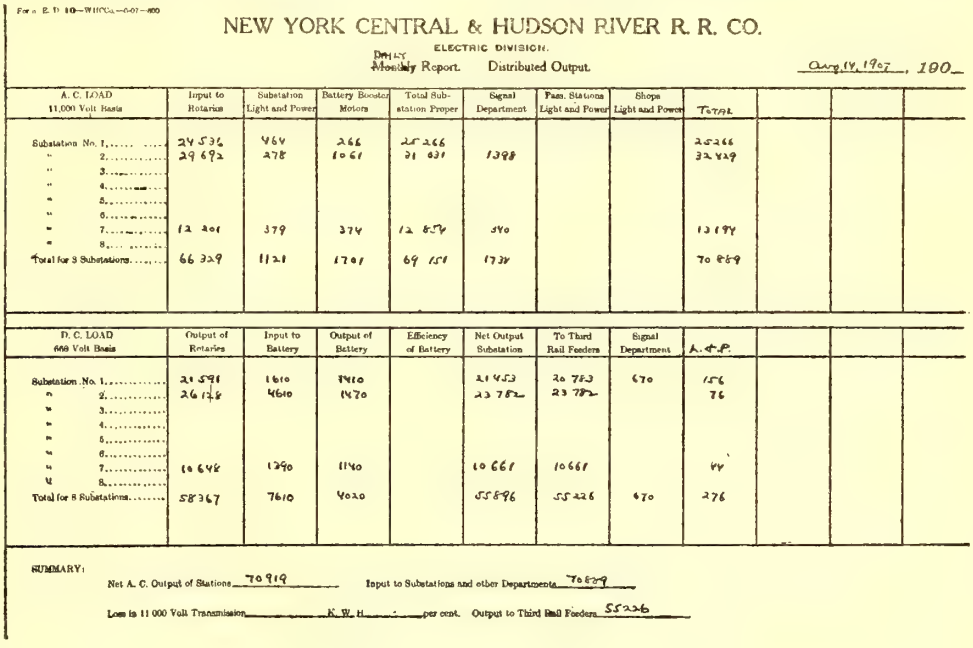
The diagram on page 546 illustrates a typical week-day load curve at the Port Morris power station. The day taken was Monday, Aug. 7, 1907, and the average load during this day was 3000 kw. The minimum load was 1000 kw, and the maximum load of the day, 6600 kw, occurred at 6 p. m. The morning peak reached a value of 5400 kw. The morning peak, as a whole, lasted for about three and a half hours, and the afternoon peak, as a whole, was of practically the same duration. The minimum load lasted for about five hours.

BLANKS AND FORMS

A considerable number of specially devised blank forms are in use in the operation of the stations.

The daily electrical log sheet of the plant, size 20 ins. x 15 ins., shows the bus-bar voltage, average load in kw during fifteen-minute periods as derived from recording wattmeter readings on each generator, the total load on the plant every fifteen minutes, average hourly load on the plant, power factor of the generators in service and miscellaneous notes. In view of the fact that the station is at present operating at less than one-fourth of its continuous capacity it must be borne in mind that figures of operation given in the following paragraphs do not carry the same significance that they will when the electrical zone is completed. On a typical day's run, taken for Saturday, Aug. 10, 1907, the bus-bar voltage averaged 10,800 all day. Turbine No. 2 was in operation from midnight until 10:45 p. m. During the morning peak load turbine No. 4 was placed in service at 7:25 a. m. and cut out at 9:32 a. m. As this was Saturday, the afternoon load necessitated the use of turbine No. 4 again between 1:59 p. m. and 7:00 p. m., and this latter machine carried the entire station load from 10:45 p. m. until the close of the day. The total output of the station on this day was 77,210 kw-hours, of which 740 kw-hours was consumed in exciting the turbine, and for direct-current light and power, and 685 kw-hours for alternate current light and power service. Deducting this auxiliary power consumption of 1425 kw-hours from the gross output of the turbines the net output of the station figures 75,785 kw-hours. This is an average commercial output of 3150 kw. The load factor from the station for the day was 58 per cent, defining the former as the ratio of the average load to the maximum hour load. The maximum momentary output recorded was 6800 kw at 8:27 a. m. and the minimum 1000 kw at 4:45 a. m. The maximum fifteen-minute load occurred between 8:30 and 8:45 a. m., being 6600 kw.

The daily boiler-room report used, original size 13⅝ ins. x 8 ins., is reproduced on page 548. This shows at a glance the condition of each one of the sixteen boilers in the station at every hour of the day, the load on the station at those times, total number of boilers in service, steam pressure and temperature of the feed water. On Aug. 10 boilers Nos. 1 and 2 were cold all day; boilers Nos. 3 and 4 were in service a large part of the day, though both were banked at 3 and 4 a. m.; boiler No. 5 was not in service during the day; boiler No. 6 was in service during one of the early morning hours and from 7 a. m. throughout practically the rest of the day; boiler No. 7 was banked until noon and then used until 9 a. m. and boiler No. 8 was banked and in use irregularly during the day. Boilers Nos. 9, 10, 11, 13, 14, 15 and 16 were cold throughout the day; boiler No. 12 was banked all day except during the morning peak load, when it was cut in service to help the others. The chart shows at a glance just how the boilers were handled as the load varied, and as it is filled out by means of simple symbols it is a very easy matter to keep it correctly. Variations of the load require from one to five boilers in service at different periods of the day.



NEW YORK CENTRAL & HUDSON RIVER R. R. CO.

ELECTRIC DIVISION.

Daily Monthly Report. Distributed Output. Aug. 10, 1907, 190_

A. C. LOAD 11,000 Volt Basis	Input to Rotaries	Substation Light and Power	Battery Booster Motors	Total Substation Proper	Signal Department	Pass. Stations Light and Power	Shops Light and Power	Total
Substation No. 1	24 536	464	266	25 266				25266
" 2	29 692	278	1061	31 031	1398			32 429
" 3								
" 4								
" 5								
" 6								
" 7	12 201	379	374	12 854	340			13 194
" 8								
Total for 8 Substations	66 329	1121	1701	69 151	1738			70 889

D. C. LOAD 660 Volt Basis	Output of Rotaries	Input to Battery	Output of Battery	Efficiency of Battery	Net Output Substation	To Third Rail Feeders	Signal Department	A. C. P.
Substation No. 1	21 591	1610	1410		21 453	20 783	670	156
" 2	24 134	4610	1470		23 782	23 782		76
" 3								
" 4								
" 5								
" 6								
" 7	10 648	1290	1140		10 661	10661		99
" 8								
Total for 8 Substations	58367	7610	4020		55896	55226	670	276

SUMMARY:

Net A. C. Output of Stations 70 919 Input to Substations and other Departments 70 889

Loss in 11 000 Volt Transmission _____ K. W. H. _____ per cent. Output to Third Rail Feeders 55 226

DAILY REPORT OF DISTRIBUTED OUTPUT

The daily report of the boiler and turbine service, original size 13¾ ins. x 8 ins., also on page 548, shows the total number of hours each turbine is in service, the maximum load carried, various temperatures and pressures, water consumption, coal on hand, ashes removed, and number of men on duty. On Aug. 10 turbine No. 2 was in service 14.45 hours, and No. 4 15.48 hours. The average temperature of the condensing water on that day was 67 degs. at the inlet and 75 degs. at the outlet. The average temperature of the hot well was 98 degs. F. for turbine No. 2 and 94 degs. F. for turbine No. 4. The total number of boiler hours re-

quired was 73 and the water used inside the house meter 1,027,950 lbs. The total coal on hand during this day was 1986 tons and eight men were required for coal and ash handling, four being on day work and four on night work. The number of men working in the plant on this day was 110.

TESTING DEPARTMENT

The headquarters of the testing department are located at the Port Morris power station, and this work is in charge of a department head called the engineer of tests, with nine subordinates reporting to him. The work of the power house chemical laboratory is included in this department. In addition to the chemical tests outlined on the next page, the engineer of tests makes all electrical tests on the machines in the power stations and substations, tests of energy consumption on locomotives and motor cars, switchboard meter tests, rail bond tests, locomotive ammeter calibrations and tests on underground and overhead lines. The routine tests of the department include monthly insulation measurements on high tension and low tension lines, monthly readings of ground potentials relative to track rails and negative conductors, and semi-annual meter tests.

BOND TESTS

Two men are working continually on bond testing. There are about 30,000 bonds to be maintained in the electrical zone as at present installed. It takes about two minutes to test a bond on the running rail, 200 bonds being a fair average day's work of eight hours. Greater care is necessary in testing the bonds on the third-rail, and here 100 bonds per day is a fair average.

A differential voltmeter is used for bond testing, the zero being in the middle of the scale and the total deflection being fifteen millivolts each way from the center. By means of a special contact device one of the coils is connected across the rail joint, the distance between contact points being 8 ins.; one terminal of the second coil is connected to one of the contact points referred to above and the other end of the coil is connected to the rail by means of an adjustable contact, this contact being moved until the drop in the rail equals the drop in the joint, this being indicated by the needle on the voltmeter coming to zero. A scale on the contact device indicates the length of third-rail equivalent in resistance to the 8-in. length at the joint. Average results show that on the third-rail 18 ins. and on the track-rail 20 ins. is equivalent to an 8-in. length at the joint. The average maximum and minimum variations for the third-rail are from 24 to 14 ins. and for the track-rail from 27 to 20 ins. If the resistance is equivalent to 36 ins., bonding of the joint is repaired.

INSULATION TESTS

The initial tests on 11,000-volt, three-conductor cables are made with a pressure of 22,000 volts between conductors and also from each conductor to ground; subsequent tests which may be necessary are made at 15,000 volts, although no regular break-down tests are made on these cables unless they have been out of service for repairs. Monthly insulation resistance measurements are made on these cables, as well as on the armature windings of the turbo-generators. A special transformer is installed in the power station for use in high voltage tests; the primary of this transformer is connected to the 11,000-volt bus and the secondary to the line to be tested. The secondary voltage can be varied from 2000 to 30,000 volts by means of moving a section of the iron core of the transformer.

Daily insulation tests are made by the substation operators on the 660-volt feeders and on the rotary converters. The overload relays and speed limit devices on the substations are tested at regular intervals.

FORMS

The form shown below, original 8 ins. x 10½ ins., is that used in reporting the results of bond tests. It shows the

NEW YORK CENTRAL & HUDSON RIVER RAILROAD CO.
ELECTRIC DIVISION
BOND TESTER'S DAILY REPORT

August 15, 1907.

Bonds inspected from ***Sta. 105 + 30***
To ***Sta. 154 + 50***

NUMBER OF BONDS TESTED

Track No. 1			Track No. 2			Track No. 3			Track No. 4			Total No.
Run Rail		3d Rail	Run Rail		3d Rail	Run Rail		3d Rail	Run Rail		3d Rail	
E.	W.		E.	W.		E.	W.		E.	W.		
150	150											300

Bonds having an equivalent of over 36 inches of continuous rail.

Location ***Sta. 130 + 25, E. Rail*** ..... = ***40*** inches
Location ..... = "
Location ..... = "
Location ..... = "
Maximum = ***24*** inches of continuous rail.
Minimum = ***14*** " " " "
Remarks and General Inspection:

.....
Bond Tester.

number of bonds tested in a day on the east running rail, the west running rail and the third-rail of each track, with the totals. The location of bonds having an equivalent of over 36 ins. of continuous rail is specified, as are the maximum and minimum bond resistance values noted during the day by the tester.

The next, original 8 ins. x 13 ins., illustrates a transmission line test made for the purpose of locating a ground. In

TRANSMISSION LINE TEST

Reason for test: *To locate how far from Shore, Ground exists under Harlem River at Drawbridge. Cable cut at both ends of Bridge, measured at No. End of Draw.*

TEST FOR GROUNDS. Date, 2/19/'07. Time.....

Phases Grounded, *One Phase Grounded.*
Insulation Resistance by Voltmeter. A.....
B.....
C.....

READINGS FOR MURRAY LOOP TEST. Date, 2/21. Time, 4.45 P.M.

Length of Line: 720 feet. *Fig. used by Contractors.*

Clear Phase	Grounded Phase	Readings A.	B.	A^1	B^1	
		40.6	59.4	59.1	40.9	
		40.8	59.2	59.0	41	
	Average	40.7	59.3	59.05	40.95	
						40.825

Calculated Distance from *End of Cable on S. Side of River* to Ground = 139.2 feet.

This indicates Manhole No.....Found.....
.....

POTENTIAL TEST. Date.....Time.....

Three / Single } Phase

Between Phases .....Volts.....Amps. Charging Current.....Time
Cable to Ground .....Volts.....Amps. Charging Current.....Time
Remarks.....
.....

making this test the cable was cut at two points, and with one phase grounded readings were taken for the standard Murray

loop test. As shown by the readings, the calculated distance of the ground from the end of the cable was 139.2 ft.

CHEMICAL LABORATORY

The chemical laboratory is located on the upper floor of the switch house and it contains a standard line of reagents. In one corner of the room is a small shop driven by a ½-hp motor, the equipment of the shop consisting of a grinder and a lathe belt-driven from a countershaft. The routine work consists of a daily coal analysis and a daily gas analysis. Other work includes tests of engine, cylinder and transformer oils, insulating compounds, acid and water. The importance of the chemical laboratory in the economy of the modern power plant is well illustrated by the character of the work done here. Several analyses are given below to show the scope of the work:

EXAMPLE OF A FLUE GAS ANALYSIS, ORSAT APPARTUS, JUNE 21, 1907

No. Boiler.	Co_2	O.	C. O.	N.	Draft.	Doors.
7	12.20	7.70	0.10	80	¾ in.	Open
7	10.60	9.30	0.25	79.85	"	"
7	11.85	8.10	0.30	79.75	"	"
7	13.50	6.30	0.25	79.95	"	"
7	13.80	6.10	0.10	80.00	"	"
7	14.20	5.60	0.35	79.85	"	"
9	13.60	6.30	0.25	79.85	"	"
9	14.20	5.80	0.00	80.00	"	"
9	14.10	5.60	0.20	80.10	"	"
9	12.70	7.10	0.10	80.10	"	"

SAMPLE COAL ANALYSIS

	Per cent moist coal.	Per cent dry coal.	Per cent combustible.
Moisture	.334	.....	.....
Volatile combustible matter	22.166	22.24	24.122
Fixed carbon	67.924	68.15	73.917
Ash	7.776	7.802	.....
Sulphur	1.8	1.808	1.961

B. T. U. per pound moist coal by calorimeter, 13,955.
B. T. U. per pound moist coal by proximate analysis, 14,500.
B. T. U. per pound conbustible, 15,136.
Boiler No. 10, draft ½ in. Co_2 12.7 per cent, 3:10 p. m.
Boiler No. 13, draft ½ in. Co_2 12.3 per cent, 3:30 p. m.

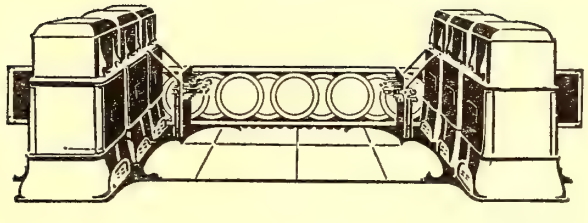
EXAMPLE OF AN ANALYSIS OF ANTI-FRICTION METAL FOR BEARINGS, JUNE 15, 1907

Lead	60.39 per cent
Copper	37.95 "
Iron	00.05 "
Tin	00.58 "
Zinc	00.01 "
Other impurities	1.02 "

The main constituents of this metal are seen to be lead and copper.

EXAMPLE OF AN OIL TEST, JUNE 5, 1907

	Cyl. Oil.	Air Comp. Oil.	Air Comp. Oil.	Cyl. Oil.	Cyl. Oil used.
Flash point	560° F.	460° F.	413° F.	569° F.	529° F.
Burning point	617° F.	497° F.	456° F.	628° F.	611° F.
Specific gravity	.895	.875	.9025	.8875	2.00 water
Resinous matter	27%	7%	13%	23%	1%
Acidity	no	no	no	no	slightly
Alkalies	trace	trace	present	trace	none



POWER DISTRIBUTION SYSTEM OF THE NEW YORK CENTRAL

In no branch of the terminal electrification has greater provision been made to insure continuous service than in the high and low tension distribution systems. The use of alternating current generators with three-phase transmission and the distribution of direct-current from rotary converter substations require a very complete operating organization to handle the routine and emergency work, in view of the large number of separate lines, switches, feeders, jumpers, rotaries, transformers and auxiliary apparatus in service. The responsibility of each employee in the power department is definite, and his duties under all anticipated conditions have been mapped out with great care. In the following section on the New York Central distribution system a number of points on power house and substation operation are included for the reason that it is difficult to draw arbitrary lines separating the different parts of the transmission, conversion and distributing equipment into distinct operating sections. The system as a whole, from the bus bars to the third-rail shoes, is an organized group of apparatus with inter-related and not separated parts.

The transmission lines and substations of the electrical division were described in the Street Railway Journal of Nov. 19, 1905, and only a brief resume will therefore be given at this time of the construction features. When the work is completed eight substations will be in operation, viz., No. 1, Fiftieth Street and Lexington Avenue; No. 2, Mott Haven; No. 3, Kings Bridge; No. 4, Yonkers; No. 5, Irvington; No. 6, Ossining; No. 7, Bronx Park; No. 8, Scarsdale.

Nos. 1, 2 and 7 are now in service, and Nos. 3 and 4 are ready for service at any time. The present equipment of all the substations is three 1000-kw rotary converters each, with the exception of Nos. 1 and 2, which have three 1500-kw rotaries each. Each substation may be fed from either power station, and the lines are so disposed that no ordinary accident can cut off a substation from its power supply. The system is designed to give the greatest protection against interruptions of all kinds, and the transmission lines are partly overhead and partly underground. Throughout the Park Avenue tunnel, along the viaduct, and also through the Harlem Division depression the conductors are carried in steel pipes, and in crossing the Harlem River the conductors are submarine cables laid in the bed of the river. The transmission line voltage at the power house is 11,000.

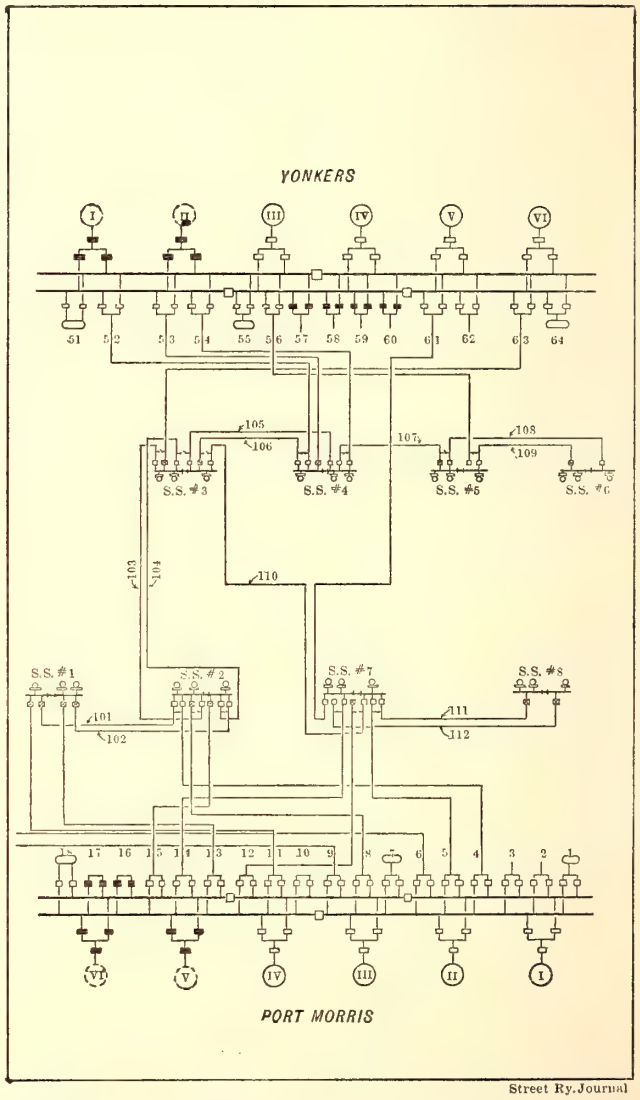
HIGH TENSION CIRCUITS

The diagram herewith shows the connections of the transmission lines with the power stations and substations. As stated, each power station has an initial equipment of four turbo-generators. Each station is provided with two sets of main high tension bus-bars. Each generator and each high tension line is provided with two selector switches and can be connected to either bus. The generators have an additional main switch in series with the selector switch. The testing transformers and the light and power transformers in each station can be operated from either set of high tension buses. Each substation is supplied by at least two high tension lines, and in the majority of cases special switches are provided in the substations, so that if desired the high tension current entering the station by one line can by-pass the substations and feed the next substation directly without going through the high tension bus of the first substation. The substation bus bars can be separated in two sections if necessary. The general flexibility of the scheme is clearly shown in the illustration.

The next cut shows the substation and power station high tension circuits a little more in detail as regards the bus bars and oil switches. Line oil switches and machine oil switches, both present and future, are shown, together with the tie switches, which enable the 11,000-volt power on any circuit to be fed past the substation if desired. All the high tension lines leaving Port Morris power station are carried underground. Both overhead and underground circuits will be run out from Yonkers power station.

LOAD DESPATCHER'S BOARD

The load despatcher's indicator board contains a skeleton diagram of the high tension system. At the Port Morris



Street Ry. Journal

DIAGRAM OF HIGH-TENSION TRANSMISSION SYSTEM

load despatcher's office, for example, the Port Morris high tension bus bars are shown near the bottom of the board, and the Yonkers buses at the top. The board is mounted against the wall close by the load despatcher's desk. The pilot lamps indicate the condition of the 11,000-volt oil switches in the station, and are operated in harmony with the oil switch movements by relay currents. A green light burning at any point on the diagram indicates that the oil switch at that point is open, and a red light indicates that it is closed. Similarly, red disks hung on the appropriate hooks indicate that the corresponding rotaries are running in the substations, and green

disks show that the corresponding machines are shut down. The high tension lines are shown in red on a slate background. The load despatcher's office also contains a direct current feeder dummy board showing the condition of each feeder and third-rail in the electrical division. Pegs are used to indicate whether switches are open or closed. A similar board is located in the office of the superintendent of power.

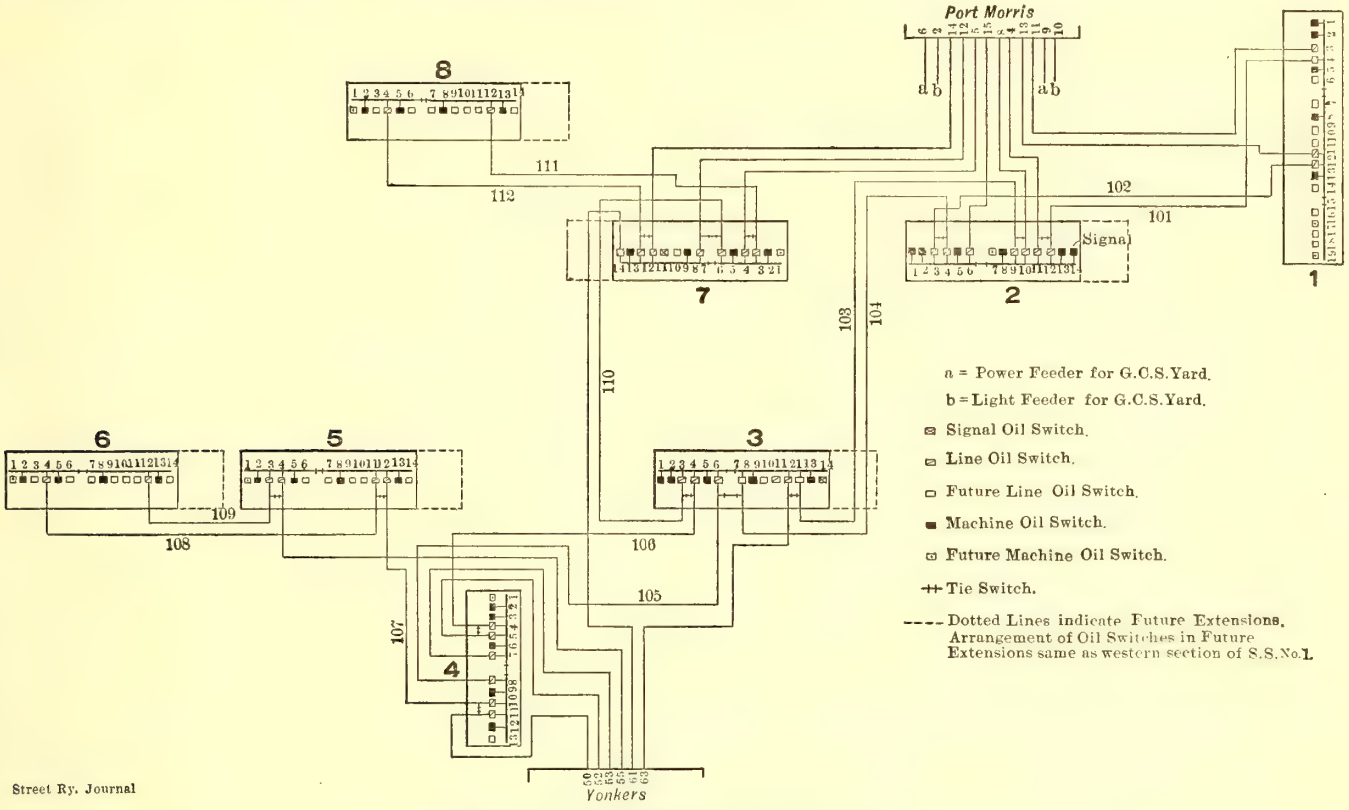


DIAGRAM OF HIGH-TENSION CIRCUITS

5, 6 and 8 entirely overhead. 1, 2, 4 and 7 entirely underground. 3, composite

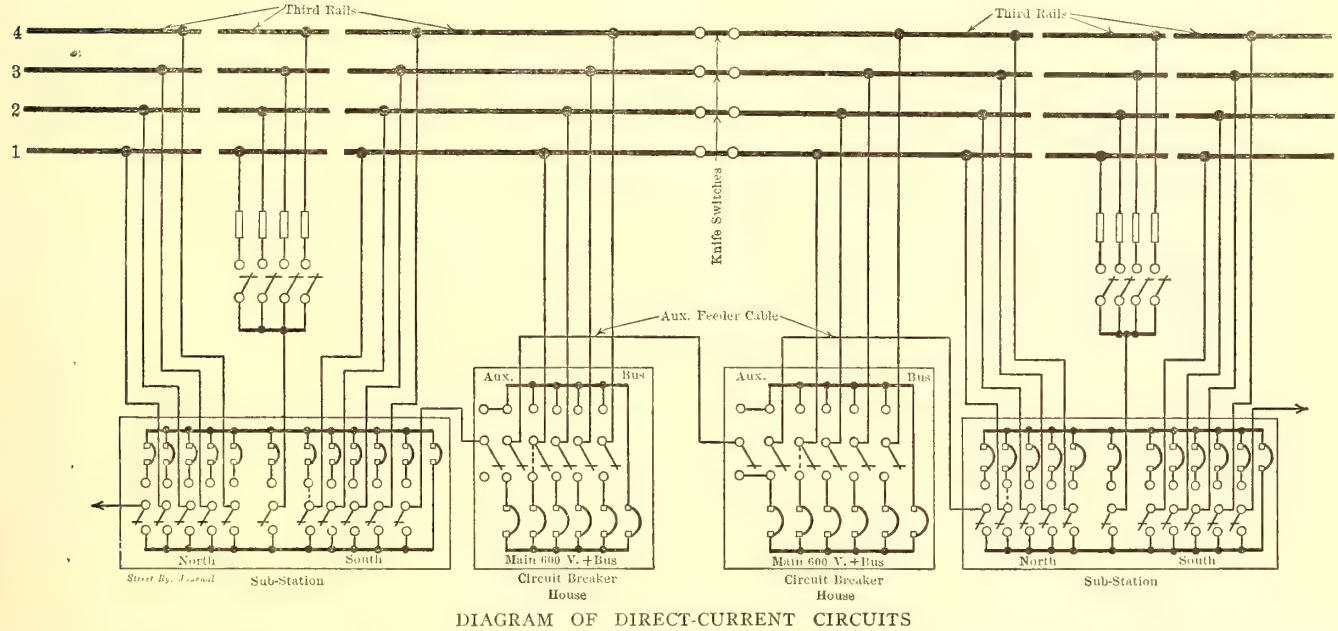


DIAGRAM OF DIRECT-CURRENT CIRCUITS

LOW TENSION DISTRIBUTION

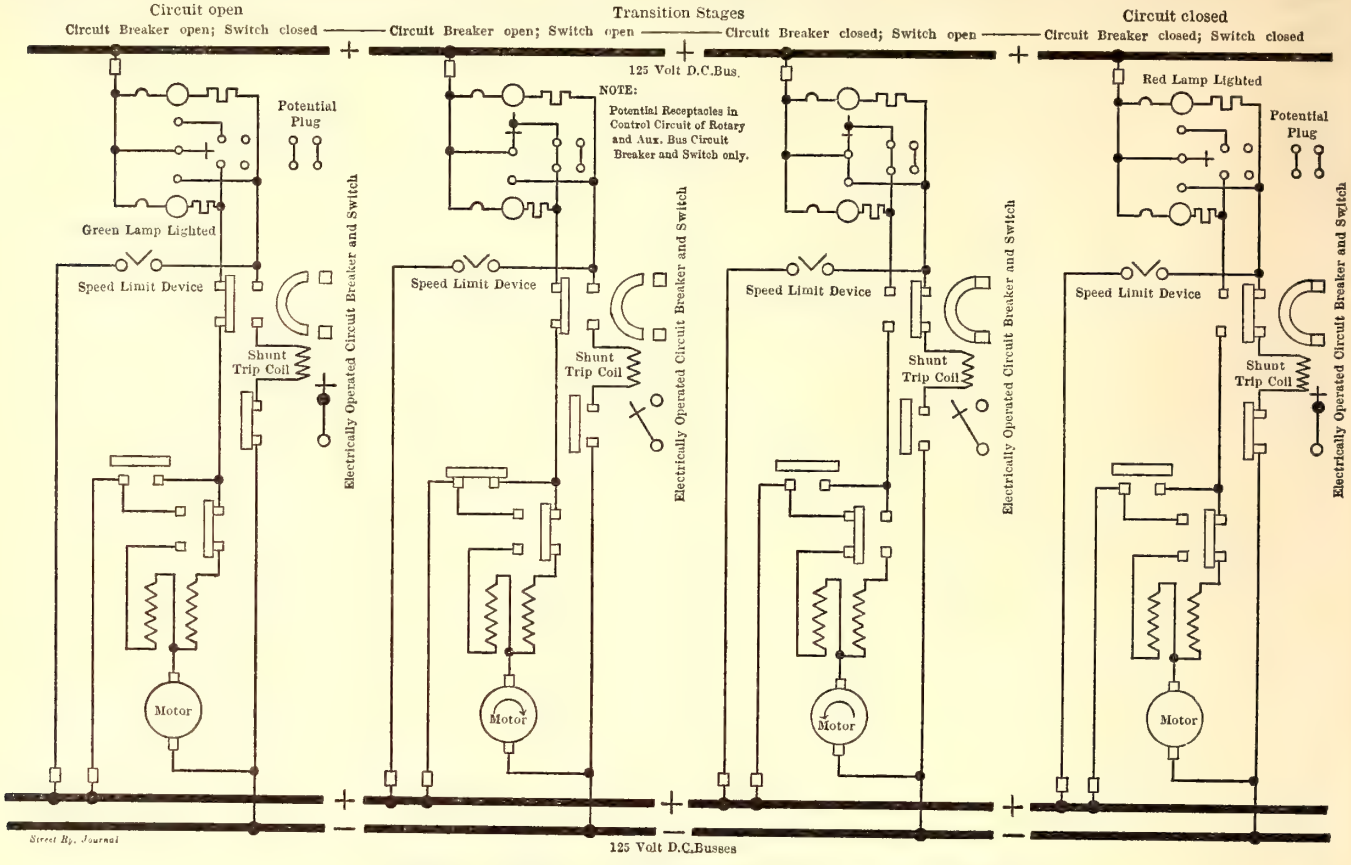
The general connections of the direct current wiring in a typical circuit breaker house are shown on page 554. The four third-rails of the main line opposite each circuit breaker house are connected at the middle points of double throw single pole switches, by means of which they can be thrown upon either the main 660-volt current bus of the house, or an auxiliary bus used in emergencies. In this figure an auxiliary feeder cable running from substation to substation is also shown. A main circuit breaker is provided for the substation connection and the circuit breaker house as a whole, and each one of the four cables leading to the third-rail is also provided with a circuit breaker, as shown in the diagram. A spare breaker is included in the circuit breaker house outfit for use in case of emergencies.

CIRCUIT BREAKERS

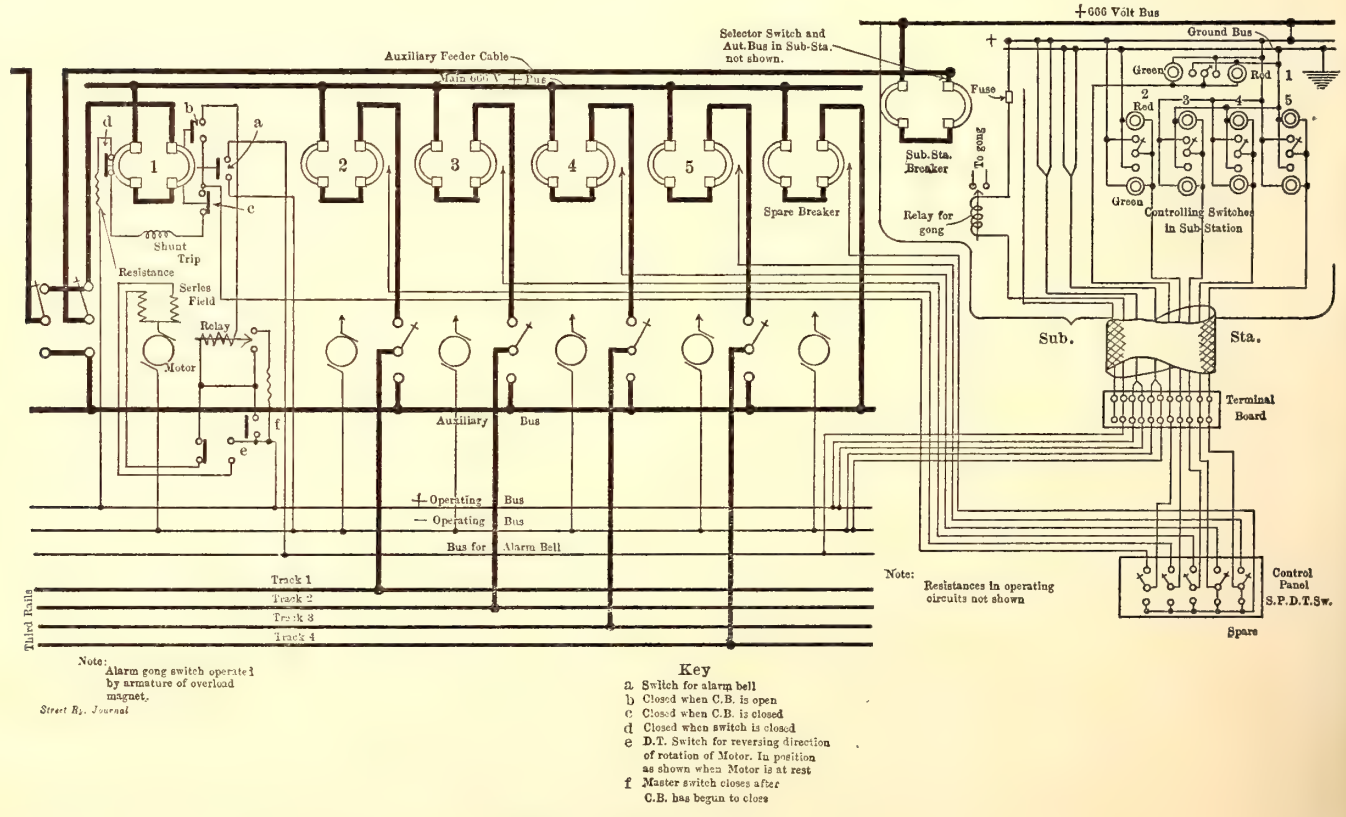
All the circuit breakers in the substations are operated by small motors, these being of the series wound type to assure sufficiently quick acceleration. A switch is in series with each circuit breaker, this switch also being operated by the same motor which operates the circuit breaker proper. In closing

the circuit breaker the breaker proper is first closed and then the auxiliary switch, so that in case the feeder is closed on a short circuit the breaker can immediately open. The connections for operating these circuit breakers are shown herewith. The two elevations of the circuit breaker are shown on page 555.

The upper diagram on page 555 gives in schematic form the d. c. connections between four typical substations and their circuit breaker houses. The isolated sections of third-rail in front of each substation are 800 ft. long. The flexibility of the third-rail supply from either the main or auxiliary substation bus or circuit breaker house buses is evident from the diagram.



CIRCUIT BREAKER AND SWITCH CONTROL FOR SUBSTATIONS



Key

a Switch for alarm bell
b Closed when C.B. is open
c Closed when C.B. is closed
d Closed when switch is closed
e D.T. Switch for reversing direction of rotation of Motor. In position as shown when Motor is at rest
f Master switch closes after C.B. has begun to close

CIRCUIT BREAKER HOUSE WIRING



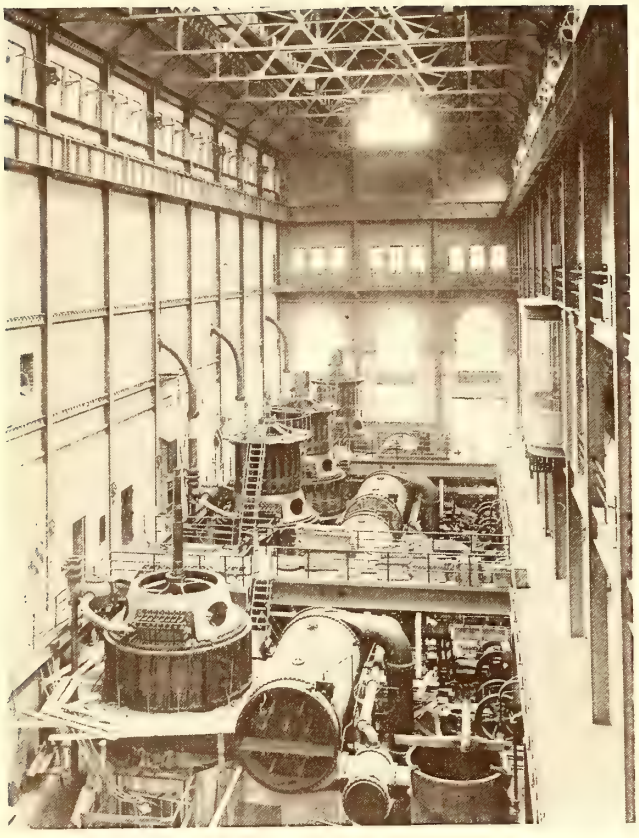
EXTERIOR OF YONKERS POWER STATION (UNDER CONSTRUCTION)



EXTERIOR OF PORT MORRIS POWER STATION



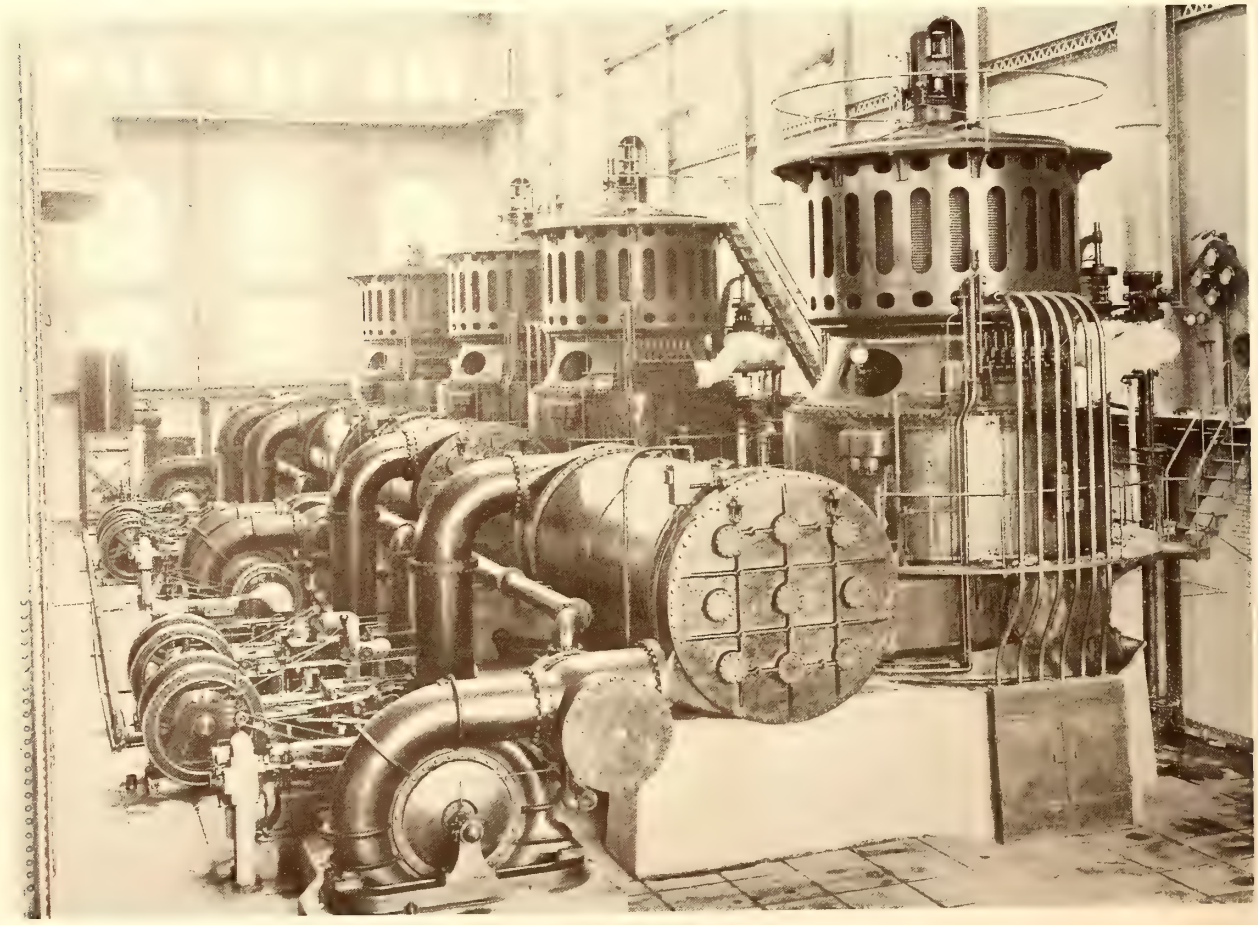
VIEW FROM RIVER OF PORT MORRIS POWER STATION OF NEW YORK CENTRAL RAILROAD, SHOWING RELATION OF POWER STATION AND SWITCH-HOUSE



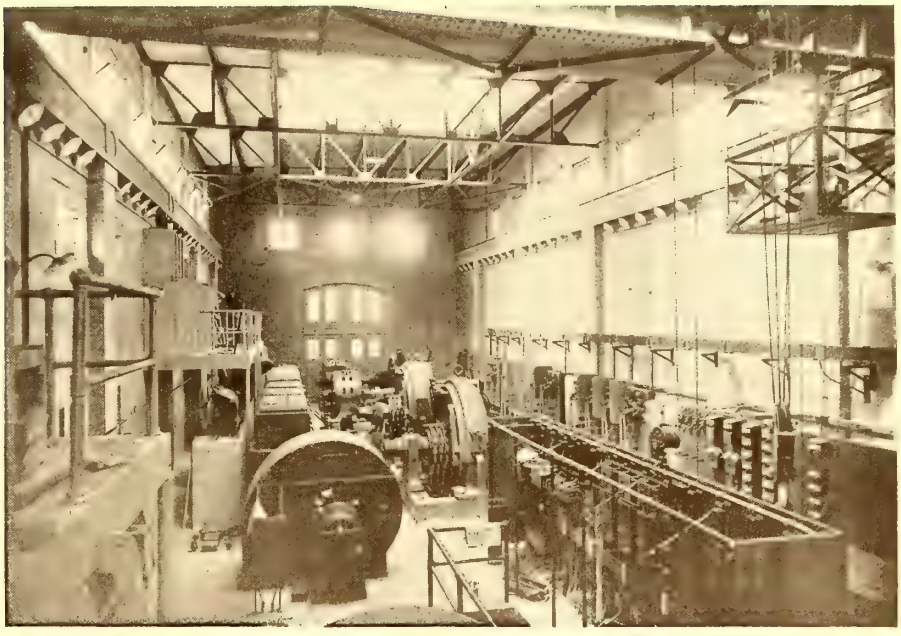
TURBINE ROOM UNDER CONSTRUCTION—YONKERS POWER STATION



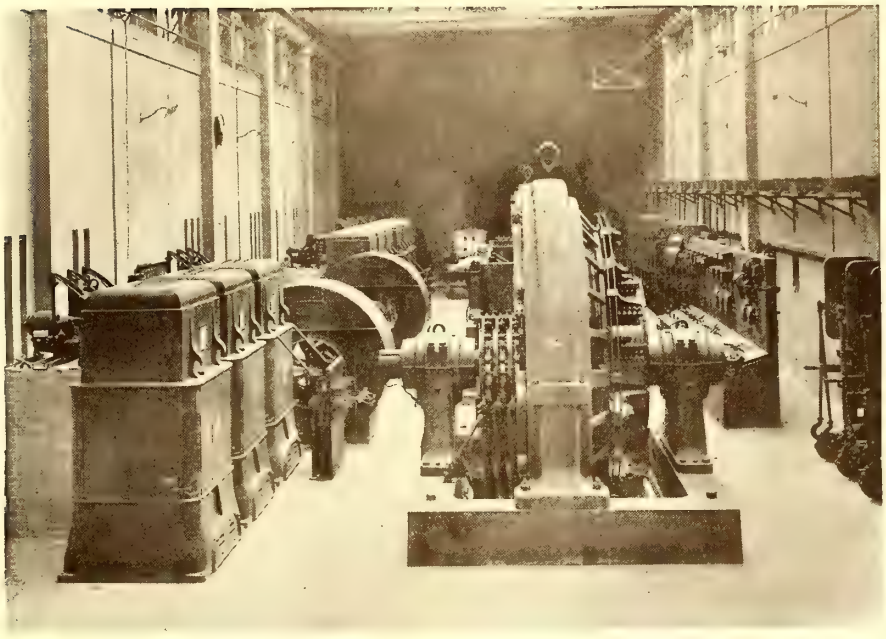
BOILER ROOM, PORT MORRIS POWER STATION



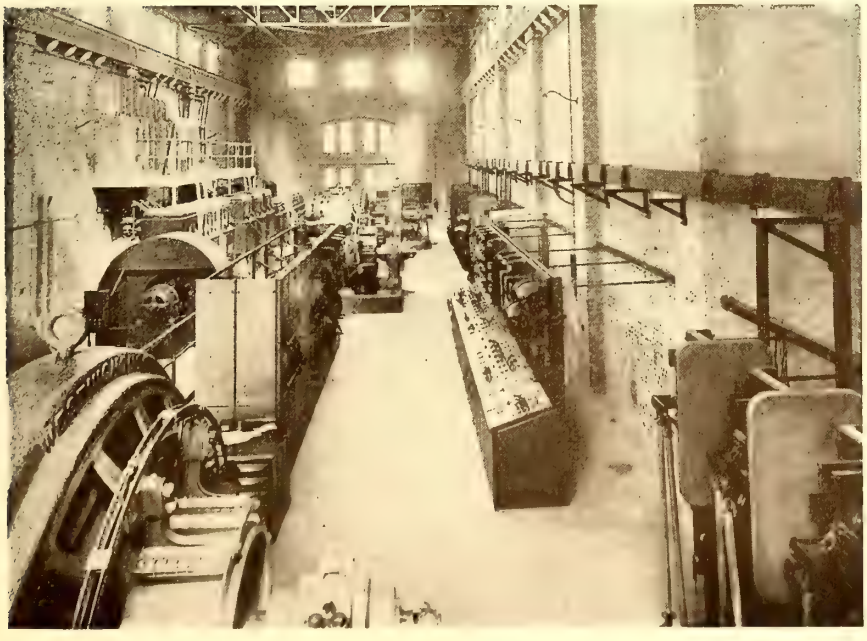
TURBINE ROOM, PORT MORRIS POWER STATION, NEW YORK CENTRAL RAILROAD



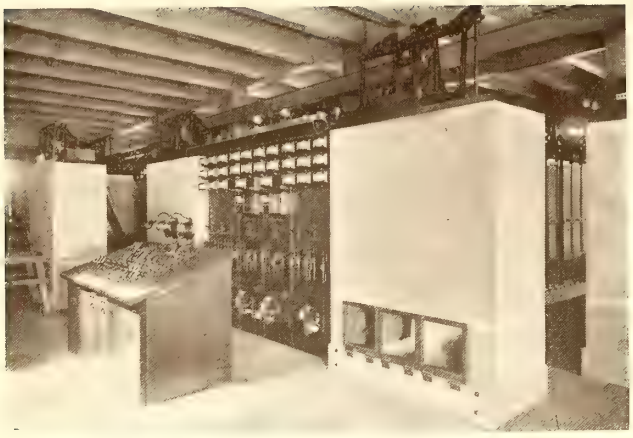
KINGSBRIDGE SUBSTATION (NO. 3), LOOKING WEST, NEW YORK CENTRAL RAILROAD



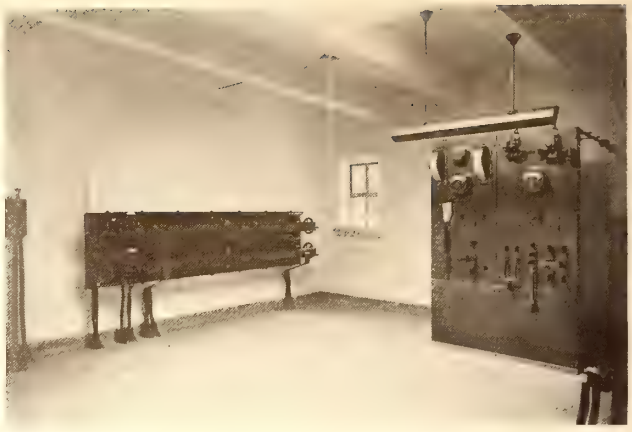
SUBSTATION NO. 1, NEW YORK CENTRAL RAILROAD



KINGSBRIDGE SUBSTATION (NO. 3), LOOKING EAST, NEW YORK CENTRAL RAILROAD



INSTRUMENT BOARD AND AUXILIARY OPERATING BOARD



BOOSTER ROOM SHOWING BATTERY END CELL SWITCH



SWITCH-HOUSE LABORATORY



BATTERY-ROOM LOOKING SOUTH



REMOTE CONTROL SWITCHBOARD



LOAD DISPATCHER'S OFFICE

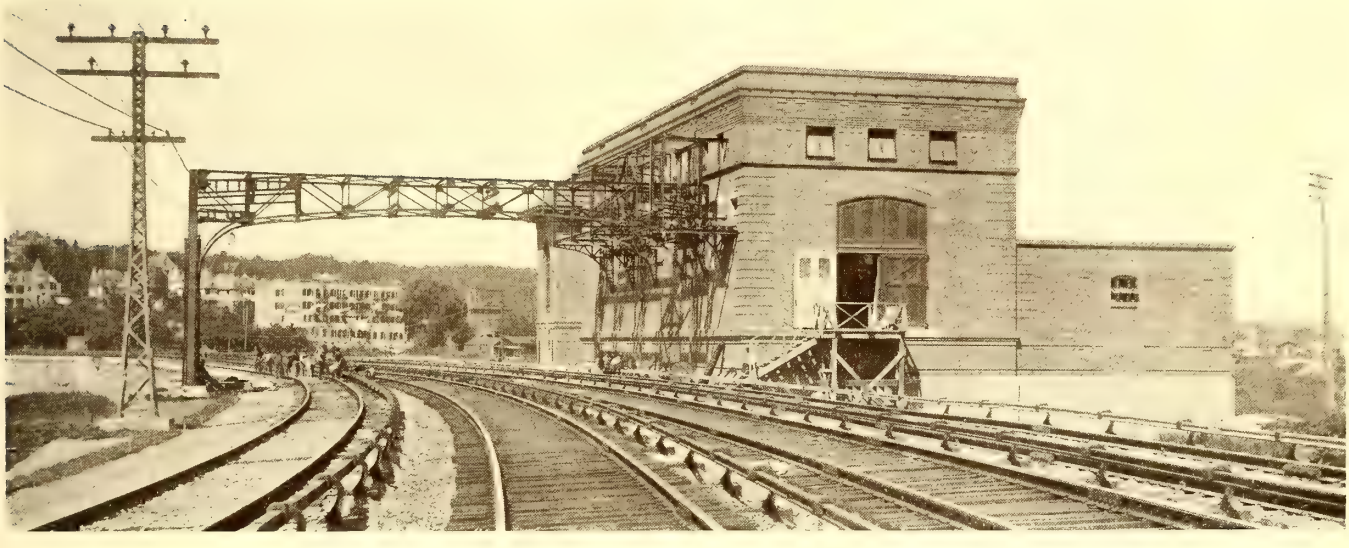
VIEWS IN PORT MORRIS POWER STATION NEW YORK CENTRAL RAILROAD



BATTERY ROOM, BRONX PARK SUBSTATION



BATTERY ROOM, KINGSBRIDGE SUBSTATION



KINGSBRIDGE SUBSTATION NO. 3, NEW YORK CENTRAL RAILROAD



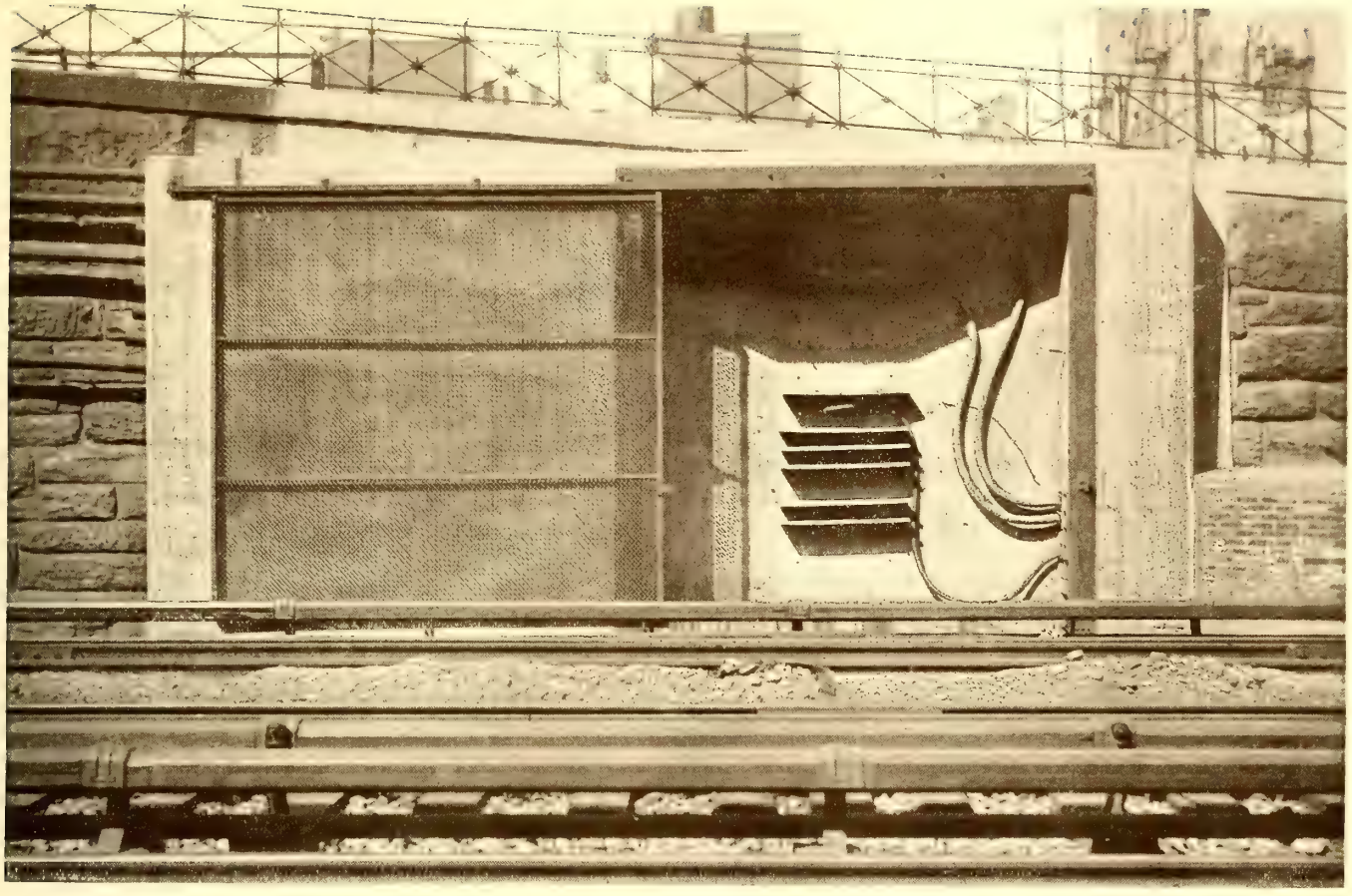
BRONX PARK SUBSTATION (NO. 7), NEW YORK CENTRAL RAILROAD



SIGNAL BRIDGE AT 168TH ST., LOOKING NORTH, NEW YORK CENTRAL RAILROAD



TYPICAL PIPE CONDUIT, LOOKING NORTH FROM 100TH ST., NEW YORK CENTRAL RAILROAD



SPLICING CHAMBER AT 99TH ST. WEST SIDE OF RAILROAD TRACKS, NEW YORK CENTRAL RAILROAD



MOTT HAVEN SPLICING CHAMBER AT HARLEM RIVER, NEW YORK CENTRAL RAILROAD



TYPICAL CIRCUIT BREAKER HOUSE, NEW YORK CENTRAL RAILROAD



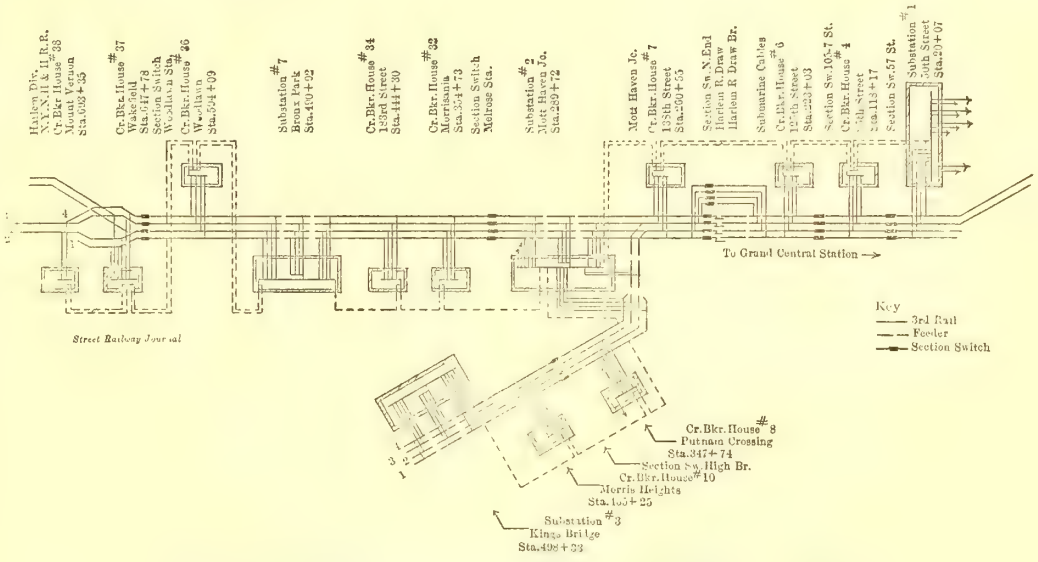
HIGH-TENSION OVERHEAD POLE LINE, HUDSON DIVISION, NEW YORK CENTRAL RAILROAD

YARD DIAGRAMS

The cut on page 556 shows the scheme of third-rail connections throughout in the Grand Central yard and in the vicinity of substations 1, 2, 3 and 7. The long lines projecting from each rectangle representing a circuit breaker house or substation indicate the substation bus bars. Fourteen train tracks and a ladder connection in the Lexington Avenue terminal for suburban trains are shown, as well as twelve tracks for through trains in the Grand Central Station itself. The various third-rail jumper connections between the different yard tracks are also indicated.

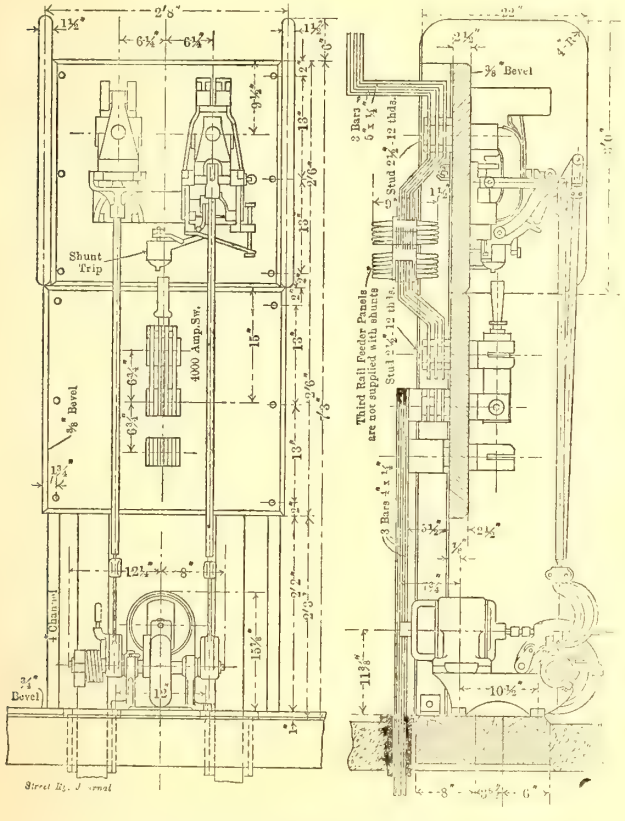
The diagram on page 558 illustrates the track layout at the Grand Central terminal, and that on page 557 the layout at the Mott Haven yard, the overhead contacts in each case being shown by cross dotted lines. The lower part of the former figure represents the Lexington Avenue terminal, and the upper part the Grand Central Station tracks. The arrangement of these tracks will, of course, be greatly changed upon the completion of the construction work for the new terminal as planned by the company and now in process of execution.

An interesting feature of the yard practice at Mott Haven is the provision of remote control switches at eleven points in the yard. In case any section of the third-rail is cut out, it is not necessary for the employee responsible for closing the circuit breaker corresponding to his section to go back to the circuit breaker house on foot and thereby lose time. Each section of the yard is provided with a separate circuit breaker in the circuit breaker house and the remote control switches control these switches as desired.



SIMPLIFIED DIAGRAM OF D. C. FEEDERS—MAIN LINE, THIRD-RAIL

In case repairs are necessary on any section of the third-rail at this point the circuit breaker corresponding can be electrically locked against closing by a suitable connection on the yard switch.



4000 AMP. MOTOR OPERATED CIRCUIT BREAKER AND SWITCH

SUBSTATIONS

Each substation converts the high tension current to direct current of 666 volts for delivery to the third-rail, and each substation is provided with a storage battery equipment of sufficient capacity to operate the maximum train load for about one-half hour. In order to provide against interruptions in the substations the following general principles of design were followed: (1) The path of the current was made as short and direct as possible from the transmission lines to the d. c. feeders; (2) the wiring is as little exposed as possible and yet is readily accessible; (3) all machinery is on the same floor as the operating switchboards; (4) the principal apparatus is under the direct control of the operator while standing at the boards; (5) all equipment is so arranged that the effects of an accident will be confined to the place where it occurs; (6) risk of accident to the operator is as slight as possible, and finally (7) the stations are of fireproof construction.

All overhead lines are provided with knife switches to disconnect them from the substation apparatus. The oil switches are provided with pilot lamps to indicate at the control board whether they are open or closed. There are two controlling switchboards situated in a part of the station which will be the center when the station is extended to its final limits. The substation batteries have capacities varying from 2250 amps. to 4200 amps. for one hour.

The direct current feeder system is designed to provide duplicate paths for the current from the substation to the third-rail. Opposite each substation is a section of the third-rail 800 ft. long separately fed from the substation. In case of trouble this isolated section can be killed to prevent a train bridging between the main sections each way from the substation.

BOOK OF RULES

The following paragraphs are taken from the book of instruction and rules for the electric power department:

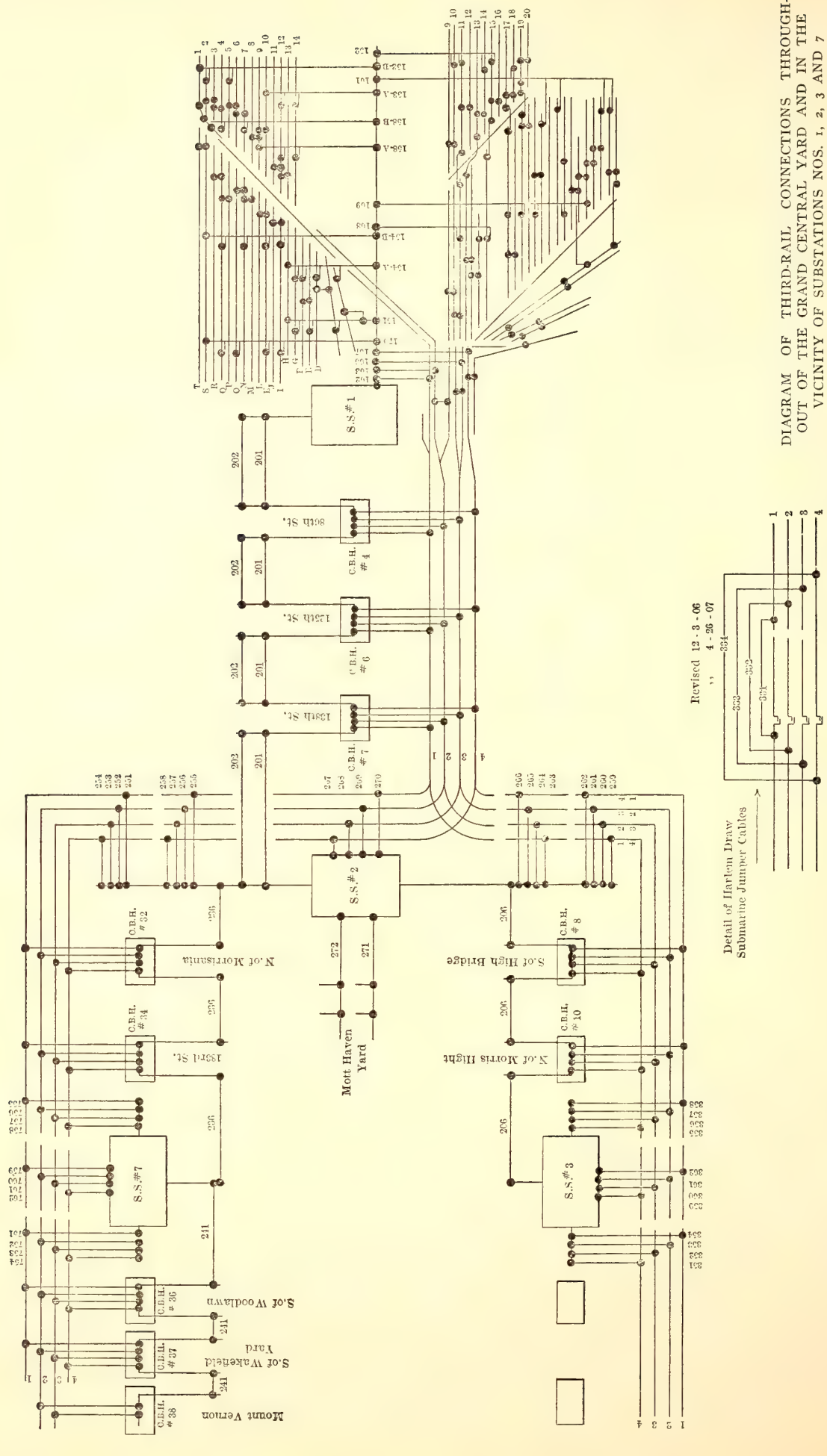


DIAGRAM OF THIRD-RAIL CONNECTIONS THROUGHOUT OF THE GRAND CENTRAL YARD AND IN THE VICINITY OF SUBSTATIONS NOS. 1, 2, 3 AND 7

NORMAL OPERATION OF THE ELECTRIC POWER SYSTEM.

A. ELECTRIC POWER SYSTEM.

1. The "electric power system" consists of the power houses, 11,000 volt lines, substations, 660 volt feeders, circuit breaker houses, the third-rail, overhead working conductors, and track rail return.

B. LOAD DESPATCHER.

2. The general operation of the electric power system is under the immediate supervision of the Load Despatchers, reporting direct to the Superintendent of Power. For the initial operation there is one Load Despatcher's office, located on the second floor of the Port Morris switch house. This is connected by a private telephone line known as the Load Despatcher's telephone system with the different substations, the two power stations and such offices as are necessary. There are also telephone connections through the public service to the Load Despatcher's office and to the stations and substation. Also through the railroad company's general service and substation party line systems as explained in emergency directory.

3. All cases of trouble, which are likely to affect the operation of the electric system, occurring in or reported to the power house or substations, must be promptly reported to the Load Despatcher on duty. The Load Despatcher will then communicate with the proper department or person and will take such further steps as may be necessary to insure continuity of operation.

C. POWER STATIONS.

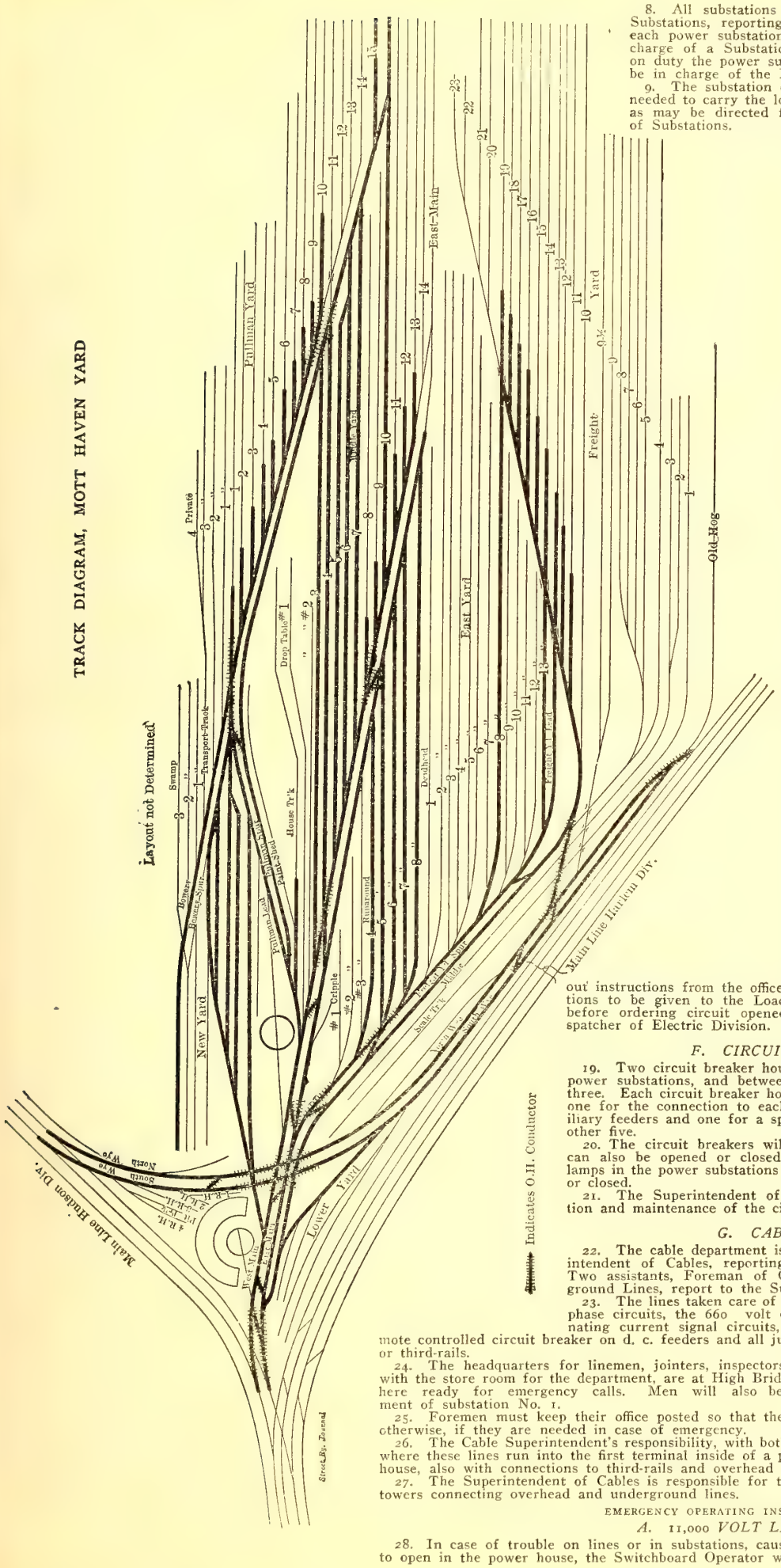
4. Each power station is in charge of a Superintendent, reporting direct to the Superintendent of Power. Reporting to the Superintendent of the Power Station are three watch engineers, one of whom is always on duty. The watch engineers have immediate charge of the operation of the power house, and are responsible for having sufficient capacity in boilers, turbines and auxiliary apparatus to carry the normal load, ready as needed. They will also, under instructions from the Load Despatcher, carry such additional load as may be needed.

5. The watch engineer on duty must see that the Load Despatcher is kept posted as to the number of turbines in service and the number of boilers under steam and banked.

6. Any trouble, actual or impending, which is likely to interfere with the operation of the station must also be promptly reported to the Load Despatcher, so that arrangements can be made with the other station to carry additional load.

D. POWER SUBSTATIONS.

7. The substations containing rotary converters and storage batteries are called "power substations" to distinguish them from those for furnishing current for signals, which are known as "signal substations."



8. All substations are in charge of the Superintendent of Substations, reporting direct to Superintendent of Power, and each power substation and its adjoining signal substation is in charge of a Substation Foreman. In case the foreman is not on duty the power substation and also the signal substation will be in charge of the Power Substation Operator on duty.

9. The substation operators will run such rotaries as may be needed to carry the load, and will operate their storage batteries as may be directed from time to time by the Superintendent of Substations.

10. No 11000 volt line switches shall be operated without instructions from the Load Despatcher, except in case of extreme emergency, and if so operated the Load Despatcher must be promptly advised. This also applies to the 2200 volt signal circuit switches.

11. The substation foremen or operators will take instructions from the Load Despatcher in regard to switching all outgoing or incoming circuits.

12. The Load Despatcher must be kept advised of the number of rotaries running and also, in a general way, as to the amount of power left in the storage batteries.

13. Any trouble occurring or impending in the substations must be reported to the Load Despatcher as soon as possible, also any trouble occurring or impending near the substation on the lines or third-rail which may be brought to the attention of the substation foremen or operators must be reported at once to the Load Despatcher.

E. SIGNAL SUBSTATIONS.

14. The signal substations furnish single phase alternating current at a frequency of 25 cycles for supplying the signal system. All signal substations furnish this current at 2200 volts pressure, except at signal substation No. 1, where 300 volt signal circuits are used for supplying the Grand Central yard. A 2200 volt signal circuit also runs from No. 1 signal substation, supplying the main line signals north of 57th Street.

15. In signal substations Nos. 2, 3 and 7 current is furnished normally by a static transformer, stepping down from 11,000 to 2200 volts. Motor generators with 660 volt direct current motors and 2200 volt alternating current generators are also provided. In case of failure of the 11,000 volt supply of current, the motor generators will be operated, current for them being furnished from the storage batteries in the power substations.

16. In substation No. 1 no static transformer is provided for stepping down from 11,000 volts. Motor generators are used for generating alternating current at a pressure of 300 volts. A static transformer is provided for stepping up from 300 to 2200 volts.

17. The operators in the signal substations will report to the foreman of their respective power substations, or to the operators on duty in the power substations.

18. The circuits running from the signal substation must not, except in case of emergency, be opened without instructions from the office of the Engineer of Signals, these instructions to be given to the Load Despatcher. The Load Despatcher will, before ordering circuit opened, obtain permission from the Train Despatcher of Electric Division.

F. CIRCUIT BREAKER HOUSES.

19. Two circuit breaker houses are located between each two adjacent power substations, and between substations No. 1 and No. 2 there are three. Each circuit breaker house contains, as a rule, six circuit breakers, one for the connection to each of the four third rails, one for the auxiliary feeders and one for a spare, in case of the failure of either of the other five.

20. The circuit breakers will open on an overload automatically, and can also be opened or closed from the nearest power substation, pilot lamps in the power substations indicating whether the breakers are opened or closed.

21. The Superintendent of Substations is responsible for the operation and maintenance of the circuit breaker houses.

G. CABLE DEPARTMENT.

22. The cable department is under the general direction of the Superintendent of Cables, reporting direct to the Superintendent of Power. Two assistants, Foreman of Overhead Lines and Foreman of Underground Lines, report to the Superintendent of Cables.

23. The lines taken care of by this department are the 11,000 volt, three-phase circuits, the 660 volt direct current feeders, the 2200 volt alternating current signal circuits, the control circuits for operating the remote controlled circuit breaker on d. c. feeders and all jumpers connecting isolated sections of track or third-rails.

24. The headquarters for linemen, jointers, inspectors and helpers in this department, together with the store room for the department, are at High Bridge. Men will be on twenty-four hour duty here ready for emergency calls. Men will also be on twenty-four hour duty in the basement of substation No. 1.

25. Foremen must keep their office posted so that they can be reached readily by telephone, or otherwise, if they are needed in case of emergency.

26. The Cable Superintendent's responsibility, with both overhead and underground lines, will end where these lines run into the first terminal inside of a power station, substation, or circuit breaker house, also with connections to third-rails and overhead working conductor.

27. The Superintendent of Cables is responsible for the operation and maintenance of the cable towers connecting overhead and underground lines.

EMERGENCY OPERATING INSTRUCTIONS.

A. 11,000 VOLT LINES.

28. In case of trouble on lines or in substations, causing one or more 11,000 volt line switches to open in the power house, the Switchboard Operator will report at once to the Load Despatcher,

giving information as to switches that open. If any damage has been caused, either to the turbines or to the oil switches, he will report the same, and will advise the Load Despatcher as to the station's ability to carry the load which has been dropped.

29. The Switchboard Operator will prepare to test the feeders which have opened, but will not put current on them until instructed by the Load Despatcher to do so.

30. If an idle bus is available the feeders to be tested will be thrown to this bus and the test made by means of one of the turbo generators or by the testing transformer in the switch house.

31. This test should be made beginning at not more than 2500 volts. If no trouble develops inside of one minute, advise the Load Despatcher, who will then notify the substations to put load on line or lines which have been tested.

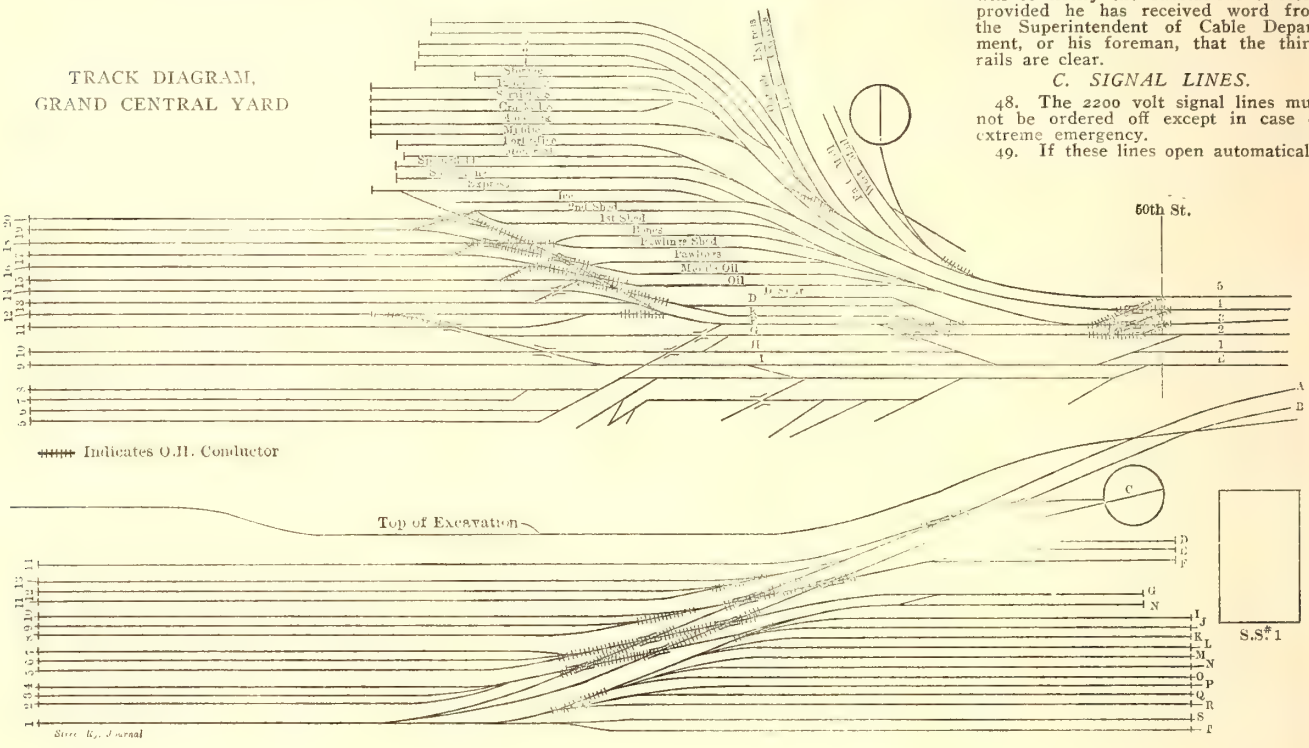
32. If an idle bus is not available, either a section of one of the two buses will be killed or temporary connections will be made from the testing transformer.

33. If but one line is out of service, and if both buses are in use, the test may be postponed for a short time if the line is not needed immediately. Instructions from the Load Despatcher will govern.

34. If test shows there is trouble on a feeder, endeavor to isolate it in case it is possible to open the feeder in a substation or cable tower.

35. These tests, as covered by paragraphs 29, 30, 31, 32, 33 and 34, will be made under the direction of the power station electrical foreman or his assistants, under instructions from the Load Despatcher.

TRACK DIAGRAM,
GRAND CENTRAL YARD



36. Further tests to determine the exact location of trouble in any given feeder will be made under the direction of the Engineer of Tests.

37. In case of a 11,000 volt line switch opening in a substation, the substation operator will report the trouble at once to the Load Despatcher, and instructions for testing this feeder will be given by the Load Despatcher.

38. As soon as possible after trouble occurs on the 11,000 volt lines the Load Despatcher will notify the office of the Superintendent of Cables, so that arrangements can be made to assemble men for repair work. This must be done at once without waiting for tests to be made to locate trouble.

39. The Superintendent of Cables, or his assistant on duty, will immediately send out one or more men to look for the trouble, and will hold his other men to await further reports from the men sent out, or from the Load Despatcher's Office.

40. If the trouble is found by the men sent out by the Superintendent of Cables they must not start work on the line without first getting permission from the Load Despatcher's Office, as there is a possibility of current being on for testing purposes.

41. As soon as repairs have been made on an underground 11,000 volt line, both insulation and phase tests must be made before the line is again put in service, this test to be made by the Engineer of Tests, who may call upon the Electrical Foreman of the Power Station, or his assistants, to make the test if necessary. The Engineer of Tests will, however, be held responsible for the test.

42. At the discretion of the Load Despatcher an overhead 11,000 volt line may be put in service after repairs have been made, without any tests.

B. 660 VOLT DIRECT CURRENT FEEDERS.

43. The four direct current feeders to the isolated section of the third-rail opposite each substation are connected to one circuit breaker. In case this circuit breaker opens, close it immediately. If it opens the second time isolate the trouble by opening first one knife switch and then another until the trouble is found, then leave the knife switch open on the section of track on which the trouble is located, reporting the same at once to the Load Despatcher. If a man is available in the substation, send him to examine the isolated section, and if the trouble is found report at once to the Load Despatcher the nature and extent of same. If a man is not available, the Substation Operator will report trouble to Load Despatcher, who will refer same to office of Superintendent of Cables.

44. In case of circuit breakers opening on the feeders other than to the isolated section of third-rail, close them immediately. If they open the second time, wait thirty seconds and close again. If they open the third time, notify the Load Despatcher, who will report the trouble to the office of Superintendent of Cables. The feeders must not be closed again without orders from the Load Despatcher.

45. The Load Despatcher may at his discretion order the feeders closed for further test. He must not, however, order this done after the feeders have been turned over to the cable department, without first receiving advice from the foreman on the work.

46. In the case of a general short circuit, causing all or part of the d. c. line circuit breakers to open in the lines feeding either to the north or south from his substation, a substation operator will first see that all or part of the d. c. line circuit breakers are open in the circuit breaker houses controlled from his substation to the north or south, whichever way the trouble may be. He will then proceed to make alive in his substation first one third-rail and then another of those which have been killed until either all are alive or until the trouble is isolated. He will then notify the Load Despatcher, who will, after talking with the adjoining substation, advise him in regard to closing the circuit breakers in the circuit breaker houses.

47. In case of current being held off from one or more third-rails on account of a wreck, it must not be put on without orders from the Load Despatcher, and the Load Despatcher must not give such orders without first receiving corresponding orders from the Train Despatcher or Superintendent of the Electric Division. As soon as notice is given by the Train Despatcher or Superintendent to the Load Despatcher to have current put on, the Load Despatcher will so notify the substations affected, provided he has received word from the Superintendent of Cable Department, or his foreman, that the third-rails are clear.

C. SIGNAL LINES.

48. The 2200 volt signal lines must not be ordered off except in case of extreme emergency.

49. If these lines open automatically in the signal substations they must be immediately closed, and if they open the second time close them again. If the trouble still holds on, report at once to the Load Despatcher, who will advise as to further tests and who will report the trouble to the Train Despatcher, to the Superintendent of Cable Department and to the Engineer of Signals.

50. The Line Foreman working under the direction of the Superintendent of Cables will, as quickly as possible locate the trouble, and if it cannot readily be removed will isolate as much as necessary of the signal circuit in order to clear trouble. He will then report to Load Despatcher, stating condition of lines and request that such parts as he has cleared, be made alive.

51. Further repairs will be made as directed by Superintendent of Cable Department.

52. Failures of 2200 volt signal transformers on overhead or underground lines will be reported from the office of the Engineer of Maintenance of Way to the Load Despatcher's Office and by the Load Despatcher to the line trouble men on duty. These men, working in pairs, will locate trouble, and will repair or replace whatever is necessary as quickly as possible.

53. The 50 volt signal circuits will be maintained by the maintenance of way department, the dividing line being at the 50 volt terminals of the transformers.

54. Trouble with the transformers, even though it be with the 50 volt winding, will be taken care of by the electric power department.

55. The 300 volt signal circuits from signal substation No. 1 will be taken care of by the maintenance of way department. The maintenance of way department will also replace 2200 volt transformer fuses.

D. SUBSTATIONS.

56. In case of loss of 11,000 volt power on substation bus bars, the substation operator will immediately open the high tension oil switches, both on the rotaries, boosters and the feed to the signal substations, leaving the high tension line switches as they are, and then throw the battery switch direct to the negative bus.

57. The operator or his assistant will next call up the Load Despatcher, stating that he has lost the 11,000 volt power and that all machines are clear from the high tension bus.

58. After this, call the operator in the adjoining signal substation and see that he has started the motor generator and is maintaining current on the signal circuits.

59. If the battery is discharging at more than the twenty minute rate, bring the discharge down to the twenty minute rate by opening feeders to one or more tracks.

60. If at the end of ten minutes a. c. power has not been restored,

open sufficient feeders to bring the discharge down to the half hour rate. The substation operator will then advise the Load Despatcher as to the situation in his substation and as to the probable length of time he can carry what load he has on the battery.

61. As soon as a. c. power is restored, start up from the a. c. end as many rotaries as were running previous to the trouble, being sure that the polarity of each rotary is right before starting the next machine. As soon as these rotaries are running, close them one after another to the direct current bus.

62. Be sure that the signal substation operator is notified before closing the rotaries to the direct current bus, so that he can watch his motor generator closely when the increased direct current bus pressure comes.

63. If the battery has been discharged to such an extent that it takes an excessive charge, open battery circuit breaker and leave battery off until provisions can be made for charging through the booster.

64. If the battery has received an excessive discharge it should be at least partially charged as soon as possible.

65. As soon as a. c. power is restored, and substation is operating normally, notify the signal substation operator so that he can shut down his motor generator and throw his signal circuits to the static transformer.

E. GENERAL INSTRUCTIONS.

66. The superintendent of cable department will see that a sufficient force of men is kept on duty night and day to handle ordinary cases of trouble, and will see that all of his men can be readily reached by telephone, or otherwise, at any hour, either nights, Sundays or holidays.

67. Notices have been sent to the agents in the passenger stations, and have been posted at various points along the right of way, giving the power station and substation telephone numbers, so that in case of an emergency, instructions can be telephoned asking to have the power cut off from the third-rail. Party line telephones with direct connections to substations are installed in all passenger stations and at other points along the right of way.

68. In case such telephone messages are received at the power houses or substations definite information should be asked as to the nature and location of the trouble, and the name of the party asking to have current cut off should be ascertained.

69. A substation operator upon receiving such a call will immediately cut off current from the track or tracks as requested, providing his substation feeds the place from which current is asked to be cut off, and he will also call Load Despatcher so that the adjoining substation can be notified to open their feeders to the same place.

70. If a substation operator receives a request to have current cut off from track not fed from his substation he will notify Load Despatcher, who will transmit the request to the proper substation. Such a call should be put down in writing as soon as possible after it has been received.

71. After the third-rail has been killed in this manner, it will not again be made alive until the Load Despatcher has received word from the Superintendent of Cables, his foremen or some other responsible party, that it is safe to put current on. If the trouble has been due to a wreck, permission must be received from the Superintendent or Train Despatcher of the Electric Division before putting current on.

F. LOSS OF TELEPHONE COMMUNICATION.

72. Ordinarily telephone communication between the power stations, the substations and the Load Despatcher will be on the private system known as the Load Despatcher's telephone system. A New York Central general telephone system is installed and connections made from this system to the Load Despatcher's office, power stations and substations. There are also connections from the New York Telephone Company's exchanges to the Load Despatcher's office, all power stations and substations. Telephone numbers will be found in the emergency directory.

73. In case of the failure of the Load Despatcher's system, use the general system, and in case of failure of this, use the New York Telephone Company's Lines.

74. In case of trouble occurring during a time that all telephone systems are out of order, the following rules should be observed:

75. If 11,000-volt line switches open at the power station two minutes will be allowed substations to clear their buses, when power will be thrown on again or as soon thereafter as the power station is ready.

76. If the switch or switches open the second time they will be left off until communication is re-established by telephone or otherwise with the substations affected.

77. If a 11,000-volt line switch opens in a substation on a line which runs beyond the substation, the operator will after an interval of two minutes close this line switch, first cutting the line clear from the substation bus bars, if there is such a connection. If it opens the second time he will leave it open until communication by telephone or otherwise is established with the Load Despatcher's office.

RULES TO INSURE SAFETY OF EMPLOYEES AND OTHERS.

A. GENERAL INSTRUCTIONS.

78. Visitors will not be allowed in power stations or substations without properly signed permits.

79. Visitors will not be allowed on switchboard gallery or in bus bar chambers of power stations, nor in basements of substations unless such permission is specifically given on their permit to visit station or substation.

80. If a visitor's pass allows him to visit switchboard gallery, or the vicinity of high tension work, he must be accompanied by a responsible employee of the station or substation.

81. No employee shall touch either with or without rubber gloves any switch, current or potential transformer, cable, bus bar or conductor or any other apparatus which ordinarily carries current at a potential higher than 700 volts, until he has positively ascertained that such conductor or apparatus is disconnected from all sources of such potential.

82. Before starting work on any high or low tension cables or bus bars which are supposed to be dead, the foreman in charge of the work will make his own tests to ascertain if they are dead. Test lamps or a light fuse to be used on low tension work and electroscopes or other suitable devices for high tension work.

83. Foremen must confer with head of department to whom they report in regard to approved methods of testing to ascertain if cable or bus bars are alive.

84. In replacing potential transformer fuses either in power stations, substations or on signal transformers rubber gloves must be used and in addition the fuse must be held in wooden tongs. In case of signal transformers on aerial lines a suitable insulated holder for the fuse block must be used in place of the wooden tongs.

B. WORK ON HIGH TENSION LINES.

85. When work is to be done upon any high tension lines, either overhead or underground, written permission must be obtained from the Load Despatcher for killing the same, unless the work is of an emergency nature so that there is not time for getting written permission. In such cases permission must be obtained by telephone.

86. After the Load Despatcher has granted permission for work on these lines, before the work is started he will arrange with the station and substations affected for having the line or lines killed, and will instruct the operators in the station and substations to tag the feeder or feeders upon which work is to be done. A regular tag (Form E. D. 18) is provided for this purpose.

87. The name of the foreman who will have charge of the work to be done on the line in question must appear on this tag, and the line cannot again be put in service after repairs have been made until released by the foreman whose name appears on the tag.

88. A tag must be placed upon each end of the line and a "not clear" card (Form E. D. 37) must be placed upon the control switches for operating the oil switches at each end of the line and also upon the corresponding dummy switches on the Load Despatcher's indicator board.

89. At the same time the Load Despatcher notifies the power station and substation operators to tag the line he will also notify them to open the knife switches in series with the oil switches at each end of the line, and also short circuit and ground at least one end of the line. In case of a line running from the power station this short circuiting and grounding must be done at the power station end. If the line is to be cut it must be short circuited and grounded at both ends.

90. When the Load Despatcher receives information from the power station or substation operators that the line has been short circuited and grounded, and that the necessary tags and "not clear" cards have been placed he will release the line to the foreman, at the same time advising him of the places where tags have been installed and also where short circuiting and grounding has been done.

91. Upon completion of the work the foreman will personally sign the tag from at least one end of the line, stating that the work is completed, and so advise the Load Despatcher. The Load Despatcher will then order off the short circuiting and grounding connections and have the tags and "not clear" cards removed.

92. If the work has been such that there is a possibility of the connections being changed a phase test must be made before the line is put in service.

93. All tags are to be removed as soon as possible after the completion of the work, and no lines are to be left tagged when work is not being done upon them if they are in condition to be used.

94. Tags which have been removed must be sent to the Load Despatcher after removal.

C. WORK ON DIRECT CURRENT FEEDERS.

95. Permission must be obtained from the Load Despatcher for any work on the direct current feeders which makes it necessary to put them out of service, and the same rules in regard to tagging as used for high-tension cables will govern in the case of low-tension cables, except that it will not be necessary to ground the feeders before working on them.

96. In case of direct current feeders which are to be killed to permit of work being done on them, tags must be placed on all switches in either the circuit breaker houses or substations from which it is possible to make these feeders alive.

97. If a third-rail is killed on account of work to be done on it, all control switches by which it is possible to throw current to the section of the third-rail to be killed must have tags placed on them in the same manner as specified for direct current feeders in the preceding paragraph.

98. In case work is to be done on low tension apparatus in stations or substations the switches controlling said apparatus must be tagged in the same manner as for high tension lines, and the foreman who is to do the work must obtain written permission from the Load Despatcher before starting the work, and must also release the apparatus as soon as the work is completed and must sign the tag stating that the work is completed and must then so advise the Load Despatcher.

99. Men working on the overhead or underground lines, or any other work along the right of way, must be careful not to leave any tools, scrap, loose wires or other material between track rails or which might lie so as to short circuit the third-rail, or foul third-rail shoes. Foremen must use great care to enforce this rule and inspectors will report violations to the Superintendent of Cables.

VI. SPECIAL RULES.

A. WORK IN POWER STATIONS AND SUBSTATIONS.

100. When work is to be done upon any piece of apparatus in a power station or substation which will prevent any turbine, rotary, motor generator or booster from being ready for service on short notice, the Load Despatcher must be so advised by the Superintendent or Watch Engineer of the Power Station, or by the foreman or operator of the substations.

101. Exciter storage batteries in the power stations, and the main and auxiliary storage batteries in substations, must not be put out of service unless absolutely necessary, and not until permission has been received from the Load Despatcher. The Load Despatcher will, before granting permission to put a battery out of service, confer with the Superintendent of Power.

B. WORK ON THIRD-RAILS.

102. If it is necessary to take current off from the third-rails which are in actual service, for other than emergency causes, arrangements must be made with the Train Despatcher or Superintendent of the Electric Division. The Division Superintendent will notify the Load Despatcher in regard to the track to be killed and also as to the time current is to be taken off and put on again. After a track has been cut dead at the request of the Train Despatcher or Superintendent, it will not be again made alive until so ordered by them.

103. The Engineer of the Testing Department shall upon request of the Engineer of Maintenance of Way, the Division Engineer, or of the third-rail foreman working under the Division Engineer, make conductivity tests to determine if track or third-rail bonds are in proper condition.

C. FIRE APPARATUS.

104. A sufficient number of fiber pails, filled with clean, dry sand, must be kept in all power stations, power substations, signal substations and circuit breaker houses.

105. A sufficient number of chemical extinguishers must be kept in all power stations, power substations and signal substations.

106. A monthly report in writing must be sent to the Superintendent of Power from the Superintendent of each Station and the Superintendent of Substations, giving the number and condition of fire pails, chemical extinguishers and other fire extinguishing apparatus, including fire pumps, hose and fire lines.

D. SAFETY DEVICES.

107. Safety apparatus, such as speed limit devices, reverse current and overload relays on power station and substation apparatus must be tested at frequent intervals to be sure that the same are kept in working order.

108. Each substation foreman, and also the electrical foreman of each power station, must make up a monthly list of spare fuses on hand, this list to also state the total number of each kind of fuses needed for the full complement of the power station or substation.

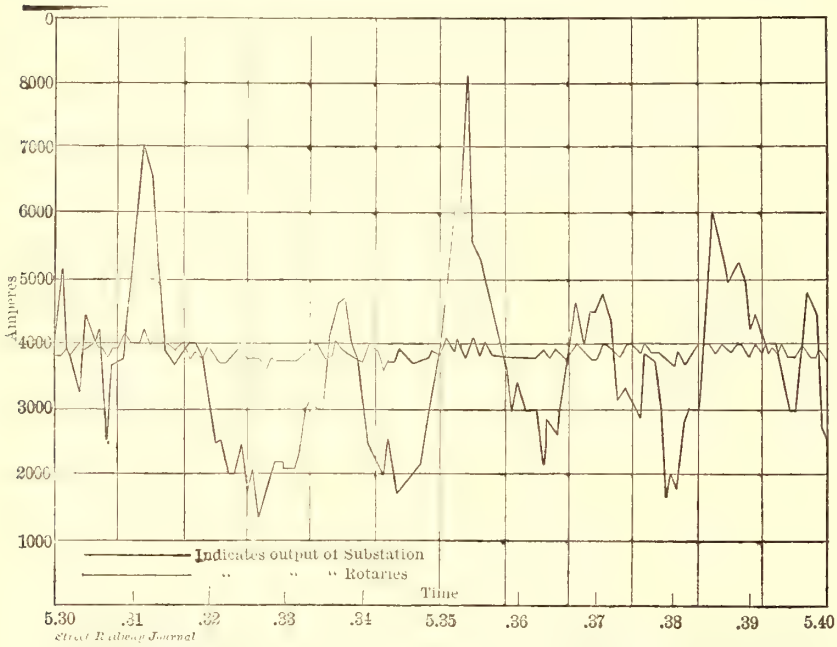
E. ADDRESS OF EMPLOYEES.

109. Each employee who is likely to be called for emergency work must keep his foreman or superintendent posted as to his residence and the number of the nearest available telephone. Foremen and superintendents will see that they have complete lists of the names and addresses of all men whom it may be necessary to call for emergency work.

SUB-STATION PRACTICE OF THE NEW YORK CENTRAL

The sub-station practice of the New York Central resembles in many of its general features that of large street railway companies as regards the handling of individual machines, but the variety of equipment installed and the importance of the service given broaden the duties of the employees in a marked degree. It is not too much to say, however, that the work of these sub-stations measures close in quantity and quality to the operating duties essential in many good sized power stations.

Careful provision through regular records of the behavior of the equipment, special arrangements for the use of auxiliary connections in case of trouble, well established methods of handling the machinery, switchboards and batteries, and the widespread adoption of the remote control principle on both a. c. and d. c. sides of the installation combine to illustrate the importance of detailed planning of operating arrangements in the electrification of a large terminal service.



CURVES SHOWING DIVISION OF LOAD BETWEEN ROTARIES AND BATTERY—READINGS TAKEN AT INTERVALS OF 5 SECONDS

OPERATING SHIFTS

All sub-stations which are in service are operated on three eight-hour shifts daily. Each sub-station is in charge of a foreman who works from 8 a. m. to 6 p. m., and under him are three sub-station operators, three dynamo men, three signal station operators and one batteryman. One sub-station operator is on duty per shift, the shift hours being 8 to 4 p. m., 4 p. m. to 12 midnight and 12 midnight to 8 a. m. The batteryman's hours are from 8 a. m. to 5 p. m.

The sub-station forces as a whole are under the jurisdiction of the superintendent of sub-stations, whose headquarters are at Port Morris power station. In addition to the regular operating force there is a circuit-breaker inspector who makes a daily inspection of all circuit breakers in circuit-breaker houses. There is also one oil switch inspector who makes repairs on oil switches and inspects all switches at least once a month. Both the circuit breaker and the oil switch inspectors are included in a repair gang. This force of men spends its entire time in repairs and construction work in the sub-stations and circuit-breaker houses.

The sub-station operators are in direct charge of the operation of the sub-station, the dynamo men look after the commutators and collector rings on the machines in service and clean up all apparatus; they also assist operators when necessary. Each rotary and motor generator is cleaned at least four times a week. The static transformers are cleaned weekly. Compressed air at 35-lbs. pressure is used for this work. The batteryman keeps the battery room clean, replaces evaporation of cells with water, and takes the necessary readings on battery. The sub-station batteries are in direct charge of the sub-station foreman. General supervision of all batteries is kept by a battery foreman reporting to the superintendent of sub-stations.

STARTING AND SHUTTING DOWN ROTARIES

Rotaries are started up ordinarily from the d. c. side, but can be started from the a. c. side. In starting up from the d. c. side the first operation is to throw the field circuit to bus excitation. The field resistance is then adjusted and the starting switches closed and rotary brought up to speed by cutting out resistance in the armature circuit. Immediately after the rotary starts the switch which connects the transformer secondary to the rotary slip rings is closed. The rotary is then thrown upon its own excitation and synchronized, at which time the d. c. switch opens automatically. The d. c. bus and machine voltage is then compared and the remote controlled circuit-breaker closed, putting the machine in service. The entire operation usually takes about a minute.

To start from the a. c. side taps are brought out from the secondary of the transformer giving one-third and two-thirds voltage. On starting, the field circuit is split up so that but two field coils are in series, thus reducing the inductive voltage when the current is first thrown on. If the machine builds up with wrong polarity, provision is made to reverse the direction of the current in the field circuit until the right polarity is established.

In taking a rotary out of service the load is first cut off by adjusting the field rheostat. The circuit breaker connecting the d. c. side of the rotary with the main bus-bar of the station is then opened; the high-tension oil switch is next opened, after which the secondary switch and the selector switch are opened. This takes about ten seconds.

BATTERY OPERATION

The largest battery on the system is the one at sub-station No. 1, near the Grand Central terminal. This consists of 318 cells of chloride accumulators, type R-71. The charging rate of this battery is as follows:

	Amperes.
Continuous normal 8-hour rate	894
" maximum battery not over 90 per cent full	1,200
" maximum battery not over 85 per cent full	1,500
" maximum battery not over 75 per cent full	2,000
Maximum for one minute under normal conditions of operation with battery in normal state of charge	4,020

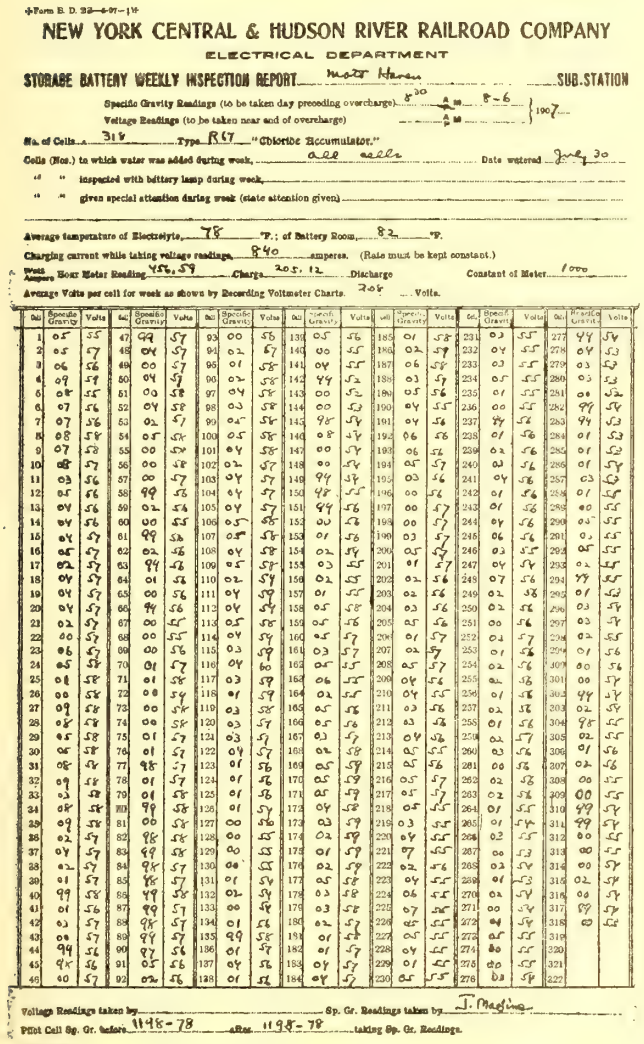
Discharging rate—

Maximum	for one hour	4,020
"	for thirty minutes	6,030
"	for twenty minutes	8,040
"	for one minute	12,060

CARBON REGULATOR

The storage battery is connected to the bus-bars at all times, but the boosters are not used excepting when the battery is being discharged at time of the peak, or when it is being charged. In order to get the proper use of the battery for taking sudden variations in load, the carbon regulator is used in connection with the booster.

The normal function of the battery is to regulate the momentary fluctuation of the load falling on the batteries, the adjustment being such that the total amount of the charge



NEW YORK CENTRAL & HUDSON RIVER RAILROAD COMPANY

ELECTRICAL DEPARTMENT

STORAGE BATTERY WEEKLY INSPECTION REPORT ... SUB-STATION

WEEKLY STORAGE BATTERY INSPECTION REPORT

compensates for the discharge, such operation being known as floating. By adjusting the tension of the spring on the carbon regulator the amount of the discharge can be made to exceed the amount of the charge producing a net discharge or vice versa.

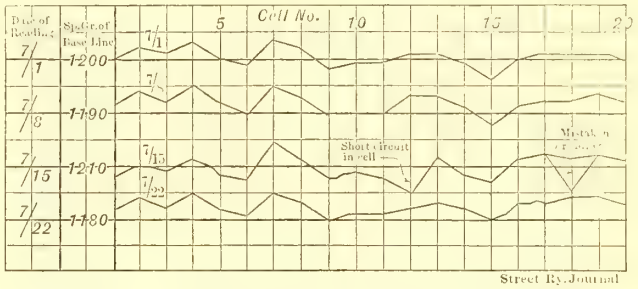
PILOT CELL

A convenient cell has been selected as a pilot cell. The automatic cell-filling apparatus keeps the height of the electrolyte constant in the pilot cell. An accurate specific gravity reading of this cell is taken every hour with the compensating hydrometer and the readings recorded on a form provided for the purpose and also on the recording voltmeter charts opposite the corresponding hours, at the time the chart is removed from the instruments. The temperature of the room and of the electrolyte is taken twice each day and recorded with other readings on a form provided.

To make sure that the automatic cell filler is always in order, the level of the electrolyte is noticed every time the other readings are taken, and any indication that it is out of order is reported immediately to the storage battery foreman. The compensating hyrometer is used in the pilot cell only.

FLOATING

Charts are figured usually by noting the average voltage for each hourly division separately and then averaging the whole twenty-four hours; the result is divided by the number of cells in circuit which gives the average voltage per cell for the day. The average is noted on the chart, together with



FORM FOR KEEPING SPECIFIC GRAVITY RECORDS

the date and number of cells in circuit, any irregularities being noted on the back. The charts are mailed daily to the storage battery foreman.

In daily operation the pilot cell's specific gravity is not allowed to go higher than 0.005 below the maximum specific gravity reached on the previous weekly overcharge, and when the battery is merely regulating, charge and discharge being the same, the specific gravity of the pilot cell is maintained as near 0.005 below the maximum as possible. For instance, when doing the regulating work only, if the maximum specific gravity of the pilot cell as shown by the previous weekly overcharge is 1207, the battery would be operated with the pilot cell reading 1202, but no higher. The average voltage while floating as shown by the Bristol voltmeter should then be between 2.06 and 2.10 per cell in circuit. If the average is above this the battery is receiving a net charge, and if lower, then a net discharge. For instance, if there are 318 cells in circuit the average voltage for floating as shown by the records should be 661 to 668.

DISCHARGING AND CHARGING

On discharging, the specific gravity of the pilot cell is not allowed to fall below the maximum by more than 0.025, attained on the previous week's overcharge; for instance, if the preceding weekly overcharge maximum specific gravity of the pilot cell is 1207, the discharge would be stopped when it has fallen to 1182. If the discharge is at the eight-hour rate the voltage would not be allowed to go below 1.75 per cell; if the current is less than the eight-hour rate the voltage is not allowed to go so low; if at the one-hour rate the voltage is not allowed to go below 1.6 per cell. Thus, if there are 318 cells in circuit the discharge would be stopped when the voltage has fallen to 556 with the eight-hour rate flowing; and to 509 with the one-hour rate flowing.

As soon as practicable after the discharge the battery is re-charged. The continuous charging rate of the average of net charge while regulating is not allowed to exceed, under ordinary operating conditions, the eight-hour rate, except in a case of emergency, and then the maximum is not allowed to exceed the one-hour rate. The charging lasts until the specific gravity of the pilot cell has risen to a point which

is 0.005 below the preceding weekly overcharge maximum. With constant charging rate the recording voltmeter is used to check the cutting off point, and the curve is allowed to just pass over the bend after the rapid rise characteristic of the end of the charge and before the voltage has ceased rising. In case of an overcharge the battery is charged until the pilot cell specific gravity has shown no further rise for a period of thirty minutes with normal eight-hour charging current flowing.

On one day each week, which is determined by the storage battery foreman, the batteries are given an overcharge at a rate as near the eight-hour rate discharge as possible. This overcharge lasts until five consecutive fifteen-minute specific gravity readings of the pilot cell are obtained at the same value similar to those used by the company in its other operating departments to instruct employees in the use of apparatus.

REPORTS TO SUB-STATION FOREMEN

The recording voltmeter charts after the average cell voltage has been carefully figured and noted on the back are sent in daily to the sub-station foreman, also a report covering the condition of the gassing on all the cells, together with the maximum specific gravity of the pilot cell during the last overcharge and maximum and minimum specific gravity of the same during the day. Pilot-cell readings for the week which ends the day preceding an overcharge are promptly sent in also.

PILOT CELL SPECIFIC GRAVITY READINGS

Plant of *N.Y.C.& H.R.R.R.* Located at *50th St.& Park Ave.* Battery No. *R*

Week Begining *Tuesday Aug 6th.* 190 7 Cell No. *99*

NOTE: Start a new sheet with each overcharge

OVERCHARGE READINGS (15 min. intervals after gassing starts) 1 div.=15 min.	DAY	Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday			Monday			
		A.M.	NOON	P.M.	A.M.	NOON	P.M.	A.M.	NOON	P.M.	A.M.	NOON	P.M.	A.M.	NOON	P.M.	A.M.	NOON	P.M.	A.M.	NOON	P.M.	
	1.220																						1.220
	1.210																						1.210
	1.200																						1.200
	1.190																						1.190
	1.180																						1.180
	1.170																						1.170
	1.160																						1.160
	1.150																						1.150
TIME START 10.15 A.M STOP 2.45 P.M																							
DATE Aug. 6th. 1907																							
AVERAGE CURRENT (during above readings) 894 AMPS																							
END OF CHARGE (Charge Stopped)	TIME			2.45 P.M.																			
	Specific Gravity			1.212																			
TEMPERATURE (Electrolyte)		80°		91°	83°		82°	82°		82°	82°		82°	80°		80°	80°		79°	80°		81°	

Max Sp. Gr. of Overcharge.

Specified floating point

Limit of discharge.

NOTE.—It is of assistance in following the regular charges to draw a line across the sheet at the floating point for the week.

READINGS TAKEN BY_____ _____ REMARKS ON OTHER SIDE

Street Ry. Journal

CHART OF PILOT SPECIFIC GRAVITY READINGS

or until five consecutive fifteen-minute readings of the voltmeters across the battery terminals show no further rise in voltage, the current being kept constant while these voltage readings are being taken. The recording voltmeter charts are made use of to determine the point of maximum voltage and the curve is run flat for an hour after the maximum is reached with the eight-hour rate current flowing. Just before finishing the overcharge, with as near constant current rate as possible, a voltage reading of all the cells is taken on a form provided for the purpose.

VENTILATION

Care is taken at all times to have the battery rooms freely ventilated, as it is of the utmost importance when charging. Care is also taken never to bring an exposed flame into the battery room during or immediately after the gassing period of charge. Trouble of any description is promptly reported to the storage battery foreman.

STIMULATING INTEREST IN BATTERY WORK

In order to stimulate the interest of the batterymen in their work, and to encourage them to attain a broad knowledge of the behavior of batteries in the service of the electrical division, a set of over one hundred questions has been prepared. These questions raise a large number of practical points with which the men are expected to familiarize themselves. They are not reproduced here, but the questions are

The form on page 561, original 13¾ ins. x 8 ins., is the storage battery weekly inspection report which is made out at each sub-station and submitted to the battery foreman. The specific gravity and voltage of each one of the 318 cells at Mott Haven sub-station (No. 2) are shown, together with the temperature of the electrolyte, battery room, average voltage of the battery per cell for the week and charging current while taking voltage readings. To save the trouble and time of writing 12 before the figures in the specific gravity columns the 12 is omitted, and the figures are understood to mean either 1205 or 1206, 1199, etc., as the case may be. The figure 2 is also omitted from the voltage per cell columns for the same reason.

The form on page 563, 14 ins. x 15 ins., shows the sub-station daily log in use at this writing. It gives a half-hourly record of bus-bar voltage a. c. and d. c. rotary inputs, battery performance and inputs of booster motors. Maximum swings of the ammeters reading rotary output, battery output and third-rail output are also given. On Aug. 14, the day shown, the high-tension voltage varied from 10,800 to 11,000 at the Mott Haven sub-station, and the voltage on the sub-station d. c. bus varied from 660 to 670. Rotary No. 1 was in service from 6:30 a. m. to 8 p. m.; rotary No. 2 from midnight to 12:30 a. m. and from 12:30 p. m. to midnight, and rotary No. 3 from 12:30 a. m. to 12:30 p. m. Two

rotaries were in service between 6:30 a. m. and 8 p. m. The maximum average kw load on the a. c. side of the sub-station was 2500 kw, occurring from 6:30-7 p. m. The battery was discharged only in the hours of peak load in the morning and afternoon, i. e., from 7 to 9:30 a. m. and from 4 to 6:30 p. m. The maximum d. c. ampere swings were 5210 amps. on the rotary output, 5000 amps. on the battery output, and 9000 amps. to the third-rail, the latter occurring at 5 p. m. The battery carried 5000 amps. of this momentary fluctuation. The company expects in the future to modify the form of this log somewhat, retaining the important features and adding several new ones. The new log will be about the same sized sheet, but will show kw-hour readings on the a. c. sides of the rotaries and boosters, with space for daily insulation tests of rotaries and auxiliary apparatus, and hourly readings of the maximum swing of the sub-station main d. c. ammeter. There will also be space for wattmeter readings at midnight of the preceding day and midnight of the day charted, with the difference. Power-factor readings will also be included.

Form E D 4—WHCCo—7-25-06—3M

NEW YORK CENTRAL AND HUDSON RIVER R.R. CO.

ELECTRIC DIVISION

Substation No. 2 *Located at* Mott Haven *Wed. Aug. 14,* 1907.

TIME	Bus Voltage		Average K. W. A. C. Input to Rotaries from Recording Wattmeters					Battery				REMARKS
	A. C.	D. C.	No. 1	No. 2	No. 3	No. 4	Total	Ave. K. W. From Recd. Wattmeter		Input to Booster Motors		
								Input	Output	No. 1	No. 2	
Mid.-12.30	10900	665		580			560					
12.30- 1.00	10800	660			680		680					
1.00- 1.30	10900	665			480		480					
1.30- 2.00	10900	665			580		580					
2.00- 2.30	10900	665			440		440					
2.30- 3.00	10900	665			400		400					
3.00- 3.30	10900	665			480		480					
3.30- 4.00	10900	665			500		500					
4.00- 4.30	11000	670			260		260					
4.30- 5.00	10900	665			200		200					
5.00- 5.30	10900	665			580		580					
5.30- 6.00	10800	665			280		280					
6.00- 6.30	10900	665			680		680					
6.30- 7.00	10900	665	600		540		1140					
7.00- 7.30	11000	670	680		720		1400	60	20	20		
7.30- 8.00	10800	660	1020		1220		2240	100	320	64		
8.00- 8.30	10800	670	1200		1320		2520	420	60	70		
8.30- 9.00	10800	660	1120		1100		2220	240	440	66		
9.00- 9.30	10900	670	1080		1280		2560	480	200	110		
9.30-10.00	10900	670	960		760		1720	580		106		
10.00-10.30	10900	670	940		860		1800	620		164		
10.30-11.00	10900	660	620		800		1420	760		164		
11.00-11.30	10900	660	740		800		1540	700		170		
11.30-12.00	10800	660	980		800		1780	800		198		
12.00-12.30	10800	670	840		800		1740	640		148		
12.30- 1.00	10900	660	900	1080			1980	780		168		
1.00- 1.30	10900	670	900	900			1800	660		158		
1.30- 2.00	10800	670	600	500			1100	80		18		
2.00- 2.30	10800	670	560	720			1280					
2.30- 3.00	11000	670	640	680			1320					
3.00- 3.30	10900	660	440	380			820					
3.30- 4.00	10800	660	640	600			1240					
4.00- 4.30	10900	665	420	560			980	600	360		58	
4.30- 5.00	11000	670	700	860			1560	80	620		96	
5.00- 5.30	10900	665	680	940			1820	240	40		44	
5.30- 6.00	10800	660	1220	1220			2440	40	380		60	
6.00- 6.30	10900	665	1300	1400			2700	200	200		80	
6.30- 7.00	10800	660	1300	1200			2500	600			82	
7.00- 7.30	10900	665	800	900			1700	400			60	
7.30- 8.00	10900	665	560	700			1260					
8.00- 8.30	10900	665		1000			1000					
8.30- 9.00	10900	665		1200			1200					
9.00- 9.30	10800	660		1040			1040					
9.30-10.00	11000	670		1360			1360					
10.00-10.30	10900	665		700			700					
10.30-11.00	10900	665		740			740					
11.00-11.30	10800	660		760			760					
11.30-12.00	10900	665		680			680					
			48240	71340	30120			476610	21480	51749	10260	

MAX. D. C. AMPERE SWINGS

	A.M.		P.M.	
Rotary Output	11.56	5210	5.45	4500
Battery Output	9.06	5000	5.00	5000
To Third Rail	9.06	8000	5.00	7000

OPERATORS IN CHARGE OF WATCH

12 8 11.00 P.M. to 7.00 A.M.		
8 4 7.00 A.M. to 3.00 P.M.		
4 12 3.00 P.M. to 11.00 P.M.		

DAILY LOG OF SUBSTATION

BATTERY PERFORMANCES

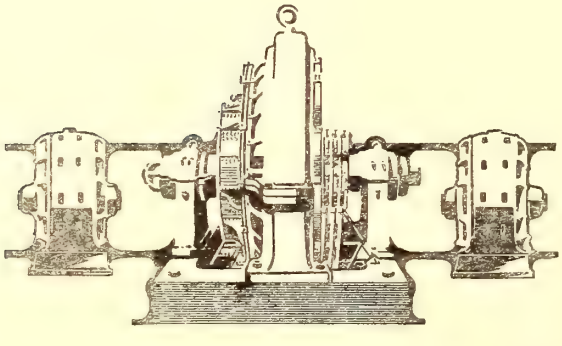
The diagram on page 560 at the beginning of this chapter illustrates the division of load between the rotaries and the storage battery in sub-station No. 2 on Aug. 7, 1907, between 5:30 and 5:40 p. m. Two 1500-kw rotaries were in operation, and the readings of the battery and rotary d. c. ammeters were taken every five seconds. Inspection of the curves shows that the rotaries carried an average load of about 3900 amps. during the time covered, with an extreme fluctuation per rotary of about 2500 amps. The sub-station output varied from a maximum of 8000 amps. to a minimum of 1300. Practically all fluctuations about the 4000-amps load on the sub-station were carried by the battery, and when the load fell below 3800 amps. the rotaries charged the battery. The maximum rate of automatic charging was about 2500 amps. The maximum sustained peak load on the sub-station lasted for nearly one minute, reaching 8000 amps. total, and during this fluctuation the combined output of the two rotaries, with carbon regulator in operation varied from but 3800 to 4100 amps., or but 150 amps. per rotary.

The form on page 549 (13¾ ins. x 8 ins.) shows the distributed output of the electric division for Aug. 14, 1907. As only three sub-stations out of eight are in operation as yet, and the loads are small, the figures given reflect preliminary rather than completed service. The outputs shown cover

the train service between the Grand Central Station, High Bridge and Woodlawn, including in the latter about twenty-four New York, New Haven & Hartford trains, which at this writing are being electrically operated. As shown on the report, the total a. c. input of the three sub-stations was 70,889 kw-hours, the largest input being taken by the Mott Haven sub-station (No. 2). Less than two per cent of the a. c. input of the sub-station was required for sub-station lighting and local power service. The total d. c. rotary output was 58,367 kw-hours, of which the third-rail feeders took 55,226 kw-hours. Each sub-station can be lighted from the a. c. 11,000-volt lines through step-down transformers, from the motor-generator control battery charging set or from the control battery itself at 110 volts. The control battery is installed as a reserve of 55 small cells to insure the operation of oil switch and circuit-breaker motors at all times. In case the a. c. supply fails at night in a sub-station, a switch can be thrown which will light a row of reflector lamps at the top of the upright board, illuminating by current from the control battery the instruments at the bench board.

The small diagram on page 561 illustrates the method adopted by the company of keeping the specific gravity records of the individual cells in the storage battery. The vertical lines represent the various cells of the battery in proper order from one to any number of cells. The horizontal black lines are taken as base lines, one for each reading, and dated and named according to the condition of the battery at the time the reading was taken: for instance, 7/1-1200, meaning that for the reading taken July 1 the base line represents a specific gravity of 1200. Each horizontal line then at the point of the intersection with the cell line represents a certain specific gravity with relation to the base line. In the case of the reading taken July 1, beginning at cell No. 1, the readings were as follows: 1200, 1202, 1201, 1203, 1199, 1204, etc. Connecting the points of these readings, we have a line crooked or straight, according to the evenness of the electrolytes' specific gravity. The principle of the method is that other readings of the same cells, if taken correctly and if the battery is in uniform condition, completed and connected in the same manner, should form a line similar in direction as shown by comparison of the lines formed by readings taken July 1, July 8 and July 22; but if anything is wrong with any cell or if a reading is not taken correctly, it will be shown up in the manner indicated in the line by readings taken July 15. Thus, in cell No. 12, a short circuit occurred July 15, the specific gravity falling to 1205. Such other data as temperature of the electrolyte, temperature of the room, the name of the party taking the reading, etc., may be noted on the base line of the reading to which they belong. This record gives at a glance the specific gravity readings at various days, a comparison of various readings showing, in a way that cannot be overlooked. trouble in any cell or changes in specific gravity caused by any other reason, or readings taken incorrectly, and a line showing the evenness of the specific gravity throughout the battery.

The chart on page 562 (6 ins. x 11 ins.) illustrates the readings for a single week on the pilot cell of the battery located at Fiftieth Street and Park Avenue. The variation in specific gravity corresponds closely to the condition of the battery as regards charge or discharge. The temperature of the electrolyte is also shown in each day, the average charging current and the specific gravity during the time of charge.



ELECTRIC ROLLING STOCK OF THE NEW YORK CENTRAL

The general features of the rolling stock used in the electrical zone of the New York Central & Hudson River Railroad have been described in previous issues of the Street Railway Journal and need not be repeated here. Both the motor cars and the electric locomotives are equipped with multiple unit control. In general the motor car control does not differ materially from that installed on previous systems, but the high power of the electric locomotives renders their control of special interest. In view of the care taken by the company to forestall troubles, the course followed in handling both the motor car and the locomotive control under normal and abnormal conditions is given in the following paragraphs at considerable length, and the essential details of locomotive control, arrangement and operation have also been included. A special feature of the motor-car equipment is the use of graduated release air brakes, and as comparatively little has thus far been printed in regard to the handling of this improved apparatus, a liberal space has been allotted to the discussion of this subject. Among the detailed tasks which accompany the electrification of a steam railroad, few are of greater importance than the training of the enginemen in the handling of the revolutionized rolling stock. The preparation of instruction books for this purpose is a problem of no small moment, and for this reason extracts from the work of the New York Central along this line have been fully utilized. Flexibility and safety in operation are apparent in all the details of the rolling stock design and service.

The company now operates thirty-five electric locomotives, 131 motor cars for suburban service, and fifty-five trailers. Six of the motor cars are combination baggage and passenger cars, Electric locomotives are operated as far as High Bridge and Wakefield, but the motor cars are at present hauled by steam locomotives from these points north to Croton and North White Plains. The Peekskill local trains consist of motor cars and trailers, and are hauled through to Peekskill by steam locomotives.

INSTRUCTION BOOK

In anticipation of the beginning of operation in the electical zone, an exhaustive Instruction Book was prepared by the Equipment Department for the use of employees in the train service. This book describes the electrical and mechanical features of the motor cars and locomotives in detail, the phraseology being carefully selected with the object of making the electrical equipment details clear to train-service employees familiar with steam locomotive practice. In addition to the description of the apparatus incorporated in this book, instructions were included to meet emergencies, and the course to pursue in overcoming troubles and in handling the equipment most effectively was given in considerable detail. In view of the fact that the rolling stock of the Electrical Division has been described in previous issues of the Street Railway Journal, only such particulars will be given in the following paragraphs as throw additional light upon the actual operation of the cars and locomotives.

MOTOR-CAR ELECTRIC CONTROL

Two master controllers are provided for each motor car. Four points are indicated on the cap plate for forward direction and two for reverse. The first point in either direction is called the "switching" or "lap" position, the second "full series." The third point forward is called the "parallel lap," and the fourth the "full parallel."

The train cable is composed of seven conductors, each being covered with different colored braiding for identification. These conductors are attached to numbered plugs in the coupler sockets at the ends of the car and branch wires extend to the master controllers. Each motor car is provided with two circuit-breaker setting and tripping switches. Moving the handle in one direction makes connection from the master controller switch through the train cable to the various setting coils of the circuit breakers, and moving the handle in an opposite direction completes a circuit through the tripping coils on the various circuit breakers throughout the train. An emergency air-brake attachment is fitted to each master controller. The panel board at the end of each car contains vestibule and headlight fuses, car-lighting fuses, fan-motor fuse, vestibule and headlight switch, heater switches, car-lighting switch, fan-motor switch, heater fuses, main switch, control cut-out switch and fuses, current-limit relay, air-compressor switch, and air-compressor fuse. The concentration of fuses and switches at one point greatly adds to the operating convenience of the car.

Before attempting to start a train the motorman closes the air-compressor switches located on the panel boards of the various cars and waits until the train line and reservoir are properly charged, following the air-brake instructions in regard to testing brakes. He then sees that all main switches are closed and all master-controller switches open, with the exception of the one near the controller which he is to operate. He also moves the circuit-breaker switch to its "on" position, allowing about one second for the circuit breakers throughout the train to close.

To start the train the motorman presses down the button in the controller handle, inserts the handle key and gives it a quarter turn. It is necessary to hold down the knob in the top of the handle to prevent the pilot valve in the controller from operating and applying the brakes. This is not necessary while in any running position, as the air brakes will not be applied automatically unless the controller handle is at its "off" position and the knob released. The main or motor current flows from the third-rail shoes to the main switch, through the circuit breaker and main fuse to the contactors, then through the reverser and No. 1 motor to a set of rheostats, then through another set of rheostats and No. 2 motor to ground. The controller handle is then gradually advanced until the full series position is reached. A "bridge" connection is established by the contactors. The motors are then connected in parallel with rheostats connected in series with each, after which all the resistance is cut out of circuit by means of the contactors, and the motors are in full parallel.

The arrangement of apparatus is such that the train may be operated in either direction from any master controller in the train. It is necessary, however, in order to operate in a reverse direction at full speed, to operate from a master controller at the end of a car toward the direction in which the train is to be moved.

Should the train break apart the control couplers pull out, cutting off current from the train cable on the section of train behind the break. This drops out all the contactors on the

rear section, while the front section continues under the control of the motorman.

OPERATING QUESTIONS

The following questions and answers have been issued by the company to assist the motormen in understanding the operation of the electric control system:

Q. 1.—If train fails to move after instructions under train operation have been followed, what should be done?

A.—Light circuit switches should be cut in to ascertain if there is power in the contact rail, or motorman should note if trains in neighborhood are moved by power.

Q. 2.—If it is found that there is current in operating car, what should be done?

A.—Master controller handle should be moved to first point, then master controller switch opened to ascertain if the master control circuits are closed, which will be indicated by the sound of slight arcing at master controller switch.

Q. 3.—What would cause the failure of train cable circuits?

A.—First, imperfect master controller fuse; second, grounded train cable; third, imperfect contact in master controller; fourth, loose coupler jumper.

Q. 4.—What should be done to detect imperfect fuse?

A.—Insert new fuse, and if this fails it is evident that the trouble is elsewhere.

Q. 5.—What should be done when a grounded train cable occurs?

A.—The master controller fuse should be replaced and the controller moved to the "on" position to determine if fault lies in construction of fuse. If this fails, an attempt should then be made to locate the ground in the train cable. The first thing to do is to throw the control cut-out switch on the operating car to "off" position. If this proves ineffective, this operation should be repeated back through the train, cutting out, however, the train cable jumper between car tested and one to be tested.

Q. 6.—What should be done to detect imperfect contact in master controller?

A.—Motorman should remove cover from controller and note the movement of contact fingers. The action of the train is dependent upon the contact of these fingers, and if it is found that the contact is imperfect he should endeavor to readjust the contacts, and if he fails in this it is then necessary to operate the train from the next car.

Q. 7.—What should be done to detect a loose jumper?

A.—Motorman should lose no time in going back through his train to determine if the coupler plugs are properly inserted in the sockets, and, if not, he should insert them properly.

Q. 8.—What are the other causes that would prevent the operation of a train or reduce the speed?

A.—First, the blowing of third-rail shoe fuses; second, the blowing of main motor circuit fuses; third, the blowing of circuit breakers or main fuses; fourth, an imperfectly acting triple valve causing brakes to remain set on one or more cars in train.

Q. 9.—How can enclosed fuse that is blown be detected?

A.—If an enclosed fuse has blown there is a deposit or collection of grayish powder at the ends of the box.

Q. 10.—What should be done in the event of a third-rail shoe fuse blowing?

A.—This fuse will blow only when there is a short-circuit on the car equipment, and fuse should not be replaced but train continued in the regular manner, and report promptly made to the train despatcher or person in charge of nearest terminal.

Q. 11.—If a circuit breaker acts or blows, what should be done?

A.—The circuit breaker setting switch should be moved to the "on" position.

Q. 12.—What should be done when a triple valve acts imperfectly?

A.—Air-brake instructions should be followed, *i. e.,* valves should be cut out and auxiliary reservoir cock opened to release brakes.

Q. 13.—If a train is standing on crossover and current cannot be obtained on the operating car, although the other cars of the train and trains in the neighborhood have current, what does this indicate?

A.—This indicates that the bus-line fuses between the operating and adjacent cars have blown, or that bus jumper is loose or disconnected.

Q. 14.—What should be done to continue operation of train?

A.—Motorman should go back to the first motor car where current can be obtained and move train through crossover, then go back to the first car again and proceed in the usual manner until a point of inspection can be reached and inspector notified.

Q. 15.—If a fire occurs in any car in the train, what should the motorman do?

A.—Open all circuit breakers by moving the circuit-breaker switch to the "off" position, and if this fails he should then open the main or motor circuit and the main cut-out switch on the car on which the trouble occurs.

Q. 16.—If smoke or fire is observed by the trainmen in any of the light or heater circuits within the car, what should be done?

A.—The trainman should immediately cut out the light or heater switches, whichever the case may be, and the trouble be reported to the despatcher in charge of the nearest terminal.

Q. 17.—If an unusual noise is observed in the movement of the train, what should be done?

A.—To prevent delay the motorman should have the conductor stand beside the train to locate the noise while he moves the train, after which if the trouble is with the brake rigging, same should be tied up.

Q. 18.—If the noise is located within the motors, what should be done?

A.—Motorman should open the cut-out switch on the car affected, and proceed after reporting trouble to despatcher in charge of terminal.

Q. 19.—If a third-rail shoe support is broken, what should be done?

A.—Motorman should first pull the bus-line jumpers at both ends of the car, insert wooden insulating slippers between the contact shoe and rail, and then proceed to detach or tie up remnants of device, exercising extreme care that the contact device is kept clear of the truck frame, contact rail, structure, or any grounded parts to prevent injury to himself.

Q. 20.—If either pilot or emergency air-brake valve leaks badly, what should be done?

A.—First try applying brakes by releasing the knob in the controller handle several times, and if this does not remedy the difficulty cut the valves out by means of a cut-out cock located in the pipe leading to them from the train line.

LOCOMOTIVE ELECTRIC CONTROL

The general features of the Sprague-General Electric type "M" control, as used on the suburban motor cars, also apply to the electric locomotive control, except that the train cable in the locomotive control has twenty wires, seventeen of which are connected to the master controller and to the motor-control apparatus. Of the remaining three wires two are used for the sander device and one is an extra bus ground. This control, in the same way as on the suburban motor cars, comprises two distinct sets of circuits, namely, the main or motor-control circuits and the master-control circuits, the former being governed by the latter. Each locomotive has four motors, the control being arranged for operating the motors first, all in series, then in series parallel, and then in parallel relation. The two ends of locomotives are designated the "A" end and the "B" end, the main switch being located on the "B" end.

The motor control on each locomotive consists of the following apparatus:

Contactors.
Reversers.
Rheostats.
Main switch.
Main motor cut-out switches.
Individual motor fuses.

In addition to these pieces of apparatus there are four sets of third-rail contact shoes—two shoes in each set—and two overhead contact shoes, with the necessary main cables connecting them to the control apparatus on the locomotive. There is also a main cable extending through the locomotive terminating with couplers at the ends, so that the third-rail shoes and the overhead shoes of any two or more locomotives may be connected together. This cable is termed the "bus-line." The circuits from the contact shoes—both third-rail and overhead—are protected by fuses, a set of two fuses in multiple being located near each shoe to protect the circuit of that shoe. From the third-rail shoes or from the overhead shoes the main circuit is carried through the respective fuses of each to bus line, to the main switch and through the motor fuses to the contactors and thence to motors.

There are forty-three contactors, located in the end compartments of the cab, one group on each side of the end compartment. The contactors are numbered progressively around the cab, No. 1 being nearest the No. 1 reverser. Each contactor has a plate with its number, which is attached in front above the arc chute.

There are two reversers—one in each end compartment. The No. 1 reverser, which is on the main switch end of locomotive, has the armature and field leads of the two motors on that end connected to the studs of its contact brushes. The connections of armature and field leads for producing forward and backward movement of locomotives are established by means of copper bars pressed against spring-contact brushes, through a toggle mechanism.

The handle for the main switch, which is a knife-blade, quick-break switch, is located in the "B" end compart-

ment of the cab. It is never opened while the current is on the motors, except in an emergency, but is opened before the individual motor fuses or contactors and reversers are examined.

The main motor cut-out switches are for the purpose of cutting out the individual motors in case of any ground or defect in a motor which renders it inoperative. There are four of these cut-out switches, one for each motor, and they are located on the sides of the cab, the switches for No. 1 and No. 2 motors being just over the No. 1 reverser and for No. 3 and No. 4 motors over the No. 2 reverser. The number of the motor to which it is connected is marked on each switch. Each switch also has a small auxiliary control cut-out switch which opens and closes with the larger switch for opening the circuit of the series contactor. These switches are normally kept closed, except in case of individual motor trouble. They are kept well closed, so that the small auxiliary switches make good contact. When one of these switches is opened on account of motor trouble, the locomotive will not move until controller handle reaches the eleventh notch.

There are four motor-fuse boxes, each motor having its individual fuse. These boxes are located one over each third-rail shoe, just above the shoe-fuse boxes. A copper ribbon fuse of 1000 amps. rating is used in these boxes. Each box has marked on it the number of the motor whose circuit it protects.

The third-rail shoe fuse boxes are similar to the motor fuse boxes, but somewhat larger. There are two of these arranged in multiple for each pair of third-rail shoes. A copper ribbon fuse of 1200 amps. rating is used in each of these boxes.

The overhead shoe fuse boxes are practically the same as those for third-rail shoe, but are mounted on the roof, two in multiple near each shoe. A copper ribbon fuse of 1200 amps. rating is used here also.

The third-rail contact shoes are of the slipper spring actuated under-running type. The shoe bracket is mounted on a wooden insulating beam. There are two shoes in multiple on each bracket.

OVERHEAD CONTACT

The overhead contact device is a pneumatically operated shoe. There is a valve near each master controller in the cab, by means of which the shoe may be raised or lowered. When air is applied the shoe is lifted so as to make contact with the overhead rail. When air is released the shoe drops; also if the shoe runs off the rail it is tripped automatically and drops. Moving the handle forward operates the pilot valve, by means of which a slide-valve is thrown to admit air from reservoir to cylinder of contact shoe device. Pulling the handle back operates another pilot valve and the slide-valve is thrown over to connect air chamber of contact device to exhaust. The handle will spring back to the middle position from either direction. There are two of these overhead contact shoes, which are controlled in common by either valve in the cab. They are mounted on wooden insulating blocks. It is very important that these shoes are not raised when they will come in contact with overhead obstructions.

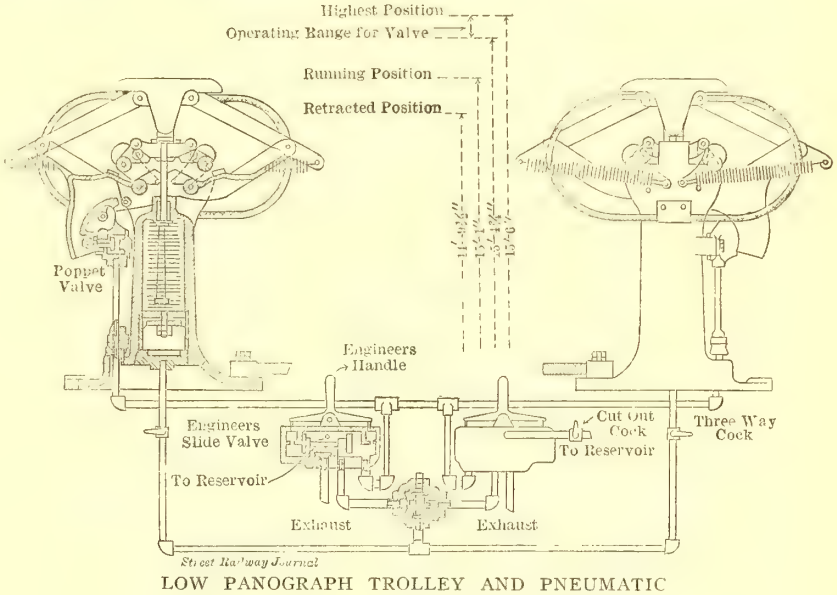
TRACK SANDER CONTROL

The track sander control comprises the following pieces of apparatus:

One main sander switch.
Two sander operating switches.
Two electro-pneumatic valves.

The main sander switch, located in the "A" end compartment of cab, is for the purpose of admitting or cutting off current from the sander operating switches. This switch contains a 10-amp. fuse. The switch is opened on inspecting fuse. This switch has plate marked "Sander."

Sander operating switches are located on one side of cab near each master controller. These are double-throw switches and are marked "Sand Forward," "Sand Reverse." Moving the handle to the "Forward" position energizes the valve which applies sand to rail for forward direction. "Reverse" position of handle applies sand for the reverse direction.



LOW PANOGRAPH TROLLEY AND PNEUMATIC CONTROL ON NEW YORK CENTRAL LOCOMOTIVES

The electro-pneumatic valves are located one in each end compartment. One valve operates a sander for one direction of movement, the other valve operates a sander for the other direction, only one valve being operated at a time. The valve is operated by a magnet, which is energized by current applied in the sander operating switch.

ELECTRIC LOCOMOTIVE OPERATION

Before attempting to start the locomotive, the motorman first closes the pump switch, then he closes the main switch and sees that the main control switch and all the cut-out switches are closed. After the reservoir and train line are charged, the overhead control switch over the controller from which locomotive is operated is closed and the reverser handle thrown in the direction of desired movement of locomotive. The motorman then proceeds on the signal. After releasing the latch on controller handle he pulls the controller handle to the first notch, then to the second notch, and so on, until the desired speed is attained. For coupling with the locomotive, light, the first and second notches are ordinarily sufficient. If it is desired to get up to speed as soon as possible the handle is moved around notch by notch, allowing the latch to take each notch until the last notch is reached. If the motorman feels, at any point, the further movement of the controller checked, he does not exert undue pressure on handle—no more than is ordinarily required to move the handle from one notch to the next. Whenever the current through the motors is higher than a certain amount the automatic governor acts and stops the further movement of handle. When the current falls to a certain amount the governor releases controller cylinders and another notch may be taken, and so on.

Every notch on the controller must invariably be taken by latch in moving controller on, whether in accelerating or in throwing controller on with motors already up to speed. In throwing off, the notches need not be observed. The off notch of the controller is called the zero notch. The first closed position of the controller is the first notch and so on.

If the reversers are not already thrown to the position corresponding with the position of the reverse handle when the controller is thrown to the first notch, current will pass through the proper operating coil to ground. After the reversers have reached the correct position interlocking contacts on each reverser cut off current to ground and establish a circuit through three contactor coils. Moving the reverse handle does not operate the reversers, but simply arranges the contacts, so that when the controller is turned to the first position the reversers will be thrown in the proper direction. The operating coil for one direction on one reverser is in multiple with the corresponding coil on the other reverser, these two coils being controlled by one wire from the master controller and protected by one fuse.

On the first notch the main or motor current flows from the third-rail shoes or from the overhead shoes through the shoe fuses to the main switch, then through the No. 1 motor fuse, through the reverser and No. 1 motor, through a set of rheostats, then through another set of rheostats to reverser and No. 2 motor, then through the other reverser and No. 3 motor through a set of rheostats, then through another set of rheostats to reverser and No. 4 motor, and then to ground. The four motors are here all in series, with all the resistance in circuit, and the locomotive, if light, may start, or if coupled to a train may simply take up draw-bar slack. Each of the next three steps cuts out one complete set of motor resistance, and on succeeding steps, until full series is reached, the remaining set is cut out in six more steps. After full series, between the tenth and eleventh notches, bridge connections are established, and then on the eleventh notch motors are thrown in series parallel relation. Resistance is cut out in six steps to full series parallel, the seventeenth notch. Bridge connections are then established and the motors are thrown all in parallel, the resistance being cut out again in six steps. When motors are in parallel each is protected by its own fuse.

When it is necessary to reverse the direction of train movement, leaving controller handle in the off position, the reverser handle is thrown in the opposite direction and then move controller handle on in the same way. The reverser handle is thrown in the direction corresponding to direction of movement required. The motors are not reversed while the locomotive is moving, except in case of emergency, and then if speed is more than a few miles per hour the wheels would probably slip. If it is necessary to reverse while moving, the motorman is not allowed to throw the controller handle beyond the first notch, if all the motors are cut in, or beyond the eleventh notch, if one motor is cut out.

OVERHEAD SECTIONS

When operating on an overhead rail section the overhead contact shoe is tripped and will drop on leaving this section. The motorman, however, as an extra precaution, throws the valve handle back. Either for raising or lowering the overhead shoe it is necessary to hold handle in position only long enough for the shoe to start movement.

To sand the rails the sander operating switch is moved over in the direction of movement of the locomotive. To stop the sand the handle of this switch must be brought back to the middle position.

The control cut-out switch, if open, disconnects the operating parts of contactors and reversers on the locomotives from the train cable, but does not affect the operation of the other locomotive if two are connected together, although it is cut out on the locomotive whose master controller is being operated. The control connections for the reverser are so arranged that unless it is at the proper position current is cut off from contactors, so that motors on that locomotive will receive no current. In case of electrical trouble within the master controller train cable, couplers, or connection boxes, the single fuse in the master control switch will protect them. In case of local trouble on contactors or reversers the fuses in the cut-out switch will protect the circuit.

ELECTRIC LOCOMOTIVE CATECHISM

The following catechism has been issued by the company to instruct the locomotive motormen in the operation of the system:

Q. 1.—If locomotive fails to move after instructions under train operation have been followed, what should be done?

A.—First, after making sure that the overhead and main master controller switches are closed, throw controller on two or three points and off, and observe by the sound whether any contactors are operating.

Q. 2.—If none of the contactors operates, what should be done?

A.—Turn on light circuit switches to ascertain if there is power on the third-rail or overhead rail.

Q. 3.—With current on the locomotive, what would cause the failure of contactors to operate?

A.—First, an imperfect master control fuse; second, imperfect contact in master controller on some of the fingers of the primary cylinder; third, two or more imperfect 4-amp. fuses in the control apparatus circuits.

Q. 4.—What should be done to detect imperfect master controller fuse?

A.—Open main master controller switch and renew fuse, and if there is still no operation of contactors the trouble is evidently elsewhere.

Q. 5.—How can enclosed fuse that has blown be detected?

A.—A small circle in center of table is charred and turned black when fuse is blown. This is termed the "Telltale" of fuse.

Q. 6.—What should be done to detect imperfect contact in master controller?

A.—Cut out master controller switch, then remove controller cover and open arc deflectors; first on the right-hand side. Turn on controller and see that the controller fingers make good contact with their respective cylinder segments. If any contact is imperfect endeavor to readjust, if there is time. Failing in this, go to the other controller and operate from that, after cutting in its overhead switch and the main master controller switch again.

Q. 7.—What should be done to detect imperfect fuses in the control apparatus circuits?

A.—Remove cover from the cut-out switch on back of No. 2 controller and inspect the five top fuses and the eighth and ninth from top. If any one of these fuses shows signs of being blown, from the telltale being black, renew the blown fuses.

Q. 8.—If some of the contactors close on the first test without giving main current, what should be done?

A.—After opening main switch throw reverser handle back and forth two or three times, throwing controller to first notch at each reversal and note whether both reversers respond, throwing over at each reversal.

Q. 9.—If neither reverser responds, what should be done?

A.—Renew fuses eighth and ninth from top on cut-out switch and then try.

Q. 10.—If one reverser responds to reversals on controller and other does not, what should be done?

A.—Throw over by hand the reverser that is not operating, making sure after throwing that the reverser is properly locked by toggle. It would require considerable force to lock reverser, but it is absolutely essential that it be locked, and no attempt should be made to operate before making sure of this.

Q. 11.—What contactors should close on the first notch of controller?

A.—1, 2, 4, 19, 22, 25, 33, 41 and 42. Contactors 1, 4 and 19 close after No. 1 reverser throws; 25, 33 and 41 close after No. 2 reverser throws. Contactors 2, 22 and 42 are governed by the No. 1 circuit on master controller.

Q. 12.—If contactors 2, 22 and 42 do not close, what should be done?

A.—First, renew top 4-amp. fuse on cut-out switchboard; second, examine main motor cut-out switches. See that they are well closed, so that auxiliary contacts are closed.

Q. 13.—If this is not effective, what should be done?

A.—After closing main switch again, throw controller to eleventh notch, moving slowly from tenth to eleventh, and begin operation in series multiple. Motorman should here move handle more slowly than ordinarily, as the automatic feature may thus be cut out. Motorman should watch meter and should not exceed 1000 amperes in series multiple and 2000 amperes in multiple.

Q. 14.—If two locomotives are being operated together and the master controller fuse blows again, after being renewed, what should be done?

A.—Pull 20-point jumper between locomotives and try renewing fuses, and then operate from locomotive on which fuse does not blow again. If a new 20-point jumper is available this may be substituted and tried.

Q. 15.—If motors do not take current between eleventh and seventeenth notches or between the eighteenth and twenty-fourth notches, what should be done?

A.—Renew the second and fifth fuses for the first case and the second and fourth fuses for the second case. If this is not effective, examine contact fingers for the primary cylinder and adjust if any of these fingers are not making good contact. Failing in this operate from the other controller.

Q. 16.—What are the other causes that would prevent the operation of locomotives?

A.—First, the blowing of the third-rail shoe fuses. Example for this, if lights are not obtainable in turning on light switches (See Q. 2). Second, the blowing of an individual motor fuse.

Q. 17.—What would tend to reduce the speed?

A.—First, in operating with two locomotives, if either locomotive is inoperative from any of the causes referred to, or if there is a loose 20-point jumper, or the bus line jumper is loose or out, and the shoe fuses blow on either locomotive, of course, one locomotive would be dead load; second, imperfectly acting triple, as would be indicated by meters showing excessive current.

Q. 18.—What should be done in the event of third-rail shoe fuses blowing?

A.—These fuses will ordinarily blow only when there is a short circuit on locomotive equipment. If the cause of fuses blowing is evident, however, as from the temporary grounding of some part of the third-rail shoe circuit or from the breaking off and grounding of a shoe, the fuse may be renewed after the ground has been removed. To do this put slipper boards under all the contact shoes of both locomotives and pull bus line jumper between locomotives and release overhead shoes from overhead rail. In removing slippers from under shoes, after renewing fuses, do not stand nearer the fuse box than is absolutely necessary. If one locomotive is grounded and the other is not, leave out bus line jumper and operate from locomotive which is free from ground.

Q. 19.—What should be done in case of an individual motor fuse blowing, as indicated by contactors 1, 2, 4, 19, 22, 25, 33, 41 and 42 closing properly on first notch without taking current?

A.—After making sure that the motor cut-out switches over reversers are all closed, open main switch and see which motor fuse is blown, renew this and proceed. If this fuse blows again, open cut-out switch for this motor and start train from the eleventh notch.

Q. 20.—If a third-rail shoe support is broken, what should be done?

A.—Motorman should first pull bus line jumper if two locomotives are coupled together, insert wooden insulating slippers between the contact shoes and rail on the crippled locomotive and retrieve overhead shoe if upon rail and then proceed to detach or tie up remnant of device, exercising extreme care that the contact device is kept clear of the contact rail and kept clear of truck or any grounded part to prevent injury to himself.

Q. 21.—What should be done in case air pump fails to operate?

A.—Renew fuse in pump switch which is located in "A" end cab. Open the pump switch before doing this. If this does not remedy the trouble inspect the governor contacts and adjust them if necessary.

While many of the conditions referred to are somewhat imaginary and may never arise in practice, the questions and answers given serve to give the motormen familiarity with the circuits and the operation of the control.

After the motormen have acquired familiarity and experience in electrical operation they are allowed on occasions to exercise their own judgment and common sense to better advantage.

LOCOMOTIVE AIR-COMPRESSOR CONTROL

The air-compressor control comprises the following pieces of apparatus:

A pump motor switch.

A pump governor.

A pump motor circuit contactor.

The pump motor switch is located on side of passage "A" end compartment. This switch is for the purpose of opening the pump motor circuit when locomotive is not in service.

This switch contains a 40-amp. fuse, which protects the pump motor circuit.

The pump governor is located in "A" end compartment on side opposite No. 2 reverser. The governor is of the diaphragm type of construction, the movement of the diaphragm, as air pressure falls or rises, operating a lever mechanism which serves to give a quick make and break to a small switch of the contactor type. This switch does not close the pump motor circuit itself, but closes the circuit through the pump motor circuit contactor, which has higher current capacity on its contacts than the governor. This contactor is located to the left of the governor. When the air pressure in the reservoir falls to 125 lbs. the governor closes its contacts, thereby energizing the contactor coil, which in turn closes its contacts; the pump motor circuit being thus completed, the pump starts. When the air pressure reaches 135 lbs. the governor opens the circuit of the contactor coil, which in turn opens and breaks the pump motor circuit and the pump stops. Both the governor and the contactor have strong magnetic blow-outs at their contacts, sufficient to handle any current which they may take in this service.

AIR-BRAKE EQUIPMENT ON MOTOR CARS

The air brakes on the cars and locomotives in electric service are essentially the same as those on the other passenger equipment, except that the steam driven air pumps on the locomotives are replaced by electrically driven air compressors, one on each electric locomotive and each motor car, and the design of the air brakes is such that their release, as well as application, can be graduated.

The use of an air compressor and main reservoir on each motor car necessitates the use of an additional train pipe to connect all the main reservoirs together and to the motorman's brake valve. This extra train pipe is called the control pipe.

The graduated release feature of the brakes makes it desirable to provide a double cut-out cock, which controls at the same time communication between the triple valve and brake pipe and between the triple valve and control pipe.

A safety valve is placed in the end of the main reservoir on each motor car to prevent overcharging the brake system in case the electric pump governor fails.

In suburban service it is highly important not to block the road. Therefore, motormen are required to remember, in case anything gets out of order, that the first important thing is to get out of the way; and to learn carefully just what to do in order to make the proper move quickly; for example:

1. In case of a burst hose, if it be the control pipe hose, the cut-out cock on both sides of it should be closed; but if it should be the brake pipe hose, then it is necessary to close the cut-out cock ahead of the brake and the double cut-out cocks on each of the cars back of it; then open, and leave open, the auxiliary reservoir bleed cocks on all of the cars that are cut out. In a case of this kind some one is designated and prepared to operate the hand brakes on the cars that are cut out in case a car coupling should break and cause the train to separate.

2. In case of inability to release a brake, caused, for instance, by the emergency valve remaining unseated after an emergency application, close double cut-out cock and open, and leave open, bleed cock of auxiliary reservoir on this car and proceed.

3. In case of brake sticking after service application make about a 10-lb. reduction and place the handle of the brake valve in release position. This will usually release the brake. If not, or further trouble is had with this brake, do as recommended in preceding case 2. It will be seen by these three examples that by a knowledge of the operation of the air brake the motormen and trainmen can formulate rules for themselves that, in case of trouble, will enable them to get out of the way with little or no delay.

To gain time the brake-pipe reduction for application of brakes is adapted to the speed. For example, for high speed make a full application and graduate off when a short distance from the stop. To handle train smoothly make the application heavy and soon enough, so that if held on the train would stop a car length or so short of the mark. Then as the stop or mark is approached graduate the pressure out of the brake cylinder so that little remains when stop is made. If on a

level, complete the release; if on a grade, hold until the signal to start is given, then release. As the pressure has been graduated down so that little remains in the cylinder, it will be seen that the start can be made promptly.

As the automatic brake is applied by a reduction of the brake-pipe pressure, no matter how produced, it is plain that leaks will produce results not intended or desired by the motorman, and sometimes interfere with the accuracy and smoothness of the stop.

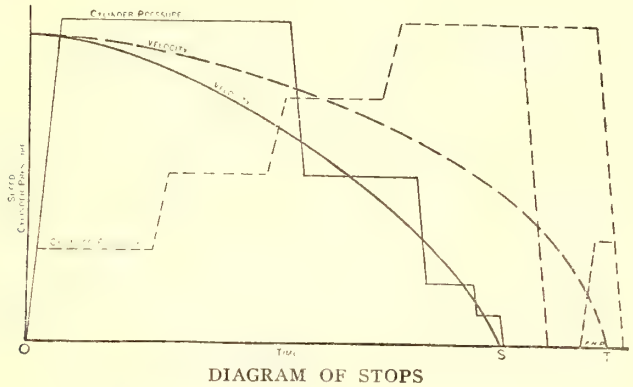


DIAGRAM OF STOPS

Therefore, they are kept down and reported as surely and promptly as any other defect. Motormen observe as carefully as possible the action of the governor, feed valve and gages; that is, their adjustment, etc., as much better operation can be obtained if all are approximately uniform.

One of the things that the motorman learns carefully regarding the automatic brake is that after a certain reduction of pressure in the brake pipe, say, 18 to 20 lbs., the auxiliary reservoir and brake cylinder have equalized. Therefore, no greater braking power can be obtained, and to further reduce the brake-pipe pressure wastes a great amount of air which must be restored to the brake-pipe before a release can be made, and interfere with that release to such an extent that a rough stop is usually the result.

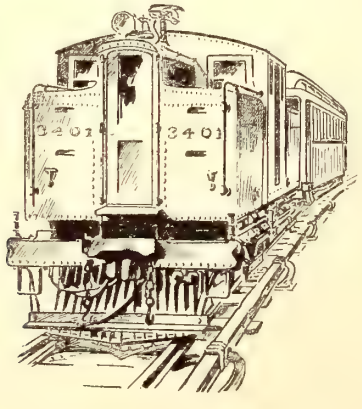
Properly handled this brake possesses all the flexibility of the straight-air brake, while the safety and reliability of the automatic brake has been greatly increased.

For instructing its employees in the use of the air brakes there is a catechism with questions and answers very similar in style to those employed with the electrical equipment. Accompanying these questions and answers are illustrations which emphasize the rules enjoined. No attempt will be made here to reproduce the text of these instructions, but the accompanying diagram and explanation are reproduced from the discussion in the hand book on good and bad braking.

The brakes are applied at 0 and the train comes to a stop at S or T. The curve shows the decreasing velocity after the brakes are applied. The diagram shows the variations of cylinder pressure during the stop. The full lines show the proper method of handling, and the dotted lines the improper. It will be seen by the dotted diagram and curve that the retardation of the train during the first part of the stop is comparatively small. The motorman is afraid to put on his brakes, and as a result applies them little by little, till at the end of a stop he has full cylinder pressure, and the retardation of the train is very sudden and dangerous. Often a motorman will find, when using such a method, that he has to make full release of the brakes and then reapply, as shown on the diagram, in order to keep the train from stopping short of the station. This causes jerks and uneven motion throughout the train and a great waste of air, resulting in overworking the compressor and causing unnecessary wear on the brake apparatus. On the other hand, if the motorman throws full pressure at once into the cylinder the retardation during the first part of the stop is much greater, and, as the speed gradually decreases, the motorman gradually releases the cylinder pressure in such a way as to keep the retardation of the train at a maximum. The amount gained in retardation during the first part of the stop by the proper method of braking makes the time required for the entire stop much less than in the other case, the time saved being represented by the distances S T.

The air compressors used on the electric locomotives each consists of a duplex, single acting vertical air pump, motor driven. The piston displacement is 75 cu. ft. per minute when operating at 600 volts, and against a tank pressure of 130 lbs. per square inch.

The air compressor is intended to operate on 600 volts, and for such operation the motors are always connected in series.





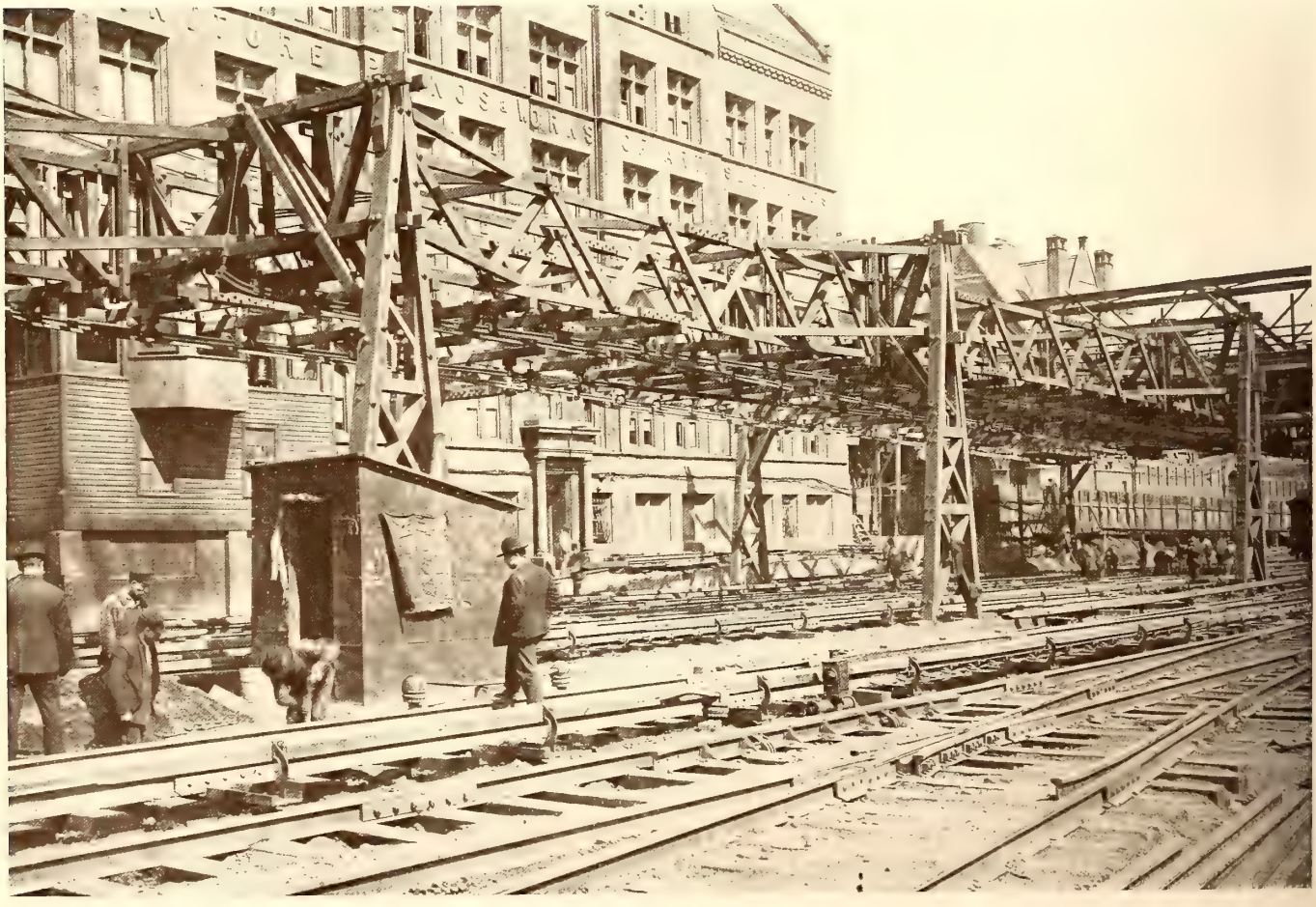
TYPICAL SECTION OF ELECTRIC ZONE, HARLEM DIVISION, NEW YORK CENTRAL RAILROAD



TYPICAL SECTION OF ELECTRIC ZONE, HUDSON DIVISION, NEW YORK CENTRAL RAILROAD



THIRD-RAIL CONSTRUCTION IN HARLEM CUT, NEW YORK CENTRAL RAILROAD



TEMPORARY OVERHEAD CONSTRUCTION IN GRAND CENTRAL YARDS BETWEEN 49TH AND 50TH STS.



FIRST ELECTRIC TRAIN ON NEW YORK CENTRAL RAILROAD, LEAVING HIGH BRIDGE



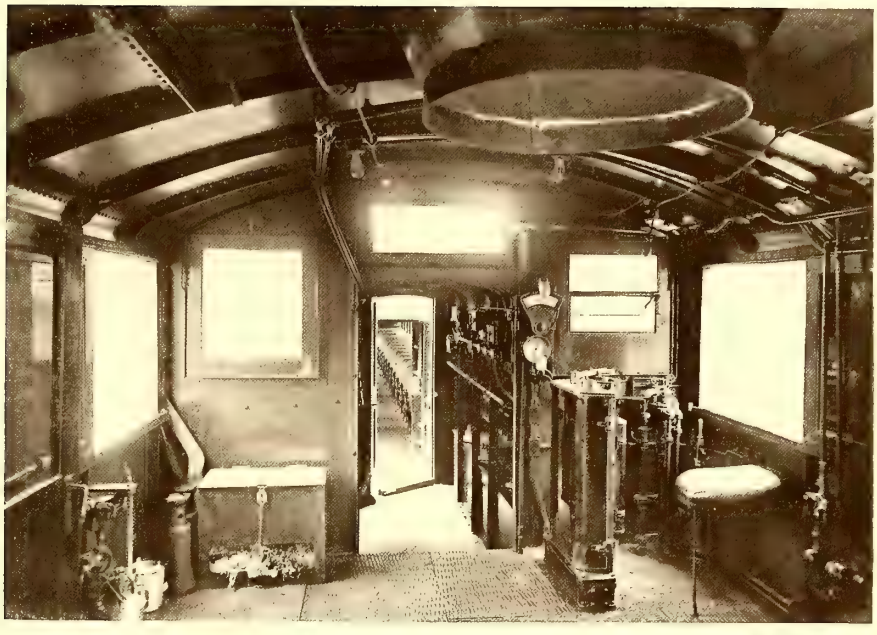
FIRST ELECTRIC TRAIN ON NEW YORK CENTRAL RAILROAD, LEAVING GRAND CENTRAL STATION ON RETURN TRIP



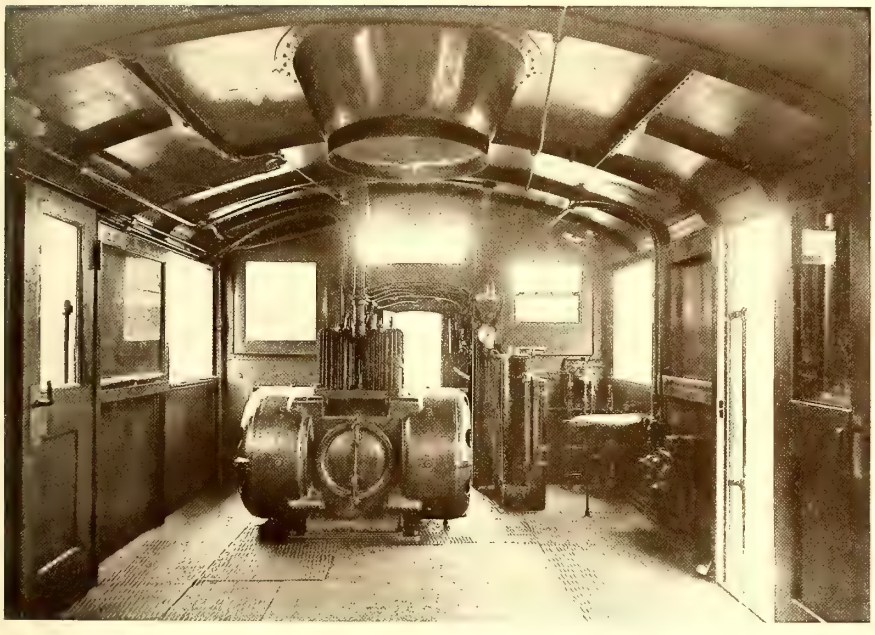
SIDE VIEW OF ELECTRIC LOCOMOTIVE, NEW YORK CENTRAL RAILROAD



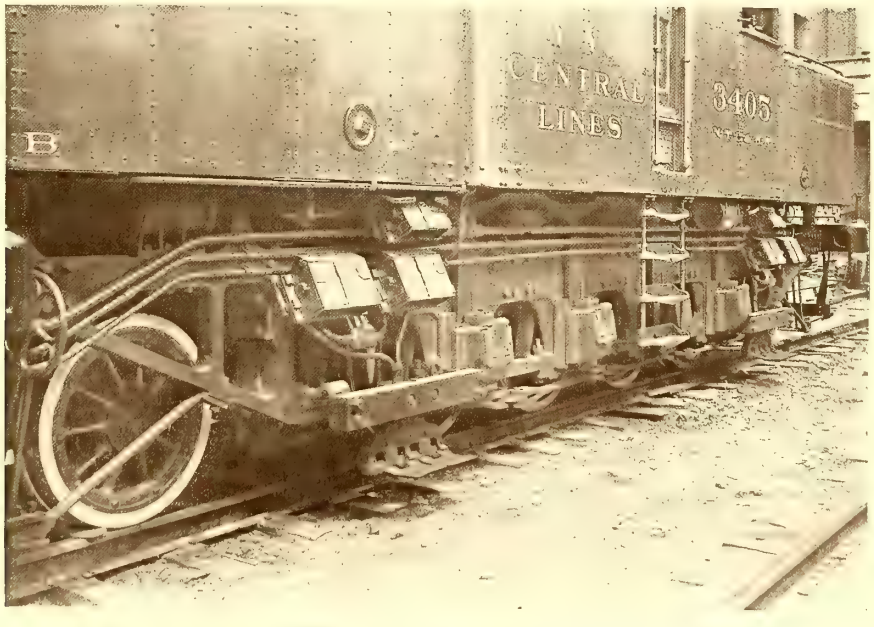
GROUP OF NEW YORK CENTRAL ELECTRIC LOCOMOTIVES IN EAST YARD AT 50TH ST.



INTERIOR OF NEW YORK CENTRAL ELECTRIC LOCOMOTIVE



INTERIOR OF NEW YORK CENTRAL ELECTRIC LOCOMOTIVE



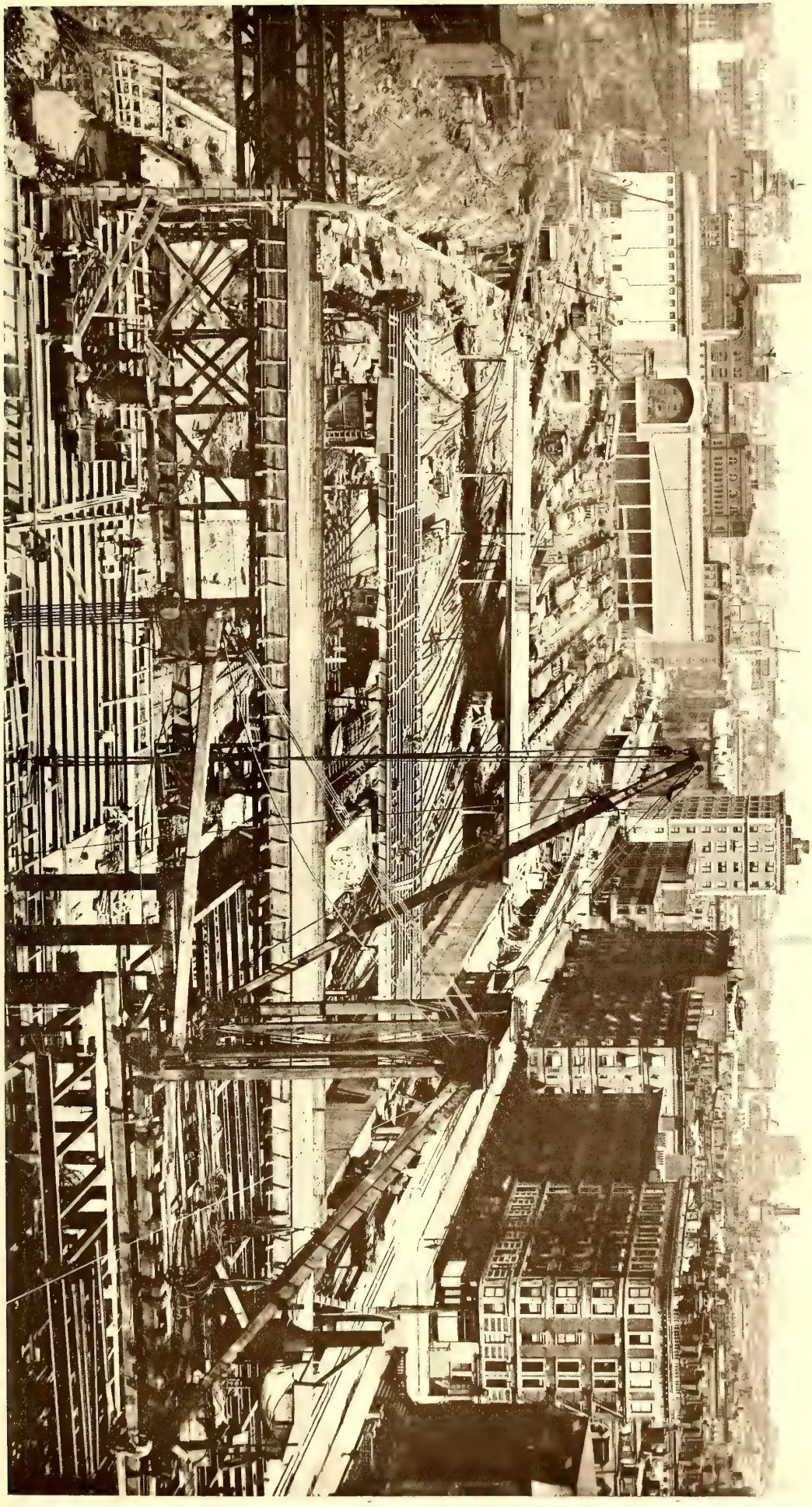
VIEW OF TRUCKS, NEW YORK CENTRAL ELECTRIC LOCOMOTIVE



STANDARD STEEL MOTOR CAR, NEW YORK CENTRAL RAILROAD



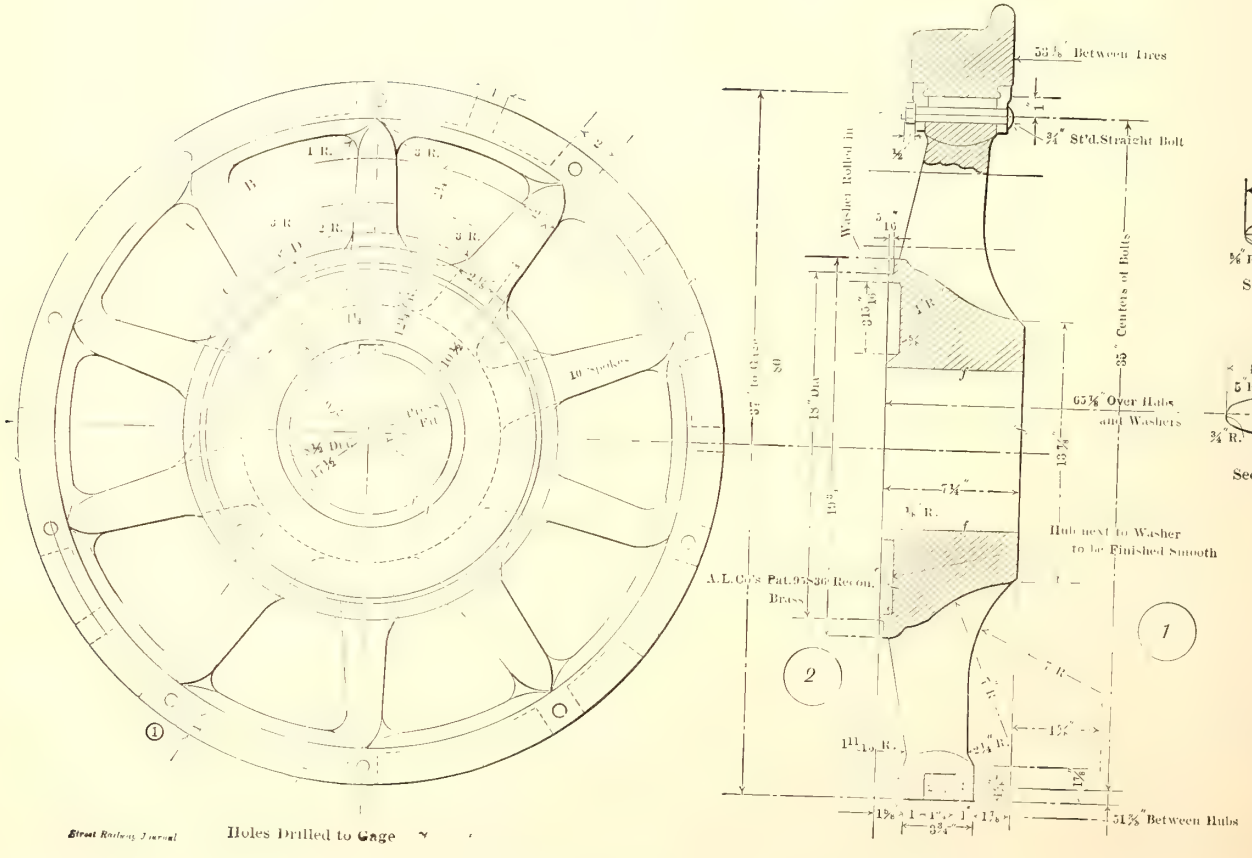
INTERIOR OF STEEL MOTOR CAR, NEW YORK CENTRAL RAILROAD



VIEW OF PART OF EXCAVATION FOR NEW ELECTRIC RAILWAY TERMINAL AT GRAND CENTRAL STATION, NEW YORK. VIEW TAKEN OCT. 12, 1906



MULTIPLE UNIT TRAIN, NEW YORK CENTRAL RAILROAD



DRIVING WHEEL USED ON NEW YORK CENTRAL LOCOMOTIVE

MAINTENANCE OF ELECTRIC ROLLING STOCK ON THE NEW YORK CENTRAL

The comparatively short time during which the New York Central electric train service has been in operation has been insufficient to bring out data of value regarding the wear of rolling stock, and in the equipment department as in others the fundamental problem has been to forestall all possible troubles and improve upon the old service. Inspection has been essential from the first, and repair facilities have in no degree been lacking. At the same time the maintenance has been of a light character and the work so far necessary has not taxed the company's facilities for repairs. A strong organization has been created, and careful records of mileage and inspection are being gathered to form bases of future policies in reference to the overhauling of the equipment. The excellent behavior of the equipment thus far has been gratifying to all concerned, and this freedom from trouble in service has contributed to keep the repair work from assuming proportions of any special magnitude. An account was published in the Street Railway Journal for June 8 of the design of the Harmon and other shops of the company and in the accompanying description the methods only in the operation of its shops will be considered.

INSPECTION

At the present time the Harmon shops of the company are in operation to only a limited extent and the third-rail has not been carried as far as this point. Both electric locomotives and cars are inspected at Wakefield, locomotives only at High Bridge and motor cars only at North White Plains. Locomotives make 750 miles each between thorough inspections and motor cars 900. Two locomotives are usually inspected at the same time. The only repairing which motormen are expected to make on the road is the replacement of fuses. Motormen do not always have the same equipment in operation. All the rolling stock has thus far shown remarkable immunity from trouble. In the case of a breakdown, the succeeding train pushes the stalled train to the nearest inspection point rather than attempting to make emergency repairs on the spot. The density of traffic is so great in the electric zone that it is not feasible to make other than the slightest adjustments on the main line tracks. The only tool carried on each electric locomotive is a No. 4 alligator wrench and no tools whatever are carried by the motormen.

The inspection of the electric locomotives takes about two hours, and the inspection of a multiple-unit train three hours. Cars are not detached from trains when an inspection is to take place, but the train is inspected as a unit. This eliminates an enormous amount of switching and train movements which would otherwise be costly and obstructive. After about 200 miles of running a new electric locomotive or motor car generally runs smoothly. The principal adjustments required are to secure proper lubrication of journals. No trouble has been experienced through the flashing over of locomotive or motor car armatures. The center of gravity of the electric locomotives is much lower than in the case of a steam locomotive and the former rides much more easily and engineers are able to work with less fatigue than in steam practice. Practically no inspection except of lamps, the oil in the journal boxes and the main switches is required of the locomotive and motor car train men. Very few modifications in the details of the rolling stock have been necessary as yet, with the exception of the locomotive control contactors. The contactors have been subdivided by means of a new interlocking arrangement to facilitate the breaking of heavy arcs. Idle contactors on the motor cars have also been used for this purpose.

Every locomotive coming to Wakefield is inspected, as is every one which reaches High Bridge. At Lexington Avenue shoes and air hose are inspected, but only a limited examination is made of rolling stock at this point. The motor-car trains are made up in units of two, three, four, five or six cars each, so that any reasonable combination of cars can be obtained to supply the necessary elasticity in handling the traffic. No fires have occurred on account of the car wiring in any rolling stock and no changes have been required in the wiring as a result of the company's experience in handling locomotives and motor cars. Sand is blown off the locomotive commutators every 750 miles and a considerable amount of sand is required on the locomotives on account of the present dampness in the Park Avenue tunnel and under the viaducts. The electric locomotives are daily handling trains weighing from 750 to 800 tons and in approaching the Grand Central Station there is a 1 per cent temporary grade which requires sanding in order to accelerate upon it.

At the time that the locomotives are inspected the gage of the third-rail shoes is also measured. In addition at 110th Street a check on the gage of the third-rail shoes is automatically maintained and an inspector, who is on duty all day, takes the numbers of the cars or locomotives upon which the shoes are too high or too low. A special device is provided at this point which rings an electric bell of one tone in case a shoe is too high and sounds a bell of another tone in case it is too low.

GENERAL OVERHAULING

The heavy repairs on all the rolling stock will be made at the Harmon repair shops. It is planned to put one motor car in the shops for a thorough overhauling after it has made from 35,000 to 40,000 miles, but the mileage which should be made between overhaulings is as yet undetermined. The rolling stock will be gradually passed through the shop until the last car or locomotive is in at the conclusion of the mileage which the company's experience shows is desirable between overhaulings. A locomotive will also be run 35,000 to 40,000 miles before a thorough overhauling for the purposes indicated above.

The company's practice is to carry extra trucks, extra wheels and extra armatures instead of holding a locomotive out of service a long time while repairs are made upon a single part of it. Thus, the electric locomotive might be out of service a week or two in case of a burned-out armature, whereas to substitute a new armature does not keep it out of service more than twelve hours. Not a single locomotive armature has burned out because of the service, and almost the only repairs on the locomotives thus far have been the replacing of brushes, contactor-wearing parts and other light maintenance work.

WEAR

Very little wear of the contact shoes has been experienced. It was found quite difficult at first to educate the trackmen to the point of giving the proper clearance for the shoes, but this has come by practice. About 40 lbs. pressure is carried by the shoe against the underside of the third-rail.

November 1, 1906.

N. Y. C. & H. R. R. R.

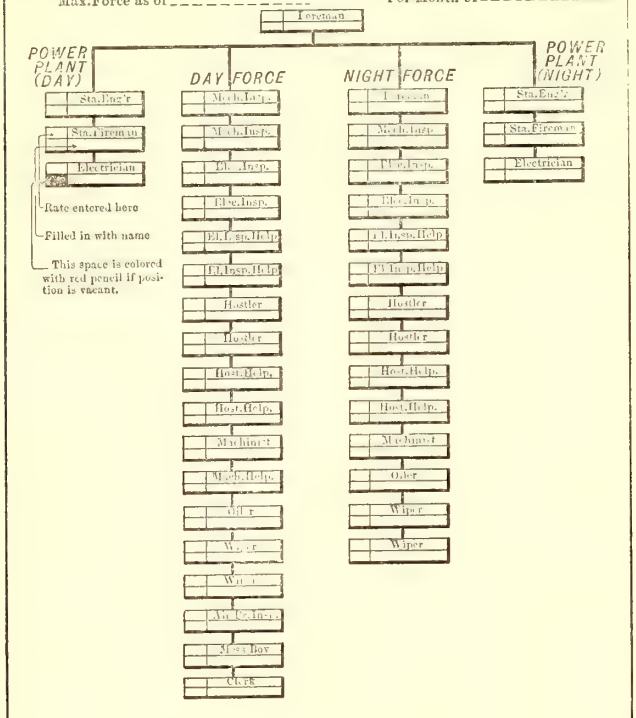
Electrical Department

OFFICE OF THE SUPT. OF ELECTRIC EQUIPMENT

WAKEFIELD INSPECTION BARN.

Previously Authorized Max. Force as of_____
Increase_____
Decrease_____
Net_____
Total Authorized, Max. Force as of_____

Previously Authorized Pay Roll Month of_____
Increase_____
Decrease_____
Net_____
Pay Roll Required For Month of Sept. 1907.



Correct for month of Aug. 1907

Sheet No. 6e. Street Ry. Journal

ORGANIZATION OF OFFICE OF THE SUPERINTENDENT OF ELECTRIC EQUIPMENT, WAKEFIELD INSPECTION BARN

TELL-TALE REPORT

.....1907.

Car No.	Gage E. Bd. W. Bd.	Car No.	Gage E. Bd. W. Bd.	Loco. No.	Gage E. Bd. W. Bd.
3000	..	3060	..	3400	..
3001	..	3061	..	3401	..
3002	..	3062	..	3402	..
3003	..	3063	..	3403	..
3004	..	3064	..	3404	..
3005	..	3065	..	3405	..
3006	..	3066	..	3406	..
3007	..	3067	..	3407	..
3008	..	3068	..	3408	..
3009	..	3069	..	3409	..
3010	..	3070	..	3410	..

TELL-TALE REPORT, SHOWING THE LOCOMOTIVES OR CARS HAVING HIGH OR LOW SHOES

.....190....

Mr. J. G. BAUKAT,
Ass't Sup't Electric Equipment,
New York.

Dear Sir:

Subject to your approval:

I have this day employed Mr. ....
key No.....as ..... Rate.....per.....at
...., in place of Mr.....who
....

I have this day transferred Mr..... ....
key No.....employed at.....as.....
rate.....per....., to take the place of Mr..... .....
key No.....employed at .....as.....
rate.....per....., who.....

Yours truly,

....Foreman.

.....190....

Mr.....

Foreman.....

Dear Sir:

Your request of.....to employ Mr.....
as.....at.....per.....meets with my approval

Yours truly,

....
Ass't Sup't Elec. Equip.

LETTER USED IN EMPLOYING AND TRANSFERRING MEN BY REPAIR-SHOP FOREMAN

1907

WORK IN PROGRESS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Changing Locomotive Trolleys	1																															1
Changing Control	2																															2
	3																															3
	4																															4
	5																															5
	6																															6
	7																															7
	8																															8

Street Ry. Journal (Blank contains space for 32 items.)

UPPER PART OF EQUIPMENT SHEET SHOWING WORK IN PROGRESS

E. E. 2. C.H.S. 3-29-07-1M.

N. Y. C. & H. R. R. R.

ELECTRICAL DEPARTMENT.

TRAIN SHEET.

Despatcher.....

Condition of Weather..... Date.....

TRAIN	DUE TO	NUMBER OF EACH CAR								MOTORMAN	INSPECTOR	LEFT	CAR DEFECTS	REMARKS

UPPER PART OF TRAIN RECORD

FORCES AND ORGANIZATION

The chart on page 572 gives the organization of the inspection force at Wakefield and is reproduced from one of the standard organization charts of the company (original size 13½ ins. x 7¾ ins.), to which reference has already been made on pages 540 to 543. In this diagram, as in the other organization diagrams in the preceding pages referred to, each position is shown with space for the number of men doing that kind of work, to be filled in, and their rates of pay. The sheet illustrated is submitted each month to the superintendent of equipment and in case a position is vacant the blank space in the lower left-hand corner is filled in in red. If it is occupied the number of men is written beneath the title of the position, and in any case the rate of pay remains in the upper left-hand corner.

OTHER FORMS

Another cut on the opposite page is a reproduction of the upper part of a sheet, original size 12¾ ins. x 8⅞ ins., used to show at a glance all work in progress in the equipment department at any time. Squares are provided for each day of the month and spaces for thirty-two different jobs on each sheet if necessary. When a piece of work is started on a car or set of cars, or on any of the locomotives, the title of the work is inscribed in the left-hand space and the number of pieces of rolling stock changed over or attended to each day is placed in the smaller squares at the right. Thus at a glance the superintendent of equipment can tell just what work should be hastened in case a delay occurs anywhere along the line.

The tell-tale report is also reproduced in part on the opposite page. This form, original size 13 ins. x 8 ins., is kept by the inspector at 110th Street, and shows the shoe-gage of the different cars, if above or below the proper gage. This report is sent to the office of the superintendent of equipment.

Another form, original 13 ins. x 7 ins., is a letter devised to save extra correspondence in connection with the employing or transferring of new men. One of these notices is sent to the assistant superintendent of electrical equipment by the foreman of the shop or inspection barn when he employs or transfers a man. The sheet is arranged with a stub at the bottom which is returned to the foreman in case the employment or transfer is approved. If it is not approved no return notice is sent.

The time-card blank shown above, original size 9¼ ins. x 4¼ ins., is filled in by each workman in the shop or inspection barn and transmitted to the main office by the foreman at the conclusion of each day's work. Inspectors and repair men all use this blank, which discusses the character of the work, the location where it is performed, the time required to complete it and the man's pay.

The chart below, original 13¾ ins. x 8 ins., gives the classification of the inspection force at North White Plains, Croton, High Bridge, Wakefield and the Grand Central Station. At each one of these points are a foreman, general inspector, machinist and carpenter and a group of inspectors, helpers and miscellaneous employees as listed. The inspection of the equipment is performed in groups; that is, one force of men inspects the air brakes while another inspects the control. Similarly the motors, the fuses, the lamps and the trucks are inspected separately. No particular order is followed in this inspection work with the exception of the fact that the

N. Y. C. & H. R. R. R.

COMPARATIVE RATES PAID TO INSP. FORCES.

Positions	N.W.Plains Day	N.W.Plains Night	Croton Day	Croton Night	H.Bridge Day	H.Bridge Night	Wakefield Day	Wakefield Night	G.C.Sta. Day	G.C.Sta. Night	Total
Foreman											
Gen. Inspector											
Machinist											
Carpenter											
Inspectors: Air Brake Inspector											
Inspectors: Control "											
Inspectors: Motor "											
Inspectors: Fuse & Lamp "											
Inspectors: " " "											
Inspectors: Truck Insp.											
Inspectors: " "											
Helpers: Air Br. Insp. Help.											
Helpers: " " " "											
Helpers: Control " "											
Helpers: " " "											
Helpers: Motor " "											
Helpers: " " "											
Helpers: Truck " "											
Helpers: " " "											
Helpers: Machinist's "											
Helpers: Carpenter's "											
Oiler											
"											
Wiper											
"											
"											
Sweeper											
"											
Lamp Trimmer											
" "											
Switchman											
" Hostlers											
"											
Despatcher											
Clerk											
Messenger Boy											
Train Clerk											
Train Recorder											
" "											
Material Clerk											

Street Ry. Journal

CHART OF INSPECTION FORCES

FORM M. P. 2254. New York Central & Hudson River Railroad Co. C.M.S. 2-6-07-600M

MOTIVE POWER DEPARTMENT.

DAILY TIME CARD.

Name of Workman..... *Date*, ... 190

Key No...... *Shop*, ... *Rate*, ...

WORK ON	DESCRIPTION OF WORK	TIME COMMENCED	TIME FINISHED	HOURS DAY WORK	HOURS PIECE WORK

EXAMINED AND APPROVED.

..... FOREMAN.

WORKMAN'S DAILY TIME CARD

N. Y. C. & H. R. R. Co.

N. R. 3058 Electric Division.

Name.....

Nationality.....

Address.....

Employed as.....

Date hired.....

Age.....

Rate.....

Foreman.....

Place.....

FORM GIVING EMPLOYEE'S RECORD

work is kept from overlapping as far as possible. The blank is designed to show the number of men at work during the day and during the night at each one of these inspection points.

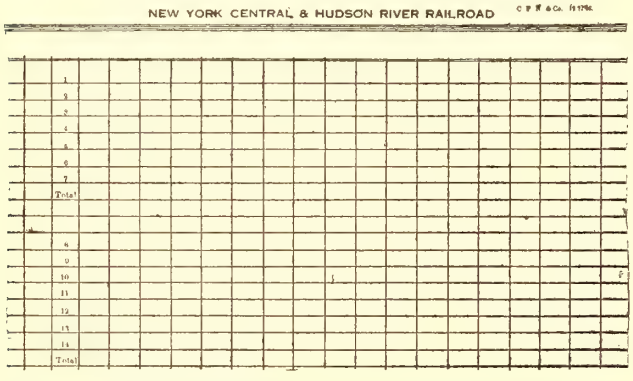
The third form on page 573, original size 4⅜ ins. x 4 ins., is used to summarize the particulars of each man's employment in maintenance work. Full records are, of course, kept of all applicants and employees, but this blank is designed to show at a glance the salient points. A duplicate of this blank is retained by the foreman under whom the man works.



RED TAG ATTACHED TO CAR REQUIRING REPAIRS DUE TO ACCIDENT

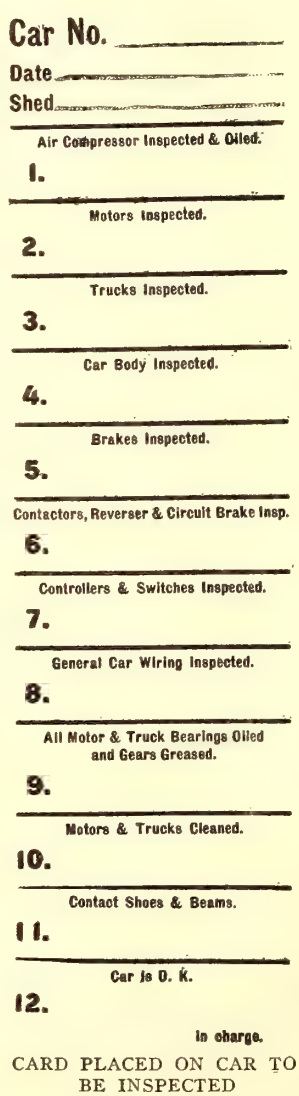
The tag shown above, original size 8¾ ins. x 3⅛ ins., is attached to any car or locomotive requiring repairs and the stub at the end of it is sent to the office of the superintendent of electrical equipment. When the stub reaches the office it is placed in a rack with a numbered slot corresponding to the number of each car and locomotive, so that the number of cars and locomotives in the shop can be seen at any time without trouble.

The record of miles run is kept in a loose-leaf book with leaves ruled as shown below. The mileage figures are not secured from the conductors' reports but are computed in the main office as follows: All trains arriving at the station are met by a platform man who puts down in a notebook the train number, individual car numbers, points of departure and time of arrival. This book is turned over to a mileage clerk who enters the data on the train sheet, reproduced on page 572, original size 15¼ ins. x 13¼ ins. This train sheet illustrates the number of trains, the leaving time, the number of each car making up the train, who the motorman was, the inspector, the time of leaving, any defects noted, whether the car was north-bound or south-bound, the despatcher, the date. At the end of the day this train sheet is submitted to the chief mileage clerk who proceeds to compute the mileage from the run data given.

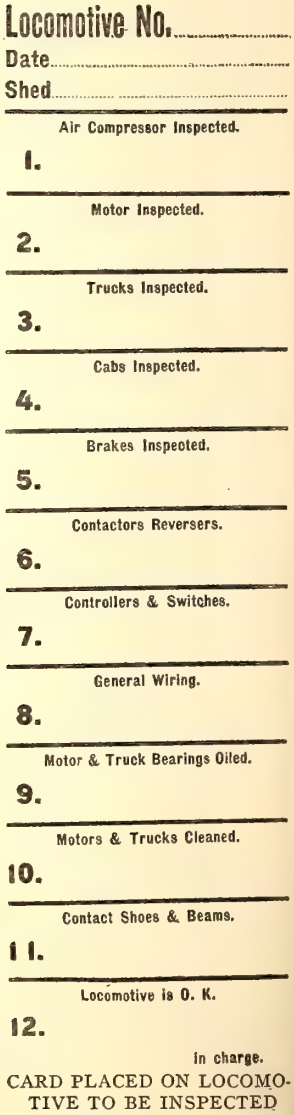


PART OF LOOSE LEAF MILEAGE BOOK, WITH PAGES RULED FOR 31 DAYS, WEEKLY TOTAL AND GRAND TOTALS

When several cars have reached the 750-mile limit a list of their numbers is sent to the proper car-house foreman. This list is turned over to the clerk who immediately copies all car numbers on delivery inspection cards which are slipped into metal holders and tied to the controller handles. These cards are 8½ ins. long by 2¼ ins. wide, original size, and as shown below, call for inspection under one general heading and eleven special headings. This scheme is more convenient than separate signed reports on a car for all the signatures are on one card, and before the final inspector adds his final o. k. he can see at a glance whether every part of the inspection process has received attention. The name of the employee who makes the particular inspection designated is always written on this card and any defective work can be traced with ease. One of these cards is kept in the foreman's office in each inspection shop, for each car upon which work is done.



CARD PLACED ON CAR TO BE INSPECTED



CARD PLACED ON LOCOMOTIVE TO BE INSPECTED

Each inspector has two small books in which he makes notes of the different items found. One of these books is used on Mondays, Wednesdays and Fridays, and the other the remaining days of the week, to enable the men to turn in their books every day for record by a clerk, who also keeps the original inspection tag. Should a car later become crippled before the next regular inspection it is an easy matter to trace the trouble due to careless work. In case a car is turned in

due to some accident, such as a broken brake beam, the red tag is tied to the controller handle, the stub is torn off and sent with a statement of defects to the superintendent of equipment for his information. The car then goes through the usual inspection process before it is allowed to go into service again.

The daily report, original size 8 ins. x 13 ins., which is submitted by the car-house foreman on the equipment in hand and the number of employees caring for it, is shown below. The total number of inspectors, helpers, repair men, car cleaners, wipers on both day and night work are shown together with the total number of motor cars, trailers, locomotives and combination cars which are o. k. or disabled, the number of the car or locomotive, its class and condition with respect to inspection, availability for service. One of these reports is sent to the superintendent's office daily from Harmon, High Bridge, Croton, North White Plains, Wakefield and the Grand Central Station.

FORM E. E. 8. C H S 4-19-07-5M

New York Central & Hudson River Railroad Co.

DAILY REPORT ON EQUIPMENT.

Date ..... 190.... Ending ..... P. M. Location .....

FORCE.			EQUIPMENT		
	DAY.	NIGHT		O. K.	DISABLED
No. Inspectors and Helpers			Motor Cars		
No. Repair Men			Trailer "		
No. Car Cleaners and Wipers			Locomotives		
Total No. Men on duty			Combination Cars		

Detail report of Disabled Equipment should be made in proper space below, showing in "Remarks" column disposition of Equipment, as to whether "Shopped" waiting for orders or date O. K. for service.

NO.	CLASS.	CONDITION OF EQUIPMENT.	UNDER INSPECTION	O. K.	Cripple	Service

FOREMAN'S DAILY REPORT OF EQUIPMENT UNDER CARE AND NUMBER OF EMPLOYEES

WHOCo.—Form E. E. 4.—6-07—10M.

NEW YORK CENTRAL & HUDSON RIVER RAILROAD

ELECTRIC EQUIPMENT DEPARTMENT

Despatcher's report at (14 B)

From (7) A. M. to (7) P. M.

" P. M. to A. M. Date (9/18/07)

TRAIN	TIME	MOTORMAN	HELPER	LOCO.	DELAY	REMARKS
26	9am	Smith	Jones	3421	3m	

DESPATCHER

DESPATCHER'S RECORD OF DELAYS

The next, original size 5¼ ins. x 8 ins., shows a slip giving a daily report of the electric locomotive mileage. One of these reports is filled out at the end of each day by each motorman and the trips which he makes and the number of his locomotive between the Grand Central Station, Wakefield, High Bridge, are shown by check marks. These sheets are figured up in the office and the mileage of the different locomotives checked by their indications.

The next, original size 13 ins. x 8 ins., illustrates the report of a despatcher at either High Bridge, Wakefield, Lexington Avenue or the Grand Central Station. This report shows the number of each train, the time of its leaving or arrival, the name of the motorman, his helper, the number of the locomotive and any delay in case such occurred.

The despatchers in charge of the movement of the electrical equipment are responsible for the make-up and the manning of all trains. There are eight of these men, four being on day work and four on night work. They supervise the supplying of men for the runs designated on the time table in the electric division and are in general charge of the provision of electric locomotives and motor cars to meet the schedule. It requires about three minutes to make the change from steam to electricity at the High Bridge and Wakefield terminals. In changing locomotives, two men are required. As soon as the train pulls in these two men uncouple, and the locomotive, which is to be cut off, moves out of the way as quickly as possible. The new locomotive immediately backs down, is coupled to the train and the air brake test is made from the rear of the last car.

DAILY REPORT OF
ELECTRIC LOCOMOTIVE MILEAGE

Date.....

Motorman.....

SWITCHING SERVICE

Engine No..... .....

Place.....

Hours.....

ROAD SERVICE

Engine Number	G. C. S. to Wake.	G. S. S. to H. Bdg.	G. C. S. to M. O.	H. Bdg. to G. C. S.	Wake. to G. C. S.	M. O. to G. C. S.

To C. H. QUEREAU,
Supt. Electric Equipment,
No. 335 Madison Ave., N. Y. City. Room No. 1245.

DAILY REPORT OF LOCOMOTIVE MILEAGE

The card on page 576, original size 5 ins. x 8 ins., is used in summarizing the troubles of each motor car throughout the year. Space is given for a summary of the troubles occurring on each day in the year, the total number of defects being recorded in a small square corresponding to the day. The frequent occurrence of any trouble or the frequency of any inspection can be told at a glance by examining this card. A white card is used in the same way for keeping track of locomotive troubles. Both sides of the cards are used.

The next form, original size 5 ins. x 8 ins., is a card used for keeping armature records. The number of the car or locomotive on which the armature is placed is given with the date of application, removal, mileage made between shop visits and notes of general repairs made. This record is kept in the office of the superintendent of equipment and is compiled from repair reports sent in from the inspection sheds and shops.

The third form on page 576, original size 5¼ ins. x 8 ins., gives the number of employees required for the maintenance of

equipment on day work and night work at the various inspection stations and at the Harmon shops. It shows at a glance when filled out the total number of each class of men at work on a given day and is compiled from the sheets which are sent in to the office daily from the different inspection and maintenance points.

The form opposite, original size 8⅞ ins. x 4¾ ins., is used in keeping records of wheel applications. A sheet of the same size takes account of wheel renewals, and is also reproduced.

N. Y. C. & H. R. R. R. CO. ELECTRIC DIVISION.

Tabulation of ..... *Troubles No. .....

DATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL
January																																
February																																
March																																
April																																
May																																
June																																
July																																
August																																
September																																
October																																
November																																
December																																

Train Detentions ..... 1 Inspection

*Includes .....

CARD RECORD OF TROUBLES DUE TO A PARTICULAR PART OF THE EQUIPMENT

GENERAL RULES

Employees of the Maintenance of Way Department in the electrical zone are governed by the book of rules of the Maintenance of Way Department of the road in effect Aug. 1,

MAKER'S No. ..... N. Y. C. & H. R. R. No. .....

TYPE ..... RECORD YEAR RECEIVED

CAR NO	APPLIED	REMOVED	MILEAGE	GEN'L REPAIRS	TROUBLE

ARMATURE RECORD CARD

1906. In addition to this book other detail instructions have been prepared for the men in this department. In every telephone booth there is posted a list of the names and addresses of men who are to be called in case of emergency; this list is revised monthly by the superintendent.

OBSTRUCTIONS

No hand car or push car or any obstructions which may not be easily removed within sight of an approaching train is allowed upon the tracks without permission of the superintendent. No ballast, ties, tools, ladders, refuse or construction material of any sort is allowed to lie within the clearance lines of a track in service. The track and road bed are kept clear of scrap, loose wire, and all material which might cause a short circuit. Special care is also taken to keep divergent track rails in the same plane for a distance of 33 ins. between divergent rails in order to prevent the contact shoes from touching the track rails, causing short circuit.

In no case are any planking, ballast, or other obstructions allowed to come above the plane of the tops of the running rails for a distance of 33 ins. out from the gage line. Special care is used to keep this clearance where tracks have a superelevation. The distance between the third-rail and track is tested frequently with a template so that the proper gage can be maintained and the templates are frequently compared with the division standard. The division standard is checked with that of the superintendent of electrical equipment at least once a year.

GENERAL PRECAUTIONS

Where work is to be done close to the third-rail, foremen are obliged to provide themselves with a special insulating form to be placed or held so that there will be no possibility of contact with the third-rail. All employees are obliged to know that metal tools or wooden tools that are wet coming in contact with the third-rail may injure them or others, or interrupt train service. Special instructions are given to the employees to avoid stepping, sitting, walking upon, or brushing against the third-rail. Unless it is definitely known that current has been turned off for a definite period it is required to be understood that current is turned on at all times on all third-rail and overhead conductors. Absolutely no change is allowed in the location or construction of the third-rail or third-rail appliances without an approved plan and letter of authority.

ORGANIZATION OF THE DEPARTMENT

The supervisor of third-rail reports to and receives instructions from the division engineer. He has charge of and is responsible for the safe and economical maintenance of all third-rail, all overhead conductors, and all rail bonding. He employs such foremen, mechanics and laborers as may be authorized and is required to know that foremen are sober, trustworthy men with knowledge and experience in the work. He instructs them as to their duties as occasion may require and sees that all his men understand their duties and faithfully perform them. He is also required to see that the men are supplied with the proper tools and that they use and care for them properly. The supervisor of third-rail employs ordinary laborers for all work which it is possible for such men to perform, and advises

REPORT ON HELP AND MAINTENANCE OF EQUIPMENT

Location	DAYS						NIGHTS						Total
	Foreman	Inspectors	Rep. Men	Car Cleanrs	Oilers	Hostlers	Foreman	Inspectors	Rep. Men	Car Cleanrs	Oilers	Hostlers	
High Bridge..													
Wakefield.....													
Harmon Insp.													
No. W. Plains.													
Harmon Rep..													
G. C. Station..													
Total.....													

the supervisor of track of any track construction or method of work which improperly affects the third-rail or overhead conductor.

The third-rail foreman reports to and receives instructions from the supervisor of third-rail. He has charge of and is responsible for third-rail and track bonding, cross bonding and frog bonding and all third-rail and overhead conductor construction in his territory. He has jurisdiction over foremen, mechanics, patrolmen, helpers and laborers in his employ. He is required to personally examine at least three times a week all construction under his jurisdiction and to take immediate action to prevent damage from exposed third-rail and other conductors, defective sheathing, inadequate clearance or defective construction of third-rail, overhead conductors or other appliances. He notifies the superintendent of power whenever there is doubt of the proper condition of any bond, jumper, cross bond or other connection. The third-rail foreman is required to see that each patrolman has a complete set of tools in good condition for the work he may have to perform and that a sufficient reserve is kept in stock and in prescribed places. He receives from patrolmen and forwards to the supervisor of third-rail daily reports showing what defects were discovered and what action was taken. He is obliged to respond to any request from the superintendent of power or superintendent for emergency repairs and is charged to give special attention to inclines to see that they do not become loosened or displaced.

Form R. S. 75.

REMOVALS.

WHEELS									AXLES			
CAR		Wheel	Makers	DIA.	Shop	Tire	Thickness of Tire	Cause of Removal	No.	Shop	Size of Journal	Cause of Removal
Class	No.	Nos.	Name		Marks	Nos				Marks		

UPPER PART OF WHEEL REMOVAL SHEET

N. R. 2199

APPLICATIONS.

Date Wheels and Axles Removed	WHEELS							AXLES			Date Wheels and Axles Applied	REMARKS
	Wheel Nos.	Makers Name	DIA.	Shop Marks	Tire Nos.	Thickness of Tire	New, Turned or Re-Tired	No	Shop Marks	Size of Journal		

UPPER PART OF WHEEL APPLICATION SHEET

The section foreman or his assistant foreman is required to be constantly with the gang. He gives such oversight to the work of track workers and special watchmen as may be possible from the time they enter upon the tracks until they leave them. He advises the patrolmen of any defects in the third-rail insulators, sheathing, track bonds, cross bonds, jumpers, and any other connections and telephones or telegraphs the information to the third-rail foreman. He also assists the patrolmen or third-rail men in emergency.

The section foreman sees that the relation between the top of running rails and the under side of the third-rail is carefully maintained so as to give proper contact at all points between the under side of the third-rail and the contact shoes on the locomotives and cars, and after every leveling or lining of tracks, replacing of rails, changes of switches or frogs, he has the patrolmen test the third-rail as to height above the top of the running rail and clearance of overhead conductors and distance from the gage line. Except in emergency the removal or renewal of rails, frogs, or switches that are in tracks which are bonded is allowed only after the co-operation of the signal forces and third-rail forces has been secured.

Each patrolman reports to and receives instructions from the third-rail foreman. Two patrolmen have immediate charge of such section of the third-rail, the bonds of the track rail and overhead conductors as the third-rail foreman may direct and are responsible for its safe and economical maintenance. Each day patrolman is in charge from 7 a. m. to 7 p. m. and each night patrolman from 7 p. m. until 7 a. m. At least twice in his trick each patrolman is required to examine the construction assigned to him and see that everything is safe. He reports by telephone or telegraph to the nearest sub-station any defects noticed in the transmission cables, supports or other connections and also reports any defects in track or roadbed to the section foreman.

Patrolmen or any persons requiring power cut off a third-rail are obliged to obtain permission of the superintendent who notifies the superintendent of power, giving the details as to the track and length of time required and the name of the person who will be in charge of the work. The superintendent of power is responsible for the handling of jumpers and switches. Immediately before cutting power off the third-rail the load despatcher advises the chief train despatcher. When the work is completed or the time has expired the person who asked to have the power cut off is obliged to report the third-rail ready for current to the chief train despatcher. The chief train despatcher then notifies the load despatcher that the third-rail is ready for current. The load despatcher then orders current turned on and notifies the train despatcher as soon as this has been done. Patrolmen are required to be familiar with all rail circuits and to report at once to the third-rail foreman any defects which cannot be corrected without assistance. Each patrolman is obliged to see that the despatchers, agents, and signal men on his section have his address and to promptly notify them in case of a change. He is obliged to respond to all calls from the despatchers for emergency work or repairs of any kind and forwards a copy of his report to the third-rail foreman. He also complies with requests of section foremen to bond the track rail and calls upon the section foreman to help him in times of emergency.

THIRD-RAIL MAINTENANCE

Broken or defective insulators are replaced at once and six 33-ft. lengths of third-rail, properly prepared for bonds, are kept in rail racks not more than one mile apart. Duplicates of all special sections of third-rail are stored on rail racks at suitable places and at yards and terminals an adequate reserve of materials for erection and repair of third-rail are stored at convenient places. Tool boxes marked "Third-rail maintenance" are kept at twenty-one places enumerated in the instruction book. Each tool box contains the following material:

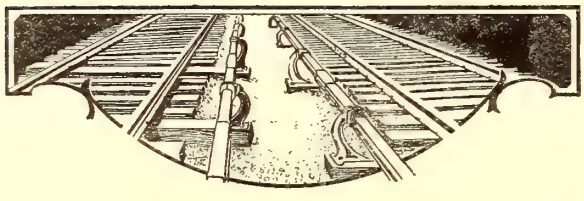
1 adze.
1 template for X bracket.
1 template for Y bracket.
1 template to gage dapping out of ties.
1 5/8-in. ship auger.
1 2-lb. No. 2 bull point hammer.
1 1¼-in. square socket lag screw wrench.
1 flogging chisel.
1 4-lb. double-face hammer.

1 hacksaw frame.
1 dozen hacksaw plates.
1 square taper shank, No. 4 packer sleeve ratchet.
6 1-in. square taper shank twist drills.
1 center punch.
2 ¾-in. bolts 20 ins. long, threaded and fitted with nuts on each end for clamp.
1 ¾-in. backing-out punch.
2 drift pins for opening bond terminals.
1 dozen sheets emery cloth.
2 track bolt wrenches.
3 14-in. flat bastard files.
1 pair 6-in. clamps.
1 Sievert blow torch.
3 small acid brushes.
5 yds. cheese cloth.
6 lbs. 2-in. insulating tape.
4 pairs rail tongs.
1 cross-cut hand saw.
1 claw hammer.
1 1½-in. wood chisel.
1 1-in. cold chisel.
1 5-gal. can gasoline.
1 1-qt. can neutral acid.
12 brackets.
3 Y brackets.
3 dozen ¾-in. x 6-in. lag screws.
3 dozen ¾-in. x 4½-in. lag screws.
1 dozen ¾-in. x 2-in. machine bolts.
1 dozen ¾-in. lock washers.
½ dozen channel extensions.
1 dozen pairs (No. 1) insulators.
3 pairs (No. 2) insulators.
1 dozen (No. 1) hook bolts.
3 (No. 2) hook bolts.
1 lb. Hydrex felt.
2 dozen solder bolts.
2 dozen track bolts.
½ dozen twin terminal bolts.
6 pairs third-rail splice bars.
36 pairs ¾-in. x 2½-in. track bolts.
6 pairs half-and-half solder bolts.
3 lbs. drive screws.
2 pairs rubber gloves.
2 rubber mats, 18 ins. x 36 ins.
1 box "first aid to the injured."

Each took box is in charge of the patrolman on whose district it is located, but tools are for the use of any one who properly has a master key. The person using the tools is responsible for their condition and prompt return.

TRACK WORK

No track jack is ever allowed between the third-rail and the track. Bracket ties are thoroughly tamped under and for 16 ins. each side of each running rail; the remainder of the tie has a uniform bearing and is lightly tamped. These ties are placed and maintained at right angles with the track and where possible are put in the track from the side opposite the third-rail. Lining bars are not allowed between the third-rail and track, but when it is necessary to line adjacent rail away from the third-rail a hook and jack are used.



EFFECT ON TERMINAL OPERATION OF THE NEW YORK CENTRAL ELECTRIFICATION.

The New York Central electric trains are being operated upon the same schedules as were formerly used with the steam trains, so that the effect of their more rapid acceleration in reducing the maximum speed is hardly perceptible to the ordinary passenger, however evident it may be at the time of starting the trains. It is in the atmosphere in the tunnel that the greatest difference from former conditions is apparent. The primary reason for the adoption of electricity on the New York Central Railroad was to eliminate locomotive smoke and gases of combustion, and the results have certainly justified expectations. The Park Avenue tunnel, which is some two and one-half miles in length, is now almost clear.

Formerly the entrance of a train into this portion of the route was the signal for the closing of all the windows and doors. Then followed a ride of some five minutes in a stifling atmosphere. It is difficult for any one who has not had the actual experience to realize the immense improvement effected in this respect. Passengers on the trains which run observation cars now occupy the rear or observation platform in traveling from Forty-Second Street to 125th Street. This was not possible a year ago.

The New York Central Railroad has changed over its equipment entirely, but 80 per cent of New Haven trains are still drawn by steam locomotives. When these are finally eliminated and electric locomotives are substituted for them, it is the intention of the management to thoroughly clean and whitewash the tunnel and possibly introduce some system of lighting.

Another reason why the full benefits have not yet been secured by the New York Central from its electrical equipment is that the work of reconstructing its Forty-Second Street terminal is still under way. Plans showing the proposed improvements were published in the Street Railway Journal for Nov. 18, 1905. The excavation east of the old station has largely been completed and all New York Central suburban and Harlem Division trains are being dispatched from the Lexington Avenue station. Others still leave and enter the old station on Forty-Second Street. As the excavation gang progresses with its work, trains are changed from one track to another and new portions of the excavation are attacked. The smoothness with which the operation of the trains is carried on is remarkable.

In spite of these facts it is already possible to determine some of the results which have followed the electrification of the New York Central terminal and it is proposed to describe them in the following paragraphs.

EFFECT ON STATION LABOR

From an operating standpoint the first question which might be raised is whether the terminal service requires less help than when steam was used as a motive power. There has been a marked reduction in this item of expense, although its extent is difficult to determine as yet. Thus, practically the entire engine house force is dispensed with, such as the turntable men, ash men, water men, etc.

This absence of attention necessary to the locomotive at the terminal is one of the marked features of the electrical machine. Formerly when a train was pulled into Forty-Second Street by a steam locomotive it would require from one to two hours to prepare the locomotive for use again. This time was taken up in dumping the ashes, receiving a fresh supply of water and the necessary attention of the inspectors. With electricity this work is of course entirely eliminated. Electric locomotives come into Grand Central Station, uncouple from the inbound train and couple to an outbound train ready to start on the return trip in a very few minutes. This has permitted the pooling of locomotives at Forty-Second Street to a greater extent than heretofore, and consequently has resulted in a considerable reduction in train movement.

The total number of movements in the yard on July 2, not only for regular trains, but also of switches, showed a decrease of about 33 per cent due to the use of electricity. This decrease in movements, combined with the enlargement of the terminal, has increased its efficiency to such an extent that on July 2 the delays had been reduced from a total of 443 minutes per day to 122 minutes per day. On July 2, 1907, the New York Central Railroad alone was handling a total of 350 trains in the Grand Central tunnel, of which 327, amounting to 94 per cent, were handled by electricity. The New Haven Company on the same day was handling 145 trains, all its motive power being steam. On Aug. 20 all New York Central trains and twenty-four New Haven trains were being handled by electricity, leaving 133 New Haven trains hauled by steam.

STORAGE AT SUPPORTING YARDS

The conditions at the Grand Central Station at present do not permit of very much storage of either cars or locomotives, and for this reason the practice is still followed of storing most of the locomotives and motor cars at the Mott Haven yards between 150th and 160th Streets. The empty trains passing between the Grand Central Station and these supporting yards are run on the same schedule as regular trains to unify train movement. From one to two electric locomotives, however, and about the same number of motor car trains are usually held at the Forty-Second Street yards.

When a train reaches the incoming platform assigned to it the duty of the crew is over. The men leave the locomotive or car and it is run to its siding or to the Mott Haven yards by a special switching motorman.

LOADS HAULED

The heaviest train under normal conditions which is hauled in or out of the Grand Central Station is made of from eleven to fourteen Pullmans with occasionally a maximum of eighteen Pullmans. There is no doubt, however, that the electric locomotives could haul longer trains. In fact, on one or two occasions, when steam locomotives have broken down in the tunnel, an electric locomotive has hauled the dead locomotive and train as well as its own.

EMPLOYEES

The electric trains are operated by the former steam engineers and firemen, and two men are kept in the cab, both with the electric locomotives and the motor cars. On the locomotive, the fireman and on the motor cars an inspector acts as an assistant. No change has been made in the wages paid to the crews, but the work is undoubtedly very much simpler than with the steam locomotives, as well as cleaner and more pleasant. Employees of the electric division are governed by the book of rules of the operating department of the New York Central & Hudson River Railroad Company.

YARD OPERATION

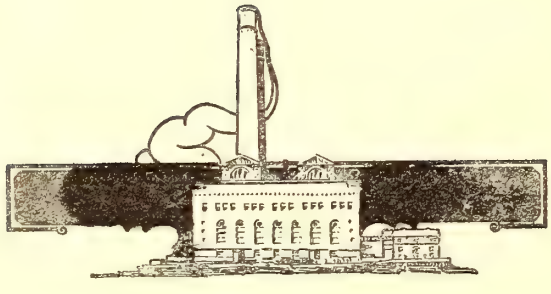
In coupling up locomotives to trains the electric locomotive has an advantage over the steam locomotive because with the latter the blowing off of steam makes it more difficult for the engineer and fireman to hear and see the brakemen doing the coupling, and in winter this is frequently a serious matter. There is also a difference in the sensitiveness of the control of the two machines in favor of the electric locomotive.

The yards are safer with electric power on account of the reduction in noise and the absence of smoke and escaping steam. The yard men have had to adapt themselves to the new conditions, however, because the electric locomotives do not give the same noisy warning of their approach as their steam predecessors.

INCREASE IN CAPACITY AND COMPARISON OF COST

It is practically impossible at the present time to determine how great will be the increase in the capacity of the Forty-Second Street terminal resulting from electric operation. The limiting feature of the capacity of the Grand Central terminal is of course the tunnel, and any increase in the capacity of the tunnel can be secured only by shortening the blocks. At present, during the rush hours, trains are run three minutes apart, the same schedule as employed in steam days. This headway corresponds to twenty trains an hour on each track, or forty trains an hour each way for the four tracks. After the New Haven steam locomotives are finally banished from the tunnel and all smoke and steam removed the blocks will be shortened. The trains during rush hours may then be run on a headway of two minutes, or even one and one-half minutes, which would correspond to an increase of 50 to 100 per cent in the capacity of the tunnel, measured in trains per hour. The figure is of course the theoretical capacity, based upon absolutely no detensions from open draws, switches, crossings or other causes.

Very careful observations of the comparative cost of operation by steam and electric power are now being made by the railroad company, and the results will soon be ready for announcement. Enough has already been learned to indicate that electricity has even other attractions than the elimination of nuisances incident to steam power, and greater efficiency.



ELECTRICAL OPERATION ON THE WEST SHORE RAILROAD

The operation of the electrified section of the West Shore Railroad between Utica and Syracuse, N. Y., illustrates a combination of urban and interurban service that is unique in the present development of heavy electric traction. The novelty of the service lies in the fact that it is a combination of street and steam railroad service. The cars use the steam tracks between Utica and Syracuse, a distance of some forty-four miles, and are also operated on local tracks in the streets of both cities, giving at the terminal cities a house-to-house distribution and collection of passengers which is out of the question in either suburban or interurban steam railroad service. For some time past transportation experts have sought to develop a system of this character which would be sufficiently free from restrictions to enable its economic value to be determined. The electrified section of the West Shore has been in operation only since Sunday, June 16, 1907, but from the company's experience thus far in this particular field there seems to be no question about the attractiveness of the combined urban and through service offered.

The regular electric service now in operation between Syracuse and Utica provides facilities which were not in existence before, and aside from offering cheaper through and round trip rates than were in force in connection with the old steam service, it affords means of tying the rural regions to the business centers in a way which was formerly impossible. This result is usually attained in the building of an interurban trolley line, but in the case of the West Shore the permanent way was already established, with low grades and long radius curves permitting a much higher schedule speed than is ordinarily the case. The increase in the frequency of the service has proved a great boon to the population tributary to the line, and journeys from the country-side to the city which hitherto consumed a large part of a day on account of the small number of local steam trains scheduled are now completed with the minimum of time consumption, easily less than half a day in many instances.

In its engineering features, the West Shore electrification illustrates standard practice in alternating current supply to rotary converter substations with third-rail direct current distribution. The construction details of the work were described in the Street Railway Journal of June 8, 1907, and only such reference will be made to them in this article as is closely related to the operation of the road. Briefly, the operating problem has been simplified as far as possible, and the remarkable differences in conditions between the West Shore situation and the electrified terminal work in the vicinity of New York are reflected in the manner of handling the service in each case. High density of traffic has yet to appear on the West Shore electrified section, and the resemblances to interurban conditions are apparent at many points. The electrified service has not been in use long enough for its operating details to become fully settled, but it is interesting to note the influences of both the steam and the street railway in the scheme as it is thus far developed.

SUMMARY OF PHYSICAL CHARACTERISTICS

The electrified section of the West Shore extends from the westerly limits of Utica to the easterly limits of Syracuse, the distance between terminals being about forty-four miles. There are 30.515 miles of double track, 8.843 miles of triple track section and 4.582 miles of four track line, the total electrified mileage being 105.887. Power is purchased at 60,000 volts from the Hudson River Electric Power Company, and delivered by that company to a substation at Clark Mills. The railroad service is supplied from Clark Mills and from three other substations, located respectively at Vernon, Canastota and Manlius Centre, which are connected with Clark Mills by a 60,000 volt three-phase transmission line carried on steel towers. Each substation contains the usual step-down transformer and switching equipment, with two 300 kw rotary converters and space for a third. The oil switches are motor-operated, current being supplied to the motors by a storage battery of fifty-five cells. The third rail is of the bullhead type, weighing seventy pounds per yard, and of the same cross section as that employed in the terminal work of the New York Central, arranged for an under-running contact. No direct current feeders are required. The rolling stock consists of fifteen cars equipped each with four General Electric "73" motors and multiple unit control.

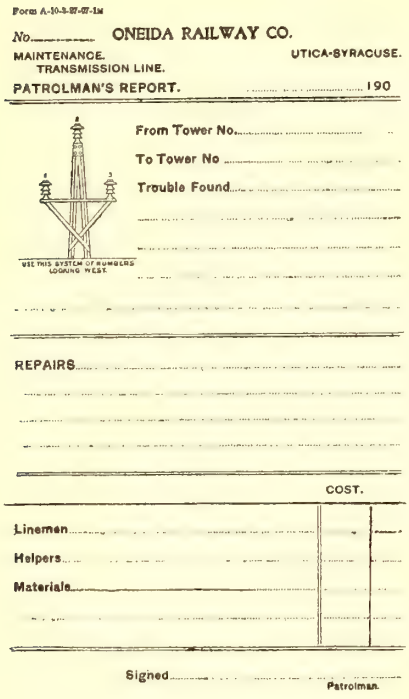
GENERAL OPERATING ORGANIZATION

An agreement between the New York Central and Hudson River Railroad Company and the Oneida Railway Company provided that the latter should lease the West Shore Railway between Utica and Syracuse, and equip its tracks for electrical operation and conduct the passenger business between these two points; while on the other hand the New York Central agreed to abandon the local trains on these tracks, reserving the right to continue its through steam trains and to haul freight over the section by means of steam locomotives.

The operation of the electrified section is in general charge of the vice-president and general manager of the Oneida Railway Company, C. Loomis Allen, of Syracuse. Operation in details falls under the jurisdiction of W. J. Harvie, electrical engineer, and F. J. Gerdon, superintendent of transportation, of the Utica & Mohawk Valley Street Railway, a property closely associated with the Oneida Railway Company. The train movements over the West Shore tracks are directed by the regular New York Central train despatchers at Utica, who are responsible jointly to the Oneida Railway Company and the New York Central. Maintenance of the transmission line between Clark Mills and Manlius Centre is handled by the Oneida Railway Company, this line belonging to the West Shore, and not to the Hudson River Electric Power Company. Maintenance of rolling stock on the electrified section of the West Shore is performed under the jurisdiction of the Oneida Street Railway Company in the Utica shops of the Utica and Mohawk Valley Street Railway Company. The Oneida Railway Company is now building a repair shop in Syracuse, which will be jointly used by the Oneida company for the maintenance of West Shore rolling stock and by the Syracuse Rapid Transit Company.

Reporting to the electrical engineer is an assistant electrical engineer, H. S. Williams, who has general supervision of the work done on the West Shore cars at the Utica repair shop, with the co-operation of the master mechanic of the Utica and Mohawk Valley Street Railway; a subordinate clerical and drafting force; a chief substation operator, and general foreman of maintenance and construction. Reporting to the superintendent of transportation are an assistant superintendent, F. L. Van Slyke, who has charge of all train crews; a clerical force, and in part the New York Central train despatchers.

All electrical and mechanical construction on the West Shore electrified section is under the jurisdiction of the electrical engineer, the work being charged to the Oneida Railway Company under the lease of this section of the former steam road. At the present time the construction work has nearly all been completed, the principal work remaining being the building of concrete platforms at each regular stopping point on the West Shore private right of way. Each of these platforms will be 100 ft. long and 7 ft. wide. The general foreman of maintenance and construction is in direct charge of this work and about half his time is devoted to each of the branches designated in his title. Three subforemen report to the general foreman and the working force includes about forty men. At the completion of the construction work this organization will be discontinued.


Form A-10-3-07-07-1M

No._____ ONEIDA RAILWAY CO.

MAINTENANCE. UTICA-SYRACUSE.
TRANSMISSION LINE.
PATROLMAN'S REPORT. _____ 190

From Tower No._____
To Tower No _____
Trouble Found_____

USE THIS SYSTEM OF NUMBERS LOOKING WEST

REPAIRS_____

COST.

Linemen_____
Helpers_____
Materials_____

Signed_____ Patrolman.

PATROLMAN'S REPORT ON LINE TROUBLE

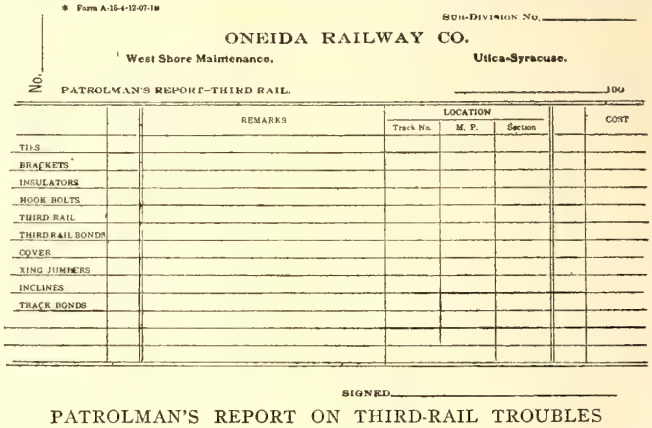
The New York Central & Hudson River Railroad maintains all the track on the West Short electrified section. The maintenance of the third-rail is handled by an organization of nine third-rail patrolmen responsible to the general foreman of maintenance (and construction). Eight of these patrolmen are regular inspectors, and each man patrols about twelve miles of single track per day on foot, making minor adjustments and repairs. The ninth man is a relief inspector. The third-rail patrolmen make their headquarters at the various substations along the line and can be reached by telephone at these points rather than at other points along the right of way. It has not yet been considered necessary to install telephones at other points than the substations and company offices. The third-rail patrolmen inspect ties, insulators, hook bolts, the third-rail itself, third-rail bonds, covers, crossing jumpers, inclines and track bonds. They replace broken parts, maintain the third-rail in the proper alignment and elevation, including inclined approaches and recessions. Thus far it has not been necessary to make any electrical tests on either the bonding of the running rails or of the third-rail. In case a third-rail bond should work loose it would result in the heating of the cover. A visual inspection suffices at present, but later it is probable that some form of regular bond test will be inaugurated.

REPORTS OF THIRD-RAIL PATROLMEN

Each third-rail patrolman makes out a daily report on a blank illustrated on this page, original size 5 in. x 7½ in. This form is kept in a book with provision for a duplicate carbon, colored yellow, which is kept by each patrolman for future reference. The original blank is a blue sheet and these are sent regularly to the Oneida company's office in Utica. The third-rail patrolman records the subdivision of the line on which he is at work, the date, the character of repairs made, the number of the track, the nearest mile post and the section number where the work was done. The cost of the work is figured in the office from the known rates and material quantities consumed as indicated on the back of the report by the general foreman of maintenance. Spare crossing jumpers are kept in cable form at each substation and bonds with line material are kept at the substations. No bracket or third-rail insulator tests are made on the road, but these were handled at the factory. It has not yet been necessary to make any resistance tests on either the third-rail or track.

LINE MAINTENANCE

Line maintenance is handled by two high tension patrolmen who report to the chief substation operator. They each cover from eight to ten miles of line per day on foot, but on Sunday


* Form A-15-4-12-07-1M

SUB-DIVISION No._____

ONEIDA RAILWAY CO.

West Shore Maintenance. Utica-Syracuse.

No. PATROLMAN'S REPORT—THIRD RAIL. _____ 190

		REMARKS	LOCATION			COST
			Track No.	M. P.	Section	
TIES						
BRACKETS						
INSULATORS						
HOOK BOLTS						
THIRD RAIL						
THIRD RAIL BONDS						
COVER						
XING JUMPERS						
INCLINES						
TRACK BONDS						

SIGNED._____

PATROLMAN'S REPORT ON THIRD-RAIL TROUBLES

mornings the trip over the line is made on a regular car. The high tension line parallels the tracks of the electrified section all the way from Clark Mills to Manlius Center, and can be inspected in a general way from a car platform without difficulty. These patrolmen report at each substation as they walk over the route, so that the office can give them special instructions if necessary. There are about thirty-three miles of 60,000 volt line maintained by the Oneida Railway Company in connection with the West Shore service.

REPORTS OF LINE PATROLMEN

Since the road was placed in electrical operation only one insulator has failed, and this, it is thought, was broken by a stone or other missile. The factory tests on the insulators were described in the Street Railway Journal of June 8, 1907, and at that time reference was made to the plan followed in specifying a certain duty for the insulators rather than attempting to settle detail dimensions and shapes. The company's experience seems to justify the former practice. In case it is necessary to change insulators on the 60,000 volt line the line is shut down for the purpose, the work being done at night if possible. Each patrolman uses a blank form like the one shown on this page, original size 4½ in. x 7½ in., in making his daily inspection and maintenance report. The line is carried on steel towers, No. 0 wire being used to give the requisite mechanical strength for the spans, which are 480 ft. in average length. The circuit is of the three phase star connected type, with grounded neutral. The inspection report is provided with a tower diagram in the upper left hand portion, the top insulator being numbered 2 and the left and right hand insulators being numbered 1 and 3 respectively, looking west. The report indicates the location of the line trouble, the nature of repairs, number of linemen, helpers and quantity of material required, the cost being figured in the office at the conclusion of the work. A gasoline motor car is used for emergency repairs on both the transmission line and third-rail. It has a maximum speed of about twenty miles per hour and is

ordinarily kept at the Oneida Castle station, which is twenty-two miles from Utica. This car is never used in routine inspection, but is held in readiness for prompt movement over the line in case of trouble, particularly in emergencies when power for operating the motor cars might be shut down.

LINE OPERATION

Thus far no shutdown from lightning has been experienced on the high tension line. Power is at present supplied at 60,000 volts from the steam plant of the Hudson River Electric Power Company at Utica, but this company's transmission line from the Spier Falls station on the Hudson River, about 100 miles distant, is being pushed westward with the view of ultimately operating the West Shore from the hydro-electric plant at Spier Falls. No line short circuits have thus far been experienced on the West Shore. The towers are thirty-nine feet high and are provided with steps to facilitate inspection and repairs. Two men are required to replace an insulator, the time expected being about thirty minutes with the use of tackle. Not enough of this work has had to be done as yet to fix a minimum time for its performance under usual conditions. The country paralleling the line is all of open character. No breaks have as yet occurred on the line. Telltale papers are not as yet used to record lightning arrester discharges, but probably will be soon. The arresters have made an excellent record thus far, one having handled four severe discharges in twenty-two minutes. Danger signs have been installed on all the West Shore high tension towers. The minimum clearance of tree sections from the line is about twenty-five feet. A few troubles have occurred in the low tension distribution on account of mechanical injury to third-rail jumpers, but these have become largely matters of experience.

SUBSTATION OPERATION

The chief substation operator on the electrified section of the West Shore Railroad has direct control of the handling of the transmission line and the four substations. The operation of the latter is effected by nine substation employees, including a helper. There are two daily shifts in each substation, the day shift being eleven hours long and the night shift thirteen hours in duration. The headquarters of the chief operator are at Clark Mills. The helper takes care of the thirteen-hour run on a change-over which occurs once in two weeks, and the rest of the time is occupied in small repairs and maintenance.

The third-rail is kept continuously alive, one rotary being run during the night in some one substation. The other substations are started at 5:30 a. m. and are operated until 1 a. m.

The inspection of the substation machinery falls under the jurisdiction of the chief operator. The apparatus is blown out once in two weeks and the switchboards wiped down daily. Oil switch motors and contacts are inspected weekly. As far as possible, inspection and repairs are confined to the daytime. The third-rail potential is 600 volts, and the sectionalizing at substations is of the simplest character. The third rail of each track is broken opposite each substation and a cable connection carried from the end of the third-rail through a switch and circuit breaker to the D. C. 600-volt positive bus bar. This enables each track to be independently fed each way from each substation, there being four feeder panels on a two-track section, as shown in the accompanying sketch. By keeping the east and west-bound tracks entirely distinct except through the bus bars an interruption on one track has no effect on the other. In one or two instances, where there are long passing sidings equipped with third-rail, there has been added an extra panel to the switchboard to supply current for this section.

In starting the rotaries half voltage taps on the a. c. sides are used. The full load on the direct current side of each machine is 500 amperes. The half-voltage taps prevent the starting current from exceeding full load and the machines are brought up to synchronism quickly and smoothly. Should the d. c. polarity chance to come up in the wrong direction, it is readily changed by means of the field-reversing switch provided for this purpose. By this method, in any circumstances, a rotary can be started, run up to full speed and be delivering power to the line inside of a minute. The rotaries are operated with their series and shunt windings both in service. The maximum continuous overload allowed per rotary is 50 per cent.

MISCELLANEOUS OPERATING NOTES

The high-tension line is continuous through each substation, and no maintenance work has as yet had to be done on the 60,000-volt circuits within the substation buildings. Each transformer and hence each rotary can be cut off from the bus bars by oil switches without interfering with the operation

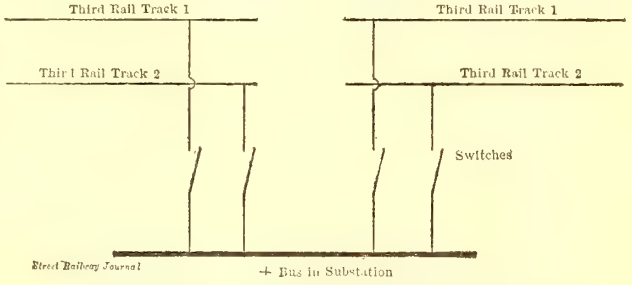


DIAGRAM OF THIRD-RAIL CONNECTIONS

of the substation beyond the one where the particular transformer and rotary are located. The voltage of the remote control motor circuits is 125. It was not considered necessary to provide motor-driven direct current circuit breakers in this installation. Totalizing wattmeters are used on the individual rotaries in the substations. The high-tension voltage is measured by multiplying the indications of a secondary voltmeter by the proper constant. Fifteen minute readings are taken on the indicating instruments in the substation switchboards during each shift. No curve drawing instruments are in service as yet, and it has not yet become necessary to make regular tests on the transmission line from any of the substations, either in sections or as a whole. Supplies for the substations are ordered through the purchasing department of the Oneida Railway Company at Utica.

The substation batteries are charged and discharged by floating on the live wire a suitable resistance between them and the 600-volt d. c. bus. Records of specific gravity and cell voltage are kept by the chief substation operator. Compressed air is used regularly in all the substations for cleaning. No trouble has been experienced with hunting in the operation of the rotaries, which are 40-cycle machines. The chief substation operator has full power to order in or out of service any machine at any time. Two rotaries are regularly used in each substation.

TELEPHONE SERVICE AND EMERGENCY OPERATION

As stated in a previous paragraph, there are as yet no telephones located along the road except at the substations, where a leased private line of the Bell Company between Syracuse and Utica enters. This connects with two private branch exchanges in the offices of the Utica & Mohawk Valley Street Railway Company and the Syracuse Rapid Transit Company. For commercial company service another line is shortly to be added, but it is not planned to carry this into the substation. No interference with telephone service has been caused by the high potential transmission line thus far. No telephones are carried on the cars. The movement of rolling

stock on the electrified section of the West Shore is handled entirely by telegraph, in the routine work of the New York Central despatches. An emergency telephone connection is in service between the Clark Mills substation and the steam plant of the Hudson River Electric Power Company at Utica, so that if any trouble occurs in the substation which relates to the high-tension power supply, immediate communication can be had with the generating station. In case of a short circuit on the third-rail, when the breakers keep coming out, the substation operator on duty at that particular moment tries to close the line three times, then waits three minutes, and then tries to close the circuit once a minute for five minutes more, after which he tries to establish a power flow once every three minutes. No outdoor line switches are in service on the electrified section of the West Shore, and no branch tracks of the road are equipped electrically as yet. No fires have as yet occurred on account of trouble on the 60,000-volt transmission line or its connections. There are no machine shops in the substations, and only minor substation supplies, like rotary brushes, spare cable and tools, are stored at these points.

* Form A-14-3-6-07-2m.

ONEIDA RAILWAY COMPANY.
UTICA-SYRACUSE.

DAILY POWER REPORT. D. C. OUTPUT, K. W. H. Friday Aug 16 1907

STATIONS		1907 —	INCREASE DECREASE	REMARKS
CLARKS MILLS SUBSTATION		1743		
VERNON SUBSTATION		2020		
CANASTOTA SUBSTATION		1791		
MANLIUS CENTER SUBSTATION		2091		
TOTALS		7645		
MONTH TO DATE		138390		

HIGH TENSION INPUT-K. W. H.

TOTALS		10450		
MONTH TO DATE		188660		
EFFICIENCY		73.2%		
TEMPERATURE		68°-82°		

DAILY REPORT OF INTERRUPTIONS.

STATIONS	FEEDER	TIME	MIN. OFF.	CAUSE
Clark Mills	D.C.	6 31 P	1	Overload.
Manlius Center	A.C.	6 25 P	2	Canastota outgoing oil switch tripped.

* Form A-14-3-6-07-2m.

ONEIDA RAILWAY COMPANY.
UTICA-SYRACUSE.

DAILY POWER REPORT. D. C. OUTPUT, K. W. H. Sunday - Aug 18. 1907.

STATIONS		1907.	INCREASE DECREASE	REMARKS
CLARKS MILLS SUBSTATION		2832		
VERNON SUBSTATION		3440		
CANASTOTA SUBSTATION		2983		
MANLIUS CENTER SUBSTATION		2922		
TOTALS		12177		
MONTH TO DATE		162917		

HIGH TENSION INPUT-K. W. H.

TOTALS		15460		
MONTH TO DATE		219490		
EFFICIENCY		78.7%		
TEMPERATURE		42°-79°		

DAILY REPORT OF INTERRUPTIONS.

STATIONS	FEEDER	TIME	MIN. OFF.	CAUSE

FORMS SHOWING SUBSTATION OUTPUTS FOR AUG. 16 AND AUG. 18

SUBSTATION LOG SHEETS

The cuts on Plate XXVIII (originals 14 ins. x 25½ ins.) illustrate two log sheets of the Clark Mills substation of the West Shore Railroad for Friday, Aug. 16, and Sunday, Aug. 18, 1907. These log sheets are kept in every substation and are sent to the office in Utica daily and bound as parts of a loose leaf book. The voltage and load records are plotted on the logs in the form of curves, and special occurrences are tabulated also. Wattmeter readings on both the incoming and outgoing circuits are recorded in figures.

On Friday, Aug. 16, single-car trains were in service all day except for a few hours in the morning and afternoon, when two-car trains were operated. The increased load due to this is plainly evident upon the curves. Rotary No. 1 was in service from 7 a. m. to 1 a. m. on Saturday and again at 6 a. m. Saturday, the 24 hours beginning at 7 a. m. Friday. Rotary No. 2 was in service throughout the same period, except that it was shut down at 11:50 p. m. Friday instead of at 1 a. m. the next morning. Between 1 a. m. and 6 a. m. Saturday the line was kept alive by some substation beyond Clark Mills. The d. c. voltage (practically at the third-rail) varied from 595 to 620, the average for the day being about 610, the readings being taken every 15 minutes. The high-tension current passing through the 60,000-volt bus bars at Clark Mills varied during the 24 hours from 3 to 20 amperes. The maximum loads at different substations do not occur at the same time, which explains the occurrence of the transmission line maximum current of 20 amperes at 11:30 a. m. instead of at 5:30 p. m. Friday, the time of maximum load at the Clark Mills substation. The average a. c. line load for the 24 hours was about 9 amperes at 60,000 volts, three phase. The voltage on the a. c. side of the substation rotaries at Clark Mills was held closely at 365 practically the entire day.

The direct current load curve of the substation on 15-minute readings shows an output varying from 0 to 1800 amperes, momentarily in swings and an average of about 400 on swings. The actual load on the station from hour to hour as deduced from the recording wattmeter readings averaged 92 kw throughout the day, with an average maximum of 140 kw between 5 and 6 p. m. It will be seen that the fluctuations are very severe in proportion to the average output of the substation. This arises from the small number of trains at present required to maintain the schedule, four cars being sufficient to hold up the present intervals, although eight cars are operated during hours of heavier traffic. The log shows that the two rotaries divided the day's load almost evenly, the d. c. kw-hour output of No. 1 being 868, and of No. 2, 875, making a total d. c. output from Clark Mills of 1743 kw-hours. The log sheet also shows the time of breaker openings in connection with the different rotaries and tracks.

SUNDAY LOG

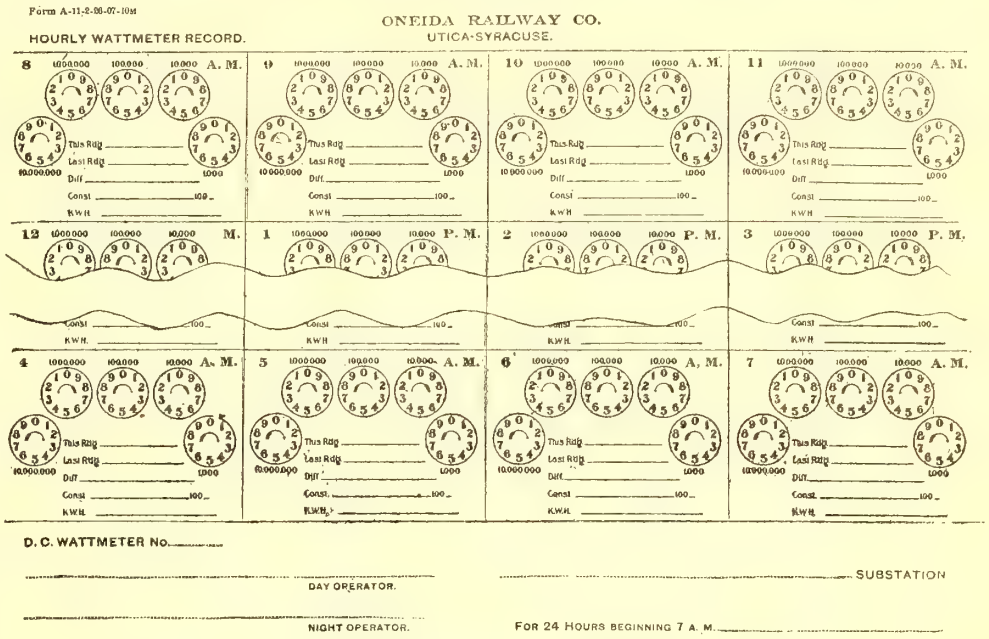
On Sunday, Aug. 18, two-car trains on an hourly schedule were run throughout the day, and the load peaks on maximum swings were very much higher, reaching an extreme of 2000 amperes twice, and exceeding 1750 amperes eight times. The average d. c. load on the substation at Clark Mills during the 19 hours in which it was operated between 7 a. m. Sunday and 7 a. m. Monday, the 19th, was 149 kw, or 62 per cent more than on Friday. The average maximum load on the substation during any hour as determined from the recording wattmeter readings was 200-kw. The average amperes output on swings was about 800. The maximum sustained loads occurred between 9 and 10 a. m.; 1 and 2, and 6 and 9 p. m. Both rotaries were in service throughout the 24 hours, except that between 1 and 6 a. m. Monday the substation was shut down. The rotaries divided the load evenly with 1412 and 1420 kw-hours d. c. output respectively.

The a. c. secondary voltage at Clark Mills varied from 345 to 365 with a well sustained average of 360 during the hours

of machine operation. The high tension 60,000-volt current varied from 4.5 to 20 amperes during the 24 hours, the average being about 11 amperes. The influence of two-car trains on the line as a whole is reflected in the higher and more frequent maximum readings. Direct current voltage was held between 600 and 630 during the day with an average of about 610.

TOTAL SUBSTATION PERFORMANCE

The forms on page 48, original 6½ ins. x 7½ ins., shows outputs of the different substations. These are designed to show the direct current output, the increase or decrease compared with any previous time decided upon, the high tension input per day and for the month, and the interruptions to the service. On Friday, Aug. 16, 1907, the total alternating current input at the substation was 10,450 kw-hours. The d. c. outputs totalled 7645 kw-hours, giving a substation efficiency of 73.2 per cent. The outputs were divided well among the substations, Manlius Center handling the largest load, 2091 kw-hours, and Clark Mills the smallest, 1743 kw-hours. The average d. c. output per substation was 1911 kw-hours. The interruptions to service were slight during the day. The efficiency of the substations to Aug. 17 for the month averaged 73.5 per cent.



FORM FOR RECORDING HOURLY WATTMETER READINGS

WATTMETER READINGS

The hourly wattmeter readings at the substations are taken on a blank 9⅛ ins. x 11¾ ins. herewith, space being provided for the recording of the individual dial readings at each hour of the twenty-four. The exact position of the pointers on the dials are sketched into the dial blanks, space being left for the subtraction of previous readings later. One sheet is used for each wattmeter and the report is signed by both the day and the night operator.

A typical Saturday load was that of Aug. 17, 1907, in which the substation efficiency reached 80.4 per cent. The total a. c. input at substations was 15,370 kw-hours, and the total d. c. output 12,350 kw-hours. The individual substation d. c. outputs to the third-rail were:

Clark Mills,	3074 kw-hours.
Vernon,	3075 kw-hours.
Conastota,	3260 kw-hours.
Manlius Center,	2941 kw-hours.

TRAIN SERVICE

Train service in Utica is handled over the Utica & Mohawk Valley Company's lines, the car movements being locally directed until the electrified section of the West Shore is reached. In Syracuse the Oneida Railway Company directs the movement of the cars. Each train service man is under the rules of the New York Central and the two local companies en route. Crews are not changed en route, and all cars make through runs between Main Street, Utica, and James and Salina Streets, Syracuse. Cars are held in the Utica Park house when not in operation. Transfers are given to connecting cars on all local lines in Syracuse and Utica. The fare from Syracuse to Utica is 75 cents, the round trip costing $1.40. Before the electrified service began, the fares were $1.08 and $2 respectively, so that the reductions by electric service are 32.6 per cent and 30 per cent. No season tickets are sold on the electrified sections, but through tickets originating on the electrified section are sold to all points as in steam railroad days. There are still four daily through trains hauled by steam locomotives and carrying passengers over the electrified section, in addition to the motor car service.

DISTANCES AND RUNNING TIME

The following table shows the distances between stations and the running time of electric trains at present scheduled:

Station.	Miles.	Hours.	Min.
Main Street, Utica	.00	0	0
Genesee and Bleecker Streets.	.41	0	3
Oneida Square	1.16	0	9
West Shore—Genesee Street.	2.26	0	15
New York Mills	3.54	0	19
Clark Mills	8.39	0	30
Hecla	12.18	0	38
Vernon Grade	13.69	0	41
Vernon	17.04	0	48
Sherrill	20.02	0	55
Oneida Castle	22.23	1	00
Wampsville	25.61	1	06
Canastota	27.92	1	10
Sullivan	31.72	1	17
Chittenango	34.13	1	21
Kirkville	38.08	1	28
Manlius Center	40.75	1	33
Eastwood	45.63	1	40
Syracuse Line	46.56	1	43
Oak Street	47.59	1	49
James and Townsend Streets.	48.24	1	53
James and Salina Streets	48.63	1	57

CHARACTER OF SERVICE

Electric train service begins at each end of the line at 6 a. m. and is continued on an hourly schedule both ways until 11 p. m. At present the cars are handled on the telegraph block system while on the West Shore, there being ten stations between Utica and Syracuse. The regular normally operated block signal system used on the main line of the New York Central is shortly to be installed, and when this is in service limited cars will be run between the two cities. As outlined in the June 8 issue of the Street Railway Journal, three classes of service will be given:

1. Limited cars or trains, two stops en route, hourly headway, 1 hr. 28 min. schedule.

2. Local cars or trains, highway stops en route, hourly headway, 1 hr. 58 min. schedule.

3. Through steam service, infrequent passenger, and freights.

The limiteds in class I will cover the West Shore right of way in 1 hour. For local trains there are a possible 39 stops all told aside from railroad crossing stops and two stops at the city line to turn the third-rail shoes up if the cars are inbound and down if they are outbound from the city. The total distance between terminals, including local street railway tracks, is covered in a shorter time than would formerly have appeared to be feasible in view of the urban running involved. Out of 19 half trips timed by the company it was found that in the Utica portion of the route the average number of urban stops was 6 in 2.26 miles, aggregating 90 seconds; and on the local tracks in Syracuse, about 2.5 miles, the average number of stops was 4, aggregating 108 seconds. About 15 minutes are required at each end in running over the urban sections.

CARS

No freight service is electrically handled on the West Shore, and no trailers are operated. The maximum speed of each car is 52 miles per hour, and the maximum grade on this section of the West Shore is 0.57 per cent. The shortest curve is a 3-degree arc. Crouse-Hinds arc headlights are used on the West Shore right of way, but in the city streets the arcs are cut off and incandescents used. No advertisements are allowed in the West Shore cars. The car signs are of the simplest character, the names of the terminal cities being the only designations used. Girder rails are in use in Utica and tram girder rails in Syracuse. Chemical extinguishers, a screwdriver, hammer, wrench, tape, section of cable 25 ft. long, fuses and one spare third-rail shoe are carried on each car. The current per car during acceleration is about 525 amperes, and the rate of acceleration 1.25 miles per hour per second. The usual axes, bars and sledges are carried on the cars; the cars weigh about 38 tons each, and are 48 ft. over all. Graduated release brakes are used on each car.

TRAINMEN

The trainmen required to handle the service number 44 regular and 16 extra men. The men like the West Shore runs better than city service and are selected from experienced employees of the Syracuse and Utica companies. Before the road was electrically operated about three weeks of practice runs were completed under the oversight of a New York Central pilot and experts from the General Electric and Westinghouse companies. The only repairs expected of trainmen on the road are the replacement of fuses, shoe adjustments and air hose replacements when necessary. The West Shore can run any steam trains it desires over the line as long as they do not interfere with the service of the Oneida company or handle local passenger business. Trunks, mail and other baggage are not as yet handled by the motor cars, with the exception of one baggage car, which carries National Express matter. No special switch is required for slow speed city running. Car crews get correct time from Western Union clocks at the ends of their runs. Inside the cities the cars are run as double headers. In case the dog holding the third-rail shoe in place gets out of adjustment, the shoe automatically returns to its vertical position.

INSPECTION AND MAINTENANCE

Each car in service makes about 250 miles per day. The mileage is figured from the conductors' trip reports by the auditing department of the Oneida company. At each end of the route and after every trip each motor car has a layover of one hour. Air brakes, trucks, control parts and shoes are inspected then, and an inspector is constantly on duty for this purpose. The repairs so far have been running repairs only, with very light maintenance. The Utica & Mohawk Valley organization handles the shop repairs in detail, as outlined before. Minor cleaning is done at the car house at the end of each trip. About one week is required before a new car runs smoothly. The gage of the third-rail shoes is tested at the end of every trip. No inter-terminal inspection takes place. Spare armatures, control, air brake and truck parts are kept in the shops to enable a car to be put back in service promptly if it is needed. Very little wear of rolling stock has thus far occurred, and it is too early to present any life records. Axle and armature bearings on the cars are lubricated every two weeks.

* Form A-43-6-13-07-10m

Oneida Railway Company.

DETENTION REPORT.

Flagman will report on this blank all detentions to his car, giving the date, train number, car number, time, place, cause, and the name of the motorman and the name of the conductor. Use a separate sheet for each detention.

DATE_____ 190____

TRAIN NO._____ CAR NO._____

DELAYED FROM_____ M. TO_____ M.

PLACE_____

CAUSE_____

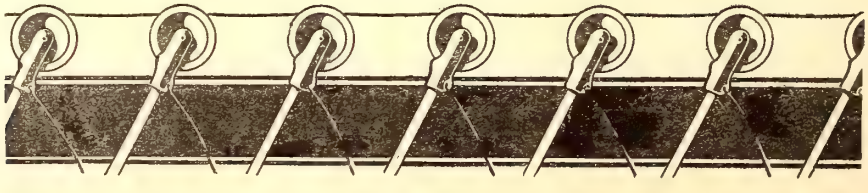
(Give reason for detention as fully as possible).

CONDUCTOR_____

MOTORMAN_____

FLAGMAN_____

DETENTION REPORT USED ON THE WEST SHORE RAILROAD

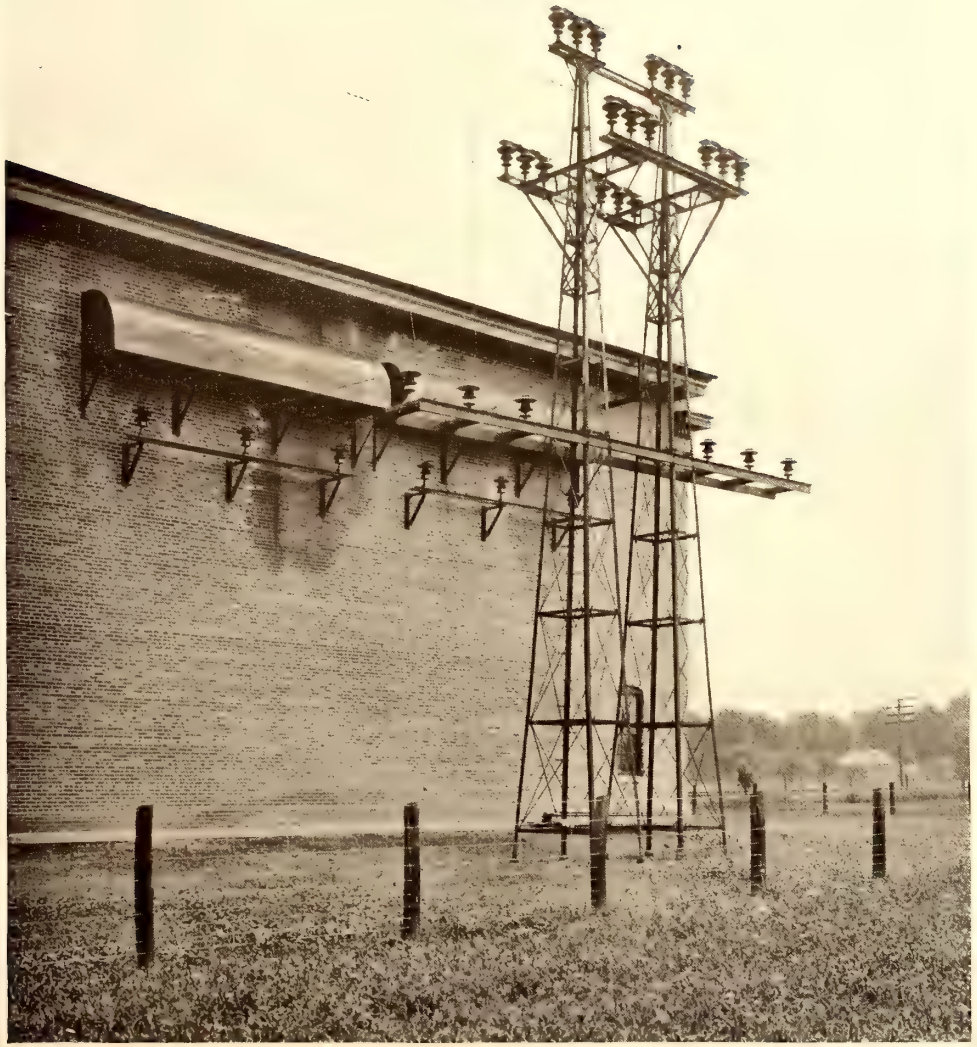




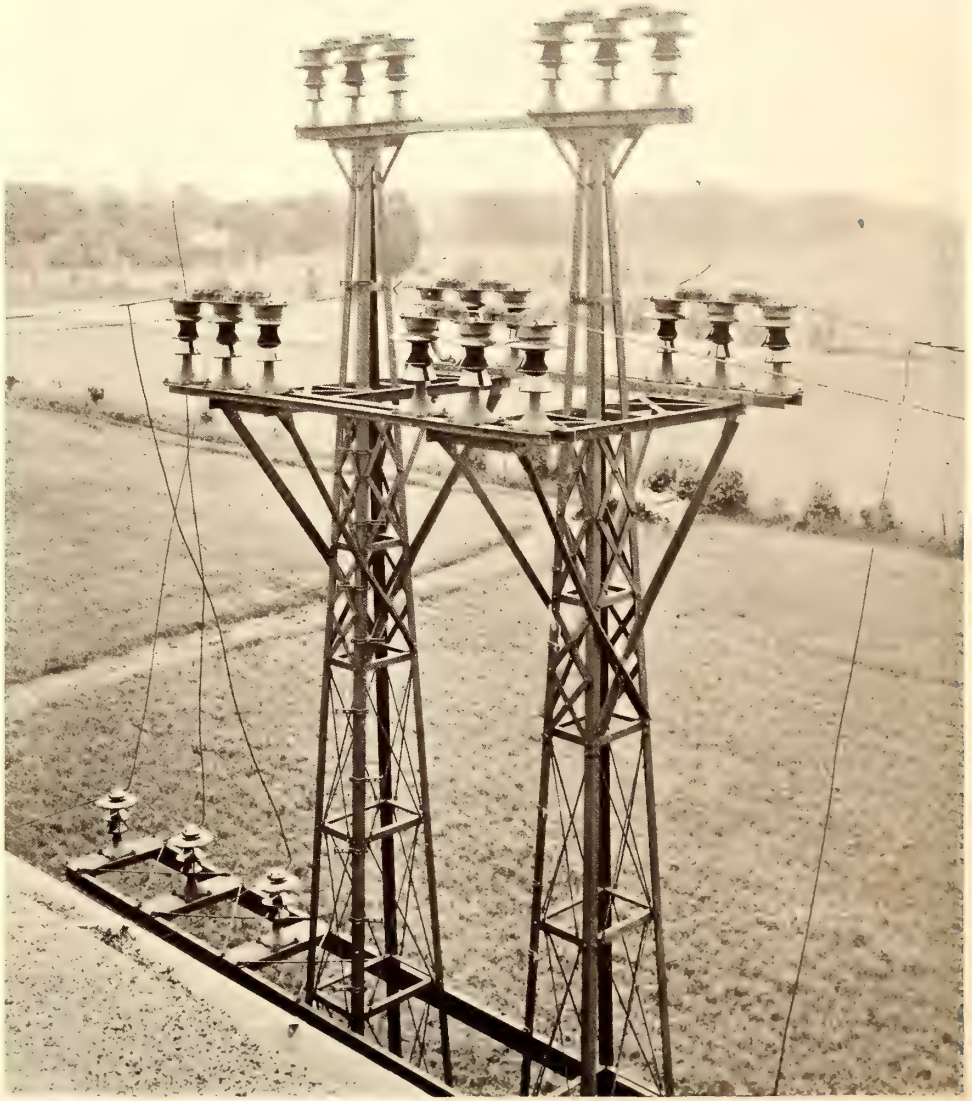
VIEW OF RAILWAY COMPANY'S TRANSMISSION LINE NEAR VERONA, WEST SHORE RAILROAD



VIEW OF HUDSON RIVER POWER COMPANY'S TRANSMISSION LINE NEAR CLARK'S MILLS



BACK OF CLARK'S MILLS SUB-STATION, SHOWING TRANSMISSION TOWER AND ARRANGEMENT OF INCOMING AND OUTGOING FEEDERS, WEST SHORE RAILROAD



TOP OF TRANSMISSION POLE AT SUB-STATION, WEST SHORE RAILROAD



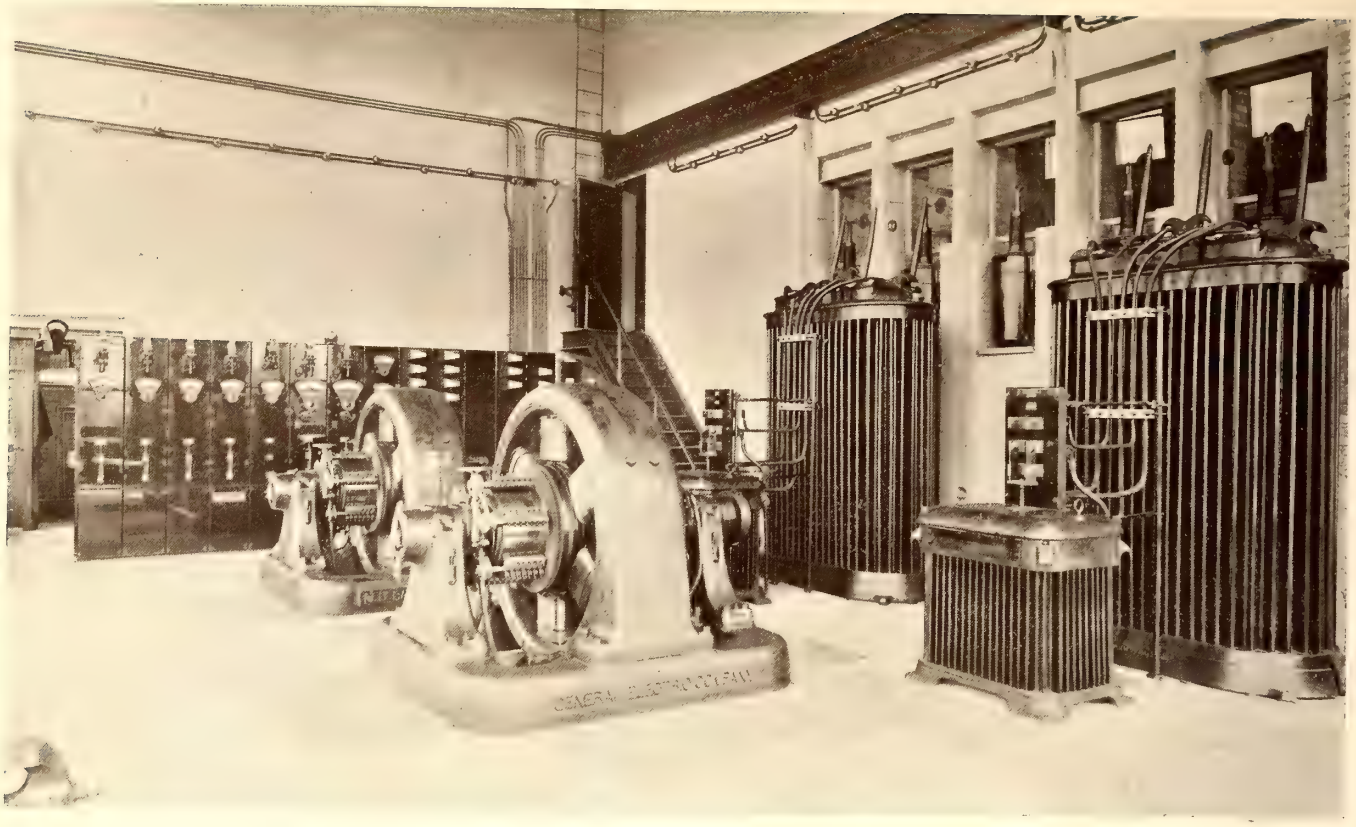
VIEW TAKEN IN HIGH-TENSION COMPARTMENT, SHOWING CHOKE COILS AND TOP OF LIGHTNING ARRESTERS, WEST SHORE RAILROAD



SECOND FLOOR OF HIGH TENSION COMPARTMENT, CLARK'S MILLS SUB-STATION, WEST SHORE RAILROAD



BATTERY OF CHLORIDE ACCUMULATORS FOR OPERATING OIL SWITCHES IN CLARK'S MILLS SUB-STATION, WEST SHORE RAILROAD



INTERIOR OF CLARK'S MILLS SUB-STATION, WEST SHORE RAILROAD



EXTERIOR OF CLARK'S MILLS SUB-STATION, WEST SHORE RAILROAD



WEST SHORE TRACKS WITH THIRD-RAIL AND FIBRE PROTECTION



TELL-TALE USED FOR GAGING TRAINS BEFORE PASSING ON TO THIRD-RAIL SECTIONS, WEST SHORE RAILROAD



EXTERIOR OF CLARK'S MILLS SUBSTATION



THIRD-RAIL ON TANGENT WITH WOODEN PROTECTION, SHOWING FORM OF JUMPER USED



INTERIOR OF STANDARD PASSENGER MOTOR CAR, WEST SHORE RAILROAD



TRAIN OF THREE MOTOR CARS, EACH WITH FOUR-MOTOR EQUIPMENT, WEST SHORE RAILROAD



JUNCTION OF TRACKS OF WEST SHORE RAILROAD AND UTICA CITY TRACKS



VIEW OF WEST SHORE TRACKS, SHOWING TYPICAL GRADE CROSSING

Plate XXVIII

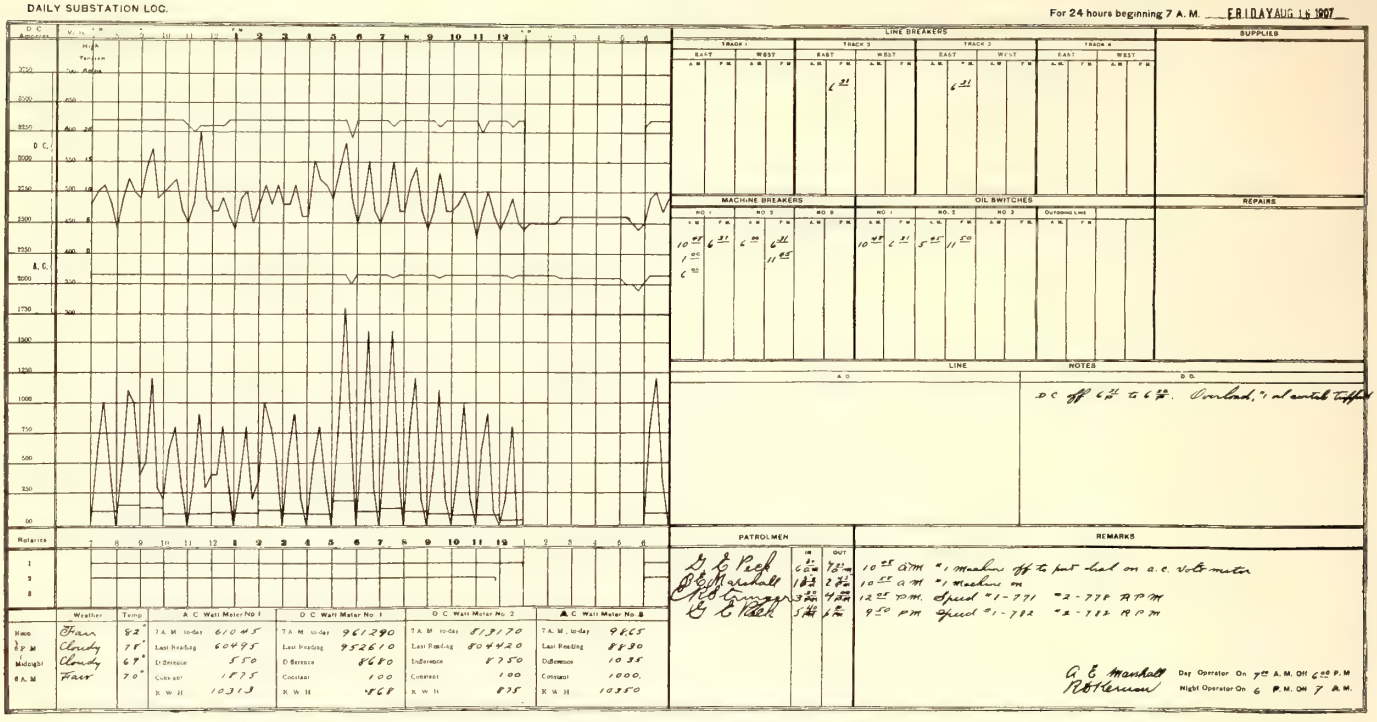
ONEIDA RAILWAY CO.

UTICA-SYRACUSE

CLARK MILLS Substation

DAILY SUBSTATION LOG.

For 24 hours beginning 7 A. M. FRIDAY AUG 16 1907



LOG SHEET FOR CLARK'S MILLS SUBSTATION FOR FRIDAY, AUG. 16, 1907

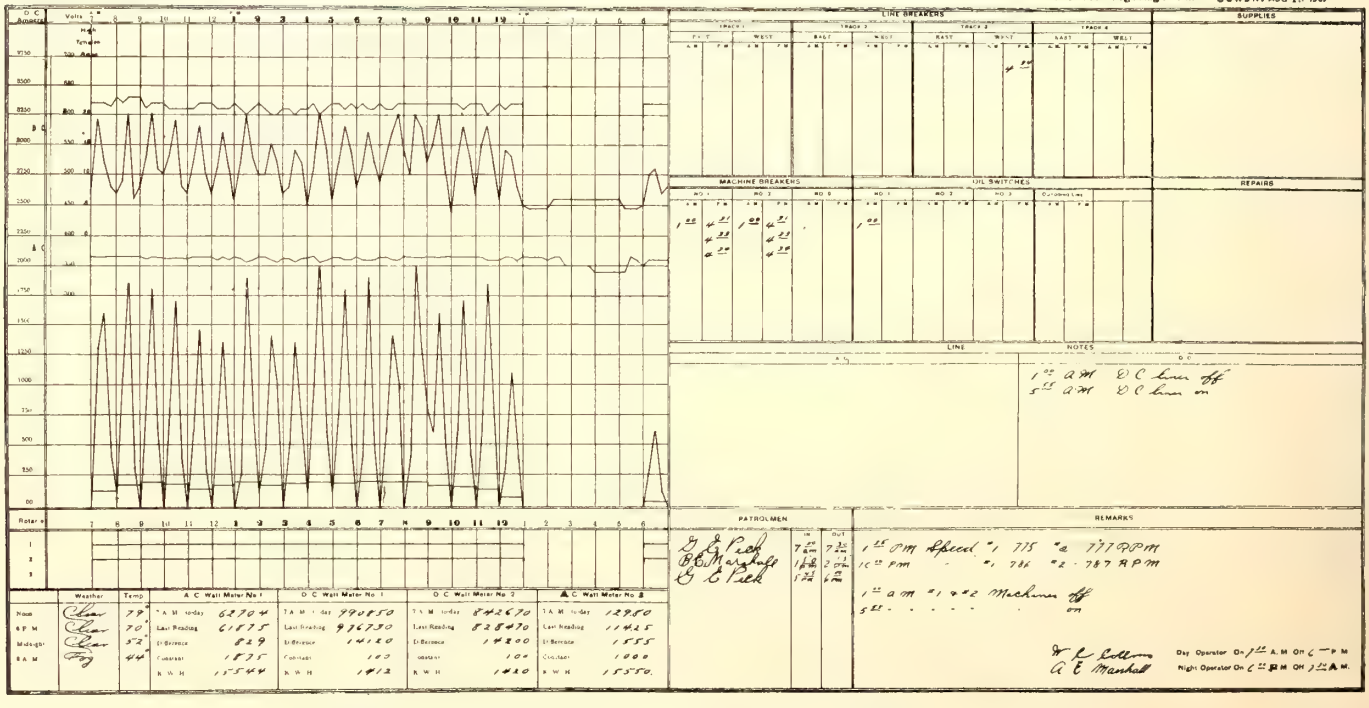
ONEIDA RAILWAY CO.

UTICA-SYRACUSE

CLARK MILLS Substation

DAILY SUBSTATION LOG

For 24 hours beginning 7 A. M. SUNDAY AUG 18 1907



LOG SHEET FOR CLARK'S MILLS SUBSTATION FOR SUNDAY, AUG. 18, 1907

OPERATING FEATURES OF THE LONG ISLAND CITY POWER STATION OF THE PENNSYLVANIA TUNNEL AND TERMINAL RAILROAD CO.

This station was described in detail in the Street Railway Journal of April 7, 1906, and in the present article particulars of the construction of the station are given only to the extent required for an understanding of the operating features.

The station is operated by the Pennsylvania Tunnel & Terminal Railroad Company, and eventually a large percentage of its output will be used in hauling trains through the tunnels now being completed by the company between New Jersey and Long Island. Since its completion about two years ago the output of the station has been purchased by the Long Island Railroad for operating the electrified portions of this system. Cost figures are not given for the reason that the station is being operated at only about one-fifth of its ultimate capacity, and any statistics given under these conditions would be without material significance.

The present building is designed for six 5500-kw generators, of which three are now installed. The power consumption of the Long Island Railroad, however, necessitates under normal conditions the use of only one turbine, but occasionally two are required. It will be readily understood that the labor and fuel cost per kilowatt is much greater than it will be when the station is operated at nearer its full capacity and when peaks and sudden fluctuations of load are smoothed out.

The station is in charge of C. S. Krick, superintendent of the Pennsylvania Tunnel & Terminal Railroad Company, and its operation is under the immediate supervision of F. G. Clark, superintendent of the station.

COAL

Coal for operating the station, generally known as mountain coal, is brought by rail from Pennsylvania to South Amboy, N. J., and is there loaded into barges of 850 gross tons capacity, which are towed across New York Bay and up East River to the power station.

The average analysis of the coal shows:

Moisture	1.16	per cent
Volatile matter	18.06	"
Fixed carbon	70.33	"
Ash	10.45	"
Total	100.00	per cent
Sulphur	1.69	"
Theoretical evaporation water per pound of coal	14.71	lbs.

The coal, it may be noted, is low in heat units and is high in ash and sulphur. Other grades higher in heat units have been tried, but these were objectionable because they contained an excessive amount of volatile matter and were consequently smoke producers.

A complete analysis is made once each month in the testing laboratories of the Pennsylvania Railroad Company at Altoona, Pa. In selecting a sample for analysis about one ton of coal is spread out on the boiler room floor and quartered. A sample is taken from each quarter and these samples are mixed together and quartered again. The process is continued until a representative 5-lb. sample is obtained. Calorimeter tests and carbon and ash tests are made twice each month in the station testing laboratories by means of a Parr calorimeter.

COAL HANDLING

The coal handling plant was fully described in the article previously referred to. A hoisting tower on the end of the dock and about 600 ft. distant from the station is connected to the station by a steel bridge built 107 ft. above the dock and at the height of the top of the coal bunkers. This bridge is provided with a cable railway which makes a complete circuit over the coal bunkers and around the tower. Three steam engines located in the hoisting tower about 25 ft. above the dock and supplied with steam from the power house boilers are employed to handle the two-ton Haywood "clam shell" bucket in which the coal is elevated from the barges. An engine to drive the coal crusher and another for operating the cable railway are installed in a closed compartment at the top of the tower.

Four men are required to operate the coal handling apparatus. Two are located in the barge being unloaded, a third stationed in the tower about 25 ft. above the dock operates the biter, trolley and hoisting engines which handle the bucket and a fourth man stationed at the top of the tower fills the cable cars.

From the "clam shell" bucket the coal is dropped in a small hopper. The fine coal passes through screens into a receiving hopper, while the larger lumps are run through a crusher. The man stationed at the top of the tower loads the cars from this receiving hopper. The cars are automatically dumped at any predetermined point over the bunkers and when empty continue around the loop track to the loading tower. The plant has a capacity of about 100 tons of coal per hour, but is operated at about a 75-ton per hour rate, as the reduced speed reduces the maintenance considerably. Usually about 3000 tons, or a three weeks' supply, of coal is stored in the bunkers. No special precautions are taken to prevent fires in the bunkers and practically no trouble has been experienced from this source. The coal is watched and whenever any is found to be heating it is used as quickly as possible. During the two years the station has been in operation the maintenance charges on the coal handling plant have been about the same as with other coal-handling systems. Repairs have been confined largely to the renewal of cables, which have a life of about 100,000 tons.

BOILER ROOM PRACTICE

The boiler installation consists of thirty-two Babcock & Wilcox water-tube boilers, sixteen boilers being installed on each of the two boiler room floors. All of the furnaces are fitted with Roney stokers driven by Westinghouse engines, there being one engine to eight stokers. The ashes from the furnaces on both boiler decks fall into chutes having outlets in the basement immediately over a track upon which small trucks carrying ash buckets are run.

Green economizers are installed in the rear of the boilers. The flue connections are such that all of the economizers may be thrown in multiple or they may be used in connection with only the boiler behind which they are installed. The gases are finally discharged into two steel stacks.

FIRING METHODS

With the present load more than fifteen boilers are never required, and it is the usual practice to operate the boilers on one floor for about six months and then to change to the other deck. The boilers on the idle deck are left entirely cool. In winter the lower deck is operated because of the danger of freezing to which the lower boilers would otherwise be subjected.

The boilers are usually fired with an .18 to .20 in. draft on the individual hand regulated dampers. There are in addition automatic stack dampers for controlling sudden fluctuations. Under a .20-in. draft the boilers are fired at about 75 per cent of their normal rating, which has been found to be most economical. A boiler fired at this rate is termed "active" and about 2000 lbs. of coal per hour are burned in the furnaces. When a peak load requires the boilers to be "forced" the dampers are adjusted to about a .5-in. draft, and at this setting approximately 3000 lbs. of coal are consumed per hour.

A "reserve" boiler is one kept in readiness for emergencies. The damper is adjusted to about .1-in. draft and about 1000 lbs. of coal are consumed per hour. A boiler held in reserve makes practically no steam, but it can be made active on a moment's notice. When the service of a boiler is not required for six hours or more it is "banked." The draft is shut off so that steam pressure is not kept up. About 3000 lbs. of coal are required to bank a boiler; no additional coal is needed for 36 hours, and with no leakage the period will be longer.

The fires are generally cleaned before the boilers are banked or reserved, and those of an active boiler are cleaned once in eight hours and those of a forced boiler once in four hours. The interval of cleaning depends, of course, on the character of the coal. One-half hour's time of one man is required to clean a fire and during this cleaning the boiler is out of service.

Soot is steamed off the tubes with the boilers in service twice a week, and at intervals of two to three months they are taken out of service and the tubes are cleaned thoroughly of soot. It is the general practice to blow the boilers down one gage once or twice a day. Attempt is made to clean the inside of the tubes when the scale or incrustation becomes 1/32 in. thick, and they are accordingly cleaned at about six months intervals. With untreated make-up water it would be necessary to clean them out about every two months.

The boilers are built for 200 lbs. pressure, but because of the small load they are operated at about 185 lbs. With high pressure at the present light load the quantity of steam would be less than required for proper operation of the valves of the turbine and accordingly the quantity is increased by decreasing the pressure. Steam leaving the boilers at normal load at 150 degs. superheat reaches the turbines at a superheat of about 125 degs. Saturated steam only is supplied to the auxiliary apparatus, but changes in the piping are contemplated which will permit all engines to be supplied with superheated steam.

FEED WATER

Fresh water is obtained from the Citizens Water Company, of Long Island City, and under present operating conditions about 30 per cent of the total used in the boilers is make-up water. The excessive amount is due primarily to the light load on the station. The auxiliary apparatus, a great portion of which exhausts into a closed heater, takes almost as much steam at half as at full load on the turbine. Arrangements are being made to use an open heater only, and this will decrease considerably the per cent of make-up water required.

The water is treated with about 4 lbs. of soda ash per 1000 gallons. The chemical is first dissolved by adding water and then boiling the mixture with steam. The solution is then allowed to mix with the make-up water in the proper proportion. The treated make-up water is heated to about 212 degs. in the Cochrane open heater and is then mixed with water from the turbine condenser hot wells at about 90 degs. The mixture enters the economizers from the closed heater at approximately 200 degs. and is fed into the boilers at an average of 265 degs. Saline tests are made on the hot well water at frequent intervals and water showing 20 grains of salt per gallon is regarded bad.

The boiler feed pumps are provided with a regulator which keeps the pressure in the feed mains fairly constant and at from 10 to 15 lbs. above the boiler pressure. The water tender regulates the feed valves of the different boilers by hand.

ECONOMIZERS

The economizers are usually operated in multiple, or in other words, flue gases are distributed through all of those on one boiler room deck irrespective of whether or not all the boilers are in service. Approximately 5 hp is required to drive the scrapers of each economizer, there being one economizer to two boilers. The maintenance on the economizers has been almost negligible. The water entering them is at a high temperature (about 200 degs.), and as there is no sweating of the pipes the scrapers remove practically all the soot deposited. The economizers are blown down each day and at intervals of a few months the soot is removed through doors provided for this purpose. They have a negligible throttling effect on the gases, the small difference in draft on the sides being due principally to the fall in temperature of the gases.

FLUE GASES

With normal load the flue gases leave the boilers at about 450 degs. When the boilers are forced the temperature rises to 600 or 700 degs. and with boilers reserved to about 350 degs. The drop of temperature in the economizer is 75 to 100 degs. A CO_2 recorder with connections to all of the boiler flues is installed in the boiler room. Gases from active boilers show about 15 per cent CO_2. Before cleaning the fires the percentage goes as low as 12, and with reserved boilers it is about 16.

TURBINE AUXILIARIES

Condenser water is obtained through an intake flume terminating at a point under the dock opposite the station. The flume is protected by two sets of screens of No. 10 gage copper wire, ½-in. mesh, which are held in vertical guides, there being three screens placed one above another in each set. The frames holding the screens are pulled up and cleaned twice each week, this work requiring about two hours' time of two men. The intake flume is provided with a rack for protection from ice and a connection has been provided from the overflow so that warm water may be run into the screen chambers in the event of ice blocking it, but no occasion has yet arisen for the use of this connection.

Water is supplied to each condenser by a 24-in. double suction centrifugal pump. Usually the pumps lift the water without any priming, but an injector is provided for use when necessary. In starting the pumps work against a 15-lb. head, but when once the condensers are filled with water the siphon effect reduces the working head to about 5 lbs. There is a very slight corroding effect noticeable on the pumps due to the salt water.

CONDENSERS

The turbine condensers are of the Alberger type, the cooling surface consisting of No. 18 S. W. G., 1-in. seamless drawn brass tubes. During the summer season the average temperature of the condenser water is about 60, in winter it is approximately 50. The vacuum maintained is in summer 28½ ins. and in winter 28¾ ins.

The condensers are tested for defective tubes whenever the saline tests of the hot well water indicate them by filling the condensers with water and noting the leakage. Wood plugs are kept on hand and when the leakage is excessive the condenser is opened up and the tubes plugged. After several tubes have been plugged in this manner and the cooling surface is appreciably lessened, the tubes are replaced. Salt water has not appreciably affected the condensers. Gases in the condensed water have corroded the interior of the cast iron centrifugal hot well pumps considerably, and these are to be replaced by bronze pumps.

CARE OF AUXILIARY APPARATUS

Auxiliary engines and pumps are tested at comparatively frequent intervals by taking indicator cards. If nothing transpires during a year's time to necessitate them being taken apart the working parts are then opened up and examined.

OILING SYSTEMS

Quite an extensive oiling system is provided for supplying bearing oil to the turbines. A storage tank 8 ft. in diameter and 14 ft. 8 ins. deep is located in the upper portion of the boiler room and from this the oil flows by gravity through the machine bearings and through coil coolers to filters. Two duplex piston pumps each with a capacity for 200 gals. per minute return the oil to the elevated tanks. All of the oil piping is of brass.

The system usually contains 7500 gals. of oil, and about 4000 gals. per hour pass through each operating turbine. The loss of oil due to the turbines is about one gallon per day per turbine operated. In passing through the bearings the oil is heated about 2 degs. and it is afterwards cooled by allowing it to come in contact with pipes containing the make-up water fresh from the city mains.

The oil is filtered through canton flannel bags approximately 1 ft. long and 4 ins. in diameter, of which about 400 are suspended from the filter tanks. The bags are washed each week in benzine or gasoline and are then wrung out with an ordinary clothes wringer. One man spends all of his time cleaning the filters and caring for the oil pumps. As the oil is entirely enclosed in the pipe system and is never open to the air except in the filters, no dirt gets into it, and practically all that the filters remove are the crushed and carbonized particles.

The oil employed is a much cheaper grade than that recommended by the turbine manufacturers. In selecting it specifications are sent out containing requirements for viscosity, flash test and other qualities and the bids sent in are accompanied by samples which are tested and analyzed in the Pennsylvania testing plant at Altoona. The oil must be a heavy one with hard globules and it must show a viscosity test of about 140 and a flash test of about 400.

CRANK CASE OIL

A separate system with two storage tanks is provided for the crank case oil used in the Westinghouse engines driving the stokers and the large centrifugal pumps. When the oil gets old it is separated out and is used to lubricate sheaves and other working parts which do not require a better grade of oil. Specifications for the crank case oil require that it be fairly heavy and that it emulsify rapidly.

TURBINE PRACTICE

The maintenance charges on the turbines have been very much less than would have been required on a reciprocating plant of the same capacity. The only repair parts carried in stock are one primary poppet valve complete, ready to put in the turbine, and a few pounds each of the different kinds of blading. The repairs to the governing mechanism have not been nearly as great as for a reciprocating engine and the repairs to the poppet valve mechanism have been less than are usually required by a Corliss valve mechanism. Very little trouble has been experienced with the blading.. The part requiring greatest attention is the governor mechanism, which is cleaned thoroughly once each week and is overhauled two or three times a day. The generators are cleaned after every shut down by blowing them out with compressed air and wiping them off with cheese cloth.

The method of excitation usually employed protects the generators against overloads. The exciter is driven by an induction motor supplied with current from the turbine generators and an overload on these lowers the voltage and decreases the power factor to such an extent that the motor slows down and reduces the excitation of the generator. This, of course, causes a further drop in the voltage. When the generator voltage on a short circuit drops below 5000 volts for an appreciable length of time the excitation is destroyed.

A Tirril regulator in the exciter field holds the voltage fairly constant, there being a variation of not more than 100 or 200 volts. In addition to the motor driven exciter, a steam driven generator or a storage battery may be employed. The load on the station is of a fluctuating character, the momentary loads running up to 16,000 kw. Fluctuations up to 12,000 kw are carried on one machine. On ordinary days the peaks are below this and the average load is usually considerably below 6000 kw, the most economical loading for one turbine.

To warm up a cold turbine properly and get it started would require two or three hours, but leakage of the throttle valve is usually sufficient to keep the machine warm so that in an emergency a turbine can be started and the load thrown on it in one or two minutes. With the turbine cold there would be no hesitancy in an emergency in getting a machine under load in twenty minutes. If valve leakage is not sufficient to keep the reserve turbine warm the pilot valve is opened sufficiently.

THE SWITCHBOARD

The switchboard is located in an enclosed compartment about 25 ft. above the turbine room floor. A small overhanging balcony permits a view of the floor, but while at the board the switchboard operator is in such a position that he cannot see the turbine room or communicate directly with the engineer. Operating signals are made by means of a special signaling apparatus. A signal device on the wall of the turbine room is connected to buttons on the switchboard operator's desk. Likewise signals on the switchboard are connected to buttons on a small board within easy reach of the throttle valve of each turbine. Pressing the different buttons illuminates the proper signals. Signals to start another turbine usually originate with the switchboard operator, but in case the engineer desires to shut down a turbine for any reason he may give the signal. Quite an elaborate code of signals has been gotten up. These care for practically every emergency that may arise. However, should it be desired to communicate directly with the engineer or any one on the turbine room floor a gong and a whistle are provided and a code of signals established whereby any one in the operating room may be called to a telephone booth on the turbine room floor.

OPERATING SIGNALS

On the south wall of the turbine room there is a general signal, a synchroscope and an air whistle electrically controlled. Opposite each turbine there is an opal globe, inside of which is a red, a white and a green lamp, and on a bracket outside of the globe a plain incandescent lamp. Near the main throttle of each turbine is a switchbox having four signals to the operating room and a gong push button for attracting the attention of the operator. The red, white and green lamps within the opal globe are used to denote the position of the weight upon the governor control of the turbine. The red lamp signifies speeding, the white lamp dead center and the green lamp slowing. These signals are pilot indications of the position of the governor control weight, which is controlled from the operating room.

The other apparatus is to be used as follows:

1. To Cut in Generator.

Operator.	Engineer.
(The number of generator) IN-Whistle.	(If O.K.) from the corresponding generator IN-Gong.

When turbine is ready for load the engineer sounds the gong again. The operator connects synchroscope and synchronizing lamp and when switched in parallel disconnects synchroscope and synchronizing lamp, signaling O.K.

2. To Cut out Generator.

Operator.	Engineer.
(The number of generator) OUT-Whistle.	(If O.K.) from the corresponding generator OUT-Gong.

Operator connects synchroscope and synchronizing lamp.
When the generator is cut out synchroscope commences to revolve and synchronizing lamp to pulsate.
Operator signals O.K.-Whistle and disconnects synchroscope and lamp.
Engineer signals O.K.-Gong.
All signals disconnected.

3. To Cut in Turbine.

Engineer.	Operator.
From Turbine, IN-Gong.	From corresponding generator, IN (if O.K.)
Operation then continues as in first case.	

4. To Cut out Turbine.

Engineer.	Operator.
From turbine, OUT-Gong.	From corresponding generator, OUT (If O.K.)
The operation then continues as in second case.	

5. To Change Over.

First and second or third and fourth to be followed in sequence, depending upon whether the change is made from the operating room or from the turbine room. In case of trouble of such a nature as to require one unit to be cut out before the other is cut in, the operator or the engineer will show both signals as (number of generator)—OUT (number of generator)—IN and give long blast of whistle or ring gong rapidly to call attention to the signals displayed.

6. To Cut in Exciter.

Operator.	Engineer.
(Number of exciter) IN-Whistle.	Brings exciter up to speed, when ready signals O.K.-Gong; from No. 1 Turbine.
Operator cuts in and signals O.K.	
All signals disconnected.	

7. To Cut out Exciter.

Operator.	Engineer.
(Number of exciter) OUT-Whistle.	O.K.-Gong; from No. 1 Turbine.
When exciter is cut out operator signals O.K.	
All signals disconnected.	

8. Stand-By Signals for Engineers.

Operator.	Engineer.
S.B.—(Number of generator) Whistle.	S.B.-Gong.
When over	Engineer signals O.K.-Gong.
Operator signals O.K.-Whistle.	
All signals disconnected.	

9. Stand-By Signals for Operators.

Engineer.	Operator.
From turbine, S.B.-Gong.	Number of generator, S.B.-Whistle.
When over.	
Engineer signals O.K.-Gong.	Operator signals O.K.-Whistle.
All signals disconnected.	

10. When whistle is given one long blast, or gong is sounded several times rapidly it is to convey the meaning that the operation, whether a single or a double one, is to be performed as quickly as possible.

To insure familiarity with the signals, the operating force goes through the complete set every few days in the same manner as when using the signals.

In starting a turbine the fields are built up gradually to full voltage after the machine has attained full speed. The generators are then synchronized and the main generator switch is thrown in. This switch is so wired that it cannot be closed until the synchronizing plug has been inserted into its socket in the operating board. In cutting out a machine the load is taken off the generator by reducing the field excitation and then the main switch is opened. Afterward the fields are cut out. With the fields out a turbine will continue to revolve about 45 minutes before coming to a standstill, but it will stop in about ten minutes with the fields excited.

The switchboard operator gets his orders to cut current off or to throw current on the high tension lines from the substation operator at Woodhaven Junction. He does not, however, change the switches until he is assured that the person giving the order has the authority to do so.

CARE OF SWITCHBOARD

The switchboard proper is wiped off two or three times a day and every three or four months it is given a coat of lacquer. The high tension switches are inspected two or three times a week, and in addition after every blow-out they are gone over carefully. Inspections include trying the switches to see that they work properly, and in going over the link motion and oiling all working parts. Once each week the contacts are inspected.

CALIBRATING INSTRUMENTS

The electrical department is provided with a testing board and precision ammeters, wattmeters and voltmeters. Some of the switchboard instruments are tested each month and the integrating wattmeters are calibrated about once in two months. In calibrating these wattmeters they are removed from the switchboard and the work is done at the testing board. They are adjusted to about ½ per cent accuracy at full load and about 1 per cent at half load.

STORAGE BATTERY

A storage battery consisting of 110 chloride cells with a discharge rate of 366 amps. for one hour is installed in the engine room basement. It was installed for operating the distant controlled switches, and for excitation and lighting in emergencies, and is controlled from the main switchboard. Usually it is floated across the lighting bus and it is generally employed to excite the first turbine started after the station has been completely shut down. In an emergency the battery would continue to excite one generator for about six hours, as about 100 amps. is required fully to excite each machine. The battery is inspected and cared for according to the standard directions of the manufacturers.

REPAIR METHODS

The power house is provided with a well equipped machine shop which occupies the gallery immediately over the switchboard gallery. It contains one of each of the following tools:

48 in. radial drill,
13 in. single spindle drill,

20 in. Bock geared shaper,
30 in. x 30 in. x 8 ft. planer,
16 in. x 8 ft. engine lathe,
11 in. x 14 in. speed lathe,
30 in. x 16 ft. engine lathe,
⅜ in. to 2 in. bolt cutter,
2-ton portable crane hoist,
2½ in. x 14 in. water tool grinder,
2½ in. x 18 in. dry tool grinder,
grindstone and hacksaw.

In addition there is located in the boiler room basement a blacksmith shop and a pipe cutting and threading machine capable of handling pipe up to 18 ins. in diameter. The machine shop was fitted up to care for the contemplated power station of the operating company in New Jersey as well. A foreman machinist has charge of the shop and of general repairs. Altogether thirteen men are employed in the repair department.

STORE-ROOM PRACTICE

A well equipped store room occupies a portion of the top gallery adjacent to the machine shop. Pipe fittings, packing and duplicate parts of all apparatus likely to get out of order are kept in stock. In addition all tools are kept in the store room and these are checked out only on a written order from the man in charge of the work for which they are required. A system of records in use in the store room has a card for every object and every kind of material in the department. Records of materials issued and materials received are kept on the cards, so that an inspection of the card shows the amount of material or supplies on hand. It is the intention to carry a two months' supply of materials.

DISTINGUISHING PIPING SYSTEMS

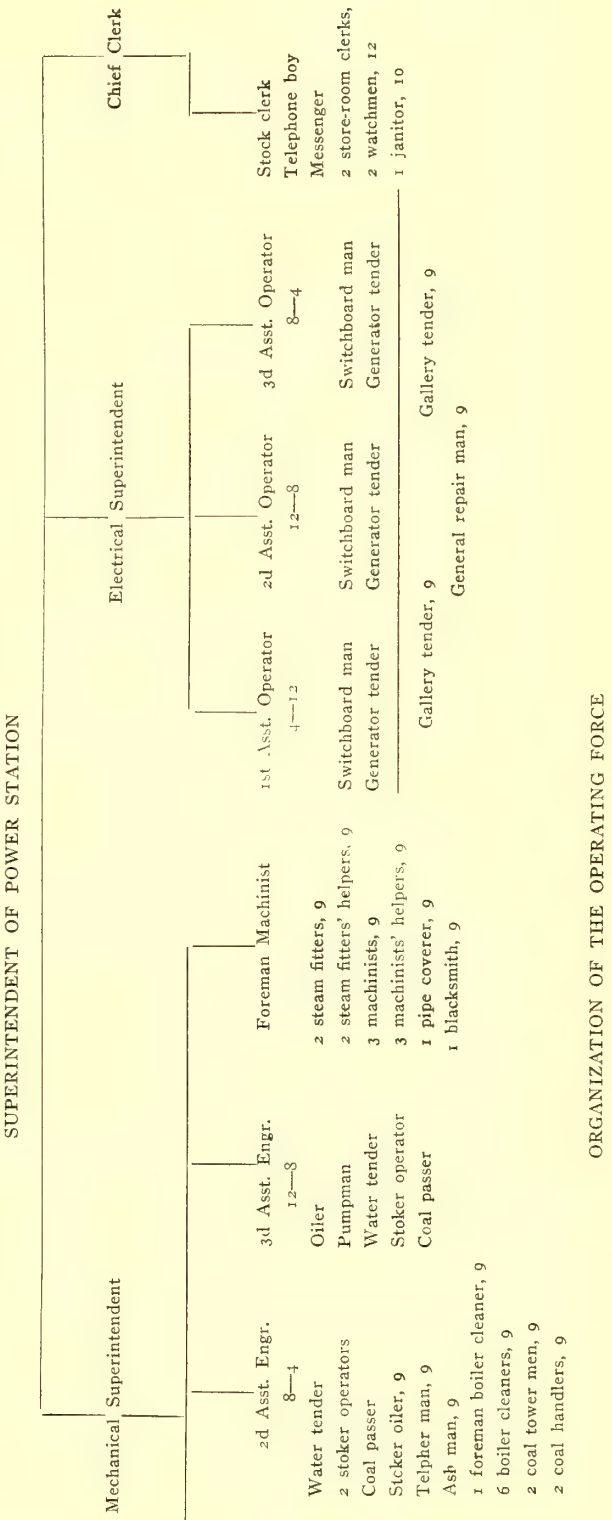
So many systems of piping are carried throughout the station that a means of readily identifying the different ones has been found of considerable convenience. A schedule of colors has been devised by the aid of which any pipe is readily identified as being a part of any system. All the pipe covers on the pipes are painted to correspond with the colors as given on a chart, posted at convenient points around the station.

PIPE COLORS

1. White—High pressure steam lines.
2. Red—Drips from superheated steam lines, including Holly system and Holly connections to boilers.
3. Red with black striping—Drips from saturated steam lines, including Holly system and connections to header.
4. Yellow—Exhaust from all auxiliary apparatus and low pressure drip pipes.
5. Black—Boiler feed pipes from feed pipes to boiler drums, closed heaters, open heaters, boiler drum heads, flues and economizer casings.
6. Blue—All water pipes other than feed pipes from pumps to boilers and fire pumps.
7. Structural—Fire protection system.
8. Maroon—Blow-off piping.
9. Green—Air piping.
10. Slate—Crank case oil piping between engines and separators.
11. Brass not painted—All oil piping other than crank case oil piping between engines and separators.

ORGANIZATION OF OPERATING FORCE

The organization of the operating force and the number of men usually employed are shown in the diagram. The number of hours a day the men in each position work is shown by the figures following the position.



ORGANIZATION OF THE OPERATING FORCE

.....to..... ..... trick 190

LONG ISLAND POWER STATION

BOILER LOG

HOURS FROM BEGINNING OF TRICK	1	2	3	4	5	6	7	8	TOTAL
BOILERS IN COMMISSION									
" " SERVICE									
ACTIVE BOILER-HOURS									
RESERVE " "									
BANKED " "									
TOTAL SERVICE HOURS									
HARD COAL USED—TONS OF 2000 LBS									
SOFT " " " " " "									
TOTAL COAL USED—TONS OF 2000 LBS.									
ASHES REMOVED—CARLOADS									
STOKER ENGINES IN SERVICE									
ECONOMIZERS									
DRAUGHT IN STACK No. 1									
" " " No. 2									
AVERAGE FURNACE DRAUGHT									
BOILER PRESSURE									
FEED PUMPS IN SERVICE									
HOUSE " " "									
COOLING " " "									
TEST " " "									
PRIMARY HEATER IN SERVICE									
SECONDARY " " "									
TEMPERATURES									
MONTAUK WATER									
OUTLET PRIMARY HEATER									
HOT WELL HEADER									
INLET AUXILIARY HEATERS—AVERAGE									
OUTLET " " "									
INLET ECONOMIZERS "									
OUTLET " "									

BOILERS IN COMMISSION—NOS. .....

" " SERVICE " .....

	DELIVERING TO	BEGINNING	END	AMOUNT USED
WATER METER No. 1				
" No. 2				
" No. 3				
" No. 4				
" No. 5				

	WATER LEVEL BEGINNING	WATER LEVEL END	FACTOR	AMOUNT USED
HOT WELL No. 1				
" No. 2				
" No. 3				
" No. 4				
" No. 5				
" No. 6				

TOTAL STEAM WATER CU. FT. ..... TOTAL MONTAUK WATER CU. FT. .....

" SERVICE " " .....

	NO.	TOTAL HOURS		NO.	TOTAL HOURS
WATER TENDERS			TOWER MEN		
STOKER OPERATORS			CONVEYOR MEN		
STOKER OILERS			FOREMAN CLEANER		
COAL PASSERS			1ST CLEANERS		
ASH HANDLERS			2D CLEANERS		
TELPHER MEN					
TOTAL			TOTAL		

SIGNED ..... Eng. in Charge

APPROVED ..... Mech'l Supt.

BOILER LOG MADE OUT BY EACH SHIFT

..... 190

LONG ISLAND POWER STATION

BOILER LOG

	12–8	8–4	4–12	TOTAL
BOILERS IN COMMISSION				
" " SERVICE				
ACTIVE BOILER-HOURS				
RESERVE " "				
BANKED " "				
TOTAL SERVICE HOURS				
HARD COAL USED—TONS OF 2000 LBS.				
SOFT " " " " " "				
TOTAL COAL USED—TONS OF 2000 LBS				
ASHES REMOVED				
STOKER ENGINES IN SERVICE				
ECONOMIZERS				
DRAUGHT IN STACK No. 1				
" " " No. 2				
AVERAGE FURNACE DRAUGHT				
BOILER PRESSURE				
FEED PUMPS IN SERVICE				
HOUSE " "				
COOLING " "				
TEST " "				
PRIMARY HEATER IN SERVICE				
SECONDARY " "				
TEMPERATURES				
MONTAUK WATER				
OUTLET PRIMARY HEATER				
HOT WELL HEADER				
INLET AUXILIARY HEATERS—AVERAGE				
OUTLET " "				
INLET ECONOMIZERS "				
OUTLET " "				

BOILERS IN COMMISSION—NOS. .....

" " SERVICE " .....

	DELIVERED TO	BEGINNING	END	AMOUNT USED
WATER METER No. 1				
" No. 2				
" No. 3				
" No. 4				
" No. 5				

	WATER LEVEL BEGINNING	WATER LEVEL END	FACTOR	AMOUNT USED
HOT WELL No. 1				
" No. 2				
" No. 3				
" No. 4				
" No. 5				
" No. 6				

TOTAL STEAM WATER CU. FT. .....

" SERVICE " " ..... TOTAL WATER CU. FT. .....

	NO.	TOTAL HOURS		NO.	TOTAL HOURS
WATER TENDERS			TOWER MEN		
STOKER OPERATORS			CONVEYOR MEN		
STOKER OILERS			FOREMAN CLEANER		
COAL PASSERS			1ST CLEANERS		
ASH HANDLERS			2D CLEANERS		
TELPHER MEN					
TOTAL			TOTAL		

..... Steam Supt.

COMBINED BOILER LOG FOR THE THREE SHIFTS

.....to..... trick 190

LONG ISLAND POWER STATION

TURBINE AND AUXILIARY LOG

HOURS FROM BEGINNING OF TRICK	1	2	3	4	5	6	7	8	TOTAL
EXCITER No. 1									
" No. 2									
TURBINE No. 1									
" No. 2									
" No. 3									
TOTAL TURBINE HOURS									
MAX. KILOWATTS									
K. W. HOURS GENERATED									
STEAM PRESSURE—AVERAGE									
COOLING WATER PRESSURE—AVERAGE									
ENGINE OIL PRESSURE "									
CRANK CASE OIL PRESSURE "									
CYLINDER OIL PRESSURE "									
INCHES VACUUM No. 1 CONDENSER									
" " No. 2 "									
" " No. 3 "									
TEMPERATURES									
No. 1 EXCITER TURBINE STEAM									
No. 2 " " "									
No. 1 TURBINE "									
No. 2 " "									
No. 3 " "									
HOT WELL DISCHARGE No. 1									
" " " No. 2									
" " " No. 3									
OVERFLOW No. 1									
" No. 2									
" No. 3									
INJECTION WATER									
AIR IN TURBINE ROOM									
OUTSIDE AIR									
BAROMETER									

CONDENSER	No. 1	No. 2	No. 3
COOLING SURFACE			
TUBES PLUGGED			
SALINE TEST			
CONDENSER + TO GROUND			

HIGH WATER ..... o'clock ..... level

LOW " " "

THRUST SETTINGS	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	
No. 1 TURBINE									
No. 2 TURBINE									
No. 3 TURBINE									

	No.	TOTAL HOURS		No.	TOTAL HOURS		No.	TOTAL HOURS
ENGINEERS			OILMEN			STOREKEEPER		
PUMPMEN			CRANEMEN			STOREKEEPER		
OILERS			ELEVATORS					
WIPERS			WATCHMEN					
TOTAL			TOTAL			TOTAL		

SIGNED ..... Eng. in charge ..... to .....

APPROVED ..... Mechanical Supt.

TURBINE AND AUXILIARY LOG MADE OUT BY EACH SHIFT

..... 190

LONG ISLAND POWER STATION

TURBINE AND AUXILIARY LOG

	12–8	8–4	4–12	TOTAL
EXCITER No. 1				
" No. 2				
TURBINE No. 1				
" No. 2				
" No. 3				
TOTAL TURBINE HOURS				
MAX. KILOWATTS				
K. W. HOURS GENERATED				
STEAM PRESSURE—AVERAGE				
COOLING WATER PRESSURE—AVERAGE				
ENGINE OIL PRESSURE "				
CRANK CASE OIL PRESSURE "				
CYLINDER OIL PRESSURE "				
INCHES VACUUM No. 1 CONDENSER				
" " No. 2 "				
" " No. 3 "				
TEMPERATURES				
No. 1 EXCITER TURBINE STEAM				
No. 2 " " "				
No. 1 TURBINE "				
No. 2 " "				
No. 3 " "				
HOT WELL DISCHARGE No. 1				
" " " No. 2				
" " " No. 3				
OVERFLOW No. 1				
" No. 2				
" No. 3				
INJECTION WATER				
AIR IN TURBINE ROOM				
OUTSIDE AIR				
BAROMETER				

CONDENSER	No. 1	No. 2	No. 3	
COOLING SURFACE				
TUBES PLUGGED				
SALINE TEST				
CONDENSER + TO GROUND				

HIGH WATER ..... o'clock ..... level

LOW " " "

THRUST SETTINGS	12 M. Upper	12 M. Lower	8 A. M. Upper	8 A. M. Lower	4 P. M. Upper	4 P. M. Lower	12 M. Upper	12 M. Lower
No. 1 TURBINE								
No. 2 "								
No. 3 "								

	No.	Total Hours		No.	Total Hours		No.	Total Hours
ENGINEERS			OILMEN			STOREKEEPERS		
PUMPMEN			CRANEMEN			SWEEPERS		
OILERS			ELEVATORS					
WIPERS			WATCHMEN					
TOTAL			TOTAL			TOTAL		

..... Steam Superintendent

COMBINED TURBINE AND AUXILIARY LOG FOR THE THREE SHIFTS

190

LONG ISLAND POWER STATION

ELECTRICAL LOG

K W H. 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 TOTAL HOURS MINUTES

20 000
15 000
10 000
5 000

M E
E 2
E 1
No. 3
No. 2
No. 1

TOTAL K W H
VOLTS A. C.
MAXIMUM AMPERES
" K W
AVERAGE POWER FACTOR
LOWEST "
AVERAGE FREQUENCY
MAX 3R MIN "
VOLTS FIELD BUS
AMPERES FIELD BUS
K W H. FOR FIELDS
VOLTS POWER BUS
AMPERES "
K W H. FOR "
HUMIDITY
WEATHER

WATTMETERS	READING	K W H	READING	K W H	READING	K W H	TOTAL
1 END LAST TRICK							
" THIS "							
2 END LAST TRICK							
" THIS "							
3 END LAST TRICK							
" THIS "							
TOTAL							
A. C. END LAST TRICK							
" THIS "							
D. C. END LAST TRICK							
" THIS "							
TOTAL							

FEEDERS IN SERVICE

12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 HOURS MINUTES

301
302
304
308
307

SIGNED, _____ Chief Operator
" _____ 1st Asst. Operator
" _____ 2d " "

ELECTRICAL LOG, WITH TYPICAL LOAD CURVE

190

LONG ISLAND POWER STATION

OPERATING REPORT

BOILERS		COAL FACTOR	POUNDS
IN COMMISSION		ACTIVE BOILERS	
MAXIMUM IN SERVICE		RESERVE "	
ACTIVE HOURS		BANKED "	
RESERVE "		**ASHES**	
BANKED "		ASHES REMOVED—CU. YDS.	
SERVICE "		LBS. ASH. LBS. COAL	
ACTIVE SERVICE			
CLEANED			
COAL	TONS OF 2000 LBS.	**WATER**	
ON HAND LAST REPORT SURVEY		MONTAUK WATER MAIN—CU. FT.	
RECEIVED		SERVICE "	
USED—ESTIMATE		MAKE UP "	
NOW ON HAND—ESTIMATE		HOT WELLS "	
" " " SURVEY		EVAPORATED "	
USED—CORRECTED		LBS. EVAPORATED LBS. COAL	
TOTAL KILOWATT HOURS—D.C.		LBS. COAL PER K.W.H. NET OUTPUT	
" " —A.C.		" WATER " " " " "	
" OPERATING COST	$	COAL HANDLING PER 2000 TON	$
OPERATING COST PER K.W.H.	$	ASH " CU. YD.	$

DISTRIBUTION OF OUTPUT

K.W.H. FOR FIELDS— D.C.		K.W.H. FOR STATION—A.C.	
" " " " LIGHT AND POWER—		" " " SUPPLIED L.I.R.R.—A.C.	
" " " SUPPLIED L.I.R.R.— "		" " " "	
" " " NET OUTPUT SUPPLIED L.I.R.R.		" " " "	
TOTAL K.W.H. NET OUTPUT			

SERVICE OF APPARATUS

EXCITER NO. 1		DRY VACUUM PUMP NO. 1	
" " 2		" " " " 2	
MOTOR EXCITER		" " " " 3	
TURBINE NO. 1		BOILER FEED " " 1	
" " 2		" " " " 2	
" " 3		" " " " 3	
CIRCULATING PUMP NO. 1		" " " " 4	
" " " 2		HOUSE SERVICE " 1	
" " " 3		" " " 2	
HOT WELL " 1		OIL " 1	
" " " " 2		" " " 2	
" " " " 3		FIRE " 1	
COOLING WATER " 1		" " 2	
" " " " 2		TEST "	

REMARKS

NET K.W.H. OUTPUT— MORE / LESS THAN
COST PER K.W.H. — MORE / LESS THAN
COAL " " — MORE / LESS THAN
WATER " " — MORE / LESS THAN
GREATEST DAILY OUTPUT
MAXIMUM HOUR "
3 MINUTE MAXIMUM "
PER CENT. OF CAPACITY OF STATION USED DURING MONTH—
HIGHEST — " " " " " A DAY —
" — " " " " " AN HOUR—
" " " " " " FOR A 3-MINUTE PERIOD—

Engr'g Power Station

MONTHLY OPERATING REPORT

19

LONG ISLAND POWER STATION

OPERATION

	TOTAL	PER K.W.H. NET OUTPUT—CENTS THIS MONTH	LAST MONTH
BOILER ROOM ENGINEERS	$		
WATER TENDERS			
STOKER OPERATORS			
STOKER OILERS			
COAL PASSERS			
BOILER CLEANERS			
PUMPMEN			
COAL HANDLING LABOR			
ASH " "			
MISCELLANEOUS BOILER ROOM LABOR			
TOTAL			
TURBINE ROOM ENGINEERS			
OILERS			
WIPERS			
PUMPMEN			
OIL MAN			
MISCELLANEOUS TURBINE ROOM LABOR			
TOTAL			
ELECTRICAL OPERATORS			
SWITCHBOARD MEN			
GENERATOR TENDERS			
GALLERY TENDERS			
MISCELLANEOUS ELECTRICAL LABOR			
TOTAL			
OFFICE			
STOREKEEPERS			
WATCHMEN			
JANITOR			
MISCELLANEOUS			
TOTAL			
COAL			
WATER			
ENGINE OIL			
CYLINDER OIL			
CRANK CASE OIL			
GREASE			
KEROSENE			
GASOLINE			
WASTE			
CHEESECLOTH			
STATIONERY			
MISCELLANEOUS MATERIAL			
TOTAL			
FREIGHT, EXPRESSAGE AND CARTAGE			
TELEPHONE CHARGES			
ICE			
MISCELLANEOUS CHARGES			
GRAND TOTAL			

SUMMARY—COST OF MAINTENANCE AND OPERATION

TOTAL FOR MAINTENANCE AND OPERATION	$
KILOWATT HOURS GENERATED	
KILOWATT HOURS NET OUTPUT	
COST MAINTENANCE AND OPERATION PER K. W. H. GENERATED	$
" " " " " " NET OUTPUT	$
AVERAGE PRICE PER TON OF COAL CONSUMED—BITUMINOUS	$
" " " " " " —ANTHRACITE	$

LONG ISLAND POWER STATION

MAINTENANCE

ITEM	LABOR	MATERIAL	TOTAL	PER K.W.H. NET OUTPUT—CENTS THIS MONTH	LAST MONTH
BOILERS	$	$	$		
FURNACES					
STACKS					
STOKERS AND STOKER ENGINES					
ECONOMIZERS AND ENGINES					
BOILER FEED PUMPS					
HOUSE SERVICE PUMPS					
OPEN FEED WATER HEATER					
CLOSED " " "					
COAL HOISTING APPARATUS					
" DELIVERY "					
ASH HANDLING "					
MISCELLANEOUS					
TOTAL					
MAIN TURBINES					
EXCITER "					
CONDENSERS					
FLUMES					
TUBE PROTECTION APPARATUS					
CIRCULATING PUMPS					
DRY VACUUM "					
HOT WELL "					
COOLING WATER "					
FIRE "					
OIL SYSTEM					
MISCELLANEOUS					
TOTAL					
MAIN GENERATORS					
EXCITER "					
SWITCHBOARDS					
OIL SWITCHES AND BUS					
H. & L. TENSION CABLES					
TRANSFORMERS					
STORAGE BATTERY					
SIGNAL APPARATUS					
INCANDESCENT LIGHTING					
ARC LIGHTING					
ELEVATORS					
MISCELLANEOUS					
TOTAL					
SUPERHEAT STEAM PIPING					
AUXILIARY " "					
EXHAUST " "					
BOILER FEED "					
" BLOW DOWN "					
SUPERHEAT HOLLY "					
AUXILIARY " "					
HOUSE SERVICE "					
WATER SUPPLY "					
FIRE SYSTEM "					
HEATING "					
DRY VACUUM "					
COMPRESSED AIR "					
OIL SYSTEM "					
MISCELLANEOUS "					
TOTAL					
TOOLS					
BUILDING					
GRAND TOTAL					

Engr'g Power Station

Engr'g Power Station

MONTHLY OPERATING AND MAINTENANCE REPORTS, SHOWING COMPARISON WITH PREVIOUS MONTH

The chart shows that a total of seventy men, not including the superintendent, are employed for continuous operation of the station. On the day watch the second assistant engineer has charge of the boiler room and of boiler room repairs and other work of a similar nature. During the afternoon watch and the night watch the first assistant engineer and the third assistant engineer, respectively, have charge of both the turbine and boiler room forces. The switchboard operators are graded first, second and third assistant operators. All of the men in the electrical department are under the immediate supervision of the operator on the watch.

The duties of the generator tenders include in addition to taking care of the main generators general supervision and care of the auxiliary motors and the lighting system. The gallery tenders inspect and clean the high tension switches and occasionally help clean the generators.

POWER HOUSE RECORDS AND LOGS

To facilitate handling and filing all record sheets of power house operation are made of a uniform size, 10½ ins. x 17 ins. Separate boiler, turbine and auxiliary and electrical logs are kept. The readings are written directly on logs covering a period of only eight hours or of one watch. Afterwards the figures for the three separate watches of each day are copied on logs representing a day's duration and the three sets of figures are then totaled. The logs for the eight-hour periods do not leave the station, but copies of the daily logs are sent to the office of the railroad company.

At the end of the month an operating report is made up from the data on the logs mentioned. There is also made out at the end of the month an itemized account of the operating and of the maintenance costs.

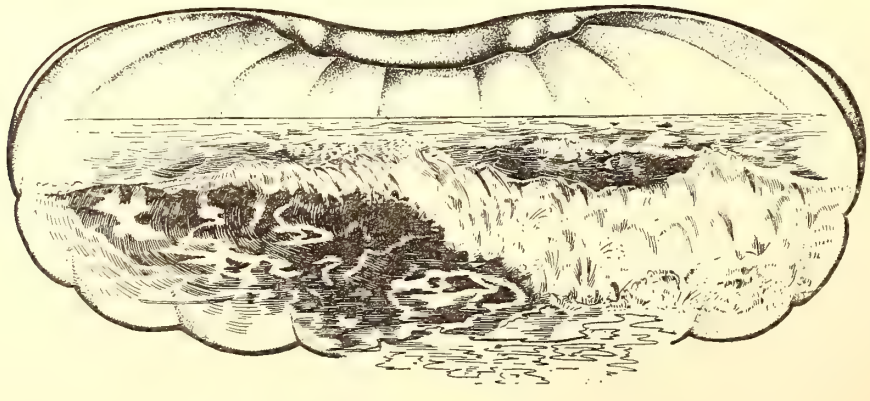
The time the several pieces of apparatus are in operation is indicated on the boiler and on the turbine and auxiliary logs by drawing a heavy line under the hours operated and opposite the particular unit. The hours of operation of each unit are copied from the logs to cards and each month the daily hours are totaled on these and transferred to a monthly report. For the several logs temperature and water meter readings and others of a similar nature are taken every two hours. On the electrical log the load curve is plotted in red ink. The several exciters are indicated on this log by the symbols M. E. for motor exciter, E_2 and E_1 for the engine driven exciters. "No. 1," "No. 2" and "No. 3" indicate the three turbo-generators. Plus and minus signs are used before the power factor readings to distinguish leading and lagging currents. The humidity is recorded on this log because of its effect on static discharges.

The monthly operating report gives the total of the operating hours of the several units, total coal and water used and the distribution of the output. The amount of coal used is arrived at in two different ways. The coal factor or the amount of coal used per hour by forced, active, reserved and banked boilers is multiplied by the number of hours of service of each kind of boiler, and the figures so obtained are checked by surveying and estimating the contents of the bunkers at the end of each month and adding to this the amount of coal received during the month and subtracting the amount in the bunkers at the beginning of the month. In filling out the sheet either "more" or "less" is scratched out so that the line when filled out reads "more than last month" or "less than last month."

Only those expenses are entered on the monthly maintenance account that are occasioned by repairs and up-keep of the apparatus. The labor and material expenses are kept separate and are finally reduced to cents per kw-hour. These amounts are then compared with the preceding month.

The operating expenses are treated in a similar manner on a separate sheet. On this latter sheet is finally summarized the cost of the current per kw-hour generated and the cost of the net output.

In addition to the reports mentioned here is made out each month a "performance sheet" or a b. t. u. balance sheet. In brief this sheet takes into account all the b. t. u. entering the station in the coal and water and then account is made of the manner in which the b. t. u. received are lost or are used. It is of course necessary to approximate such items as the amount of water and consequently b. t. u. lost in boiler and economizer blow downs, but nevertheless comparatively accurate results are arrived at. The sheet shows the thermal efficiencies of the boilers, economizers, open and closed heaters, and finally gives the total thermal efficiency of these appliances.



SUBSTATION AND POWER TRANSMISSION PRACTICE OF THE LONG ISLAND RAILROAD

During April, June and July, 1906, the Street Railway Journal published a complete description of the physical features of the electrification of the Long Island Railroad. Electric trains have now been running for two years and some details of the operating features are available. In this article it is intended to describe such of them as may prove of interest, but for a clear understanding of these, a few points descriptive of the electrical features are necessary.

The distribution system consists of:

High tension circuit (overhead, underground, submarine).

Low tension feeders.

Protected third-rail.

Track return circuits.

The power house is located at Long Island City and the six substations and two portable substation houses, exclusive of two portable substations, are located as follows: (1) Atlantic Avenue near Grand Avenue, (2) Atlantic Avenue near Vesta Avenue (East New York), (3) Woodhaven Junction, (4) Rockaway Junction, (5) Hammel, (6) Valley Stream. The portable substation houses are located at Belmont Park and Springfield Junction.

Between the power house and Woodhaven Junction is a trunk line part underground and part overhead, consisting of five circuits. The underground portion, which is nearest the power house, is located in a conduit system containing eighteen ducts and the overhead section is supported upon steel poles. From Woodhaven Junction substation the transmission circuits go in three directions, west to substations Nos. 1 and 2, east to substations Nos. 4 and 6 and to the portable substation houses, and south to substation No. 5. The circuits west and the circuits east for about 2 miles are underground. The circuits to No. 5 substation are overhead and are carried part of the way on steel and the remainder of the distance on wood poles. From substation No. 4 overhead circuits lead to the Valley Stream substation, to Glen Cove and also to Belmont Park and Springfield Junction portable substation houses.

The current furnished from the power house to these substations is metered at both ends of the line. The power house meters are checked by those of the individual rotary panels in the substations and both sets of meters are calibrated as often as indications show necessary.

HIGH-TENSION CIRCUITS—OVERHEAD

All the high tension overhead lines are patroled once a day. Each of the several sections of the line is inspected by a man whose special duties are to report all defects in that section. As this inspection is made, the inspector, in some cases a lineman, in other cases a patrolman, makes it a practice to call up the substation operator at Woodhaven Junction from telephone boxes placed approximately 2000 ft. apart, and this permits the substation operator to keep in touch with the men at different points on the line. Whenever any trouble is noted report is at once made by telephone to the high tension emergency crews located either at Woodhaven Junction or at Long Island City. The high tension emergency force at Woodhaven Junction is on duty all the time. At Long Island City it is on duty only during the day, the night work being cared for from Woodhaven Junction. The crews at each point consist of a foreman, two linemen and a chauffeur, who also acts as a helper to the linemen. The crew are carried from their quarters to the point where trouble occurs on a gasoline emergency car. At times bicycle cars are also used.

Very little trouble has been experienced on the overhead lines. The breakage of insulators from all causes, during 1906, amounted to only sixty-nine. Part of this breakage was due to the small boy with the rock and part to electric and mechanical breakdown. As there are over 11,000 high-tension insulators on the system, this is considerably less than 1 per cent per year.

There has been little or no leakage over the insulators, notwithstanding the fact that a portion of the line is in close proximity to large bodies of salt water, and is subjected to the constant action of moist salt air.

There have been several short circuits on the high tension overhead lines caused by metallic materials being thrown across the wires, but in no instance have they been of sufficient severity to cause damage to other parts of the system or to interfere with train service. In most cases, it has happened that only one circuit has opened at a time, so that power was not entirely off the lines, even for a very short time.

To prevent injury to men working on the high-tension lines, the following precautions have been adopted:

When trouble occurs on a line, the substation operator cuts it out at each end and it is then grounded and tagged in such a way as to show that it is cut out for repairs. A feeder repair permit is then given to the foreman of the emergency crew, which is to work on the line. When repairs have been completed, the man receiving the permit reports, either over the telephone or in person, that the line is ready for current and no one else has authority to order restoration of current to that particular circuit. Tags and grounds are then removed and the circuit made ready for operation. Linemen on high-tension lines are provided with a grounding clamp which is attached to the running rail or to any other suitable ground before they go up the pole. The cables of the tagged circuit are then thoroughly grounded to this wire and clamp, after which any necessary repair work is done.

During the two and a half years that the pole lines have been erected, it has been found necessary to repaint a portion of the steel poles but once, and the paint was applied principally near the base of the pole over spots where rust had appeared.

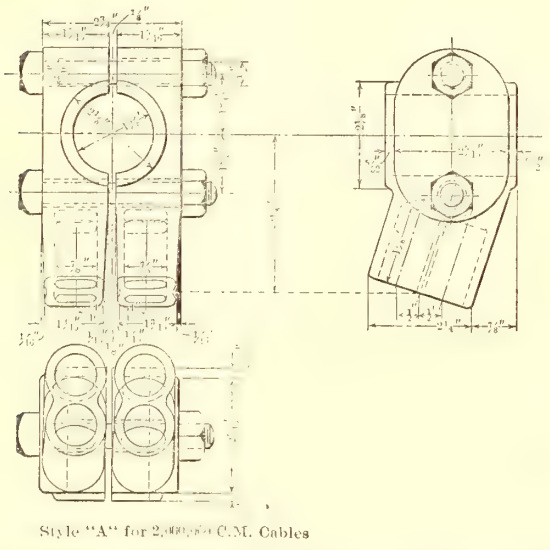
HIGH-TENSION CIRCUITS—UNDERGROUND

The underground high-tension circuits consist of three conductor paper-insulated lead-covered cables located in a conduit system, which is provided with manholes at frequent intervals. These manholes are inspected regularly by men who keep them free from water and dirt and who also see that the cables are in good condition. There are approximately 220 manholes in the conduit system and with the force employed the inspection of each manhole occurs about once in five or six weeks.

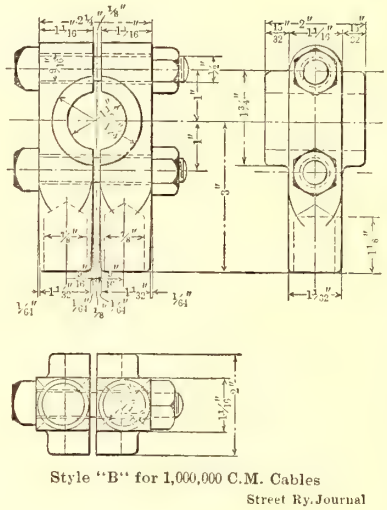
At Long Island City a portion of the conduit system is constructed below high-tide level, and to prevent accumulation of water, tile pipes running underneath the ducts carry seepage to sumps in which electric pumps with automatic control are located. The two pumps provided at each sump are arranged so as to operate when the water reaches different levels.

In this way should one pump fail to operate the second pump would cut in at a little later time and take care of the difficulty. Each pump is of ample capacity to care for the entire service, but the arrangement of floats is altered from time to time, so that each will get its fair share of duty.

Along the Atlantic division the conduit system for part of the distance is built into the walls of the tunnels, and at other points adjacent to the right-of-way fence and partly beneath some of the operating tracks. In these sections where it was possible the manholes are drained into the city sewer system. In tunnel sections the manholes drain directly into the tunnel system. On other portions where drainage has not been provided owing to the condition of the soil but little trouble has been experienced. What little water has accumulated has been removed by the crew that makes the regular manhole inspection.



Style "A" for 2,000,000 C.M. Cables



Style "B" for 1,000,000 C.M. Cables

Street Ry. Journal

SPECIAL TERMINALS FOR JUMPER CABLES—FLEXIBLE LEADS TO THE THIRD-RAIL ARE SOLDERED INTO THE SMALLER TERMINALS

A second conduit-inspection crew examines at regular intervals the electrolytic condition of cables in the conduit system. On the basis of the reports turned in by this crew necessary precautions are taken to prevent damage to the cables from this cause.

HIGH-TENSION CIRCUITS—SUBMARINE

At two points on Jamaica Bay there are located drawbridges, and these necessitate the use of submarine cables which are connected to the overhead lines through lightning-arrester houses. No trouble whatever has been experienced with the submarine cables.

LIGHTNING ARRESTER HOUSES

Lightning-arrester houses are located at two other points on the system where overhead and underground lines meet. The choke coils and arresters in these houses are inspected daily by the high-tension emergency crews. At each inspection one panel in each house is "cut out" and cleaned, so that the entire equipment is cared for at regular intervals. Sub-station Nos. 3, 4 and 6, and the portable sub-station houses at Belmont Park and Springfield Junction are entered by overhead high-tension lines. These sub-stations are equipped with lightning-arrester galleries which are cared for by the regular sub-station attendants and not by the emergency crew.

After lightning storms the arresters throughout the system are carefully inspected and tested for open circuit and ground. Although the overhead lines have been struck a number of times, no damage to cables or sub-station apparatus, outside of the arrester galleries, has been experienced, and the repairs required have been confined to some parts of the lightning-arrester equipment itself.

High-tension tests are not made on any of the circuits or apparatus at regular intervals, but are made only as required by change in the arrangement of cables to suit load conditions. When so required a test of 24,000 volts is applied between conductors and also between all conductors and ground for a three-minute period. This voltage is obtained by connecting the test apparatus at Woodhaven Junction through a separate line to one of the generators in the power station at Long Island City and varying the excitation of the generator to meet requirements. Should the insulation on the apparatus tested break down, a heavy surge of current would follow were it not for a water rheostat which consists of twelve cells containing a brine solution and arranged six in series. This limits the inrush of current to a predetermined amount. The high voltage is measured by a static voltmeter, which is checked for accuracy by means of a spark gap with needle points.

It is the usual practice to operate all high-tension circuits in multiple so as to get the most economical results from the copper in the conductors. During severe storms, however, the lines are separated and only such circuits are put in use as are required to carry the load. This leaves spare circuits between the power house and Woodhaven Junction sub-station and also between Woodhaven Junction and the remaining parts of the system. When operating under these conditions, it has happened that one of the active circuits has opened so that the apparatus was momentarily cut off. When this happens one of the spare circuits is immediately thrown into commission and the circuit which opened is tested out at convenience. Such a method of operation safeguards much of the spare apparatus as it is not in any way subject to the lightning disturbances. This applies especially to sub-station apparatus and to underground cables. It also tends to limit the damage to the lightning arresters, which can handle lightning discharges themselves more easily than when the lightning is followed by generator current.

LOW-TENSION FEEDERS

The only low-tension feeders on the system consist of short sections between the d. c. bus-bars in the sub-station and the third-rails, which pass near the sub-station buildings outside. No long feeders of this class have been found necessary.

THIRD-RAIL INSULATORS

There are approximately 90 miles of protected third-rail on the system, and this is inspected daily. The inspection is made by third-rail patrolmen who are on duty during the day only. They report broken insulators, damage to protection board and other defects, and indicate by chalk mark or some other convenient means the part which is considered defective so that the repair gang can locate the defects without loss of time. Urgent repairs are attended to immediately, while those of minor importance are taken up in regular order, as the repair gang works around the system on an established route.

Two or three men are kept busy replacing third-rail insulators. These men, who usually travel together, carry with them a small jack for raising and holding the third-rail while the insulators are being changed. They usually start with a

day's supply of insulators, which they place according to the distinguishing marks made by the patrolmen. There are approximately 50,000 insulators and the repairs average about 250 a month.

The chief causes of the failure of insulators are breakage or chipping of the glazed surface due to rail movement, burning of the insulators due to excessive moisture trickling down over the surface, displacement due to creeping of the third-rail, and breakage due to derailments. A considerable amount of leakage over the insulators, which would finally result in burning them, has been corrected by cleaning off the dirt with a piece of cloth. Breakage due to the rail creepage has been reduced by anchoring the rail as is described later on in this article.

JUMPERS

At road crossings and points in yards where there are insulated sections of third-rail, underground cables or "jumpers" are installed. These cables are provided with a varnished cambric insulation, covered with lead protected by jute and asphalt and are laid directly in the ground. The jumpers have been subjected to some mechanical injury on some sections, and on account of this, where there is likely to be a large amount of track work it has been found advisable to install the jumpers in ducts. The ducts terminate in concrete posts which are of sufficient strength to withstand a chance blow from pick or shovel without injuring the cable. Into these ducts are drawn jumpers having a varnished cambric insulation and braid covering, the lead, jute and asphalt not being considered necessary. The concrete posts are provided with terra-cotta caps which fit over the end of the jumpers where they are exposed to the weather.

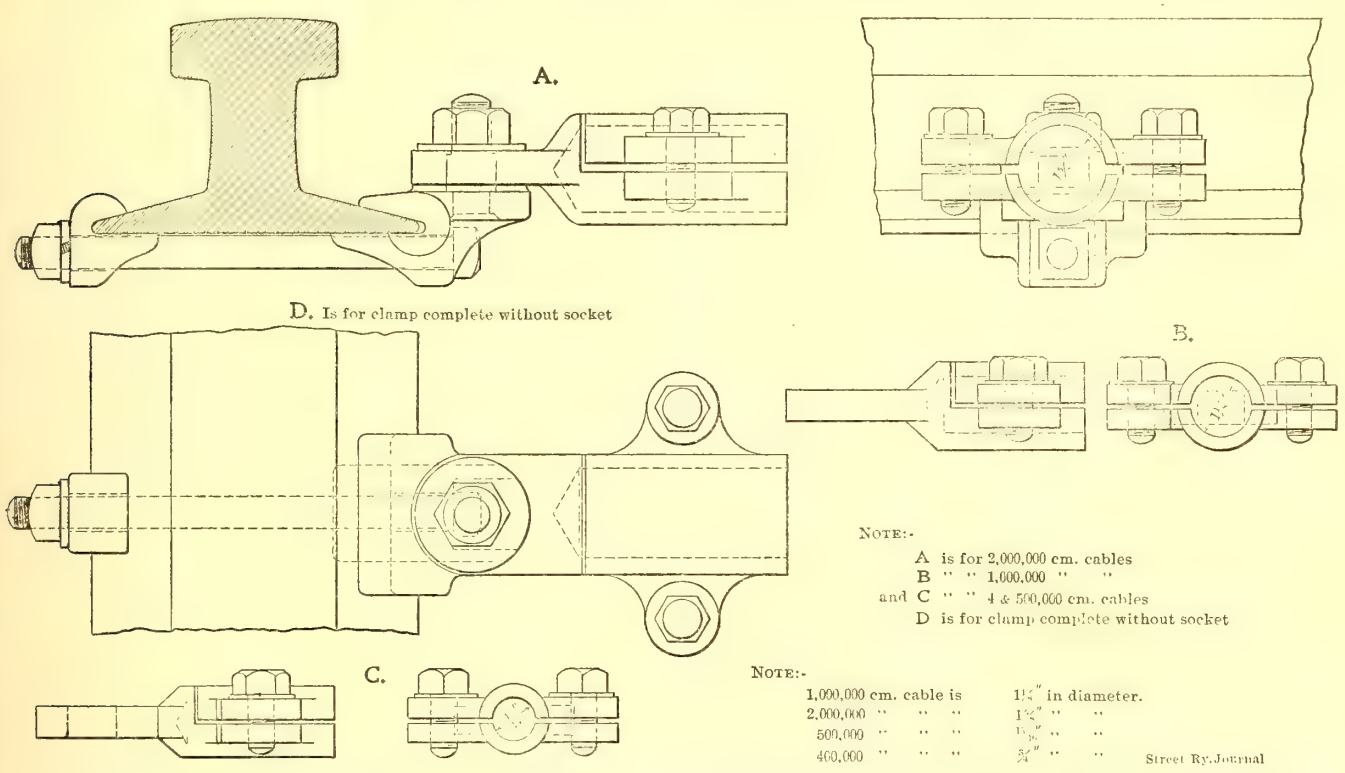
It frequently happens that temporary jumpers between sections of third-rail are necessary. For this purpose a special cable clamp has been used. This is made of bronze, and is secured to the base of the rail by a bolt extending underneath. Split cable terminals of the different sizes used are attached to these clamps. The clamp does away with the necessity of drilling the rail whenever a jumper connection is required for a short time only. All jumper repair work is taken care of by four men, two of whom are splicers. Whatever excavation is necessary is done by the regular section gangs.

THIRD-RAIL PROTECTION

For making repairs to the third-rail protection boards, two carpenters are employed. The field work is kept to a minimum by making the boards of a specified length in the shop and keeping a stock of these and of the posts on hand. The chief repairs to the protection board have consisted in replacing those damaged through accidents.

APPROACHES

A change has been found necessary in the wood side-approach boards which are placed at switches where the car shoes approach the third-rail at an angle or from a cross-over. These approach boards were originally set at an angle of about forty-five degrees with the horizontal, but this slope proved too steep for the shoes to mount at a high rate of speed and many shoe breakages occurred. All of the old boards have been replaced by others set at an angle of thirty degrees with the horizontal, and this change has obviated the trouble. The new side approaches are made of well seasoned maple and are so designed that they can be readily attached to or removed from the third-rail, as conditions require.



CABLE CLAMPS AND SOCKETS FOR WIRE OF DIFFERENT SIZES USED IN TEMPORARY WORK TO SECURE JUMPERS TO THE THIRD-RAIL

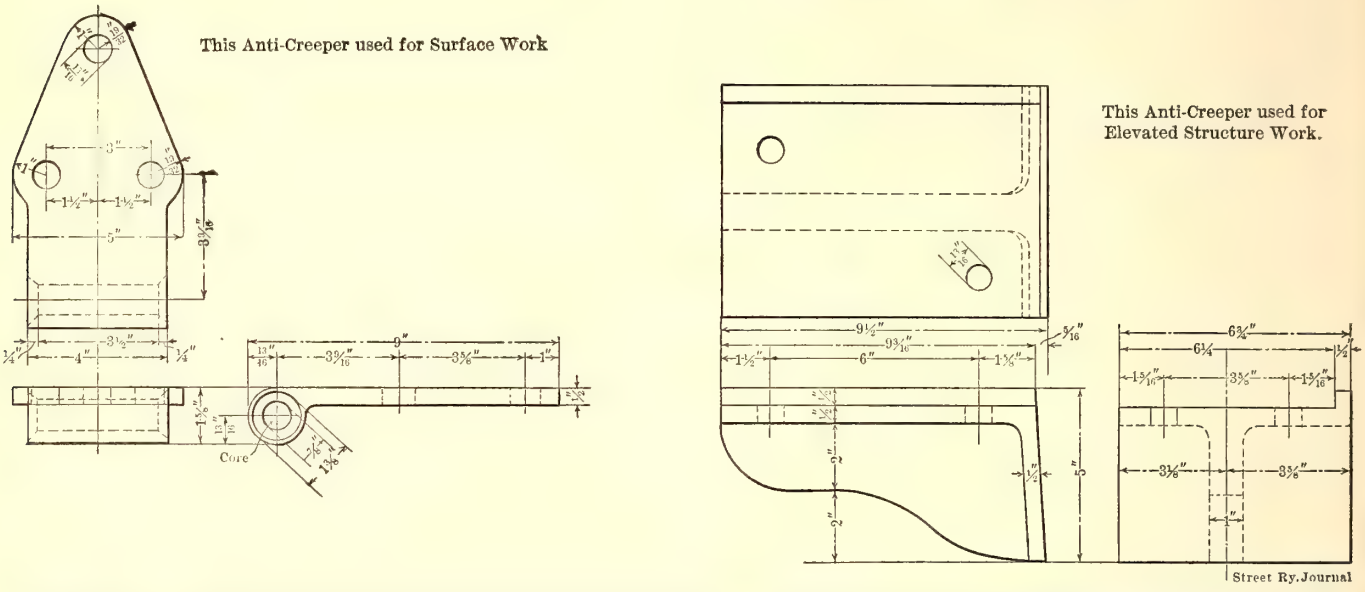
THIRD-RAIL

There has been no appreciable wear of the third-rail or the cast-iron end approaches due to action of the car shoes running over them, but the wooden approaches require occasional renewal, as the sleet scraping contact shoes cut into them. Considerable rusting has occurred on the sides and base of the third-rail and to prevent further oxidization the rail has been treated with a cheap grade of crude petroleum applied with a brush. Before this application of the oil, all of the loosened rust was scraped off with a wire brush, but the action of the oil has loosed scales of iron which were not removed by the brush. In these places it is probable that a second coat of oil will be necessary to give the desired protection.

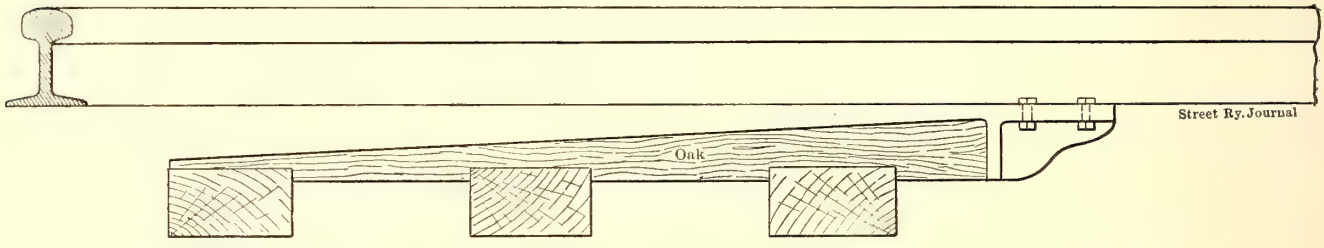
While third-rail creepage was anticipated it was not possible to determine the direction in which it would occur and consequently no attempt was made during construction to install anchors or other means to prevent this trouble. Two types of anchors have since been tried. One used on elevated structures consists of a wooden block, one end of which rests against a tie and the other end against a clamp attached to the third-rail. On ground sections a mica strain insulator is inserted between a clamp attached to the third-rail and a long iron strap lagged to several ties. The first of these anchors is intended to stand a pushing and the other a pulling strain. It is perhaps of interest to note that on one section 2 miles long where the rail is located on a dead level, no creepage has occurred. The anchors, as above described, were installed in other sections at intervals of approximately 1000 ft. Both types of anchors have stood service conditions in a fairly satisfactory manner, although in some instances the mica strains have proved inadequate to the pull exerted by the section of rail to which they were attached.

CLEARANCE INDICATORS

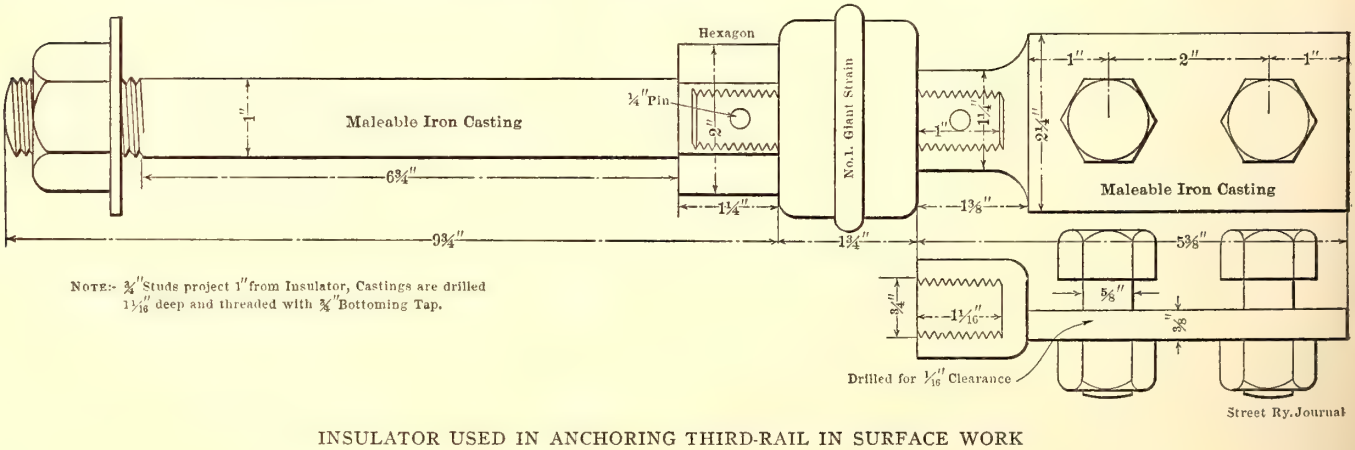
The gage line of the third-rail, or the edge of the head on the track side, is 26 ins. from the track gage line, and the elevation of the third-rail is 3½ ins. above the track rails. The protection board is 2½ ins. above the third-rail and is 2 ins. thick. This location has given a satisfactory clearance to all cars which have been brought on the system through transference of freight except in the case of a few hopper coal cars. While the latter would clear the rail itself they would interfere with the protection board. To prevent trouble from this source, at the two points on the system where foreign cars are received, namely, at Long Island City and Bay Ridge, indicators are placed so that all cars having on them projecting parts which would injure the third-rail or the protection board will automatically give notice to an inspector who will prevent their further move-



MALLEABLE CASTINGS SECURED TO UNDER SIDE OF RAIL, AND TO WHICH INSULATOR IS BOLTED IN ANCHORING THIRD-RAIL



METHOD OF ANCHORING THIRD-RAIL AGAINST CREEPAGE ON ELEVATED STRUCTURES



NOTE:- ¾" Studs project 1" from Insulator, Castings are drilled 1 1/16" deep and threaded with ¾" Bottoming Tap.

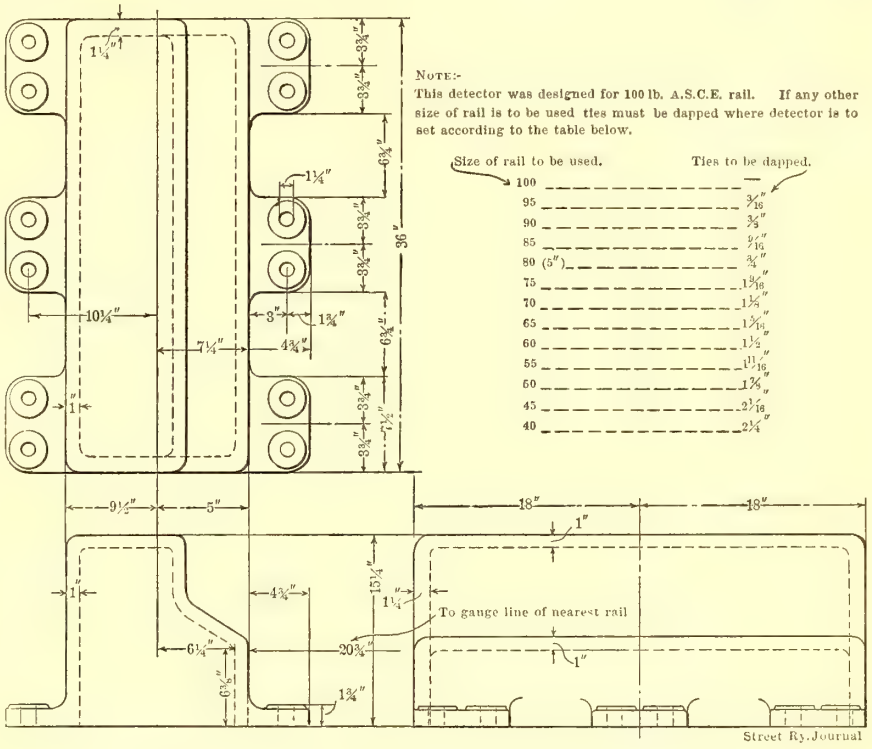
INSULATOR USED IN ANCHORING THIRD-RAIL IN SURFACE WORK

ment. Each indicator is bolted down near the track and consists primarily of a sheet-iron vane covered with carpet daubed with white paint. The vane is attached to a shaft provided with a commutator, and contact points on this commutator complete an electric bell circuit when the vane is turned. When the position of the vane is altered by being struck by a car, the bell rings and a mark is made by the white paint on the projecting part of the car making the contact. The inspector's attention is attracted by the ringing of the bell and he can easily determine the causes of interference, and either have the part removed or arrange for a transfer of load.

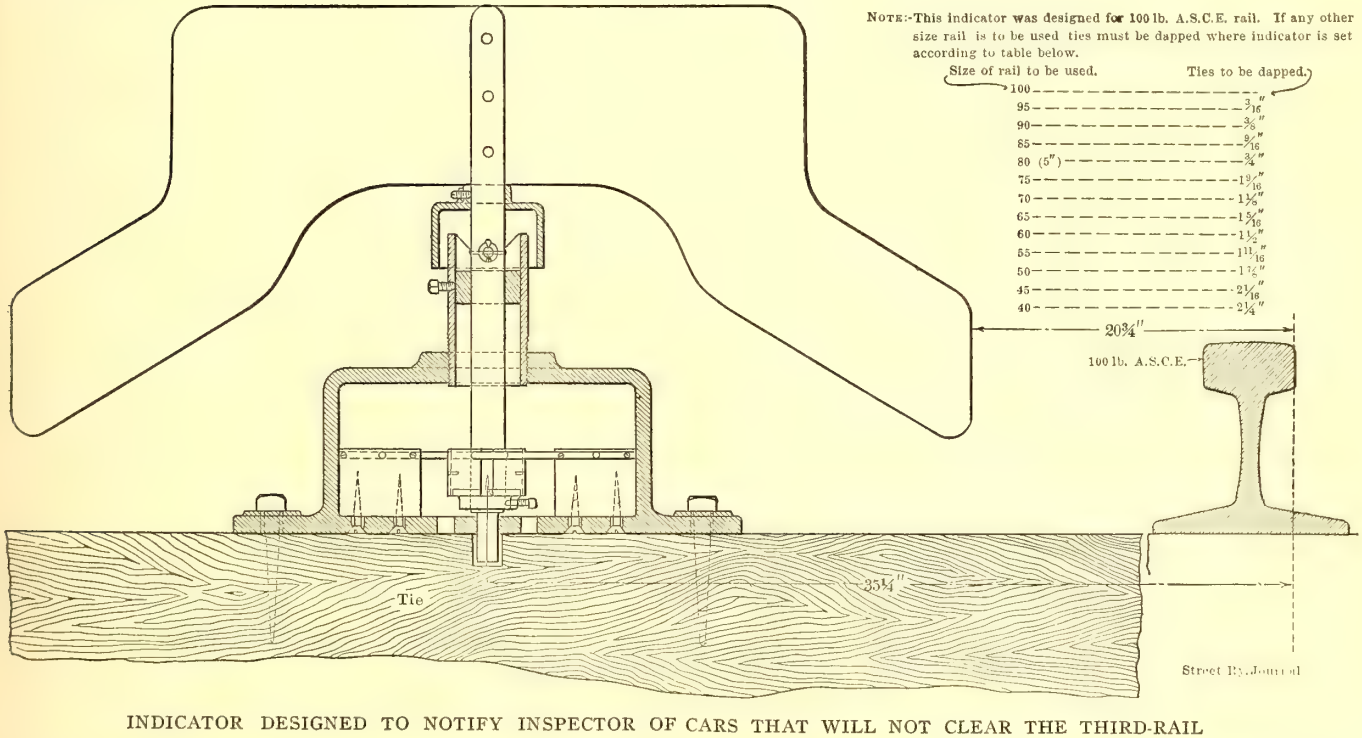
To prevent the possibility of the part being overlooked and afterwards injuring the third-rail or its protection, heavy cast-iron clearance blocks are located beyond the detector signals. These blocks are of such a design and are so set in position that anything which passes them will clear the third-rail and they are made of sufficient strength to tear from any car any rigid projecting part striking them. They are 36 ins. long, 15¼ ins. high and 14½ ins. wide at the base and are filled with cement mortar and bolted to a concrete base.

SNOW AND ICE

Snow and ice have occasioned very little inconvenience to the electric system. Single and two-car trains may experience some difficulty, but the use of trains having greater length and weight with a larger number of contact shoes, has proved that the electric service is liable to very little interruption from ice and snow. At stations where the third-rail is installed near the platform and no opening exists to the rear, snow packs in between the rail and protection board, making a cushion over which several of the contact shoes may ride without breaking through. Under these conditions a short train may become stalled. With trains of greater length some one of the shoes forms contact with the third-rail and under these conditions service is maintained. The introduction of an electric system has resulted in a change of implements used by the section men, especially those for the removal of snow. Metallic shovels have proven dangerous, and consequently the men employed in cleaning interlocking parts and station tracks are now provided with wooden shovels and stable brooms for cleaning out points where snow would cause difficulty.



CAST-IRON BLOCK PLACED AT BEGINNING OF THIRD-RAIL TO PROTECT THE RAIL



INDICATOR DESIGNED TO NOTIFY INSPECTOR OF CARS THAT WILL NOT CLEAR THE THIRD-RAIL

TRACK-RETURN CIRCUITS

Both running rails are used for the return circuit without additional negative feeders. The rails are bonded to their full

capacity by bonds of the soldered and compressed terminal types. These bonds are periodically tested by a gang of two and sometimes three men, who test two hundred and fifty or more joints per day. For this work a Whitney bond testing outfit is used. To obtain sufficient current for the test, regardless of what may at the time be flowing in the rails, a portable resistance consisting of iron wire coils, such as are used in the electric heaters in the cars, is employed. This is connected between the third-rail and running rails and allows a current of 30 amps. to 40 amps. to flow. A portable storage battery has also been used to give the required current through the rail.

The testing instrument is connected in the same manner as a Wheatstone bridge, and comparison is made between four feet of rail containing the joint and four feet of unbroken rail. The instrument reads directly in rail feet. If the section of rail containing the joint has a resistance exceeding eight feet it is considered defective, and a distinguishing mark to indicate the fact is placed on the protection board or tie nearby.

SUB-STATIONS

The six sub-stations, portable sub-station terminal houses and lightning arrester houses are in charge of a general foreman, whose headquarters are at Woodhaven Junction. The operating force and capacity of each sub-station are given in the following table:

Rotary Converters, K. W.	Fore. men.	Switch-board Men.	Rotary Tenders.	Wipers.
1. Grand Ave.....3-1000 kw.	1	3	3	
2. East New York.....3-1000 kw.		3	3	
3. Woodhaven Junction. 3-1500 kw.	1	3	3	1
4. Rockaway Junction 2-1500 kw.		3	3	
1-1000 kw.	1			
6. Valley Stream.....2-1000 kw.		2	1	
5. Hammel .....3-1000 kw.	1	3	3	1

These men operate in eight-hour shifts, beginning at 8 a. m., 4 p. m. and 12 midnight, and two men are continuously on duty in all the sub-stations, except the one at Valley Stream. This is built with the switchboard on the operating floor so that it may be run by one man. Because of light traffic it is not usually operated as late as the others, and only a rotary tender is on the night shift. However, this man can in an emergency start up the machines.

In addition to sub-station operators the sub-station force includes repair men under a foreman, who take care of all repairs, an oil switchman and an instrument tester and his helper. The sub-station men, some of whom are technical graduates, usually start in as rotary tenders, and are afterwards promoted to switchboard operators.

Train movements are such that all sub-stations are usually shut down between the hours of 1 a. m. and 4 a. m. In order that no trains may be left stalled on the line the rotaries are not shut down until the operator at Woodhaven Junction receives word from the train dispatcher that all trains are in. In an emergency, should current be required while the sub-stations are shut down, power could be put on the line in about five minutes.

The rotary converters are liberally designed and can stand loads up to 150 per cent of their normal rating without injury, but the load on each machine is usually kept down to the normal rating by starting up additional machines when the total load warrants it. One machine in each sub-station normally carries the load from the time current is put on until 6.15 a. m. From this time until 7 p. m., two or three machines are required, after which machines are cut out as the load permits. Whenever there is any special movement of trains, the dispatcher notifies the operator at Woodhaven Junction, who orders enough machines cut in to care for the extra load.

The rotaries are usually started up by an induction motor mounted on the armature shaft. The connections are, however, so arranged that they may be started from the direct current side, should occasion arise.

In the Woodhaven Junction sub-station a wiper is employed to clean the electrical and other apparatus, but in the other sub-stations the rotary tenders do this work. Each sub-station is equipped with an air compressor and the rotaries and switches are blown out with compressed air every other day. The commutators are wiped off daily with cheese cloth and vaseline. The oil switches are regularly inspected and in addition they are carefully gone over whenever they are tripped out under short circuit. The instruments and meters are inspected regularly by the instrument man and kept accurately calibrated.

STORAGE BATTERY

The only storage battery in use on the power circuits is located at the Hammel sub-station, and consists of 314 cells having a one-hour rating of 3200 amp-hours. It is inspected and specific gravity and voltage readings taken on each cell weekly. In addition, specific gravity readings are taken every hour on a pilot cell. The battery is given an overcharge once a week and during the period of overcharging specific gravity readings are obtained every fifteen minutes and the overcharging is continued until five successive similar readings are obtained. The outside of the wooden boxes of the cells are treated with paraffine once a month, the paraffine oil being wiped over them with a rag. This is done to preserve the wood from the effect of the acid fumes. The batteries are kept filled with distilled water obtained from a still in the station and stored in a porcelain-lined tank. Samples of this water are sent to the battery manufacturing company for analysis before it is used. In normal operation the battery is floated on the line with the use of a booster. It thus takes the heavy swings on the station and at times when the high-tension current is suddenly cut off, it feeds the whole system. In some instances the swinging loads have reached 7000 amps.

PORTABLE SUB-STATIONS

The two portable sub-stations of 1000-kw capacity each are used regularly during the racing season; at Belmont Park while the races are at that track, and at Springfield Junction while the races are at the Jamaica track. At each of these places a terminal house has been specially built for them. At these times they are connected in multiple and operated as one sub-station by two men. At other times they are held in reserve in the permanent sub-stations, each of which except No. 1 is equipped with a connection for the portable.

EFFICIENCY

The high-tension lines were designed for a 10 per cent drop to the most distant sub-station at maximum load, but under normal operating conditions the loss is approximately three per cent. The combined efficiency of the rotary converter sub-stations from the high-tension side of the step-down transformers to the direct current bus-bars is from 82 to 84 per cent.

MAINTENANCE OF ELECTRIC ROLLING STOCK OF THE LONG ISLAND RAILROAD

The electric car equipment of the Long Island Railroad consists of 130 steel motor passenger cars, 5 express cars and a rotary snow plow. In addition there are 55 wooden trail cars which have been wired with lights and heaters. The express cars are provided with trucks, motors and controllers identical with those of the steel cars.

The steel cars are very similar to those on the New York subway and are of the Gibbs design. They are 51 ft. 2 ins. long over bumpers and 8 ft. 6¾ ins. wide over side sills. They are mounted on Baldwin M. C. B. trucks, the motor and trail trucks having wheel bases of 6 ft. 8 ins. and 5 ft. 6 ins. respectively. The wheels of the motor truck are 36 ins. and those of the trailer truck 30 ins. in diameter. The steel tires on all wheels are 3 ins. thick and are fastened to the centers by shrinkage and with double lipped retaining rings. Two Westinghouse No. 113 motors each of 200 hp are mounted on the motor truck and these are controlled by Westinghouse electro-pneumatic controllers.

Repairs to both electric and to steam equipments are combined to a great extent in the original steam equipment repair shops at Morris Park under the supervision of G. C. Bishop, superintendent of motive power. In view of the fact that the greater percentage of repairs on the electric equipment could be done in the already existing shop, it was deemed unnecessary to erect a separate shop for the electric equipment only. However, to care for the electric repairs a new building was erected adjacent to the old shop and a new electric equipment department was created. The new building consists of a one-story portion containing thirteen repair tracks each of which will accommodate two cars, and a contiguous two-story structure, the upper floor of which is used as a mill room by the steam equipment department. The one-story portion containing the repair tracks is 216 ft. long and 110 ft. wide. All of the tracks have pits and the two tracks adjacent to the two-story structure are provided with five-ton electric traveling cranes. The lower floor of the two-story structure is equipped for winding armatures and there are installed in it lathes and drill presses for doing minor repair work. The repair work of the electric equipment is all done by three departments of the shop. Wheels and air brake apparatus repairs are cared for by the locomotive department. The steam car department makes necessary repairs to truck and the car body, and the purely electrical apparatus is cared for by the electric car equipment department. While in the shop organization the electric car equipment department is on equal footing with the others, it is in reality somewhat isolated from and independent of them. The general foreman of this department is responsible for the condition of the electrical equipment and must see that the other sections are advised when repairs of any kind are necessary. He gets such repairs made by issuing shop orders on the other departments, and in issuing these care is taken to indicate to what they are to be charged, as in the accounting system all the maintenance charges on the electric equipment are kept separate from those for the steam cars.

DIVISION OF ELECTRIC EQUIPMENT REPAIRS BETWEEN DEPARTMENTS

In the maintenance of the electrical equipment of a car quite a large proportion of the repairs are of a semi-mechanical nature, and rather than provide facilities for making these repairs in the electric car department there has been a decided tendency to divert them to the other two departments in the original steam car shops. Accordingly air compressors are maintained with the exception of making field and armature repairs in the locomotive department. The same department takes care of the air valves and air cylinders of the controller. Although the armature winding is done by the electric car department the winders are principally mechanics promoted from the regular shop force.

To familiarize the old shop employees with the electrical apparatus, a regular instruction course is from time to time conducted by the electrical department. At one time all of the controller parts were mounted on wood frames and connected up so that their working could be observed. The shop apprentice course now includes a period of three months in the electrical department. In general it might be said that every effort is being made to free the regular shop men of the idea that there is any radical difference between the repairs to electric and steam cars.

As a result of the method of dividing the work very few mechanical repairs have been left to the electrical department and a few men in the regular repair shop keep up the work left to this department. Motor and controller breakdowns are of rather infrequent occurrence and the work of the repair force is largely that of overhauling the motors and repairing defects due to accidents. In addition to caring for the heavy cars this force of fifteen men also does considerable repair work for the Ocean Electric Railway, the Nassau County Railway and other trolley lines subsidiary to the Long Island Railroad, and it takes care of numerous motors installed on the railroad system.

OVERHAULING AND REPAIR PRACTICE

Cars are usually cared for and kept at the two inspection sheds at Dunton and Rockaway Park, and are brought into the repair shop only when in need of repairs.

Several cars have not yet been in the shops and the motors of these cars and also of some of those brought into the shop for car body repair only as well have not been opened since being mounted on the trucks more than two years ago. During this period the cars have averaged about 60,000 miles. The appearance of many of the original bearings, which are of brass with a thin babbitt lining, indicate that they are good for another year at least.

When a car is brought into the shop for any defect whatever the electrical equipment is gone over thoroughly, except that the motors are opened up only in case of motor troubles or of worn bearings. The motor axle bearings which wear first are changed when end wear on each bearing is ¼ in. or the wear of the bearing surface is ⅛ in. When a motor is overhauled it is lifted off the truck and the top shell is taken off. The field coils are taken out and treated with three coats of shellac. When replaced a sheet of red fiber 1-64 in. thick is inserted between the field and the motor shell.

In order to get the pinion housings off the armature shaft the pinion must be removed. In replacing them they are heated in a box to which steam is admitted for a period of about one-half hour before being mounted. This treatment not only expands the pinion but also cleans it thoroughly.

Several extra armatures are kept on hand, and usually to save time a spare one is substituted for the defective one.

Before being declared o. k. repaired armatures are subjected to a test of about 2000 volts, the high voltage being obtained from a transformer testing set mounted on a truck. Three spare motor trucks are kept in the shop and when there is a shortage of cars instead of holding a defective car in the shop for truck repairs one of these trucks is substituted for the defective one. Likewise three spare trail trucks are kept for emergencies.

In removing one pair of wheels the motor is lifted from the truck, and if both pairs are to be changed the motors are removed and after disconnecting the tie straps under the journal boxes the truck is lifted off the wheels by means of a crane. There has been no occasion to turn wheels because of wear of the tread or because of sharp flanges. All changes have been necessitated by flat spots. The wear on mate wheels is about equal, there being no tendency toward sharp flanges on one wheel and double flanges on the other.

In overhauling the controller the line switch is removed from the car, is taken apart, and is assembled after replacing any worn or defective parts. The reverser, unit switch box and other parts of the controller are inspected and the resistance grids and shoe beams are painted with an inexpensive grade of insulating paint. The paint is applied by spraying and the work requires about ten minutes per car. At each overhauling the 600-volt wiring and the 12-volt or control circuit wiring are tested by using the high voltage testing apparatus previously mentioned. A pressure of about 2000 volts is used in making the test which is applied for ground insulation only.

At each overhauling the compressor is dropped from the car and is removed to the air brake department of the steam shops. Here it is taken apart and cleaned and worn parts replaced. On being returned it is tested to 120 lbs. before being put under the car. Reducing valves, slide valves, feed valves and engineers' valves are taken apart and cleaned by the electrical department, but are repaired by the air brake department.

When a car is brought into the shop a tabulated sheet is placed on it and on this blank are recorded the repairs made, the materials used and the signature of the workman who does the work and who is afterward held responsible for it.

CAR BODY REPAIRS

None of the steel cars has been in an accident involving heavy repairs and it is therefore impossible to make a comparison of the costs of repairing bodies of wood and of steel construction. However, there have been several minor accidents resulting in bent vestibule fronts. For a time boiler makers and metal workers were called upon to make these repairs, but recently the work has been done by regular freight car repair men. In cases of bent dashes or beams the bent parts are heated with a large gasoline burner and are then hammered back to shape.

Repairs so far made indicate a less cost for steel cars than for those of wood construction. The labor item on the steel car is about 30 per cent higher, but the material cost is almost negligible, as in most instances the original materials are bent back into shape. The steel car, however, is out of service longer, as more time is required to make the repairs.

INSPECTION

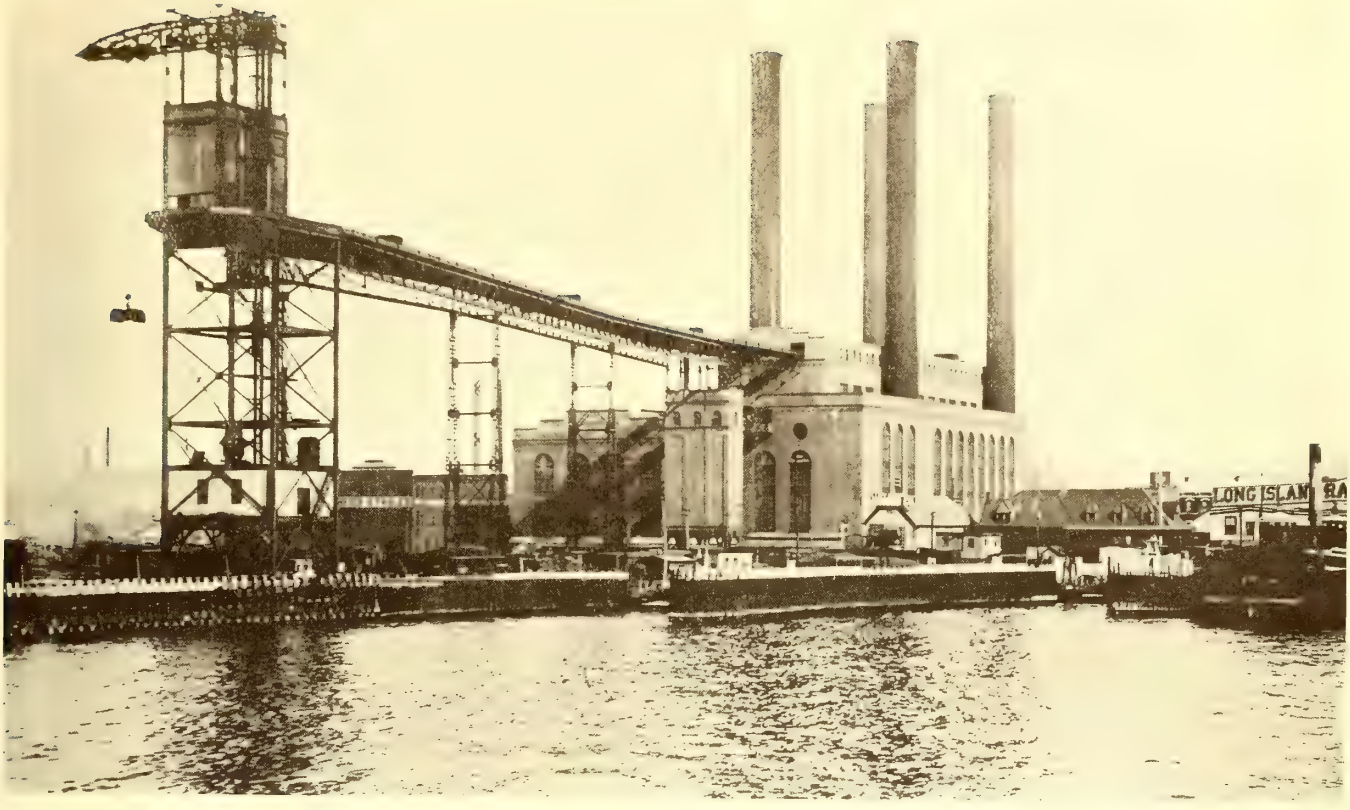
The small number of electrical repairs is no doubt due in a great measure to the careful inspection to which the cars are subjected at the Dunton and the Rockaway Park inspection sheds. The inspection shed at Dunton is 242 ft. 8 ins. long and 92 ft. wide and contains six pit tracks, each of which will accommodate five cars. The Rockaway Park inspection shed contains three pit tracks.

Cars are brought in for inspection on a mileage basis. After making 800 miles they are submitted to a general inspection. They are inspected for every ten days of service, even if this mileage is not made. One man spends about one-half hour per car inspecting and cleaning the control apparatus. In making this inspection all the reverser, unit switch box and other covers are removed, the contacts are brightened, the tension on fingers is tested and finally the apparatus is blown out by compressed air. In inspecting the brushes the motor inspector removes them from the holders in order to inspect the face of the brush and this also assures that any tight fitting brush will be detected. The armature bearings are oiled and the motors are finally blown out with compressed air. The trucks and brakes are inspected, new brake shoes applied and the piston travel adjusted by other inspectors. The shoe fuses are all tested with a bank of lamps.

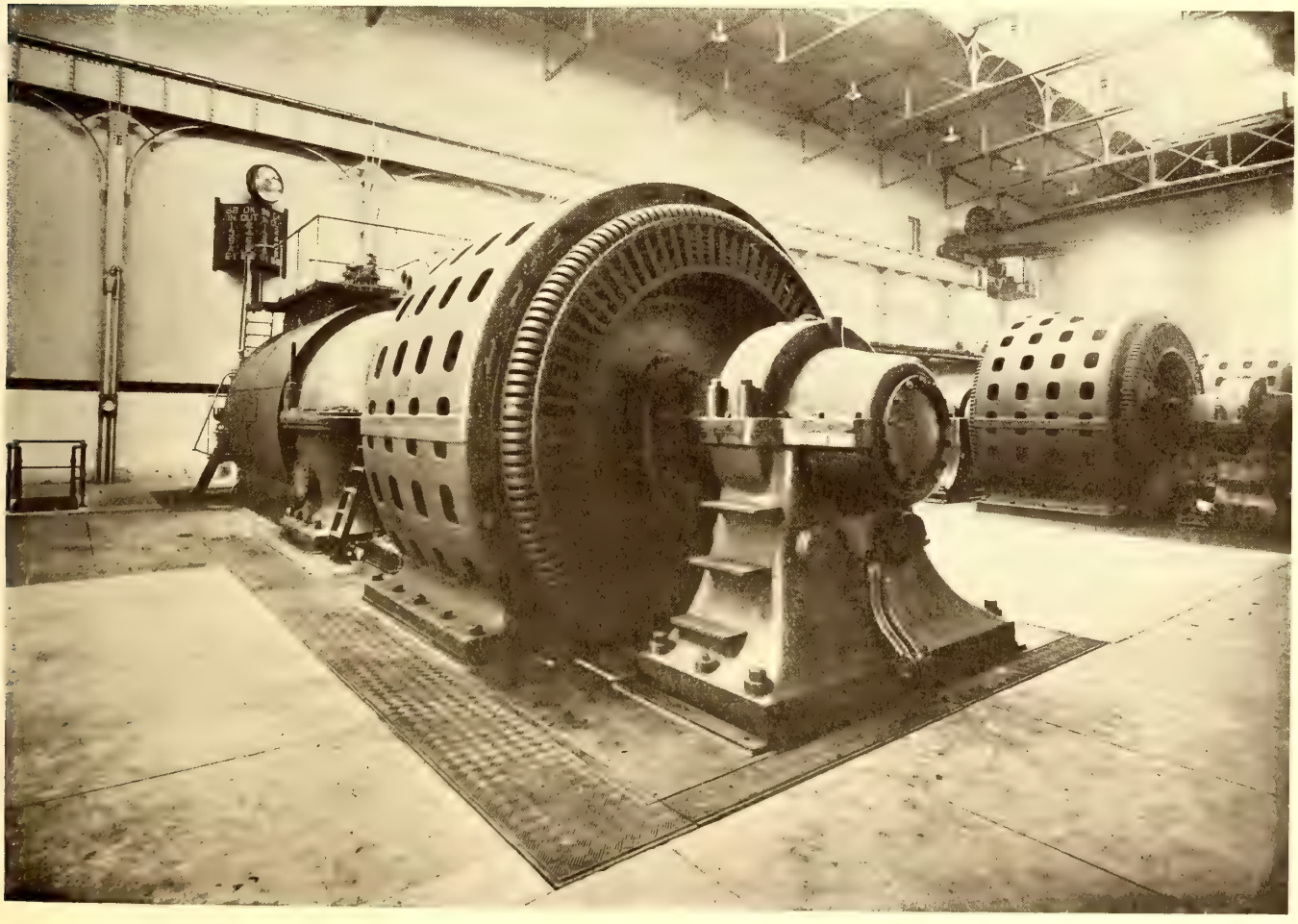
On a basis of 4800 miles the cars are brought in for "general oiling." The oil and waste is removed from the motor bearings, the waste is "teased" and the bearings are washed out. The armature clearance is determined by a gage having two thicknesses, 7-32 in. and 1/8 in. If the thin gage cannot be inserted under the armature the car is taken out of service. Failure to get the thick gage under indicates that this motor must be watched carefully in the future. The pedestals, side bearings, center castings, sector bars and all parts that chafe are oiled. The waste is pulled out of the journal bearings, is teased and the journal is lubricated with two gills of oil. The controller parts are all oiled and a coat of insulating paint is applied to the inside of all of the covers and to the insulators in the pipe conduits. Compressor oil is used in lubricating the 12-volt contacts and interlocks, as it has been found that vaseline sometimes destroys the contact. The thoroughness of the controller inspection may be judged from the fact that for a month during which ninety motor cars were being inspected daily at Dunton only five cases of controller trouble were reported, and these reports were for minor defects.

CARE OF BATTERIES

As the control system is completely dependent on the batteries for its operation these are given particular attention. Two sets are installed on each car. They are connected in multiple with a resistance which is in series with the compressor motor circuit so that when the motor is being operated they are charged. Double-throw switches are provided on the switchboard in the cab and by means of these the batteries may be thrown either on the pump circuit for charging or may be discharged through the control system. It is intended that one set of batteries be charged while the other operates the controller. As it is important that the batteries be not allowed to run down, it has been made the duty of one man at each inspection shed to throw the battery switches each morning. On even days the switches are thrown up and on odd days down. When two odd days come together, as at the end of months having thirty-one days, the switches are left up until the middle of the first odd day and then are thrown down until the end of the first day of the month. The man throwing the battery switches also tests the batteries by placing a lamp bank of 2-volt lamps across the switches. Batteries found weak are replaced by others and are recharged in a charging rack. The battery terminals outside the boxes are scraped clean once each month and a thick coating of vaseline is applied over them. When cars are not in use, or when the surplus equipment is stored during the winter, the compressor motors are run for about half an hour once each



EXTERIOR OF LONG ISLAND CITY POWER STATION, PENNSYLVANIA TUNNEL & TERMINAL CO.



INTERIOR OF LONG ISLAND CITY POWER STATION, SHOWING 5000-KW TURBO-GENERATOR UNITS



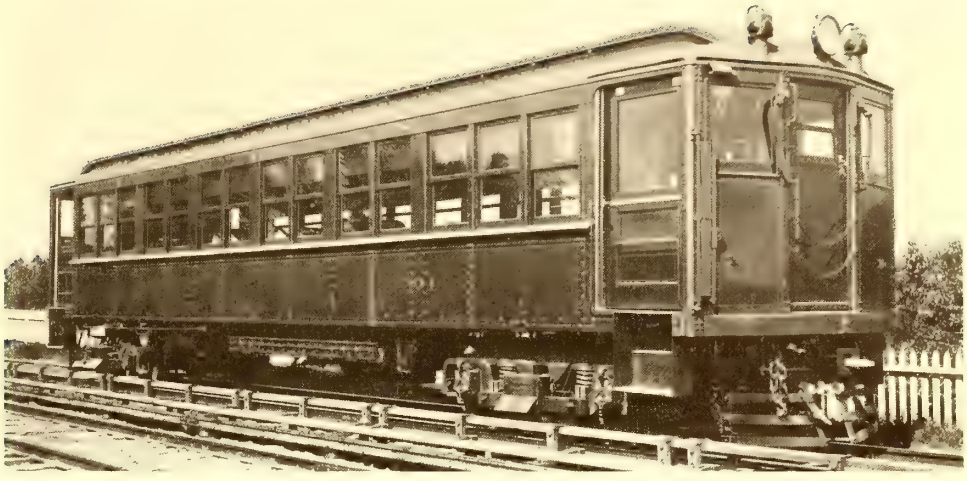
INTERIOR OF EMPTY COAL BUNKER



CABLE FUEL-CONVEYOR ABOVE COAL BUNKER



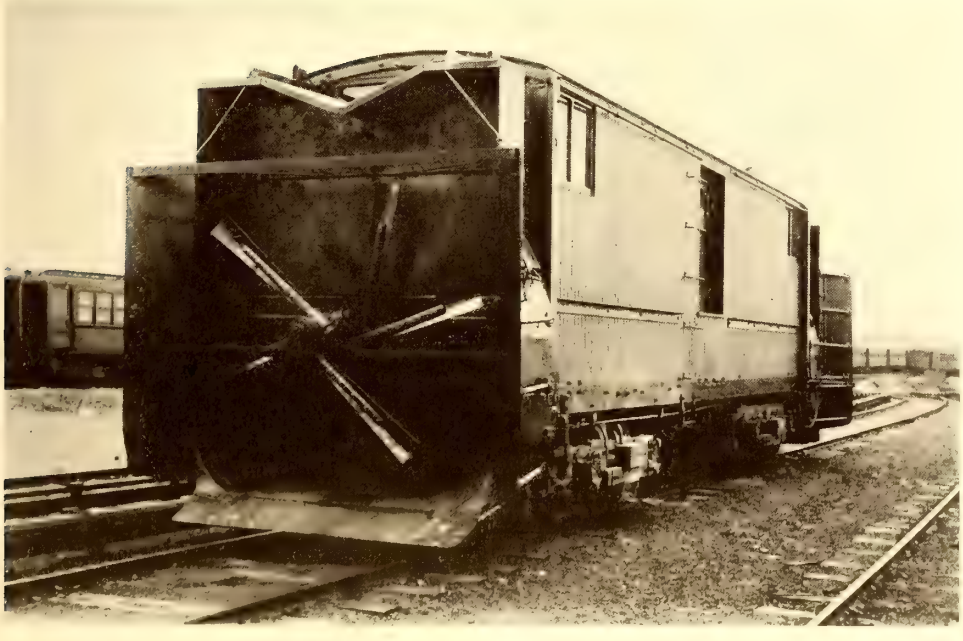
VIEW OF BOILER ROOM, LONG ISLAND CITY POWER STATION, PENNSYLVANIA TUNNEL & TERMINAL CO.



STEEL PASSENGER CAR, LONG ISLAND RAILROAD



D. C. LOCOMOTIVE AT PRESENT IN USE ON LONG ISLAND RAILROAD



ROTARY SNOW-PLOW, LONG ISLAND RAILROAD



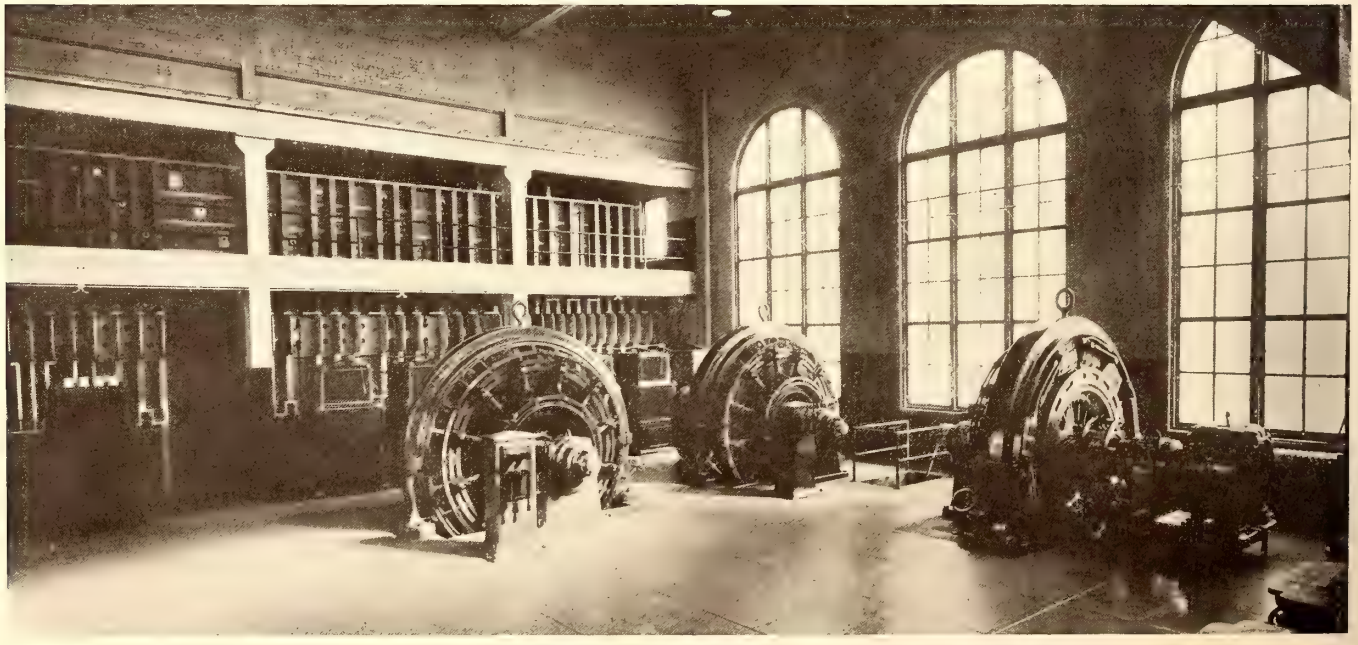
HIGH-TENSION TRANSMISSION LINE BETWEEN LONG ISLAND RAILROAD POWER STATION AND WOODHAVEN JUNCTION



EXTERIOR OF PORTABLE SUBSTATION HOUSE AT BELMONT PARK



EXTERIOR OF EAST NEW YORK SUBSTATION



INTERIOR OF WOODHAVEN JUNCTION SUBSTATION, LONG ISLAND RAILROAD



EXTERIOR OF INSPECTION SHED AT ROCKAWAY PARK



CONCRETE CAR-HOUSE AT DUNTON

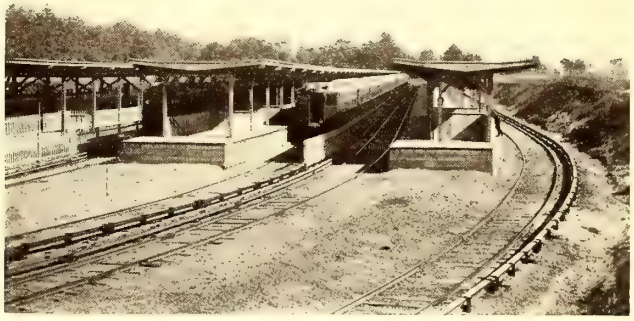


INTERIOR OF INSPECTION SHED AT ROCKAWAY PARK.



INTERIOR OF DUNTON CAR-HOUSE

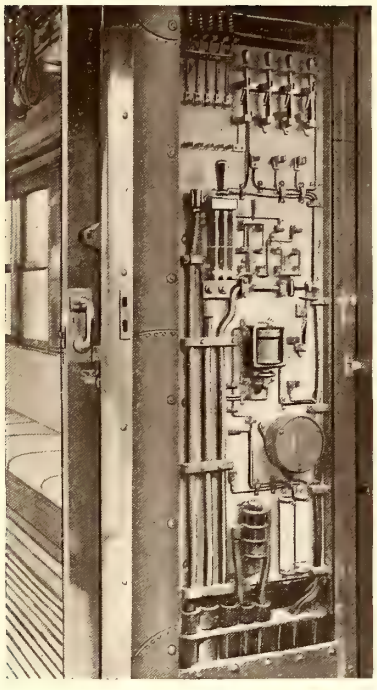


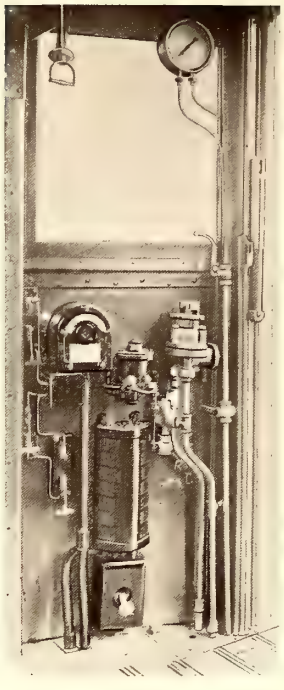


ELECTRIC RAILWAY TERMINAL AT BELMONT PARK, LONG ISLAND RAILWAY



DIRECT-CURRENT LOCOMOTIVE HAULING CONSTRUCTION TRAIN ON LONG ISLAND RAILROAD





CAB SWITCHBOARD AND CONTROL APPARATUS



TROLLEY FOR MOVING CARS IN SHED

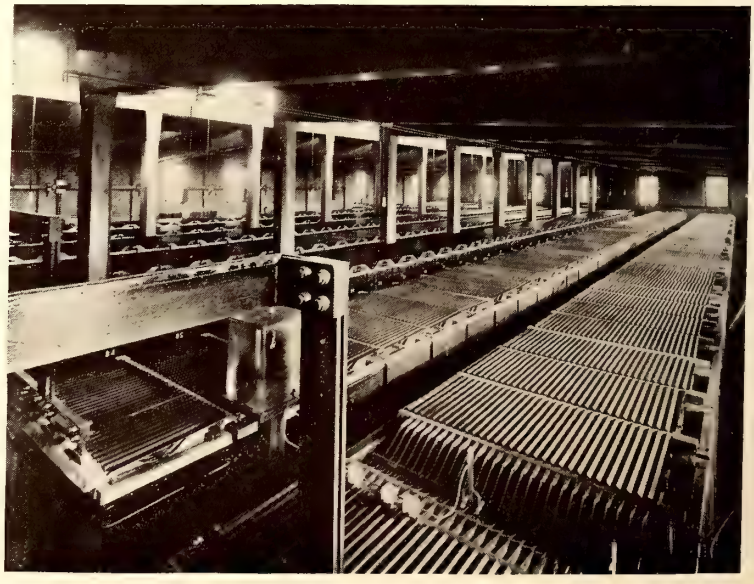




PITS AT DUNTON INSPECTION SHED, SHOWING METHOD OF LIGHTING



END VIEW OF STEEL CAR



BATTERY AT HAMMEL



LOCOMOTIVE WITH SINGLE-PHASE PANTOGRAPH TROLLEY RAISED, NEW HAVEN RAILROAD



LOCOMOTIVE WITH SINGLE-PHASE PANTOGRAPH TROLLEY LOWERED, NEW HAVEN RAILROAD



RAISING TOP GIRDER FOR FOUR-TRACK OVERHEAD TROLLEY BRIDGE, NEW HAVEN RAILROAD



BRIDGES IN YARDS, VIEW TAKEN BEFORE ERECTION OF CATENARY, NEW HAVEN RAILROAD

week in order to keep the battery charged. The air brakes and control system are also operated (without power) several times during these intervals to prevent rusting and sticking. Practically no battery troubles have been experienced; about the only trouble, in fact, is the occasional breaking of the jumper at end of cells, due to corrosion.

BRUSHES AND COMMUTATORS

Both soft and hard brushes have been tried and best results have been obtained by staggering the brushes in the holders so that a soft and a hard brush bear on the same commutator surface. The brush holder springs are set to a tension of six pounds for hard and four pounds for soft brushes. In putting in new brushes a scale is used to get the proper tension. No shunts are used in connection with the brushes. The bare brush is simply slipped into the holder with the brush holder spring pressing directly upon it. Whenever it is found that a brush is cutting the segments the commutator is rubbed off with an oily rag. Very little trouble has been experienced with flat commutators. The mica has been grooved out of a few commutators, but as no trouble has been experienced with high mica the practice has been discontinued. These slotted commutators have in fact given trouble by short circuiting between bars.

BRAKE SHOES

Brake shoes have shown a life in express service on the trail truck of approximately 6500 miles and of about 4700 miles in local service with a loss of about 18 lbs. of metal. The life of the motor truck shoes is shorter, due to the heavier braking.

CONTACT SHOES

The contact shoes with which the cars were originally fitted were flat with upturned edges. This type of shoe had a tendency to ride over ice and sleet on the third-rail and because of this a special winter type was designed having sharp edges on either side. The shoe also has two openings through the sliding surface which permit of additional cutting edges. Normally the shoe is applied to the rail with a pressure of from 10 to 15 lbs. In winter a special tension device is applied to the shoe beam which enables a tension of 100 lbs. or more to be used. The motormen are instructed to increase the tension on the shoes by means of the device in the event of sleet. Shoe troubles have been confined to the breakage of shoes, due largely to obstructions left in the path of the shoe by track repair men.

LONG ISLAND RAILROAD.

DATE_____

SUPT. M. P. & EQ.

Dear Sir:

LAMPS REPLACED.

Car No.	Burned Out	Broken	Missing	Car No.	Burned Out	Broken	Missing

Total lamps replaced in Car on above date____

Total lamps replaced in House on above date_____

LONG ISLAND RAILROAD.

TRAIN TROUBLES.

SUPT. M. P. & EQ.

Shop _____

Dear Sir.

Cars No._____

_____Line, taken out of service at _____

Cause:

LONG ISLAND RAILROAD.

PLACE_____

DATE_____

SUPT. M. P. & EQ.

MATERIAL REQUIRED AND NOT RECEIVED.

No.	When Ordered	DESCRIPTION	TO BE USED FOR

LONG ISLAND RAILROAD.

INSPECTION AND REPAIR REPORT.

SUPT. M. P. & EQ.

_____Shop _____

Dear Sir:

I have to report the following, discovered while going over cars for inspection:

SOME OF THE BLANKS USED IN THE CAR MAINTENANCE DEPARTMENT

OPERATION OF ELECTRIC LOCOMOTIVES BY THE NEW HAVEN RAILROAD

The construction details of the electric locomotives used by the New York, New Haven & Hartford Railroad were described in the issues of the Street Railway Journal of April 14, 1906, and Aug. 17 and 24, 1907. The actual handling of the machines in service illustrates the flexibility with which such high powered rolling stock units, designed for both direct and alternating current working, can be utilized under the exacting conditions of the terminal service between New York and Stamford. Under the present conditions it is inevitable that the electric locomotives of the New Haven road shall constitute the most complex portion of the physical equipment which is displacing the steam hauled trains. A study of the manner in which operation is carried on within the cabs of the machines, however, shows that if the number of parts in a combined single-phase d. c. locomotive is large, it is still possible to arrange the handling of those parts in a clear and straightforward way.

PRECAUTIONS

Each motorman is provided with one reverse lever with a controller plug attached. This lever is returned to the terminal office at the end of each run, and locomotive operators are not allowed under any circumstances to leave it on the machine.

In case any irregularity, such as a short circuit, arcing, blowing of a fuse or smoke, develops in any part of a locomotive while either standing or running, the controller is immediately thrown to the off position, and if on a. c. power the controller button marked "A. C. Trolley" is pressed down. If the machine is on d. c. power, paddles are placed between the shoes and the third-rail before investigating the cause.

PREPARING LOCOMOTIVE FOR A. C. OPERATION

When the locomotives are in the terminal or lying idle in the a. c. zone at the end of a run the condition of the apparatus is supposed to be:

1. Both trolleys (18 and 57)* locked down.
2. Both a. c. circuit breakers (19 and 143) open.
3. Both air compressor switches (71 and 128) and blower switches (70 and 127) open.
4. Controller lever in "off" position.
5. Reverse lever and controller plug removed.
6. Battery switches (167 and 168) and motor-generator switches (169 and 170) open.
7. Third-rail shoes up.
8. D. C. main switch (61) closed.
9. D. T. heater switches (114 and 181) in down position. Train line heater switch open.

When preparing to run on a. c. power the motorman first sees that both a. c. circuit breakers (19 and 143) are open and that both trolley safety chain catches are unhooked. He then raises the a. c. trolley, either by a push button or by the use of the hand pump. Both a. c. circuit breakers are then closed, and it is noted that the transformers are energized. The next step is the starting of the air compressors, securing 140 lbs. pressure, and noting that the compressors automatically cut off at this pressure. The battery switches are thrown up on even days of the month and down on odd days, and the charging motor generator is started by closing the motor generator snap switch and after it the knife switch. The controller plug is then inserted, the bell tested and sanders and light circuits tried. The control is tested out as is later described, and the d. c. trolley and third-rail shoes are lowered and raised three or four times to make sure that they operate properly. The fan motors are then started, the fans being kept in constant operation while the locomotive is running.

When running on a. c. power only one trolley is used normally, the other being kept in good working condition for emergency use. The trolley not in use is kept locked down and the lock cut out by closing the air cock on the trolley side of the magnet valve leading to the unlocking cylinder of this trolley. Trolleys are changed each day and under no circumstances is one trolley used continuously. At the end of each day's run the trolley used during that day is cut out and the other one cut in ready for the next day's run. The trolley is greased once each day before starting on the first run in the morning by filling its central groove with heavy grease. The a. c. trolley locks are inspected each morning before starting out, and both batteries are tested out at least once each day or before starting on each run, by the use of a 20-volt lamp.

PREPARING LOCOMOTIVE FOR D. C. OPERATION

Emergency procedure in case of a short circuit or other irregularity is the same when standing in the d. c. zone or in leaving a terminal as in the a. c. zone. It is assumed that while in the d. c. zone, standing, all apparatus will be in the condition described when standing in the a. c. zone, except that the shoes will be in contact with the third-rail, direct current will be in the locomotives and the motor generator switches will be open.

When it is necessary to retain a locomotive in the d. c. zone and ready for service for a period of over one hour the battery switches are opened, and if the temperature of the motors is less than 50 degs. C., as read on the temperature meters, the blowers are shut off. After reaching the end of the run the blowers are allowed to run until the temperature of the motors is reduced to 50 degrees.

In preparing to run on d. c. power the motorman first starts the air compressors and sees that 140 lbs. reservoir pressure is secured, with automatic cut-off of pumps at this pressure. The battery switches are then operated as in preparing for starting on a. c. power, and the motor generator switches are open. The controller plug is inserted, the control tested out, with trial of bell, sanders, lights and d. c. trolley.

In leaving a terminal, passing over switches, transfer or turntables and coupling up to a train, and in running at other places where slow speeds are required, the controller handle is allowed to be retained in one of the switching positions, but these positions are not allowed to be considered for anything but unavoidable conditions. There are six economical running positions of the controller handle when operating on a. c. power, and four in d. c. service. All other positions are uneconomical and are avoided as much as possible, not only to save power, but to keep from burning out grid resistances. When the motorman first throws current into the motors he is required to be sure that the ammeters in both ends of the locomotive are registering, as a check on both pairs of motors being cut in.

OPERATING TRAINS WITH A. C. POWER

When starting a train with a. c. power the controller handle is drawn promptly to a. c. position No. 1, and from this point

*These numbers refer to those on Supplement to Street Railway Journal, Aug. 17.

to positions 2, 3, 4, 5 or 6, with whatever speed is necessary for obtaining the desired acceleration. While the locomotive is accelerating, the ammeter is watched carefully and a current of 1600 amps. is maintained as nearly as possible, the rule being never to exceed 1800 amps. If the controller lever is by mistake pulled beyond No. 6 a. c., the power is cut off from the locomotive and the lever is at once to be pushed back to No. 6. Should the locomotive slow down before this is done, the plug is removed from the side of the master controller and the controller handle then pushed to the off position, the plug reinserted and the controller handle then pulled to the desired running position. A locomotive is never allowed to stand with current in the motors.

OPERATING TRAINS WITH DIRECT CURRENT

In starting a train with direct current the controller handle is promptly brought to a notch which will give a current of about 1600 amps. on the meter, and then promptly brought up to the series d. c. notch, taking care never to exceed 1800 amps. In case 2500 amps. are exceeded the d. c. circuit breakers open, and in order to reset these the controller handle has to be thrown to the off position. If a speed is desired lower than that obtained with the controller handle in the d. c. series notch, the handle is retained in this notch for a short period and then shut off, with coasting, to get a low average speed.

CHANGING FROM A. C. TO D. C. POWER

When running on a. c. power and approaching the change-over point to d. c. two posts are noted on the right of way. These posts are illuminated at night. On reaching the first one, marked "Shoes Down," the motorman presses the controller button similarly marked and notes that all the shoes are down on both sides of the locomotive. On reaching the second post, marked "Power Off," the controller lever is thrown to the off position. The storage battery knife switch and the motor generator snap switch are opened. The third-rail shoes after being down are automatically locked in that position and the train is allowed to coast over the lap between the a. c. power and d. c. power supplies. As soon as the third-rail shoes come in contact with the third-rail the a. c. trolley is automatically lowered, the a. c. apparatus in the locomotive is automatically cut out, and the d. c. equipment is cut in. As soon as the motorman notes that direct current has entered the locomotive, and the above changes have taken place, he pulls the controller lever to the proper speed point. If the third-rail shoes are not lowered in time to catch the third-rail the locomotive will receive no current, and the train must be pulled back by a switch engine. If the third-rail is not charged when the shoes come in contact with it, the a. c. trolley will not be lowered automatically, but must be lowered by pushing the appropriate controller button.

CHANGING FROM D. C. POWER TO A. C. POWER

When running on d. c. power, and immediately after reaching the overhead a. c. construction, a sign post (illuminated at night) is noted on the right of way, marked "Controller Off." On reaching this post the engineer throws off power as directed, taking care to throw the controller to the off point before the end of the third-rail is reached, to avoid drawing an arc which would damage the shoes. The controller button marked "Shoe and Trolley Unlock" is pressed and held down until the shoes leave the third-rail, and the motor-generator switches are closed in the order named.

When the shoes leave the third-rail they automatically fold up to the side of the locomotive, and the a. c. trolley is automatically forced up in contact with the trolley wire. As soon as a. c. power enters the locomotive all d. c. apparatus is automatically cut out and the a. c. apparatus cut in. As soon as it is noted that this operation has taken place and that the transformers are energized, the controller lever can be handled for the proper speed point.

MULTIPLE OPERATION

When two or more locomotives are to be operated together, all locomotives are operated from one locomotive and one controller, preferably the one at the forward end of the leading locomotive. The first operation is to make the three jumper connections between the locomotives; the second is to test the control and make sure that its operation is perfect in all locomotives, and the third is to remove reverse levers and controller plugs from all controllers except the one from which the train is to be handled. While operating locomotives in multiple on a. c. power, one trolley on each locomotive is used.

OPERATION WITH D. C. OVERHEAD RAIL

About the d. c. zone, at crossovers and switches, d. c. overhead conductors have been installed at many points where there is a gap in the third-rail. Some of these points can be coasted without the use of the overhead trolley, but in other cases, where the gap in the third-rail is long, or when handling heavy trains, power is obtained from this overhead conductor as follows: First, the controller handle is allowed to remain in a running position if the speed is not reduced; second, the master controller push-button marked "D. C. Trolley Up" is held down and the controller handle is operated as in d. c. service on the third-rail. The d. c. overhead trolley remains up only as long as the controller button is held down, and it is necessary to retain pressure on this button until the shoes come in contact with the third-rail. The d. c. overhead trolley is always kept down when the locomotive is not under the overhead rail.

RAISING A. C. TROLLEYS

Under normal conditions air pressure for unlocking the a. c. trolleys comes from the main reservoirs, which carry 130 lbs. pressure. After a locomotive has been standing for some time, such as over night, the pressure may leak off from these reservoirs, and the unlocking can then be done by pressure from the emergency control reservoir, which under normal conditions carries 130 lbs. pressure. To do this the handle of the three-way cock is thrown to the right, and after the trolley has been unlocked the handle is restored to its central position.

If there is no pressure on the emergency control reservoir. trolley No. 2 is unlocked by the use of the hand pump. The trolley can be unlocked by three or four strokes, after which it will be raised automatically. If both these methods fail, the latch in the trolley lock may be pulled by the hook on the end of the wooden pole carried in the locomotive. This is not done from the top of the locomotive, as it can be done safely by standing in the side door, or on a ladder. The pole is kept dry and rubber gloves are used in handling it in wet weather.

TESTING CONTROL ON A. C. POWER

In testing the control by daylight without electric lights the motorman first sees that at least 70 lbs. air pressure is on the control reservoir, and then opens the a. c. circuit breakers. He inserts the reverse lever in the controller, moves it to its forward position and notches up the controller to each successive a. c. position, making sure that the proper switches as shown in Fig. 6, Aug. 24 issue, come in at each successive a. c. position. The controller handle is then returned to the off position, the reverse lever thrown to the backward position and the test repeated. Finally the a. c. circuit breakers are closed.

In testing the control on a. c. power at night when electric lights are required either controller may be used and only half

the equipment can be tested at one time. The first move is to see that the balancing transformer is completely disconnected by throwing its connecting switches to the down position and opening the air compressor switches. No. 1 right hand auto-transformer is then disconnected from the trolley by opening the right hand a. c. circuit breaker. The handle of No. 2 motor control cutout is then thrown to the "out" position, and the controller and reverse lever tests made as in daylight testing. This tests switch groups 4, 5 and 6 on the right hand side of the locomotive. The next step is to throw the handle of No. 1 motor control cutout to the "out" position, then to reset the right hand a. c. circuit breaker, open the left hand a. c. circuit breaker, throw the handle of the left hand motor control cutout to the "in" position and test with reverse lever and controller handle. This tests switch groups 1, 2 and 3 on the left hand side of the locomotive, and completes the test. The left hand circuit breaker is then reset, and the handle of the left hand motor control cutout thrown to the "in" position.

TESTING CONTROL IN D. C. ZONE

This test may be made from either master controller. The first move is to open the d. c. main switch. The reverse lever is then inserted in the controller and thrown forward. The master controller handle is then brought to the d. c. switching position and then notched up to full multiple, the action of the appropriate switches being noted. The controller is then thrown off, reversed, and the test repeated, after which the d. c. main switch is closed. This does not cut current out of the lighting and heating circuits, or the circuits for the compressor or blower motors.

INTEGRATING WATTMETERS

Each locomotive is fitted with one a. c. integrating wattmeter and one d. c. integrating wattmeter which show the total amount of power used. On taking charge of a locomotive both of these meters are read and a record kept of the reading. On releasing charge of a locomotive both instruments are read a second time, and a signed record of both readings is turned in to the foreman at the terminal.

ELECTRIC HEATERS

Current at about 600 volts, both a. c. and d. c. for heating trains, will be fed through the heater change-over switch to the heater bus line of the locomotive. The bus line has a jumper socket beneath the floor at each end of the locomotive for attaching a jumper with which to make connection to the cars. The change-over switch is connected to the heater bus line by the single pole single throw heater bus line knife switch. This switch must be closed in order to secure either a. c. or d. c. power in the heater bus line, and when the electric heaters are not in use it is opened. A. C. power is fed to the change-over switch through a small balancing transformer which may be connected to either one or both of the main transformers through the single pole double throw knife switches. One switch connects the balancing transformer to the No. 1 main transformer, and the other switch connects it to the No. 2 main transformer. When the electric heaters are required, under normal conditions, both switches are in the upward position, and when they are not required the switches are down.

In the event of one of the transformers being out of service and heaters required, one of them should be up and the other down, under which condition all heating current will be drawn from one transformer. These switches have no work to perform while operating on d. c. power, as the heater change-over switch has a connection direct to the third-rail shoes. When running from a. c. to d. c., or vice-versa, the heater change-over switch adjusts the circuits automatically.

TRANSFORMERS

In case of trouble with a transformer it is cut out by opening the circuit breaker which feeds current to that particular transformer, and also by making sure that the switch connecting that transformer to the balancing transformer is in the down position and by opening the compressor motor switch.

A. C. CIRCUIT BREAKERS

While running on a. c. power, if over 1800 amps. are thrown on the motors, the circuit breakers one or both are liable to go out, and can be reset by hand, but the controller handle is always kept in the "off" position then. If a circuit breaker goes out repeatedly with less than 1800 amps. on the motors, the adjusting screw on the overload trip is screwed down to a point which will allow of this amount of current without the operation of the trip. If a circuit breaker goes out repeatedly without apparent cause, the control cutout on the side of the locomotive on which the circuit breaker is located is thrown upon the "out" position, which cuts out one pair of motors.

A. C. TROLLEYS

In case any mechanical difficulty occurs with the a. c. trolley in use, the trolley is lowered, and if the locking mechanism permits it is locked down, the air cock on the trolley side of the magnet valve leading to the unlocking cylinder of the trolley also being closed. The trolley is tied down with a rope if the locking mechanism is out of order, and the safety chains are not allowed to be used for this purpose, as they are grounded and would cause a short circuit. In case of trouble with the cable which connects the two trolleys, this cable is disconnected from both trolleys by adjusting set screws and drawing out the cable terminals. Under this condition it is necessary to use both trolleys for operating the locomotive in order to secure the use of both pairs of motors.

If trouble occurs between one of the trolleys and the circuit breaker the cable between them is disconnected, cutting out one pair of motors. Employees are not allowed to go on top of a locomotive under any circumstances when any trolley is in contact with any wire. Immediately after anyone goes on top of a locomotive when the trolleys are down the safety chains are snapped to both trolleys, which locks them down and makes it impossible for them to be raised from the inside of the locomotive. Before the top of the locomotive is left both safety chains are unsnapped in order to permit raising the trolleys. If one trolley should be raised while the other is chained a short circuit would occur between the high tension trolley wire and the ground.

UNIT SWITCH GROUPS

A failure of the unit switch groups is due usually to low air pressure, low battery voltage or to improper contacts in the control circuits. If low air pressure is suspected the gage is required to register at least 70 lbs. in the control line, with normal pressure of 130 lbs., on the main reservoir gage. Trouble in the three-way cock, if due to some slight obstruction, is usually removable by throwing the handle from one extreme position to the other several times. Any slight obstruction in the reducing valve can as a rule be remedied by tapping it with a hammer. In the event of low battery voltage, in case the switches do not respond to controller movement with the apparatus in normal condition, the battery switches are thrown to the reverse position, which cuts in the other storage battery.

If a movement of the controller handle to running position results in the coming in of a portion of the switches and a failure on the part of others, the trouble is usually due to improper contacts of some of the fingers of the motor control cut-

outs, change-over switches or master controller. In this event, if it is possible to handle the train with one pair of motors, the side of the locomotive in which the failure occurs is cut out and operation takes place on the other side. If this cannot be done the locomotive circuits are arranged as described for testing control, and the master controller is notched up until the point of failure is reached. The cases of the control cut outs, change-over switches and master controllers are opened, and a piece of wood is run along the control fingers and interlocks. A failure to make contact is noted quickly in this way and an adjustment of the troublesome fingers follow. If the failure cannot be located in this way and it is impossible to run the train on two motors the only recourse is a call for assistance.

THIRD-RAIL SHOES

A broken third-rail shoe or shoe support is broken entirely off when in the judgment of the motorman it will cause the least delay. In either case before the shoes are touched the d. c. switch is opened, compressor and blower switches opened; also the single pole single throw switch to the heater change-over switch, and wooden paddles are inserted between the third-rail and all contact shoes on the locomotive. A tool with a wooden handle is used to break off the remainder of a broken shoe. A crowbar or a coupler pin are not allowed to be used around the electric locomotives, and locomotives are not allowed to enter the d. c. zone without at least one good shoe on each side of each truck.

CHANGE-OVER SWITCHES

Air pressure for operating the change-over switches is supplied from the control reservoir at eighty pounds. If one of these switches does not throw properly under at least seventy pounds, the relay box is opened and it is noted whether the relays are in their proper positions; that is, if on a. c. power, both relays up and the d. c. relay down, and if on d. c. power, both a. c. relays down and the d. c. relay up. If they are not in their proper positions the change-over switch is thrown by hand and the trouble reported at the terminal. A lever for throwing this switch by hand is provided in the cab.

MASTER CONTROLLER

A failure of the master controller caused by an improper contact or the displacement of one of the contact fingers is readily noted and any slight difficulty of this nature is remedied on the road. In case of any serious disarrangement of the parts the controller is cut out, the reverse lever and plug removed, and the locomotive operated with the controller at the other end.

REVERSING

In case the brakes fail, as an extreme measure the motors are used for braking by throwing the controller lever to "off," reversing and notching up slowly until a stop is made. A train can be stopped by the above method if power is off the line. If running in the a. c. zone the lever is moved to any position, but if in the d. c. zone the controller is brought to a notch beyond the d. c. shunt No. 2.

OPERATING ON A. C. POWER WITH ONE TRANSFORMER OR ONE PAIR OF MOTORS CUT OUT

In case a motor or transformer becomes disabled and it is necessary to cut out a pair of motors the control cutout is thrown out, the circuit breaker leading to the pair is opened and the balancing transformer on the side of the locomotive to be killed is cut out by the reversing switch. When operating under this condition a maximum of 2000 amps. is allowed.

OPERATING ON D. C. POWER WITH ONE PAIR OF MOTORS CUT OUT

If it becomes necessary to cut out motors Nos. 3 and 4 when on d. c. power, the corresponding motor control cut out is operated, and the same thing is done with Nos. 1 and 2 when necessary. The d. c. main switch is then opened, and the trap door raised in the floor over the motors. The leads are disconnected and the cable ends taped to prevent grounding. When operating in this condition the locomotive is handled in exactly the same manner as when operating with four motors, and a current of 2000 amps. is the maximum allowed.

OPERATING WITH ALTERNATING CURRENT THIRD-RAIL

The draw of the Cos Cob bridge is not equipped with the overhead trolley, and it is the company's intention that under normal conditions trains will be allowed to coast over this draw without the use of any current, and with the a. c. trolley down. When a motorman approaches this draw he watches the overhead wire closely, and just before reaching the draw throws the controller handle to the "off" position. He then lowers the trolley and after the draw has been passed raises it again. This draw is equipped with an a. c. third-rail to be used in the event of a train becoming stalled on it. To operate under this condition the first step is to see that the d. t. heater switches are both in the "up" position. The main d. c. switch is then thrown up and the third-rail shoes lowered. The tower operator is signalled to cut current into the third-rail and the controller is handled as in other a. c. operation. The train is run on as low a speed point as is possible on the master controllers, as rapid acceleration under this abnormal condition is liable to injure the equipment. Just before reaching the end of the third-rail the controller handle is thrown to the "off" point, the d. c. main switch is then thrown down and the trolley raised, which operation folds up the shoes.

BLOWERS

Each locomotive has two motor-driven blowers for forcing a blast of air through the main motors, transformers and resistance grids to prevent their becoming overheated. The blower motors run on both a. c. and d. c. power. Each blower has a conduit which carries the air from it through one pair of motors and the transformers and grids connected thereto; but the conduits are connected in such a manner as to, in the event of one blower being disabled, carry air from one blower through both pairs of motors, both transformers, and both sets of grids. Each conduit is fitted with two dampers close to the blower, and in the event of a blower being disabled both of these dampers are kept closed in order to prevent the air from the blower in service from exhausting through the standing blower instead of through the apparatus.

The air inlet to each blower is fitted with snow shutters which can be closed during snow storms. Under this condition air is supplied to the blowers from the interior of the cab, and in order to furnish this air, if the storm is not severe, one of the cab doors is opened, otherwise one or two of the trap doors in the floor.

REPLACING FUSES

In replacing third-rail shoe fuses the main compressor and heater switches are opened and wooden paddles inserted between the shoes and the third-rail. In replacing light, blower and heater circuit fuses the appropriate switches and breakers are first opened and paddles used whenever the third-rail itself is involved through direct connection.

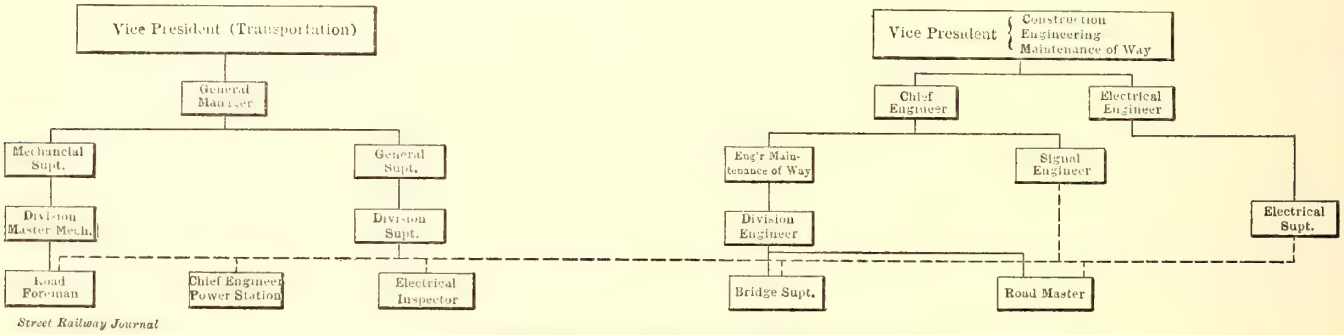
MISCELLANEOUS OPERATING CONVENIENCES

The push buttons for operating the sanders, both forward and back, are also connected with foot treadles. Each locomotive is provided with an electric speed indicator which receives current from a small magneto and registers the speed in miles per hour on dials located on the instrument board in each end of the locomotive. The cab lights are controlled separately from the head and instrument lights. The readings of the temperature meters are obtained from exploring coils, one of which is located in motor No. 1 and the other in motor No. 4. Each locomotive is provided with a steam boiler for heating trains in cold weather. It is fired with oil, the fuel being forced in by an air pressure of about 25 lbs. The oil tank can be filled either from the top of the locomotive or from the floor.

ELECTRIC RAILWAY PRACTICE OF THE NEW HAVEN RAILROAD

The electric train service of the New Haven system in and near New York has been in operation so short a time that practice has not yet become thoroughly settled in any department of the work. Experience alone will determine the routine of handling the business electrically and the form of records best adapted to the requirements. The problems of a rapidly developing system, however, are no less interesting than those of a long established organization, and the fact that any given expedient or method may be modified later in no wise detracts from the value of that method in representing the best knowledge of how to meet a present situation.

Simplicity of organization has been sought to a remarkable extent in the New Haven electric zone, as well as freedom from complication in the equipment as a whole. As a high official of the company tersely remarked, "The road is remarkable for what it has not." As far as possible every effort has been made to disturb the existing steam organization as little as possible; to handle the business with a new motive power but with as little additional or altered operating personnel as is consistent with good service. At this writing the New Haven electric train service in and out of the Grand Central Station aggregates but thirty trains per day. The load is therefore too small to enable representative studies to be made of either the power house operation, the train movements in terms of equipment capacity, or of maintenance problems. Sweeping conclusions cannot as yet be accurately drawn as to the value of detailed practice, but already the central fact stands forth, as in the case of the New York Central service, that the electric locomotive is crowding its steam driven predecessor off the rails. In the months to come there is to be little question about the complete triumph of electricity as a motive power in heavy terminal service.



Dotted line indicates jurisdiction is limited to electrical subjects

CHART SHOWING OPERATING ORGANIZATION OF THE NEW HAVEN RAILROAD

ORGANIZATION OF ELECTRICAL DEPARTMENT

The inter-relation of steam and electric practice can be seen readily in the chart on this page, which represents the organization of the electrical service in the New York terminal zone of the New Haven system. As far as possible the regular steam organization handles the work. Operation is in general charge of a Vice-President, whose special interest is transportation; and construction, engineering and maintenance of way matters are likewise under the authority of another Vice-President. The general manager, mechanical superintendent, division superintendent and division master mechanic are responsible as indicated on the transportation side of the diagram, and the chief engineer, electrical engineer, signal engineer, engineer of maintenance of way, division engineer and roadmaster are responsible as indicated on the construction and maintenance side. Up to this point electrical operation is not in evidence. The central operating authority in the electrical zone is the electrical superintendent who reports to the general superintendent in transportation matters, and is expected to work with the division superintendents and master mechanics. In maintenance of way and construction matters he reports through the engineer of maintenance of way and electrical engineer, and is expected to work closely with the division engineers. Road foremen, bridge supervisors and roadmasters act under his instructions in electrical matters. His authority over the chief engineer of the power station and the electrical inspector is practically exclusive. The responsibilities in electrical matters are indicated in the dotted lines in the chart.

The division of work of those reporting to the electrical superintendent on electrical matters is as follows:

Road Foreman of Electric Locomotives, who has jurisdiction over the maintenance and operation of electric locomotives, and instructions to motormen and their helpers. He receives his instructions in electrical matters pertaining to the operation and maintenance of electric locomotives from the electrical superintendent. In mechanical and ordinary routine matters he reports to the master mechanic in the usual manner. Requisitions and accounts are controlled in the master mechanic's office.

Chief Engineer of Power Station (Cos Cob), who has charge of the operation and maintenance of the electrical equipment. In all matters pertaining to the operation and maintenance of the power station, he receives his instructions from the mechanical and electrical superintendents. All requisitions on the mechanical department must be approved by the electrical superintendent.

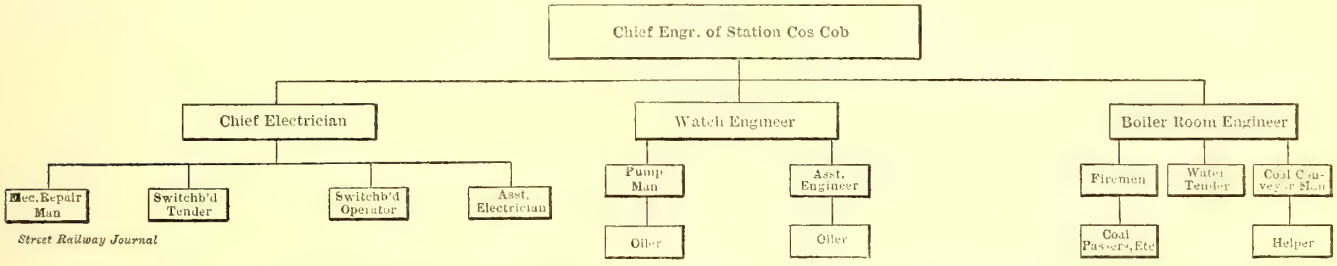
Electrical Inspector, who reports direct to the electrical superintendent. He has access to the power station and the privilege of inspecting electric locomotives during operation.

Supervisor of Bridges, who has charge of the maintenance of all bridges and culverts, and of the catenary bridges and electric transmission lines. He reports to the division engineer in all ordinary and routine matters, and to the electrical superintendent in all matters relating to the character, method and execution of all maintenance, repairs and restoration of catenary

bridges, transmission lines and other appurtenances not otherwise excepted. All routine reports, material and payroll distributions, methods of accounting, etc., are handled through the division engineer's office, being noted for his information, so far as desired by the electrical superintendent. The electrical repair and car force in connection with the same are under the jurisdiction of the supervisor of bridges.

Track and bonding repairs are under the charge of the Roadmaster, reporting through the division engineer to the engineer of maintenance of way. The electrical superintendent supervises and directs the proper installation and maintenance of track bonds through the engineer of maintenance of way.

In matters pertaining to the maintenance and repairs of track bonding, catenary bridges, overhead lines, signals and signal apparatus, the electrical superintendent reports through the engineer of maintenance of way. In matters pertaining to the operation of the power station and the electric locomotives, other than electric, the electrical superintendent takes his instructions from the mechanical superintendent and from the division superintendent. The electrical superintendent furnishes, through the electrical engineer, such data and reports as may be required.



PRELIMINARY ORGANIZATION OF STAFF AT COS COB POWER STATION

In all matters pertaining to the operation of trains, not specified above, the division superintendent has absolute control.

POWER PLANT OPERATION

The operation of the New Haven power plant at Cos Cob has not as yet settled into the routine practice which should result from the completion of the electric train service between New York and Stamford. The load upon the station manifests itself mainly in the morning and afternoon hours when local traffic between Portchester and New York is at its height. The different shifts have not as yet acquired a full measure of routine duty, and construction work is still in progress at the plant. Records of plant performance have not reached the point where they would be instructive to the general reader, but some tentative chart blanks and forms are included in the following notes for the reason that they show the way in which the company is working toward a settled routine.

The present equipment of the Cos Cob plant represents a generating capacity of 15,000 kw. Three 5000-kw Westinghouse turbo-alternators are ready for service and a fourth unit of 6000 kw rating will shortly be installed. Twelve 550-hp Babcock & Wilcox boilers with superheaters provide the steam for the plant. Mechanical draft is used instead of natural draft, and the station supplies current at 11,000 volts, 25 cycles, to the single-phase trolley lines in the 21 miles of electrified four-track line between Stamford and Woodlawn.

Bituminous coal is brought to the plant by rail at the present writing, but it will shortly be handled by barges on the Mianus River, which flows past the plant. This is a tide water stream, and an extensive coal handling equipment has been installed to facilitate the transfer of coal from the barges to the pockets in the power plant. Coal will pass from the barges into a hopper, thence to a crusher and second hopper, whence cable cars will carry it to an automatic weighing outfit. From this point it will be delivered to the bunkers and handled at the boiler furnaces by Roney stokers. The capacity of the coal machinery is 400 tons in 9 hours.

At present the plant is burning about 30 tons of coal per day. The coal is crushed to nut size or finer before being used. The bunkers are of the underground type and have a total capacity of 350 tons. They are kept full practically all the time. No trouble has as yet been experienced from fires in the bunkers, and as the coal is turned over completely about every 12 days, it is not considered necessary to take temperatures. If necessary the bunkers can be flooded. Besides the capacity available in the bunkers a temporary storage of 350 tons in the yard is available.

BOILER AND AUXILIARY HANDLING

Three shifts of 8 hours each per day are now on duty at Cos Cob. The station is in service continuously, but as outlined above the output is largely confined to the hours of peak load. These are from 5 a. m. to 9:30 a. m. and from 3 p. m. to 7 p. m. One boiler in full service is sufficient to handle the load during the light hours, the rest being either banked or dead. As yet only six boilers are required at the hours of peak load. Typical records and charts of boiler performance are not as yet in shape, as some of the boilers are still under construction. The grates are cleaned about every two hours by shaking. The make-up water supply at present comes from the mains of the city of Greenwich, Conn., and a tank of 600,000 gals. capacity is located in the yard to provide enough extra make-up water to tide over any emergency. The draft of the boilers is controlled by a Ford regulator installed in connection with the throttles of the fan engines. The usual silver nitrate test is used in connection with the water returned to the boilers from the surface condensers. The supply of feed water is controlled by a Ford regulator in the pump lines. In nine months' operation of one boiler no scale has been discovered. The boilers are blown off daily, the work being done at about midnight to about half the water gage. The exteriors of the tubes are blown off daily with a steam jet blower. It takes two men half an hour to do this. All the auxiliaries are supplied with superheated steam, and the boiler pressure carried is 200 lbs., with 75 to 100 degs. F. superheat. The boilers are ordinarily operated in multiple, but if desired the station can be operated on the unit plan. The feed water reaches the boilers at from 240 to 300 degs. F. Three Green economizers are installed, one unit for each four boilers. The scrapers are driven about two hours daily, a 4 in. x 5 in. engine being installed on each economizer. So far but one economizer has had to be used regularly, but all

can be run in multiple if desired. Flue gas temperatures and analyses have not yet been studied.

The average temperature of the circulating water discharge is from 75 to 80 degs. F., and the vacuum carried is 29 in. The condensers are cleaned weekly, but to prevent deterioration in daily service they are flushed with fresh water for two minutes each time they are shut down. The circulating pumps are designed to deliver water against a static head of about 20 ft., and have not lost their suction in regular service. All the auxiliaries are engine driven with the exception of two exciters and the coal handling system. If the condenser intake gives trouble next winter on account of ice a steam jet will be used to keep the conduit clear.

An important accessory to the condensing equipment is a motor generator set installed to prevent the electrolysis of condenser tubes by saline circulating water. In many plants this trouble has attained serious proportions. At Cos Cob a 400-volt 8-hp General Electric induction motor is direct connected to a 110-volt direct current dynamo, and from the latter current is led to a regulator panel board at each condenser in the basement. Each condenser is provided with seven taps into which current is led at a potential of 4 or 5 volts in opposite direction to that of any probable electrolytic current to counteract the effect of the latter. The plant has, of course, not been in operation long enough for a final determination of the value of this apparatus, but it is expected that it will do away with the annoyance and expense of having to open up condensers frequently, plug defective tubes, and then replace them when enough have accumulated to interfere with the most successful performance of the outfit.

TURBINE OPERATION

At present two turbines are required in service between 5.30 and 9 a. m. and between 4 and 7 p. m. Galena turbine oil is used on the bearings, Galena valve oil on auxiliaries, and the same brand of crank case oil in the exciter and auxiliary engine crank cases. Control switches, emergency lights and signal lamps are supplied with current from a 55-cell storage battery at 110 volts.

In starting a turbine from the cold state the centrifugal circulating pump is first primed, and then started, to pass circulating water through the condenser. The turbine is warmed up by the admission of steam to the throttle valve and started up by being slowly turned over for ten minutes. It is then brought up to half speed; the atmospheric valve is closed, and the turbine exhausts into the condenser. It is brought up to full speed, full field is put on, and the machine synchronized at 11,000 volts. This takes about 15 minutes.

In starting a turbine which is warm, the turning over process is dispensed with, and in from 3 to 5 minutes the machine is ready for service.

In shutting down the "stand-by" signal is first given. The machine is cut off the line by the high-tension oil switch, the field excitation reduced and the field opened. The automatic stop valve which closes the throttle valve is then tripped, and after this the atmospheric valve is opened, breaking the vacuum. With an open field the turbine will run about 30 minutes.

The signal system in the Cos Cob plant represents the latest ideas in this branch of power-station operation. The usual red and green pilot lamps are in service to show the condition of high-tension switches. To facilitate communication with the floor from the switchboard gallery and vice-versa an illuminated transparency is installed in a central position on the gollery facing the floor. This contains space for each machine number, and the designations "stand-by," "in," "out" and "o.k." An emergency blank, and exciter numbers are also included. This is operated by switches on the main control board, and eliminates the possibility of mistake due to misinterpreting the sound of an audible signal. A whistle signal in the turbine room simply calls attention to the transparency and the work goes on from that point. Between the turbine-room floor and the pump-room in the basement below the signalling is done by two mechanical gongs and by speaking tubes, the former simply calling attention to the latter. The plant also has a private branch telephone exchange with instruments located in the chief engineer's office, switchboard gallery, boiler-room, turbine-room, coal tower, machine shop and the nearest anchor bridge. The switchboard operator is charged with the responsibility of following the load and putting machines in and out of service.

ORGANIZATION

A diagram of the preliminary organization at the Cos Cob power house is shown on page 609. Each shift is in immediate charge of a watch engineer. On the turbine-room floor are an assistant engineer and oiler on each shift, and in the pump room, a pump-man and oiler. The plant has one boiler-room engineer, and in his absence each shift is in charge of a water tender, under whom are one fireman for every 4 boilers, coal passers, a coal conveyor man and helper. The complete organization here has not yet been settled. The station has one chief electrician. Reporting to him are on each shift a switchboard operator, a tender or helper, assistant electrician (night service), and one repairman for the 24 hours.

PIPE COLORS

To facilitate the handling of piping the following colors have been adopted, and in the boiler, pump and turbine-rooms tabulations in actual colors are posted:

High pressure steam lines	White.
Holly drip system	Red.
Exhaust from auxiliary apparatus	Yellow.
Boiler feed	Black.
All other pipes except fire lines	Blue.
Fire protection system	Gray.
Blow-off piping	Maroon.
Air piping	Green.
Crank case oil piping	Light green.
Cylinder oil piping	Pink.
Turbine oil piping	Brass (not painted).

MACHINE SHOP

A small machine shop is installed at the Cos Cob station, and it contains the following tools, driven in group by a 15-hp motor:

2 lathes, 36-in. and 18-in.
1 planer, 24-in.
1 shaper, 16-in.
1 radial drill, 48-in.
1 speed drill.
1 pipe-cutting machine, 6-in.
1 emery grinder and stone.

The turbine room is lighted by eleven 24-in. Cooper-Hewitt mercury vapor lamps and two large flaming arcs, which in combination produce a brilliant yet soft and pleasing illumination.

BLANKS AND FORMS

Several blank forms for station records have been drawn up in a tentative way, and are shown in the accompanying reproductions:

The daily engine-room log, original 17½ ins. x 11 ins., gives the important pressures and temperatures of each unit at each even hour of the twenty-four, as well as the attendance, hours of service, oil and waste consumption, inpection and repair accounts.

The daily boiler-room log, original 17½ ins. x 11 ins., gives the hours of service of each boiler, economizer, pumps,

NEW YORK, NEW HAVEN & HARTFORD RAILROAD
COS COB POWER STATION
DAILY BOILER ROOM LOG

X running
– banked
out

Ending Midnight_____ 190

Time	Boilers 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Economizers 1	2	3	4	Feed Pumps 1	2	3	Blower Engines 1	2	3	4	Stoker Engines 1	2	3	4	Coal Conveying Machinery 1	2	3	4	Steam Pressure	Temperatures: Aux. Heater	Economizer	Boilers	Draft: Flue No.	Flue No.
12:00 Midn't																																									
1:00 A.M.																																									
2:00																																									
3:00																																									
4:00																																									
5:00																																									
6:00																																									
7:00																																									
8:00																																									
9:00																																									
10:00																																									
11:00																																									
12:00 Noon																																									
1:00 P.M.																																									
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8:00																																									
9:00																																									
10:00																																									
11:00																																									
12:00 Midn't																																									
Total Ser. H'rs.																																									
" Reserve "																																									

Fuel

Estimated Amt. on Hand		Lbs.
Used		Lbs.
Total Ashes		
Heater in Service	M. to	M. = Hrs.

Water Meters

	Midnight Yesterday	Midnight Today	Consumption
1			
2			
3			
4			
Total			

Total Steam Consumption	
Steam per K.W.H.	
Water per Pound Coal	
Coal per K.W.H.	

Morning Watch / Day Watch / Night Watch

Name	Hours Worked	Class of Work

Repairs & Remarks

_____ Chief Engineer

Street Railway Journal

DAILY BOILER ROOM LOG, COS COB POWER STATION

NEW YORK, NEW HAVEN & HARTFORD RAILROAD
COS COB POWER STATION
DAILY ENGINE ROOM LOG

Ending Midnight_____ 190

Time	Unit No. 1 Inlet Press.	Temp. Superheat	Vacuum	Temp. Hot Well	Temp. Disc. Water	Unit No. 2 Inlet Press.	Temp. Superheat	Vacuum	Temp. Hot Well	Temp. Disc. Water	Unit No. 3 Inlet Press.	Temp. Superheat	Vacuum	Temp. Hot Well	Temp. Disc. Water	Unit No. 4 Inlet Press.	Temp. Superheat	Vacuum	Temp. Hot Well	Temp. Disc. Water
12:00 Midn't																				
1:00 A.M.																				
2:00																				
3:00																				
4:00																				
5:00																				
6:00																				
7:00																				
8:00																				
9:00																				
10:00																				
11:00																				
12:00 Noon																				
1:00 P.M.																				
2:00																				
3:00																				
4:00																				
5:00																				
6:00																				
7:00																				
8:00																				
9:00																				
10:00																				
11:00																				
12:00 Midn't																				
Average																				

Total Turbine Hours		Exciter No. 1	M. to M. Hrs.
Total Exciter Hours		Exciter No. 2	M. to M. Hrs.
Barometer	12:00 Midnight 12:00 Noon	Exciter No. 3	M. to M. Hrs.
Atmospheric Temperature			

Oil and Waste	Inspection
Turbine Oil	Turbine Engine
Engine Oil	Condensers
Cylinder Oil	Exciter Engine
Crank Case Oil	Circulating Engine
Kerosine Oil	Circulating Pumps
Grease	Vacuum Pumps
Waste, White	Hot Well Pumps
Waste, Colored	Oil Pumps
Rags	Oil System
Lamps	Crane

Repairs and Remarks

Morning Watch / Day Watch / Night Watch

Name	Hours Worked	Class of Work

_____ Chief Engineer

Street Railway Journal

DAILY ENGINE ROOM LOG, COS COB POWER STATION

blowers, stoker engines, and coal handling machinery, steam pressures, atendance, temperatures, voltmeter records and unit performance are planned for.

In the daily electrical log, original 11 ins. x 18 ins., spaces are provided for an hour to hour load curve, readings on different phases and meters, attendance, remarks and weather conditions.

The weekly comparison and efficiency report, original 8 ins. x 10½ ins., shows the labor, fuel, repairs, construction and material accounts in lots and per kw-hour for two compared weeks, with space for increase, decrease and percentage.

Another form provides for the distribution of charges for labor and material in a week in terms of the different equipment, for both operation and maintenance. The original is 8 ins. x 10½ ins.

DISTRIBUTION SYSTEM

The distribution scheme of the New Haven electrical zone has been described in previous issues of the Street Railway

NEW YORK, NEW HAVEN & HARTFORD RAILROAD
COS COB POWER STATION
DAILY ELECTRIC LOG

Ending Midnight _____ 190

K.W.H. 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12

10,000
7,500
5,000
2,500

Time	Volts	Amperes 1-3	Amperes 2-3	Amperes 1-2	Power Factor	Exciter Volts D.C.	Exciter Amp. D.C.	Wattmeters No. 1	Wattmeters No. 2
12:00 Midn't									
1:00 A.M.									
2:00									
3:00									
4:00									
5:00									
6:00									
7:00									
8:00									
9:00									
10:00									
11:00									
12:00 Noon									
1:00 P.M.									
2:00									
3:00									
4:00									
5:00									
6:00									
7:00									
8:00									
9:00									
10:00									
11:00									
12:00 Midn't									

Name	Hours Worked	Class of Work
Morning Watch		
Day Watch		
Night Watch		

Repairs and Remarks

Humidity _____
Temperature _____
Nature of Weather _____

Wattmeters

	Midnight Yesterday	Midnight Today	Output
A			
B			
C			
D			

_____ Chief Engineer

Street Railway Journal

DAILY ELECTRICAL LOG, COS COB POWER STATION

Journal, as have the other essential physical features of the work. The arrangement of 11,000-volt circuits from the operating standpoint, however, has not been discussed to any extent. It partakes of the simplicity which characterizes the New Haven problem's solution in general, but allows for a flexibility in operation scarcely realized by those who have not made a personal study of the layout. Safety and continuity of service are the keynote of the treatment.

The diagram on page 613 shows the 11,000-volt trolley and auxiliary connections in detail between Stamford and Woodlawn. Between Woodlawn and the Grand Central Station the service is on the 660-volt third-rail operated tracks of the New York Central & Hudson River Railroad.

At each anchor bridge the four main line catenary trolley wires, No. 0000 B and S cross section, are carried through oil switches to a bus-bar looping around the bridge. Overhead trolley wires are given the same numbers as the main tracks beneath them; that is Line No. 1 is the line suspended over track No. 1, etc. Parallel to the trolley wires are four other wires carried along the sides of the roadbed for supplementary work. One pair of these lines are power wires, and the other pair, auxiliary lines. One power and one auxiliary line are carried along each side of the right of way. The auxiliary wire on each side is broken by a section insulator at every alternate anchor bridge, and the power wire on each side is tapped to a transformer primary at every alternate anchor bridge. At every anchor bridge the bridge-bus is supplied with 11,000-volt power through two auxiliary lines, the auxiliary connection being double, one branch passing through an oil switch to the auxiliary on one side of a section insulator, and similarly with the other branch, a connection is made through a switch to the auxiliary. There are two transformers at each anchor bridge with permanently alive primaries. These transformers supply power for bridge lighting, motor-driven signals in some cases, and for the remote control from the adjacent signal towers of the oil switches on the bridges. Two were provided to enable a reserve to be available.

Every cross-over is divided by one or more section insulators so that it will not interfere with the cutting out of either adjoining sections of track. No section of the line can be cut dead from a single tower or anchor bridge, but two adjacent towermen must co-operate in order to kill any section of trolley between two successive anchor bridges. Any section of trolley can be fed from either end of the section, and any section can be cut out over any corresponding track without interfering in the slightest degree with the supply of power to the other sections. Any given double tower section of auxiliary line can be killed by opening the necessary oil switches in the towers affected. If the power supply fails at one end it can

THE NEW YORK, NEW HAVEN AND HARTFORD RAILROAD COMPANY

COS COB POWER STATION

Weekly Comparison & Efficiency Report, week ending _____ 190

	Week Ending Date	Week Ending Date	Increase	Decrease	Per Cent
Operation					
Repairs					
Construction					
Total Cost of Labor					
Number of Men					
Cost of Fuel					
Cost of Fuel per Ton					
Tons Used					
Kinds of Coal					
K.W. per Hr. Output					
Lbs. Water per K.W.H.					
Lbs. of Water per Lbs. Coal					
Lbs. of Coal per K.W.H.					
Cost of Fuel per K.W.H.					
Cost of Labor per K.W.H.					
Total Cost Fuel Water Labor and Material used					
Total Cost per K.W.H.					
K.W. hours per man per week					

Remarks:

Chief Engineer

Street Ry. Journal

WEEKLY COMPARISON AND EFFICIENCY REPORT

THE NEW YORK, NEW HAVEN AND HARTFORD RAILROAD COMPANY

COS COB POWER STATION, week ending _____ 190

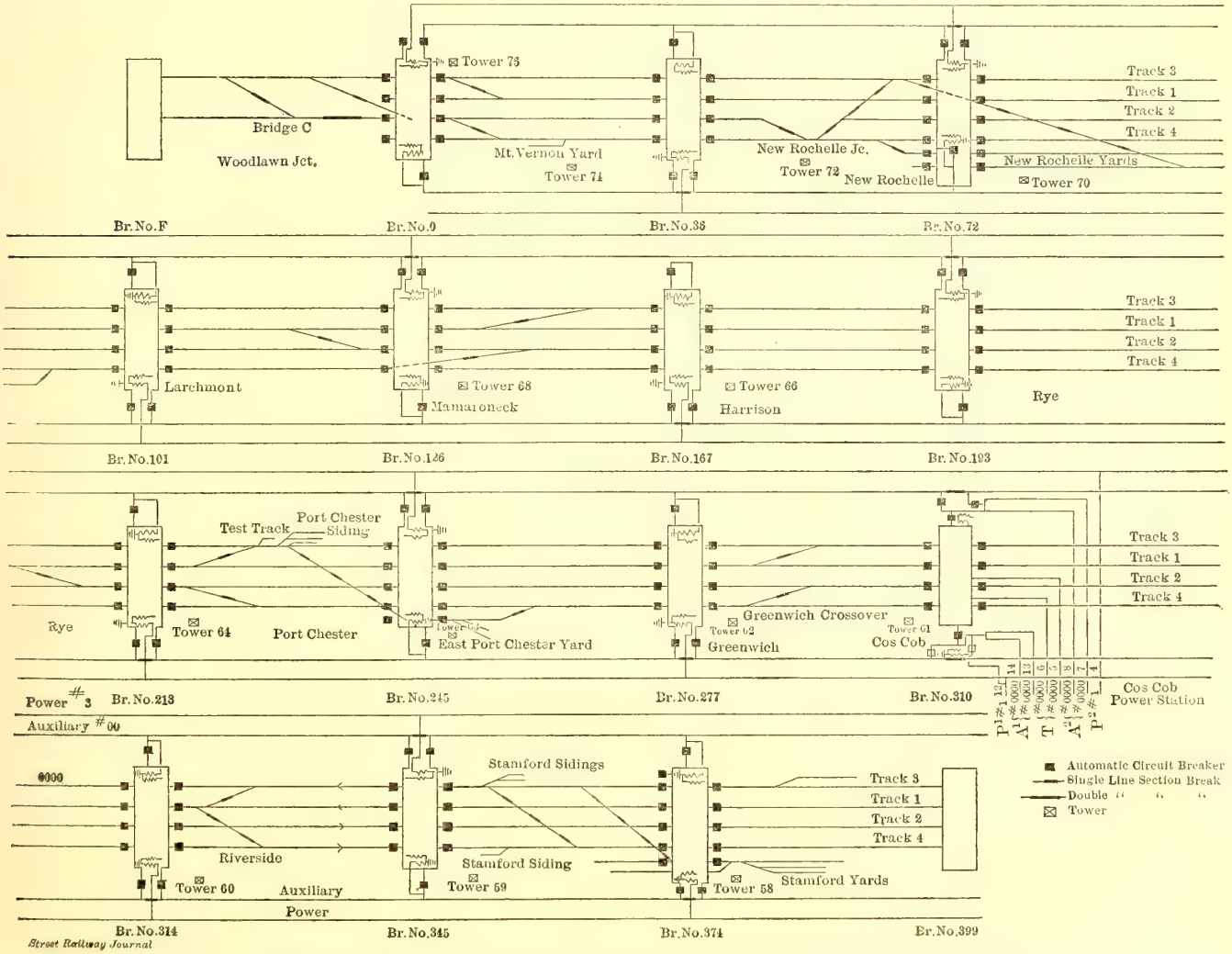
Distribution of Labor & Material:	Operation	Maintenance Labor	Maintenance Material
Engineer, Oilers, Pumpmen			
Turbines & Exciter Engine			
Condenser & Pumps			
Fireman and Water Tenders			
Boilers			
Stokers			
Economizers			
Steam & Water Piping			
Coal & Ash Handling Machinery			
Switch Board Operation			
Generators & Exciters			
High Tension S.B. & Cables			
Low " " " "			
Static Transformers			
Storage Batteries			
Storage Batteries			
Motors			
Lamps & Small Wires			
Fuel			
Water			
Lubricants			
Waste			
Other Supplies & Expenses			
Total Expenses			

Remarks:

Chief Engineer

Street Ry. Journal

WEEKLY DISTRIBUTION OF LABOR AND MATERIAL



Street Railway Journal

DIAGRAM SHOWING TROLLEY AND FEEDER DISTRIBUTION SYSTEM, NEW HAVEN RAILROAD

be had from the other, and if one side goes out of service, the other side is available for the supply of current. The combinations possible are easily apparent as the diagram is studied.

No definite dates have been set for the inspection of the catenary. Anchor bridges are inspected once in ten days. It has not been found necessary to inspect overhead trolleys at any definite period. Oil switches are inspected when the anchor bridge inspection is made. Gases from the steam locomotives have not caused any trouble. For overhead inspection and maintenance between Port Chester and Woodlawn six linemen and one oil switch inspector and helper are required. These are under the bridge supervisor, and are also subject to call for emergency work. An emergency train fully stocked with material is located at New Rochelle, and is held in readiness at all times for service.

EMERGENCIES

In case of a wreck in the electric zone, the conductor is required to proceed at once to the nearest tower, and advise the towerman as to the location, extent of wreck, tracks obstructed, wires affected, etc., and then to fill out the regular accident report, which is wired at once to the superintendent of the division. The towerman first opens the switches supplying power to his end of the affected section over tracks obstructed, and instructs the towerman in the tower next beyond the wreck to open the switches at the other end of the affected section, thus cutting off all power from the lines immediately over the wreck. The conductor remains at the tower until notified in writing by the towerman that power has been turned off the lines affected, and he then returns to the wreck and notifies all concerned that the power has been removed.

The superintendent notifies the electrical superintendent, the bridge supervisor, the electrical inspector, the road foreman of electric locomotives and the electrical emergency crew. The first duty of the emergency crew upon arriving at a wreck, is to ground the overhead wires from which power has been removed. In clearing wrecks great care has to be taken that the derrick boom does not come in contact with the overhead wires. After a wreck has been cleared and the overhead construction is in order, the last duty of the emergency crew is to remove these grounds and notify the towerman that the line is ready for operation. The rules for handling wrecks remain unchanged except as modified in the foregoing paragraphs to meet the requirements of the electric service. Every train will carry a telephone, and a complete telephone system will shortly be in service with a plug box at every third column in the catenary bridge construction. The emergency repair crew is located at New Rochelle, and live material is kept at both New Rochelle and Stamford.

The repair car used by the emergency crew is equipped with a small gasoline engine and generator set of sufficient capacity to operate the car at a low rate of speed independently of the overhead system. This insures the movement of the car to the scene of trouble, even though the normal operating current is entirely shut off. The advantages of such an arrangement are apparent.

MAINTENANCE

The maintenance work so far performed in the New Haven electric zone consists almost entirely of the light adjustments resulting from inspection of the equipment in partial service. As has been intimated before, the service at present given by electricity is too small a percentage of the service of the completed electric zone to produce normal conditions of wear. The inspection work has in itself not been standardized, and practically no repairs have as yet been necessary in connection with the electric locomotives. Some provision for inspection and repairs has of course been made, and this is touched upon in the following paragraph, though with the qualification that it does not necessarily represent permanent conditions and methods.

Electric locomotives are inspected upon their arrival in the Grand Central Station, New York, at the end of each round trip. Nothing like the full mileage possibilities of the locomotives is yet obtained in the limited service given. At the end of each 300 miles' run the locomotives are given an exhaustive inspection, the work taking place at New Rochelle or Port Chester. The inspection at the Grand Central takes a man and his helper about an hour. Thirty-five electric locomotives are now nearly in readiness for service in the New Haven electrical zone, one of these being at the Jamestown Exposition. New locomotives were shipped from Pittsburg by fast freight, and only minor adjustments and assembly were required before the machines were ready for service.

Practically no spare parts except fuses are carried upon the locomotives. Motormen make no repairs on the road. No trouble from excessive wear of third-rail shoes or pantograph trolleys has been experienced, and the overhead trolley shows no signs of wear as yet.

TEMPORARY SHOP

At Stamford a small temporary shop has been set apart for the maintenance of the electric locomotives. This is a wooden building with two inspection tracks and a pit with a short section of third track in the middle of the building. The shop is equipped with a 24,000-lb. radial cantilever hoist, and the following machine tools driven by a 47-hp 500-volt General Electric motor:

1 speed lathe,
2 engine lathes,
1 shaper,
2 vertical drills,
1 planer,
1 emery wheel grinder.

Spare armatures, facilities for bench work and racks for control storage battery cells are providtd. The general store room for line material is located close by.

TRAIN SERVICE

Eight cars per locomotive is the maximum number allowed before a second locomotive is brought into service on that specific train. Commercial service began July 24, 1907. Through trains are not as yet handled by electricity.

THE POWER STATION PRACTICE OF THE WEST JERSEY & SEASHORE RAILROAD

The West Jersey & Seashore Railroad was the first steam railroad whose adoption of electricity as a motive power was suggested by reasons other than, principally, to avoid the use of smoke-producing locomotives. The New York Central and the New York, New Haven & Hartford Railroads for that reason had been required by statute to install some other motive power than steam, and the Long Island Railroad, while not yet running its trains under the East River into New York, expects to do so during the next two years, so that its electrification was due largely to its future plans in this respect. With the West Jersey & Sea Shore, however, there was no requirement as to the reduction of smoke. Its electrification was due primarily to the desire upon the part of the owners of the property, the Pennsylvania Railroad Company, to give uniformly frequent and agreeable means of transportation for its local travel and also for its through travel between Philadelphia and Atlantic City, its great seashore resort, and at the same time to forestall possible competition.

The electrified section of this road was described in the Street Railway Journal Oct. 10, 1906, and a detailed account of its equipment will not be given here. The present series of articles is devoted to operation, but they require for their better understanding a brief description of the system.

The electrified lines consist of 64 miles of double track between Camden and Atlantic City and 10 miles of a line branching off from the main line at Newfield and extending to Millville. With the exception of the Millville branch and a short portion of the main line in the city of Camden the road is equipped with a third-rail. Power is generated in a turbine station at Westville about six miles out of Camden, and is fed to seven substations exclusive of the one in the power station. The road was electrified during the winter and spring of 1906 by the General Electric Company as contractors for the electrical equipment. As chief engineer of electric traction of the railroad company George Gibbs had general supervision of the work. The electrified lines are operated as a division of the West Jersey & Seashore Railroad, of which D. H. Lovell is superintendent. This road is in turn a subsidiary line of the Pennsylvania Railroad system. The operating electrical features of the road are in charge of an assistant electrical engineer, which position is held by C. B. Keiser.

POWER HOUSE OPERATING FEATURES

When the power house was built twelve Sterling boilers and three Curtis 2000-kw turbines were installed. Four boilers and one turbine have since been added to the station. The plant is not built strictly on the unit system, but each turbine has its own auxiliary apparatus, and in the event of accident the boilers may be cut off from each other to furnish steam to separate turbines.

Coal for operating the station is obtained from Cresson, Pa., and is delivered in hopper bottom cars. The coal shows the following analysis:

Fixed carbon	66.97	per cent
Volatile matter	19.67	"
Ash	12.26	"
Moisture	1.10	"
Total	100.00	per cent
Sulphur	3.37	"
B. T. U.	13497.	

It is known as E vein coal. Better grades have been tried, and there was a smaller consumption per kw-hour with these, but the difference in the price makes it more economical to use the lower grade. Coal is handled by a standard C. W. Hunt coal handling plant. A tower outside the building contains a hoisting engine crusher and hopper, and a steel bridge extends from the tower into the station and over the bunkers. After the cars are unloaded the coal is dropped into a concrete hopper between the track rails, from which it is passed through a gate and into a skip bucket. The bucket after being hoisted up the side of the tower is dumped into a crusher hopper at the top. After passing through the crusher the coal is caught in a hopper underneath the crusher and from this it is let into a gravity return car operating on the bridge, which car is automatically dumped over the bunkers at any predetermined point and returned to the tower.

Usually five men are required to operate the coal handling plant. Two are stationed in the car being unloaded, another loads the skip bucket and signals to the engineer at the top of the tower and another is required at the top of the tower to load the gravity car. About 50 tons per hour is the maximum capacity of the hoist.

Ashes are loaded into cars on the boiler room floor and are then discharged into the skip bucket used to elevate the coal. From this bucket they are dumped into a bin in the coal handling tower under the crusher and when they accumulate the ashes are dropped into standard steam road cars.

The coal bunkers have a capacity for 400 tons, or about four days' supply of coal under conditions of operation during the summer season. The bunkers are usually kept well filled and in addition seven or eight loaded cars are kept on the siding. The frequency with which the coal in the bunkers is changed removes any danger of overheating in the bunkers and no trouble from fires has occurred. But in the event of a fire the coal could quickly be let down to the boiler room floors.

Coal tests and tests of other materials and supplies for the station are made in Altoona by the regular testing department of the Pennsylvania Railroad.

The four boilers recently installed are equipped with Roney stokers. The others are hand fired, but arrangements have been made to install stokers under all of the boilers. The number of boilers in service in the summer season varies from twelve during the day and evening to four in the early morning hours, when the others are "reserved." Under ordinary conditions boilers are never banked as it is believed that banking them for short periods necessitates a greater coal consumption than putting them in reserve. The fires get frequent cleanings during the day, but the grates are all cleaned out thoroughly after 11 o'clock at night. Draft regulation is obtained by means of hand regulated dampers in each boiler flue and a Spencer automatic damper in each stack uptake. Boilers in service have their individual dampers opened wide, and when reserved the damper is left open only enough to permit the gases to escape. At 50 per cent overload the draft in the boiler flues is about 0.8 ins. The auxiliary operator takes care of the boiler-feed pumps, which are provided with automatic regulators and a water tender regulates the feed to each boiler.

The soot is blown off the tubes about four times a week and the exterior parts are given a thorough cleaning once a month when the boilers are washed out and the interiors inspected. At this time a hydrostatic test is made at the work-

ing pressure. A turbine tube cleaner is used to remove scale from the tubes that cannot be removed by washing.

The turbine condensers are of the barometric type and the boiler feed water is all taken from the condenser overflow flume. Analysis shows it to be entirely free from salt and comparatively free from scale-forming ingredients, so that no chemical treatment is required. The plant is not provided with economizers, and the water after passing through Cochrane heaters goes directly into the boilers. The feeding temperature is usually 212 degs. Gases pass from the flues at a temperature of approximately 500 degs. with full load on the boilers. No provision is made for obtaining a continuous record of the flue gas analysis, but analysis on a test gave the following results:

CO_2	9.10 per cent
O	9.54 "
CO	.36 "

AUXILIARY APPARATUS

The intake for the condenser water extends about 20 ft. into Big Timber Creek, a branch of the Delaware River, and terminates in a concrete well supplied with screens. Some slight trouble was caused by anchor ice last winter, but changes will be made before the coming season to prevent their recurrence. The screens are usually cleaned two or three times a week. During the fall and early winter, however, choking up with leaves sometimes necessitates their being scraped off as many times a day. The centrifugal pumps supplying the condensers can be started without priming except during periods of low water. It is customary, however, to start the dry vacuum pumps first, and let the vacuum in the condenser cause the water to rise into the centrifugal pumps. Other than at times when ice has interfered with the flow of water through the intake no trouble has been experienced with pumps losing their vacuum. Due to the purity of the condenser water there is no corrosion of the interior parts of the pumps. The vacuum carried in the condensers under ordinary conditions is about 28 ins.

OILING SYSTEMS

There are two separate oiling systems in use in the station. One is under 80 lbs. pressure and is used for the top bearings of the turbines and for other purposes. The other is under 600 lbs. pressure, at which it is maintained by an accumulator, and is for the step bearings of the turbines. For a time water was used on the step bearing, but in accordance with the policy of the turbine manufacturers, oil was recently substituted. Cooling coils are placed in a filter through which the oil passes before being pumped back into the pressure system. A good grade of engine oil is used on the bearings.

TURBINE PRACTICE

Practically no trouble has been experienced with the operation of the turbines and the maintenance cost has been exceedingly small. No provision is made for heavy repairs to the machines and the only extra parts carried in stock are a few governor and bearing parts. The throttle valves when closed permit very little leakage of steam. In fact, leakage is so small that in a few hours the turbines get cold enough to permit the men to work on them. It is, therefore, necessary to warm them up before starting. The load on the station is comparatively regular from day to day and the requirements can usually be anticipated so as to have

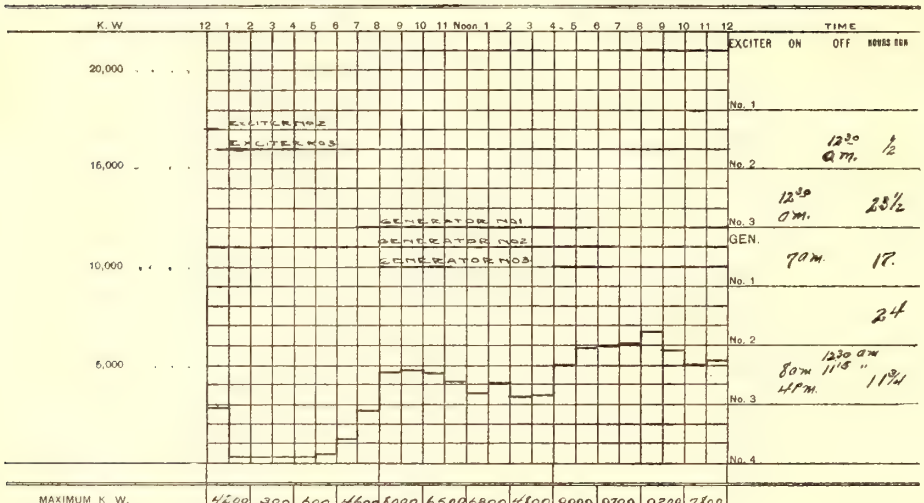
M. P. 893 A.

PENNSYLVANIA RAILROAD COMPANY

WEST JERSEY & SEASHORE RAILROAD COMPANY

ELECTRICAL LOG

WESTVILLE POWER STATION. DATE SUNDAY AUGUST 25TH 1907.



MAXIMUM K. W.	4200	300	600	4600	8000	6500	6800	4800	9000	9700	9200	7800
AVERAGE K. W.	1550	300	350	1950	4650	4300	3750	3350	5400	6000	6150	5100
MAXIMUM AMPERES	340	20	40	390	710	560	590	420	780	825	790	620
A. C. VOLTAGE	33600	33600	33600	33600	33600	33600	33600	33600	33600	33600	33600	33600
AVERAGE POWER FACTOR	27											
LOWEST POWER FACTOR												
AVERAGE FREQUENCY	27	27	27	27	27	27	27	27	27	27	27	27
VOLTS EXCITER BUS	110	110	110	110	110	110	110	110	110	110	110	110
AMPERES EXCITER BUS	290	280	280	275	395	330	290	330	390	525	525	540
AMPERES FIELDS												
AMPERES CIRCUIT A.	15	1.	1.	18	30	30	125	30	35	45	45	25
AMPERES CIRCUIT A.	15	1	1	18	30	30	125	30	35	45	45	25
HUMIDITY												
WEATHER		CLEAR										
LOAD FACTOR %												

Switchboard Operators must report in full on back of sheet any unusual occurrence, accident or failure to apparatus or circuits

KILOWATT HOUR OUTPUT

WATTMETERS	Reading Machine No. 1	K. W. H.	Reading Machine No. 2	K. W. H.	Reading Machine No. 3	K. W. H.	Reading Machine No. 4	K. W. H.	TOTAL
1 END OF LAST TRICK	5951000		6934400		5892100				
1 END OF THIS TRICK	5952400	1400	6939900	5500	5893500	1400			8300
2 END OF LAST TRICK	5952400		6939900		5893500				
2 END OF THIS TRICK	5966100	13700	6953600	13700	5898200	4700			32100
3 END OF LAST TRICK	5966100		6953600		5898200				
3 END OF THIS TRICK	5988800	15700	6967600	14100	5913700	15500			45300
TOTAL K. W. H.									85700

OPERATOR

FROM 12 P.M. TO 8 A.M. H. Hermann

FROM 8 A.M. TO 4 P.M. R. H. Graham

FROM 4 P.M. TO 12 P.M. J. S. Phelps

ASST. OPERATOR

FROM M. TO M.

FROM M. TO M.

FROM M. TO M.

APPROVED:

A. M. Dimmer

FOREMAN OF POWER STATION

ELECTRICAL LOG, WESTVILLE POWER STATION

machines warmed up and in readiness. Whenever there is to be any unusual movement of trains the power house is previously notified. The trainmaster notifies the assistant electrical engineer at Camden and the order is then sent to the power-station foreman who orders the necessary machines started.

To warm a turbine, the throttles are opened slightly about one-half hour before the machines are required. They are never started without first warming. In starting, the turbine is brought up to speed with the throttle opened one-fourth or half way. The excitation is then brought up so that when the machine is cut in it will be practically without load. After it has been cut in, the throttle is opened wide and the excitation is brought up until the machine takes its share of the load. About five minutes is required to get a turbine under load after it has been warmed. When the engineer is at the throttle he is in plain view of the switchboard operator, so that a simple signal system suffices to make the two men understand each other.

When the station was first put in operation it was customary to start up other machines as the load came on, to avoid loading the turbines much above their rated capacity. Lately the practice has been to defer cutting in other machines until those in operation are considerably overloaded. In fact, machines are allowed to take peaks of half a minute duration of 75 per cent overload. On a test with 28 ins. vacuum, 175 lbs. steam pressure and 125 degs. superheat, the turbines required 18.3 lbs. of steam per kw-hour at full load. At 50 per cent overload the consumption was 18.12 lbs.

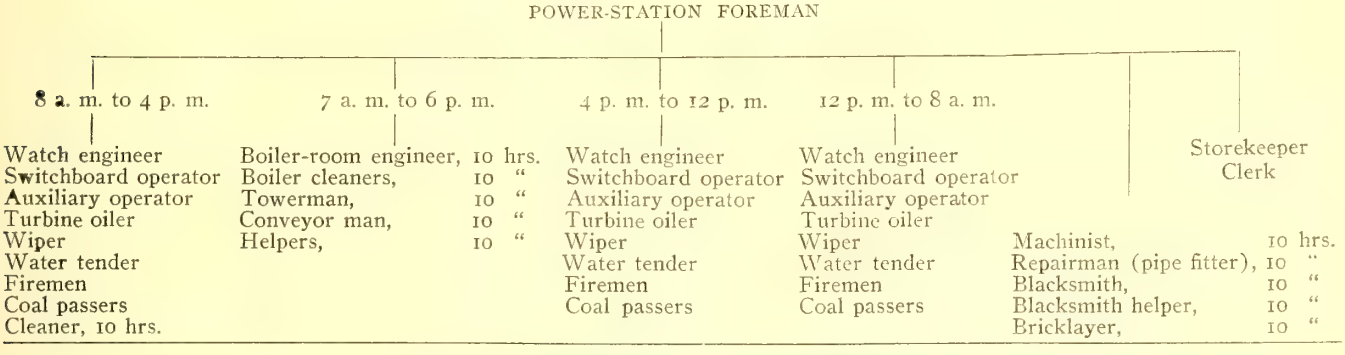
SWITCHBOARD AND ELECTRICAL APPARATUS

The switchboard is located on a gallery between the turbines and the transformers. The mechanism of the oil switches is gone over every two weeks, but the parts are inspected only after storms or blow-outs. Although periodic testing and adjustment of switchboard instruments has not yet been put into practice, the important instruments are tested whenever readings indicate that they are out of adjustment. The electrical machinery, including the air blast transformers, is blown out at frequent intervals by compressed air.

An adjacent building contains a machine shop in which the greater portion of the power house repairs are made. The equipment of machine tools consisting of lathes, shaper, drill presses and emery wheels, is driven by a motor. Another building contains a well-equipped blacksmith shop. The repair force consists of five men, a machinist, a pipe fitter, a blacksmith, blacksmith helper and bricklayer.

STORE-ROOM PRACTICE

Repair materials for the power house, sub-stations, third-rail and overhead lines are kept at Westville in a store room which is in charge of and handled by one man. A card system is employed to keep account of the material on hand. Each bin is provided with a tin card holder and whenever material is put in or withdrawn from the bin proper entry is made on the card. On the first of each month entry is made from the card on a stock record book, of the amount of the different kinds of material on hand. The stock record book shows about 2500 different classifications of material in the store room.



ORGANIZATION CHART, WESTVILLE POWER STATION

POWER-HOUSE ORGANIZATION

The watch engineer has entire charge of the station in the absence of the power-house foreman. The only electrical operator in the station is the one switchboard man, and he is directly under the watch engineer. The regular operating force work on eight-hour shifts; the repairmen, coal passers, boiler cleaners, the turbine-room cleaner and the men operating the coal-handling plant, however, work ten hours. As the coal-handling plant is operated only about five hours per day the men operating it are employed the remainder of their time in cleaning the intake screens, assisting in boiler cleaning and in doing work of a miscellaneous character about the power house. The number of firemen varies considerably at different seasons of the year, being heaviest during July and August. There is usually one man to two boilers, and a total of fifteen men is usually required in the heaviest season, there being six on the day watch, six on the night watch and three on the early morning watch. The clerk and the store keeper divide their time between the power station and the sub-station and third-rail departments. The repair force is also called upon from time to time to do considerable work for the sub-stations and the third-rail repair men.

THE DISTRIBUTION AND SUB-STATION SYSTEM OF THE WEST JERSEY & SEASHORE RAILROAD

The high-tension transmission system of the West Jersey & Seashore Railroad reaches eight sub stations. One of these, however, supplies current to the Atlantic City and Shore Line with which this article is not concerned. The high-tension lines, which are in duplicate throughout, are carried on 45-ft. poles, spaced 125 ft. apart, with the six wires disposed in inverted triangles on two cross arms 12-ft. and 8-ft. 6-in. long respectively. The insulators are 42 ins. apart, and the transformers are Y-connected with the neutral point grounded. The lines are protected by a ground wire of 5/16-in. galvanized steel cable stapled to the top of the pole. Both lines are installed in sections extending between sub-stations, which sections terminate at the sub-station bus-switches, with cutting through and disconnecting switches arranged so that either line may be made continuous throughout its length and may be used to feed any or all of the sub-stations. This arrangement makes it possible to dispense with a section of either line between sub-stations without interfering with the operation of the road. In the event of a short circuit the affected section may be cut out and all the current for the sub-stations beyond the point of trouble may be carried the distance between the two sub-stations on one line. At the sub-station just beyond the short circuit the current may be divided at the bus-bars between the two lines continuing from this sub-station.

For convenience in operation the different sections of the lines are distinguished by letters and numbers. Between the Camden and Glasboro stations, for example, the sections are designated A_1 and A_2. Succeeding sections are termed B_1 and B_2, C_1 and C_2.

The sub-stations are all built with a view of their being operated by one man. All of the apparatus and the switchboard is installed on one floor. The lighting arresters and other high-tension apparatus are in a separate room.

The following stations each contain two 750 and one 1000-kw rotaries: South Camden, Westville, Glassboro, Newfield and Atlantic City.

Reega contains two 750-kw rotaries, Mizpah two 500-kw rotaries, while Clayville contains two 500 and one 1000-kw machines. The machines are connected for starting from the a. c. side through low voltage taps brought out from the transformer. The transformers are of the air-cooled type.

SUB-STATION OPERATING FORCE

The sub-station operating force (Westville excepted) consists of two men at each station, one extra operator and one repairman. The sub-station men work alternately; one-half of the month day-time and the other half night-time. They are relieved by the extra operator who goes about from station to station, thus enabling the shift to be made without necessity of the men working overtime. On the first of the month the extra operator takes the day shift at the South Camden sub-station; the former day man follows him at night and the former night man goes on the following day. As a result each man gets 24 hours off from the time he leaves duty to the time he reports. The extra operator works in succession at each of the other sub-stations, reporting again at South Camden on the 8th of the month, relieving the day operator. Each day operator at the other stations is relieved in a similar manner. A change of shift is again made at the South Camden sub-station on the 16th, and the day operator is relieved on the 24th. The extra operator has the 15th, 30th and 31st of the month off. The extra man is not required to do cleaning about the sub-stations, but acts rather as an inspector, making daily report to the electrical supervisor of the condition of the station apparatus, and any suggestions which he may see fit to make regarding the operation of the station. This position is held by a college graduate or technical man, and is a training course to fit himself for responsible positions should the electrification of the lines be continued by the company. After the extra operator has received thorough training in the operation of sub-stations, he is given work at the power station, after which he is transferred to the Engineering Department.

TESTING-OUT APPARATUS

As all of the oil switches and other apparatus are in use almost every day, they are not operated at any stated periods simply to see that they are in order. Instruments are tested only when there are indications that they are out of adjustment. As the voltmeters in all the sub-stations are kept at 650 volts, instruments out of adjustment to an appreciable amount would be evidenced by one station feeding back into another.

CARE OF APPARATUS

Sub-station operators are required to care for all the apparatus, and are held responsible for the general condition of their station. The rotaries are blown out at frequent intervals and the transformers are blown out every two weeks. The bearings of the rotary converters are drained and washed once a month. Each sub-station is provided with a 40-gal. Liberty filter, through which the oil is cleansed. The commutators are cleaned with cheese cloth and gasoline at frequent intervals. Ordinary dynamo oil is applied to the commutator several times a day with a piece of oil-soaked cloth on the end of a stick. The alternating current brushes are removed from the holders at frequent intervals and are washed in gasoline.

The rotary converters are always started as induction motors from the a. c. side. When the machine comes up with polarity reversed the commutating switch in the field circuit is used to reverse the fields. The rotary converters are built to stand overloads of 100 per cent, and it is the practice to allow the peaks to rise to this amount on one machine before another is cut in.

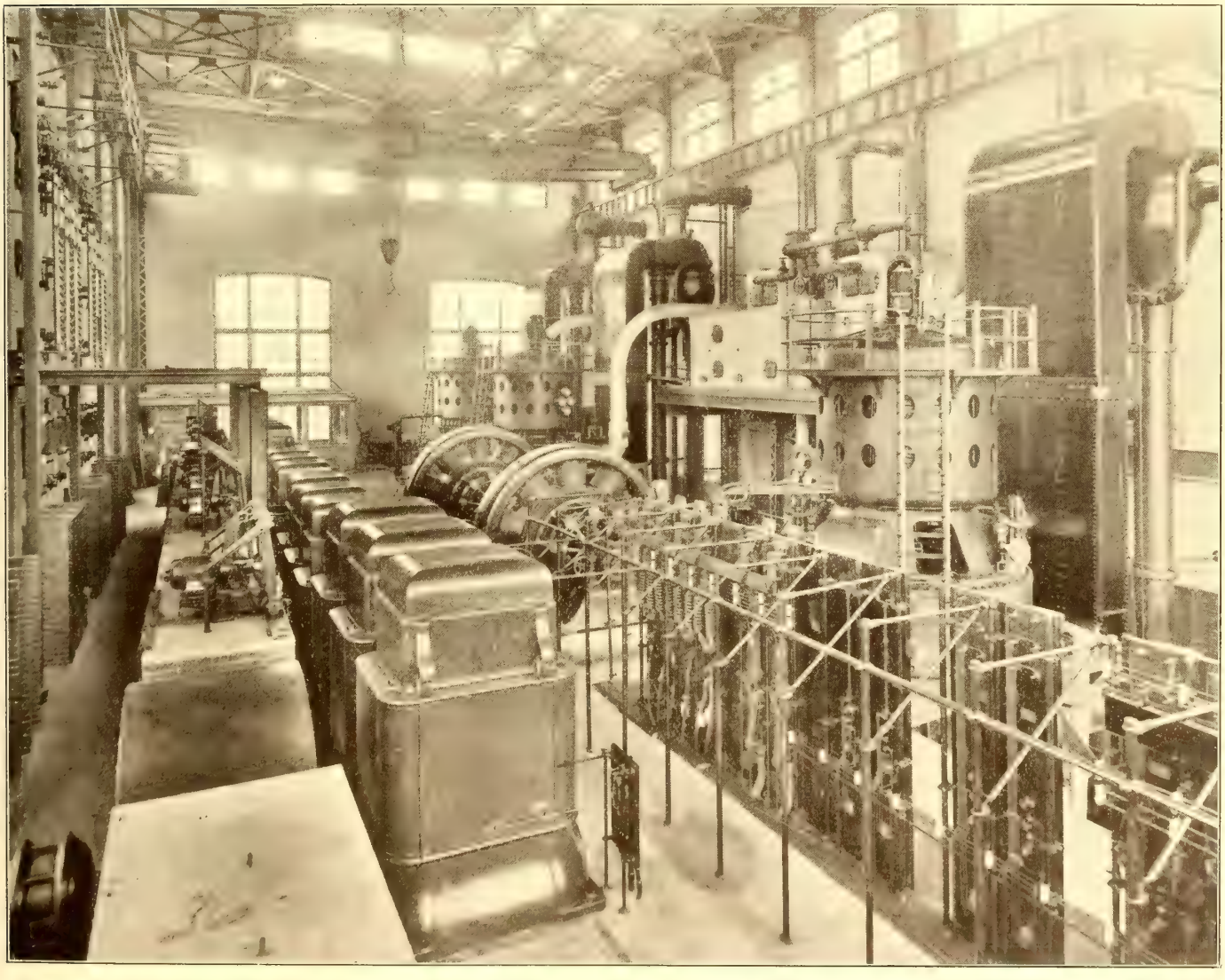
Readings of the sub-station wattmeters are taken every hour. These readings and other matters relating to operation are entered on sub-station log sheets, one of which serves over a twenty-four-hour period. In addition to entering the opening of automatic circuit breakers on the log sheet the sub-station operator notifies the power station operator by telephone as soon as a breaker has been put in. Whenever for any reason current is cut off the high-tension lines at the power house the sub-station operators are given one minute to clear their boards. In the meantime the power house operator is clearing his own sub-station board. When the high-tension lines are cut in again the men are instructed to get their machines in as quickly as possible. With the high-tension lines dead current has been gotten on the third-rail from all of the sub-stations in three minutes.

STORAGE BATTERIES AND PORTABLE SUB-STATIONS

There are no storage batteries in connection with the system, and as there is very little shifting of load over the system no portable sub-stations are provided.



MAIN TERMINAL STATION FOR ELECTRIC CARS OF THE WEST JERSEY & SEASHORE RAILROAD, TENNESSEE AVENUE, ATLANTIC CITY



INTERIOR OF TURBINE ROOM, WESTVILLE POWER STATION, WEST JERSEY & SEASHORE RAILROAD



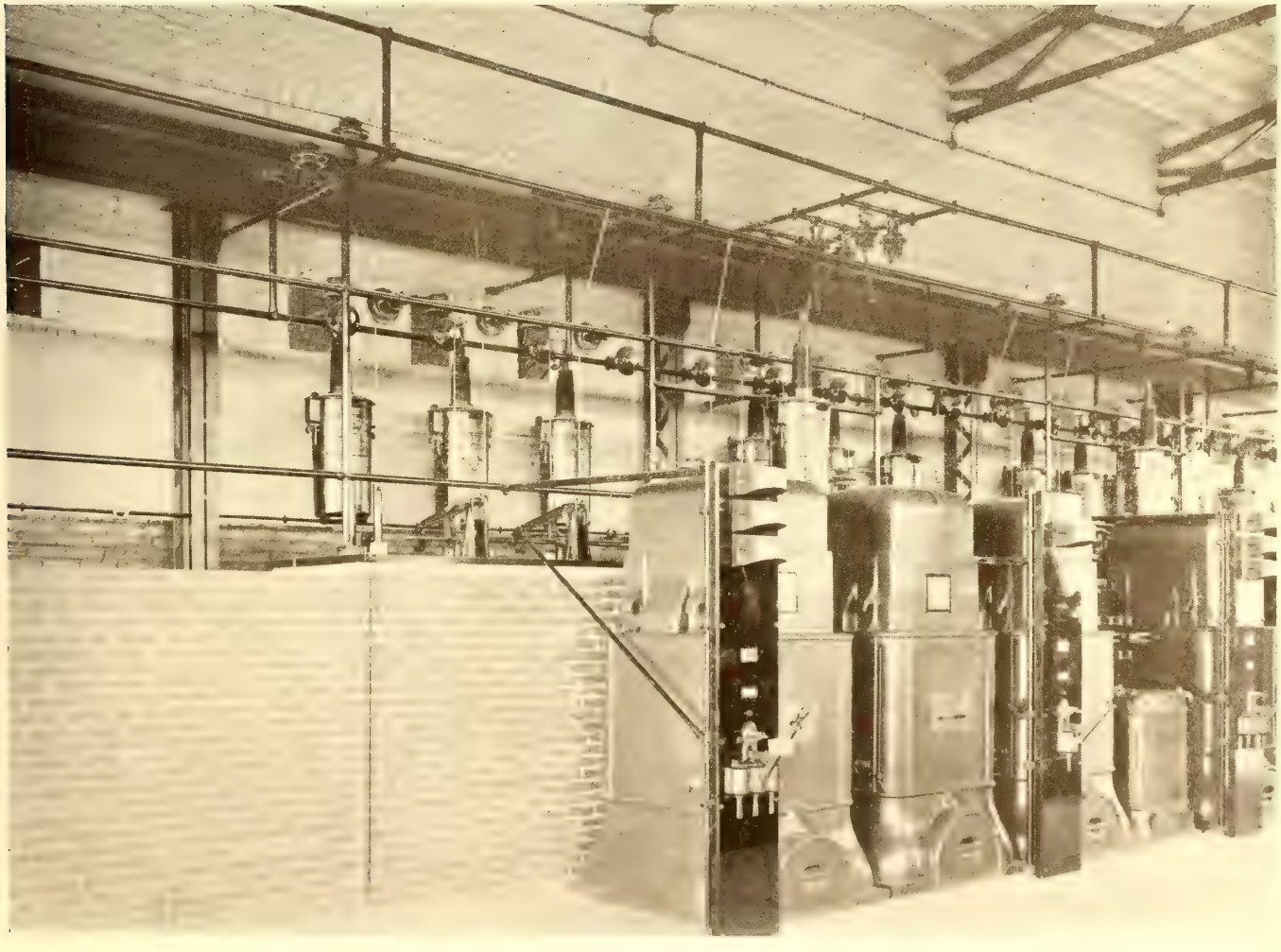
ATLANTIC CITY MEADOWS, LOOKING TOWARD ATLANTIC CITY SUBSTATION, WEST JERSEY & SEASHORE RAILROAD



END OF THIRD-RAIL ON TRESTLE AT CAMDEN AND BEGINNING OF TROLLEY, WEST JERSEY & SEASHORE RAILROAD



APPROACH TO SOMERS POINT LINE TRESTLE WORK, ATLANTIC CITY MEADOWS, WEST JERSEY & SEASHORE RAILROAD



HIGH TENSION WIRING, NEWFIELD SUBSTATION, WEST JERSEY & SEASHORE RAILROAD



INTERIOR OF ATLANTIC CITY SUB-STATION, WEST JERSEY & SEASHORE RAILROAD



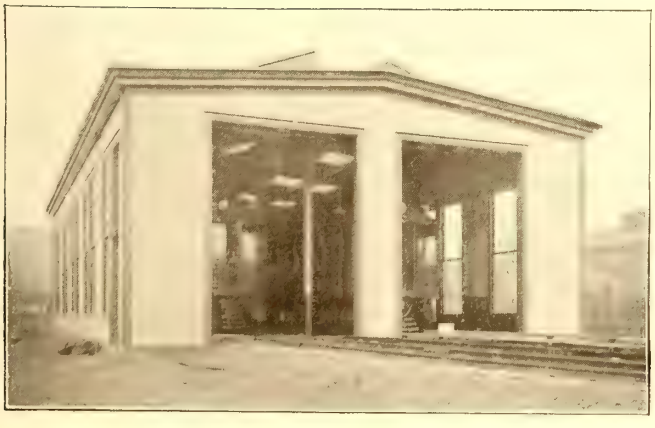
SECTION OF TRACK NEAR MIZPAH, N. J., SHOWING THIRD-RAIL AND TRANSMISSION LINE OF THE WEST JERSEY & SEASHORE RAILROAD

EXTERIOR
OF
NEWFIELD
SUBSTATION,
WEST JERSEY & SEASHORE
RAILROAD

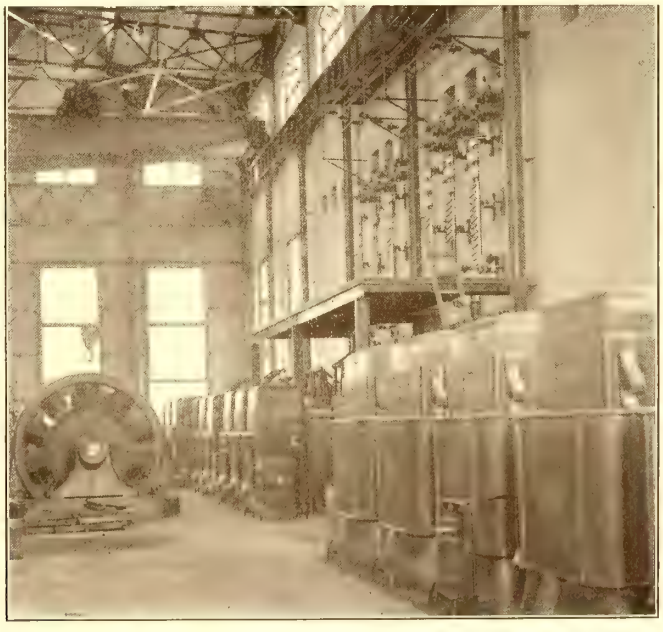




EXTERIOR
OF
GLASBORO
SUBSTATION,
WEST JERSEY & SEASHORE
RAILROAD



INSPECTION SHED AT ATLANTIC CITY



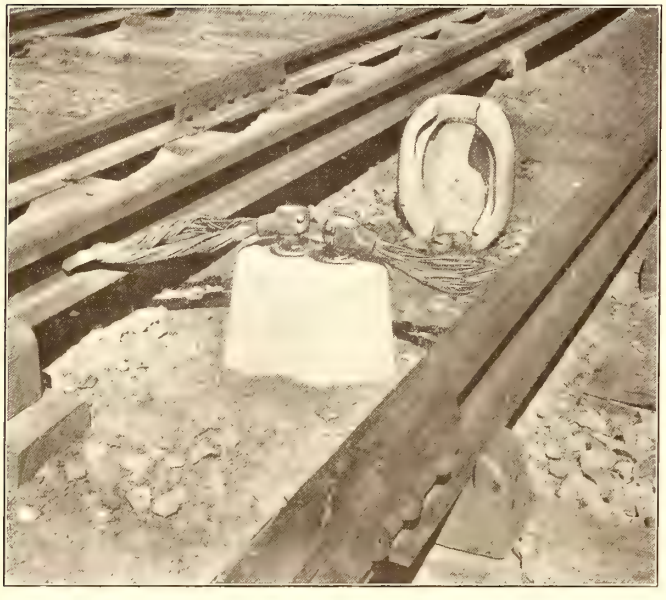
TRANSFORMERS AND LIGHTING ARRESTERS, WESTVILLE



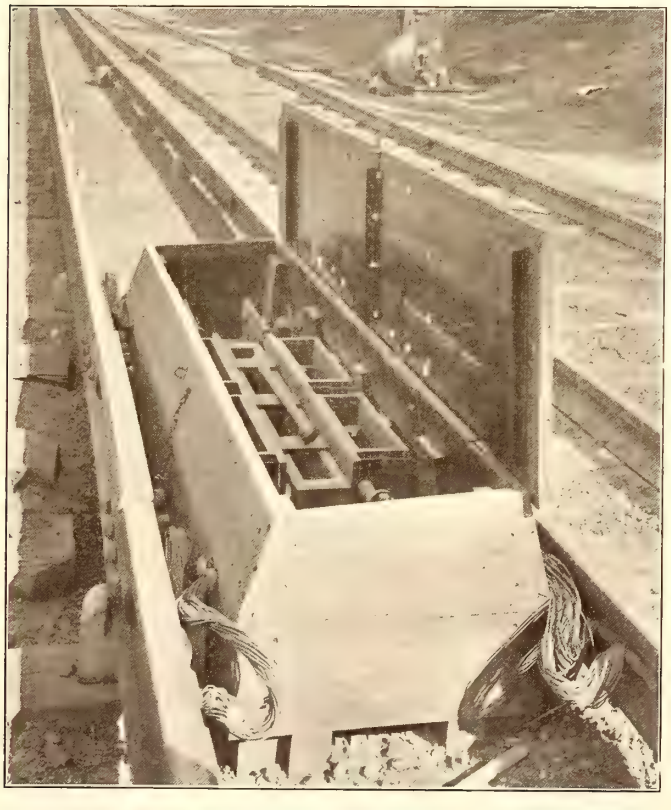
SINGLE THIRD-RAIL JUMPER



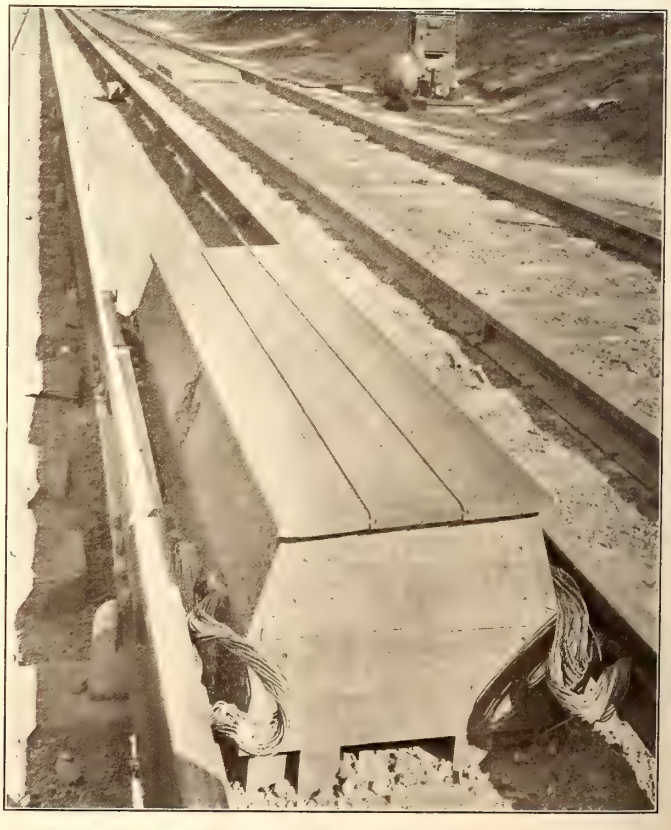
MOTOR CAR TRAIN



DOUBLE THIRD-RAIL JUMPER, WITH COVER REMOVED



THIRD-RAIL SECTION FUSE BOX, OPEN, WEST JERSEY & SEASHORE RAILROAD



THIRD-RAIL SECTION FUSE BOX, CLOSED, WEST JERSEY & SEASHORE RAILROAD



LIGHTNING ARRESTER ROOM, NEWFIELD SUBSTATION



INTERIOR OF MOTOR CAR



STANDARD BAGGAGE AND MAIL CAR, WEST JERSEY & SEASHORE RAILROAD



STANDARD PASSENGER MOTOR CAR, WEST JERSEY & SEASHORE RAILROAD



TERMINAL YARD AT ROCHESTER OF THE ELECTRIFIED DIVISION OF THE ERIE RAILROAD



SIDING AT MORTIMER, ERIE RAILROAD, SHOWING OVERHEAD CONSTRUCTION, SWITCH TOWER, SIGNAL AND SWITCH LOCK

SYSTEM OF CURRENT SUPPLY

With the exception of about 4 miles, the main line is equipped with third-rail. The third-rail insulators are placed 8 ft. apart, and the rail is bonded with concealed ribbon compressed terminal bonds, two of 500,000-circ. mil capacity being used per joint. Third-rail protection is used only in yards and at stations and on a short strip near Camden. The branch to Millville, 10 miles long, and a stretch about 4 miles long near Camden are equipped with an overhead trolley. The transmission line, sub-station and third-rail maintenance and operation are in charge of the electrical supervisor who reports to the assistant electrical engineer. The department has its headquarters and store rooms at the power station.

INSPECTION OF THIRD-RAIL, TROLLEY AND TRANSMISSION LINES

To look after the third-rail, overhead trolley and high-tension transmission lines there are one foreman and eleven men, seven of which patrol the 74 miles of electrified track between Camden, Millville and Atlantic City. The other three consist of two first-class linemen and one third-rail repairman, who assist in making heavy repairs and changes and in installing new work. The patrolmen are divided into two classes; namely, first and second. The first-class men are in reality linemen, who make repairs on the 1100-volt signal line and 33,000-volt high-tension line, which are necessarily in service twenty-four hours a day, while the second-class men are used to assist

WEST JERSEY & SEASHORE R.R. CO.

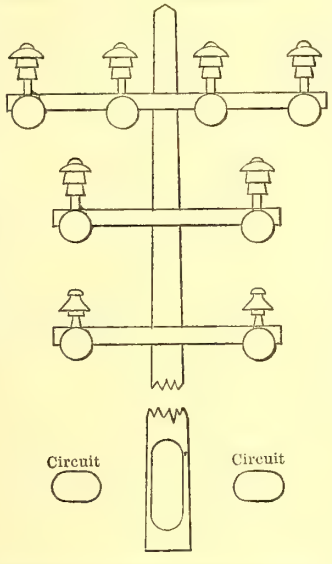
HIGH TENSION TRANSMISSION LINE

Patrolman's Trouble Report

OBSERVED REPAIRED

Date ------- Time ---------- Date ------- Time -------

Patrolman ---------- Patrolman ----------



NOTE:-Mark location of trouble by arrow point on diagram

Remarks: ----------

Material used for repairs: ----------

Time Tag ordered on circuit ---------- M ----------

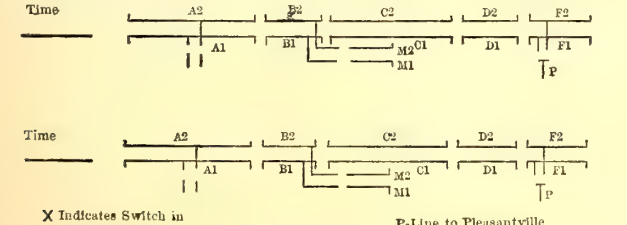
Time Tag ordered off circuit ---------- M ----------

Street Railway Journal

WEST JERSEY & SEASHORE RAILROAD
ELECTRICAL DEPARTMENT
FEEDER CHART

From M. to M. 190

Switches	SUBSTATIONS So. Camden	Westville	Glassboro	Newfield	Clayville	Mizpah	Reega	Atl. City
Line	A1	A1	A1	B1	B1	C1	C1	D1	D1	F1	F1
Line	A2	A2	A2	B2	B2	C2	C2	D2	D2	F2	F2
Line				M1	M2	M1	M2				
Cutting Thru											
Bus											
Rotary Nos.											
Operator											



X Indicates Switch in
O Indicates Switch out

P-Line to Pleasantville

REMARKS:

Street Railway Journal

Switchboard Operator

WEST JERSEY AND SEASHORE RAILROAD COMPANY
ELECTRICAL DEPARTMENT
DAILY REPORT OF PATROL CALLS AND LINE TROUBLE

SUB-STATION FROM 12 NIGHT TO 12 NIGHT 190

TIME OF CALL	PHONE NUMBER	CIRCUIT NUMBER	CIRCUIT TIME OUT	CIRCUIT TIME IN	POLE NUMBER	CAUSE OF TROUBLE	NAME OF PATROLMAN

FORWARD DAILY TO LINE FOREMAN.

SUB-STATION OPERATORS.

WEST JERSEY AND SEASHORE RAILROAD COMPANY
ELECTRICAL DEPARTMENT
SUMMARY OF HIGH TENSION LINE TROUBLES

MONTH OF 190

DATE	INSULATOR BROKEN BY STONE	SHOT	STRAIN	UNKNOWN	LOOSE INSULATORS	LOOSE GUARDS	LOOSE GUYS	PINS BROKEN	LOOSE TIE WIRES	SHORT CIRCUITS	BURNT ARRESTORS	KITE TAILS REMOVED	CROSS ARMS REPLACED	POLES REPLACED		
1																
2																
3																
4																
5																

WEST JERSEY AND SEASHORE RAILROAD COMPANY
ELECTRICAL DEPARTMENT
SUMMARY OF OVER-HEAD FEEDER AND TROLLEY TROUBLES

MONTH OF 190

DATE	BROKEN Trolley Wire	BROKEN Suspension Wire	STRAIN INSULATORS	SUSPENSIONS Straight Line	SUSPENSIONS Single Curve	SUSPENSIONS Double Curve	EARS	FROGS	CROSSINGS	BROKEN FEEDER INSULATORS	FEEDER GROUNDS		REMARKS
1													
2													
3													
4													
5													

WEST JERSEY AND SEASHORE RAILROAD COMPANY
ELECTRICAL DEPARTMENT
GENERAL REPAIRS TO OVERHEAD FEEDER AND TROLLEY WIRE

WEEK ENDING 190 SECTION BETWEEN

DATE	TROLLEY WIRE RENEWED IN FT	SUSPENSION WIRE RENEWED IN FT	GUY WIRE RENEWED IN FT	TROLLEY SLEEVES	SUSPENSIONS STR. CONT. LINE	SUSPENSIONS SINGLE CURVE	SUSPENSIONS DOUBLE CURVE	SUSPENSIONS FEEDER TAP	EARS FROGS	CROSSINGS	STRAIN INSULATORS	GUY CLAMPS	GUY RODS	EYE BOLTS ETC.	TURNBUCKLES BRACKETS INSULATORS	

FORMS OF REPORTS USED BY THE LINE DEPARTMENT, WEST JERSEY AND SEASHORE RAILROAD

in making third-rail and line repairs, and also to do all track bonding. The sections which these men patrol are arranged as follows:

One first-class patrolman who looks after third-rail, high-tension trolley and signal lines between Camden and South Westville, a distance of 6.4 miles. This man also looks after the electrified portion of the Camden yard, and is located at Westville.

One second-class patrolman between South Westville and Glassboro, a distance of 12.9 miles. This man is located at Pitman.

One second-class patrolman between South Glassboro and Forest Grove. Distance, 14.3 miles. This man is located at Newfield.

One second-class patrolman between Forest Grove and Mays Landing. Distance, 13.9 miles. This man is located at Newfield.

One second-class patrolman between Mays Landing and Pleasantville. Distance, 11.6 miles. This man is located at Mays Landing.

One second-class patrolman between Pleasantville and Atlantic City. Distance, 4.7 miles. This man is located at Pleasantville. In addition to patrolling the lines he looks after the switch tower built at Pleasantville to connect the Somers Point sub-station of the Atlantic City & Shore Railroad to the transmission lines.

One first-class patrolman between Newfield and Millville. Distance, 10 miles, who looks after the overhead trolley and high-tension transmission line.

One second-class patrolman stationed at Atlantic City, who, in addition to looking after the third-rail at the electric terminal, has charge of all yard and station lighting at both the steam and electric terminals; also the motors used at the round house and machine shop.

All the men are provided with telephone connections and are subject to call twenty-four hours every other day; or in other words, one-half of the force is on duty twenty-four hours each day. Patrol boxes are located along the line one mile apart. As the men go over their section they call up the nearest sub-station operator from each box, reporting broken insulators, tight jumpers due to third-rail creepage, loose or broken protection boards at stations, loose or worn side approaches, broken conduits, conduit caps, broken cross bonds, burnt-out cables, feeder bells, trolley ears, span wires, side guys, broken feeder taps, blown fuses in section boxes, etc. The men are provided with screw drivers, socket wrenches, pliers, small monkey wrenches and climbers; and they make all repairs possible while covering their section. On such repairs as cannot be made alone the men of two adjacent sections double up and assist each other. The repairs made consist in cutting off or extending the third-rail when creepage necessitates, rebonding both third and running rails, replacing insulators for both the third-rail and high-tension lines, and replacing and tightening guy wires.

In addition the patrolmen are sworn in by the governor of the state, thus enabling them to make arrests in any county. The mere fact that they are officers of the law has saved the company considerable annoyance from persons throwing wires and scrap iron on the third-rail and high-tension lines and shooting at insulators. The company has, therefore, without extra expense, eleven police scattered the length of the line.

The men are being made familiar with the operation of the sub-stations, so that they may be called upon to operate them in cases of emergency. They also assist the electrical repair force in making repairs at sub-stations, and thereby avoiding the necessity of sending a number of extra men over the road. They are sometimes called upon to assist the men at Westville in doing regular construction work, such as replacing poles, stringing trolley wire and laying third-rail. As they are all electrical men and work in the electrical department they can be called on to do any work on the third-rail, overhead trolley, sub-station and power house.

The high-tension lines are comparatively free from troubles of any sort. The section traversed is open country and is not subjected to many of the troubles of lines near large cities. The ground wire run on top of the poles has proven effective in shielding the line from lightning troubles. The high-tension lightning arresters which are all installed either in the sub-stations or in the power station, are inspected and cleaned every two weeks and are kept free from dust. After showers they are gone over and inspected for trouble. Test papers are kept between the cylinders, and these are examined for puncture from time to time and always after storms. The papers bear the date when put in and when removed. Those punctured are always sent to the sub-station foreman together with a report of any unusual happening or occurrence. Since installation there has been no necessity for replacing any of the arrester parts.

INSULATOR BREAKAGE AND REPLACEMENT

Patrolmen are supplied with a special blank on which the breakage and replacement of high-tension insulators are reported. The blank has upon it a diagram of a pole top with the insulator drawn in such a manner that the nature and position of a crack or defect may be indicated definitely by pencil marks. The patrolman also indicates the circuit or line on which the broken insulator is located, as this is not always shown by the position of the insulator, because wires are transposed to make a complete revolution between sub-stations. The insulator blanks which are sent in after repairs are made bear the date the broken insulators were observed and replaced, the patrolman's name and any additional remarks.

Insulator breakage has been comparatively light since the line was installed. For July, 1907, two insulators were reported broken and there was none the two preceding months. There are about 32,000 insulators on the system, and the breakage for a period of three months was therefore about .0006 per cent.

PROTECTION TO REPAIRMEN WHEN WORKING ON THE HIGH-TENSION LINES

When men are sent out to make repairs on the high-tension line, an order is sent to the foreman of the power station to have the line cut "dead." A written order is then given to the switchboard operator, who proceeds to cut out the line as follows: The sub-station operators at either end of the line or section to be cut out are instructed to cut the line "dead," which is done by first opening the oil switch controlling the line, then the disconnecting switches. A warning tag is placed on the switch panel and the switchboard operator at Westville notified that the line is cut "dead." The sub-station operators then proceed to make out a standard tag, filling in the time and date at which the circuit is cut out, placing the tag on the oil switch, and removing the warning tag. If the section is connected with the power house, the switchboard operator also opens and tags the proper switches. After the line is cut out the foreman of the repair gang is notified.

The lineman is provided with a grounding device on one end of which is a clamp for attachment to the running rail. The other end terminates in three branches provided with small clamps for attachment to the three wires of the high-tension circuit. The small clamps, moreover, are fastened on bamboo rods. After the device has been grounded to the rail the lineman ascends the pole and attaches the smaller clamps to each

of the three wires, to which they are secured firmly by thumb screws. When the repair work is completed, the grounding devices are removed from the line and the foreman of the power station is notified that the work is completed. If there are two breaks in a line, or repairs are to be made on the same section at two points, the repairmen act independently of each other in getting the line cut out. Even though it is known that the line is "dead," the second repairman proceeds just as though it is "alive." In such an event the switchboard operator receives two orders, and must receive an order from each of the repair gangs that the work is done before putting current on the line. The three wires of each circuit are located on each side of the pole, and it is customary for repairmen to work on one circuit while that on the other side of the pole is alive. However, they never work under this condition on wet

REPORTS ON SWITCHES

An accurate record is kept of the position of all switches at all times on the high-tension lines. The switchboard operator in the power house is provided with a blank having upon it spaces for indicating the position of each switch, and a diagram of the high-tension lines for indicating the position of cutting through switches. When the switchboard operator comes on the watch at the power house he calls each sub-station operator over the telephone and has him report the position of all the switches in his sub-station.

The switchboard operator then marks his sheet, indicating the closed position of the various switches by connecting the lines left disconnected on the chart with a pencil mark. This chart is then compared with the preceeding one, and if it does not agree, the proper sub-station is called up and the error

PENNSYLVANIA RAILROAD COMPANY
WEST JERSEY & SEASHORE RAILROAD COMPANY
ELECTRICAL DEPARTMENT
SUB-STATION LOG SHEET

SUB STATION ..... DATE 190

TIME	ALTERNATING CURRENT: AMPERES INPUT ROTARY NO. 1	2	3	4	DIRECT CURRENT: OUTPUT: ROTARY No. 1: WATT METER	K W HRS. PREV. HR.	DIFF.	ROTARY No. 2: WATT METER	K W HRS. PREV. HR.	DIFF.	ROTARY No. 3: WATT METER	K W HRS. PREV. HR.	DIFF.	ROTARY No. 4: WATT METER	K W HRS. PREV. HR.	DIFF.
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
NOON																
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
MID-NIGHT																
TOTAL																
Total Kilowatt Hours D. C. Output																

SERVICE — HOURS RUN: ROTARY No. | ON | OFF | HOURS
SERVICE—HRS.

D. C. OUTPUT: MINIMUM TIME | VOLTS | TIME | AMPS. ; MAXIMUM TIME | VOLTS | TIME | AMPS.

OIL SWITCH AND CIRCUIT BREAKER RECORD: TIME OUT | IN | LINE | A. C. ROTARY | D. C. ROTARY | FEEDER | CAUSE

Entry is to be made above only when Switch or Circuit Breaker is opened automatically or under orders.

TIME | OPERATOR | HELPER
FROM M. TO M.
FROM M. TO M.
FROM M. TO M.
APPROVED

Sub-station Operators will report in full on back of sheet any unusual occurrence, accident or failure in apparatus, together with repairs made.

Foreman of Power and Sub-stations.

WEATHER.....

SIGNAL WATT METER READING.....
" " .....
TOTAL K W HOURS OUTPUT.....
12 O'CLOCK MIDNIGHT TO 12 O'CLOCK MIDNIGHT

SUB-STATION LOG, WEST JERSEY AND SEASHORE RAILROAD

or rainy days. On such days, if repairs must be made, both lines are cut out.

No provision is made for subjecting the lines or other high-tension apparatus to high-voltage tests. Broken insulators are always located by inspection. The peculiar humming sound given off by a cracked insulator usually enables it to be located a week or more before it breaks down completely.

Telephone and telegraph lines are located on poles on the opposite side of the track and about 75 feet distant from the high-tension lines. Except in very damp or foggy weather there is no inconvenience from induced currents. The two high-tension lines are always operated in multiple, as this is the most economical method of operation. Each line is connected to the bus-bar at every sub-station and the two lines are therefore tied together at each sub-station. This method is not only the most economical one but, as already stated, a break down or cutting out of one line between two sub-stations simply results in the shunting of all the current over the other line for a short distance.

located. Any changes made in the connecetions afterwards are reported and indicated on the sheet, together with any special remarks, such as time current was off the line.

THIRD-RAIL REPAIRS

The patrolmen usually wait until several third-rail insulators are broken on their section before beginning to replace them, and they then call upon the patrolmen of the adjacent section for help. The two men carry a lever with which the rail is raised high enough to allow the insulator to be slipped under it. During July there were 91 broken insulators. There is a total of about 82,000 insulators on the 125 miles of third-rail, and the breakage for July was consequently a little over one-tenth of 1 per cent. The trouble report for July, which is a typical one, also showed three broken posts and eleven defective protection boards and one defective jumper. Only one or two cases have been reported of grounding of underground jumpers under highway crossings and at other points. The jumpers are of rubber covered weather-proof wire run in bituminized fibre conduit laid in concrete. Rail creepage

and the straining of jumpers, however, has caused some trouble. For emergency use cables are kept at several of the sub-stations and the patrolmen are instructed to watch jumpers closely, and in the event of one being found hot to install the extra cable in a temporary manner by burying it a few inches below the roadway.

BOND TESTING

Comparatively little trouble has been experienced with poor bonding. A Whitney bond tester is used, but on account of the intermittent flow of current through the rails little headway has been made in making a thorough test of the bonding. The company is contemplating the use of a car fitted with a motor generator set and the necessary instruments for making these tests.

WEAR AND CREEPAGE OF THIRD-RAIL

Creepage of the third-rail occasioned considerable inconvenience soon after its installation. The tendency of the rail is to creep in the direction of travel and, as has been mentioned, caused trouble by pulling on and straining the jumpers between sections. In a few extreme cases of creepage three or four feet of one end of the rail was cut off and was spliced to the short end. Expansion of the rail gave trouble particularly on curves by breaking insulators. Trouble from creepage and expansion was practically eliminated by loosening the angle bars and oiling the joints. The bars were made loose and are kept so by the patrolmen, who go over the joints occasionally and strike them with a sledge. As a further precaution anchors are being installed at intervals of from 1000 to 1500 ft. Nothing is being done to prevent the rail from rusting. It has become coated with rust, but it is believed that it will not be eaten to any depth.

FIGHTING SLEET

Sub-station men are instructed to keep close watch at times when sleet is likely to form, and to give immediate notice of any signs of sleet to the line foreman, who is in constant touch with all points on the line. Calcium chloride cars are held for emergencies at Camden and at Atlantic City, and these are hauled over the road by steam locomotives or motor cars. The cars are simply old box cars provided with barrels having an outlet extending over the third-rail. In summer the cars are usually dismantled and used for other purposes. Shoes with cutting edges of practically the same design as used on the Long Island Railroad are employed in winter, and are supplied with an extra tension device. Without the device the tension on the shoes is about 18 lbs. and the pressure may be increased up to 90 or 100 lbs. with it. It can be put into service without tools in a very few minutes. The winter shoes are removed in summer because of the danger of wearing the side approaches and replaced by lighter shoes. These approaches are the only part of the third-rail insulators showing wear, there being no perceptible wear of the rail or the end approaches or of the section insulators, which are installed midway between sub-stations and at sub-stations.

Switches and fuses are located in boxes at the section insulators between sub-stations. Instructions issued to operators and others concerned state that the station and signal tower operators are to open the switches when instructed to do so by the superintendent or in case of wreck at the request of the motorman or conductor or the section foreman. The third-rail foreman is to see that they are properly closed. Those who open the switches are to take the name and occupation of the person requesting them to do so, and they are to advise the superintendent promptly after doing so. Each box is supplied with a hook on a long wood handle and this is hooked into the blade when opening the switch.

THIRD-RAIL PROTECTION

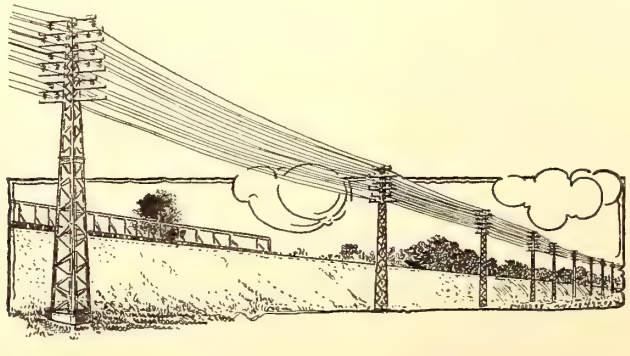
The third-rail is provided with protection boards in yards, at stations and at other points where people might come in contact with it. Cast iron warning signs are erected on posts at all highway crossings, and notices in the cars state that the third-rail must not be stepped on or touched and that passengers must not get off cars except at stations and upon station platforms.

NIGHT OPERATION

Electric cars are not usually operated between the hours of 1 and 5 a. m., but as the motor-driven compressors used in connection with the signal system take current from the third-rail the sub-station in the power house is usually operated continuously and current kept on the third-rail twenty-four hours.

TROLLEY AND OVERHEAD CONSTRUCTION

The patrolmen on the sections equipped with trolley keep record of all repairs and defects the same as the third-rail patrolmen and send in reports to the foreman, who makes out reports summing up all troubles, which he sends to the office of the assistant electrical engineer. These reports are then summarized for the month on special blanks. A baggage car fitted up as a repair or tower car is used in making repairs. The car is pulled over the road by a steam locomotive or motor car. Lightning arresters are placed on every eighth pole or at 1000-ft. intervals, and these protect the trolley line satisfactorily. Arresters are inspected after every storm. Only one car has been struck by lightning. This happened when lightning struck a signal bridge just as the car was passing under it and resulted only in the blowing of the control circuit fuses.



MAINTENANCE OF ELECTRIC ROLLING STOCK, WEST JERSEY & SEASHORE RAILROAD

The original electric car equipment of the West Jersey & Seashore Railroad consisted of sixty-two passenger cars and six combination baggage and mail cars. Recently seventeen additional passenger cars, two combination passenger and baggage and two straight baggage cars were added. The cars are 55 ft. 5½ ins. long and 9 ft. 8¾ ins. wide over side sills and are of the Pennsylvania standard wood construction. They are mounted on Baldwin M. C. B. trucks. Two G. E. 69 C. motors of 200-hp capacity each are hung on one truck, which has a 7-ft. wheel base. The wheels of this truck are 36 ins. in diameter and have 3-in. steel tires shrunk and bolted on. The control equipment is the Sprague-General Electric automatic multiple unit type. All the wiring is in iron pipe conduit. The trail trucks are fitted with Schoen 33-in. solid rolled steel wheels.

CAR REPAIRS AND INSPECTION

Heavy repairs and general overhaulings are made in the Pavonia shops of the Pennsylvania Railroad Company, located near Camden. These shops were formerly used as a general locomotive and coach shop, but repairs to locomotives have been discontinued and the shops are now used for steam and electric car repairs only. There are three inspection sheds on the road. One at Camden near the terminal train sheds has three tracks, each of which will hold three cars. The shed at Atlantic City has two tracks and that at Millville one track. The tracks in all the sheds are provided with pits. At the two smaller sheds only emergency repairs and inspections are made. All regular inspection is done in the Camden shed, which is well equipped for such inspections and also for making light repairs. One track is equipped with an overhead traveling crane and a small shop is provided in one corner. There are no storage barns for electric cars on the system and when not in service the cars are stored outside at the points at which they are likely to be required.

Inspection of the electrical apparatus is made on a mileage basis. When the road was put into operation the limit was 600 miles, but it has since been increased to 1200 miles. The mileage is computed by the night inspector from the conductors' slips by multiplying the number of trips the car has made during the day by the miles between terminal points. When the cars have made in the neighborhood of 1000 to 1200 miles, a list of such cars is given to the station master at the electric terminal, who instructs the yard drill crews to have the cars set aside for inspection. The average time between inspection varies from three to seven days, according to the season of the year. The inspections are so arranged that all cars will be in service Saturday afternoons and Sundays.

On Monday mornings about half of the total equipment is due for inspection, and all men in the shop are put at inspection, and from 20 to 30 cars are gone over. The number inspected per day then diminishes towards the latter part of the week and by Saturday noon all reported have been gone over. At these inspections the hand-hole covers of the motors are removed and the motors are blown out and the commutator brushes and the clearances are inspected. A French brush manufactured by Le Carbone Company is being used. The commutator end armature bearing is oiled with 1½ gills and the pinion end bearing with 2 gills of oil. The compressor motor armature bearings are also oiled. The control apparatus is opened up and the switch and interlock contacts are cleaned with sandpaper.

Triple valves and engineers' valves are inspected and cleaned every three months.

OILING

The journals are oiled and taken care of by a man stationed on the terminal platform. An unusual amount of oil is required on the motor axle bearings because of the sand roadbed. Attempt is made to flood the sand out by using a pint of oil on a 5000-mile basis. Because of this sand roadbed, the side bearings are not lubricated, but the center bearing is lubricated every three months. Gears are greased with 4½ lbs. of grease every two months. The crank shaft bearings and the gears of the compressors are oiled every 30 days.

TROLLEY WHEELS

Although the cars are operated in trains, it is necessary to have one trolley wheel on each car in contact with the wire, for otherwise there is danger of blowing the trolley fuses. The trolley wheel is 5½ ins. in diameter and is of special type, having a hub 3 ins. long and ½ in. in diameter. The long hub necessitates a special type of harp to prevent the wire catching between the harp and the wheel. The wheels have a life of about 1500 miles and are oiled and inspected by a man at the Camden terminal after each round trip.

BRAKE SHOES

Cast-iron brake shoes have been tried, but their life was too short and the U Lappin flanged steel back shoe made by the American Brake Shoe & Foundry Company is now used. The original weight is 39 lbs. and they are worn down to 16 or 17 lbs., giving 22 and 23 lbs. of wear. Due to the fact that the cars are not turned at terminals the shoes wear very evenly.

CONTACT SHOES

There is very little breakage of contact shoes and practically all of them are replaced because of wear. A few have been broken by striking obstructions left by track men and laborers. The number replaced per month varies from 20 to 75. In June, 34 were renewed and replaced. During that month 65 cars were operated with a total mileage of 292,767 miles.

ELECTRICAL EQUIPMENT TROUBLE

Troubles with equipment have been extremely light. In a year's time there has been only one grounded armature. There has been no field trouble at all and the motors have never been known to flash over between brushes. Trouble with pump motors have been limited to those caused by bad brushes and there have been very few cases of control trouble.

INSPECTION FORCE

The inspection and light repairs are in charge of the foreman of electric cars. The force in the inspection shed at Camden consists of a barn foreman, electrical and air brake inspector and oilers. There are also four men engaged on truck repairs and replacing wheels, and there are two carpenters employed in making general repairs.

The outside inspection force consists of day and night general inspectors and a trolley pole inspector at the Camden terminal and day and night inspectors at Millville and Atlantic City. For the use of the Atlantic City and Millville in-

spectors extra jumpers, trolley wheels, oil and waste are kept at these points.

GENERAL OVERHAULING

The cars are given a general overhauling in the Pavonia shops on a 50,000-mile basis. The motors are opened, the fields removed and the shell is cleaned. The fields are cleaned, the armature blown out and fields and armatures are given a coat of insulating paint. The armature is then given a ground test of 1000 volts. Armature bearings are usually renewed to prevent possible danger of them wearing through the babbit lining and cutting the shaft. The lining is only 1/16 in. thick, and with new bearings there is only 3/16 in. clearance of the armature. The controller compressor, air brake equipment and all parts get a general cleaning at overhaulings. It is the intention to bring the cars in for varnishing and painting every year.

DEFECTIVE	REMARKS
Seats	
End Door	
Side Door	
Side Glass Broken	
Vestibule Glass Broken	
Door Glass Broken	
Windows	
Water Cooler	
Ventilators	
Lights	
Saloon Fixtures	
Curtains	
Bell	
Bell Cord	
Hand Brake	
King Pin Cover	
King Pin Broken	
Pull Chain	
Platform Chains	
Drawbar	
Car Floor	
Truck Noisy	
Rough Riding	
Trolley Poles	
Trolley Wheels	
Trolley Ropes	
Reversers	
Heaters	
Markers	
Illuminated Number	
Miscellaneous	

Repaired at _____ Date _____ 190____

Signature _____

BACK OF CONDUCTOR'S DEFECT REPORT

C. T. 208 718 11-25-1906 8½ x 11

WEST JERSEY AND SEASHORE RAILROAD COMPANY

DAILY REPORT OF MILEAGE OF ELECTRIC CAR EQUIPMENT

12 o'clock Midnight to 12 o'clock Midnight ..... 190....

Miles of Run	64.6	64.6	17.9	17.9	40.1	40.1	34.5	34.5				Miles of Run	64.6	64.6	17.9	17.9	40.1	40.1	34.5	34.5			
No. of Car	Camden to Atlantic City	Atlantic City to Camden	Camden to Glassboro	Glassboro to Camden	Camden to Millville	Millville to Camden	Atlantic City to Newfield	Newfield to Atlantic City			Total Mileage	No. of Car	Camden to Atlantic City	Atlantic City to Camden	Camden to Glassboro	Glassboro to Camden	Camden to Millville	Millville to Camden	Atlantic City to Newfield	Newfield to Atlantic City			Total Mileage
	7/24												7/24										
6701												6754											
6702												6755											
6703												6756											
6704	✓											6757	✓										
6705												6758											
6706												6759	✓										
6707												6760											
6708	✓											6761											
6709	✓											6762	✓										
6710																							
6711																							

BLANK FOR RECORDING MILEAGE OF CARS

M P 217 A 1-14-07

PENNSYLVANIA RAILROAD COMPANY

WEST JERSEY & SEASHORE RAILROAD COMPANY

PASSENGER CONDUCTOR'S REPORT OF DEFECTS OF ELECTRIC EQUIPMENT

Detention ____ minutes Train No ____ Car No. ____

Date _____ 190 Conductor _____

CONDUCTORS must fill out this report in all cases where defects are found on any car in their train, either while enroute or at stations where repairs cannot be made. The parts found defective should be marked with a cross, thus, "X," in front of the corresponding items on the opposite side, and under head of "REMARKS," as much information as possible should be given to enable repairmen to locate such defects. Conductors must see that these reports are handed to the Car Inspectors immediately on arrival at the end of their run, so that the defects can be promptly attended to.

INSPECTORS at terminals, on receiving these reports, will make the necessary repairs before car is again returned to service, making proper notation on report as to place and date repaired, as provided for.

FRONT OF CONDUCTOR'S DEFECT REPORT

M P 218 9-1-05

PENNSYLVANIA RAILROAD COMPANY

Philadelphia, Baltimore & Washington Railroad Company
Northern Central Railway Company
West Jersey & Seashore Railroad Company

DATE _____

REPORT OF BROKEN GLASS AT _____ INSPECTION BARN

DATE	CAR No	SIZE OF GLASS	LOCATION OF WINDOW

BROKEN GLASS REPORT

EMPLOYMENT AND INSTRUCTION OF TRAINMEN

Steam locomotive men only are being employed as motormen, and of the applications for motormen those longest in the service are given preference. The men are already familiar with the road so that they need instruction regarding the electrical equipment only. A special instructor is employed to teach them regarding the apparatus and the general principles on which it works. Particular attention is given to overcoming troubles which would result in delay on the road. For use in instructing the men a book has been compiled and special instruction apparatus has been built.

INSTRUCTION APPARATUS

All of the controller parts have been hung on frames in such a manner that their working can be readily observed. The circuit breaker and reverser and lamps to represent the motor are on one frame, the apparatus located on the car switchboard and the master controller are on another and the contactors are hung on two others. All of the wiring is open and the wires are spread out so they can be easily traced. Lamps placed over the painted outline of motors serve as fields and armatures and other lamps in series represent the rheostats.

M. P. 390-F. 1-14-07.
4 x 7¼

Pennsylvania Railroad Company

West Jersey & Seashore Railroad Company

ELECTRIC TRAIN SERVICE

MOTORMAN'S REPORT OF DEFECTS AND TRAIN DETENTIONS

THIS COPY TO INSPECTOR AT TERMINAL

Date _____ 190____ Train No. _____

Total Length of Detention _____ Time made up _____

Conductor _____ Motorman _____

CAR No.	MINUTES	PLACE OF DETENTION	CAUSE OF DETENTION

MOTORMEN shall report in duplicate ALL train detentions at the end of each trip. If any are due to failure of equipment he shall make proper note of same, using list printed on cover as guide. If there are no detentions or defects to report mark blank "O. K."

INSPECTORS on receiving these reports will examine the equipment in question and will either endorse his approval of the motorman's report or accompany same with a more complete account of the defect or defects found, forwarding same to the Foreman of Electric Cars at Camden.

MOTORMAN'S DETENTION REPORT

After the men have received instruction they are subjected to examinations regarding what they would do to get a train in operation under different conditions.

THE INSTRUCTION BOOK

A general notice in the instruction book states that all trainmen will be required to become familiar with the name, location and purpose of all apparatus in order that they may carry out instructions given them by motormen or conductors, and that motormen will be required to know in addition the general principle upon which the operation of the various apparatus depends, the manner in which it should be operated and the method of procedure in case of train failure. The book describes in a rather detailed manner the air brake apparatus, including the compressor and the compressor governor. Instructions are given regarding handling the brake in service and also regarding what is to be done in cases of failure of the brake to work. The motor control and the master control circuits are treated in a similar manner. In connection with the descriptive matter numerous cuts are presented, several of which show cross section views of the apparatus. A complete diagram of the control and motor circuits is given so that there is nothing to prevent the student going as deeply as he desires into the workings of the apparatus. The cuts on brake equipment and control apparatus are bunched, and those to which frequent reference must be made in following the reading matter are on insets, so that they can be studied while the book is open at any page.

The instructions regarding caring for failures of the motors and control apparatus are very much to the point and are as follows:

A train failure—that is, a failure of a train of one or more cars to move or to attain full speed when the directions for train operation have been followed—may be due to one or more of the following causes:

First—Failure of power.

Second—Defect in master control circuit.

(a) Master control fuse blown or imperfect.
(b) Grounded train cable.
(c) Poor contact in master controller.
(d) Loose train cable jumper.

Third—Defect in motor control circuit.

(a) Circuit breakers open.
(b) Bus fuses blown.
(c) Loose or disconnected bus jumper.
(d) Main fuse blown.
(e) Shoe or trolley fuses blown.

Fourth—Failure of air brakes to release.

A failure of power can be detected by closing the lighting switches; if lights burn, power is on.

To determine if master control circuit is open, turn master controller handle to the first notch and open the master controller switch. The noise of slight arcing indicates that the master control circuit is closed and that the trouble is elsewhere. No arcing shows that the master control circuit is open and indicates that fuse is blown or imperfect. A black or charred spot in the center of the label, called a "Tell-tale," indicates that the fuse is blown and should be replaced. A fuse which shows no indication of being blown should be tested to detect faulty construction by removing a fuse from a lighting circuit and inserting the fuse to be tested. The lights burning indicate that the fuse is good, and it can then be replaced.

To determine if train cable is grounded, operate the master controller. If the master controller fuse blows, it indicates that one or more wires of the train cable are in contact with the ground, and the cable is said to be "grounded."

To locate a ground in the train cable, disconnect train cable on operating car from rest of train by removing train cable jumper from its socket on second car. If the fuse now blows, when the controller handle is operated, it indicates that the ground is either in the operating car or its train-cable jumper.

To determine whether ground is in train cable or jumper, remove the jumper. If the fuse blows when the controller is operated, the ground is in the car. If it does not blow, the ground is in the jumper, and a new one should be inserted. If the fuse does not blow when the jumper is disconnected from the second car, the jumper should be replaced and the one between the second and third car disconnected from its socket on the third car, and so on until the fault is located.

If the fault is found to be caused by a defective jumper, and if the train is not provided with an extra jumper, the jumper between the last two cars of the train should be taken to replace the defective one.

If the fault is found to be on the car and not in the jumpers, the seven-point control cut-out switch on that car should be turned to the "off" position, and the test repeated. If the fuse still blows when the handle is operated the fault is in the train cable. If the fuse does not blow, the ground is between the cut-out switch and the contactors, reverser and circuit breaker. If this is the case the cut-out switch on the defective car should remain in the "off" position, thus cutting out the fault as well as rendering that car inoperative, but in no way interfering with the train cable, and permitting the operation of other cars in the train, through the train cable in the usual manner.

If opening the cut-out switch does not remove the fault—that is, if the fault is in the train cable and the defective car is near the rear end—the train should be operated from the front car as usual, the defective car and those following being cut out by removing both train cable jumpers on that car; if at or near the head of the train, the train should be run from the following car, all cars ahead being cut out.

To detect poor contact in master controller, open the master controller switch, remove the cover from the controller and turn the handle slowly, noting if each finger makes good contact with the drum. If any contact is poor and cannot readily be readjusted by the motorman, he should run the train from the next car.

To detect loose train cable jumper the trainmen should note if the contactors on each car are working while the train is accelerating. If there is a loose train cable jumper, all cars ahead of the jumper will operate; others will not. The motorman should be immediately informed if any car is not operating.

If one or more circuit breakers of a train blow when starting or running, return the controller handle to the "off" position and move the handle of the circuit breaker switch to the "on" position. If the circuit breakers again blow when the controller handle is operated, the brakes should be examined to see if they have released.

If the circuit breaker on any car repeatedly blows, the motorman should make an examination to see that it is properly adjusted. If the trouble is not with the circuit breaker, the car should be cut out by opening the seven-point cut-out switch on the switchboard and the main switch beneath the car.

An open circuit in bus-line may be detected when the train is at a crossover and current cannot be obtained on operating car, although other cars of the train have current. This indicates that the bus-line fuse or fuses are blown, or that a bus-line jumper is loose or disconnected between the operating and adjacent cars.

The motorman should inspect the bus-line jumpers, and if the trouble cannot be quickly remedied, he should go back to the first car having current and move the train through the crossover. The motorman should then return to the first car and proceed in the usual manner.

When the main fuse is blown the motors will not operate, although the contactors may be in working order and the circuit breaker closed. This should occur very seldom, as it can only be caused by short circuit or grounding in the motors or motor circuits, which are usually protected by the quicker acting circuit breaker. This fuse should not be replaced on the road except to avoid serious delay to the service, as in the case of single cars. Before renewing main fuse, open the main switch.

A shoe fuse may blow from short circuit, grounding of the car wiring on some part of the car or truck, or may be caused by a contact shoe on the car or train grounding, due either to being broken or from fouling or picking up something along the line. If it is necessary to replace a shoe fuse on the road so as to prevent delay to service, the motorman should open the third-rail switch on the switchboard and insert the wooden paddles, provided for that purpose, between all shoes on that car that are in contact with the third-rail.

A trolley fuse may blow from short circuit or grounding of the car wiring on the car or truck, or because it has been overloaded by running in a train with other trolleys down and taking current for the whole train through the one fuse. If this latter has been the cause, the fuse should be replaced on the road if it is required to prevent delay to service. Before replacing the fuse, pull down both trolleys and open the trolley switch.

REPORT OF CARS INSPECTED

The foreman of electric cars sends in to the office of the assistant electrical engineer a daily report which shows by their numbers the cars inspected, their mileage since last inspection, and the number of days out of the shop.

There is also given the total mileage of all the cars since their last inspection, the average mileage maximum and minimum mileage and the average number of days out of the shop. The report for Aug. 6, which is a typical one for the summer season, showed:

Total mileage	26,511
Number of cars inspected	21
Average mileage	1,262 3/7
Average number of days out of the shop	5 20/21
Minimum mileage	740
Maximum mileage	1,845

RECORDS OF DETENTIONS

An effective method is pursued to find out the exact cause of all train detentions and the amount of detentions. Motormen are supplied with blanks for reporting the extent and

BLANK FOR RECORDING DELAYS DUE TO DEFECTS OF VARIOUS KINDS

PENNSYLVANIA RAILROAD COMPANY
WEST JERSEY & SEASHORE RAILROAD COMPANY
ELECTRIC TRAIN SERVICE
REPORT OF DETENTIONS TO PASSENGER TRAINS DUE TO FAILURES OF TRAIN EQUIPMENT FOR _____ 190

| DATE | MASTER CONTROL: Master Control | MASTER CONTROL: Switches Defective | MASTER CONTROL: Circuit Breaker | MASTER CONTROL: Control Fuse Blown | MASTER CONTROL: Train Cable | MASTER CONTROL: Train Cable Jumper: Grounded | MASTER CONTROL: Train Cable Jumper: Loose | MASTER CONTROL: Relay: Current Limit | MASTER CONTROL: Relay: Potential | MASTER CONTROL: Controller | MOTOR CONTROL: Fuses Blown: Main | MOTOR CONTROL: Fuses Blown: Shoe | MOTOR CONTROL: Fuses Blown: Trolley | MOTOR CONTROL: Fuses Blown: Bus | MOTOR CONTROL: Bus Line: Grounded | MOTOR CONTROL: Bus Line: Loose Jumper | MOTOR CONTROL: Circuit Breaker Defective | MOTOR CONTROL: Reverser Defective | MOTOR CONTROL: Contactors Defective | MOTOR CONTROL: Resistance Grids | MOTORS: Armature: Grounded | MOTORS: Armature: Short Circuited | MOTORS: Armature: Open Circuited | MOTORS: Fields Defective | MOTORS: Leads Defective | MOTORS: Flash-overs | MOTORS: Brush Holder | MOTORS: Broken Gears | MOTORS: Loose Gears | MOTORS: Broken Pinions | AIR BRAKES: Compressor: Fuse Blown | AIR BRAKES: Compressor: Governor Out of Adj'n | AIR BRAKES: Compressor: Pump Defective | AIR BRAKES: Brakes: Fail to Release | AIR BRAKES: Brakes: Equalizer | AIR BRAKES: Defective Rigging | AIR BRAKES: Hose: Burst | AIR BRAKES: Hose: Defective | AIR BRAKES: Pipes Broken or Defective | AIR BRAKES: Valves: Feed | AIR BRAKES: Valves: Triple | AIR BRAKES: Valves: Brake | AIR BRAKES: Valves: Drain Cock | AIR BRAKES: Valves: Emergency Attachment | TROLLEY: Poles Lost | TROLLEY: Wheels Defective | TROLLEY: Rope Broken | TROLLEY: Retriever | WIRING: Fuse Blown | WIRING: Burnt Out | HOT BEARINGS: Armature | HOT BEARINGS: Motor Axle | HOT BEARINGS: Journal | COMPRESSOR: Compressor Motor | COMPRESSOR: Broken | COMPRESSOR: Defective | TRUCKS: Contact Shoes | TRUCKS: Shoe Beam | Whistle Defective | MISC. | Total Failures | Minutes Lost | CAR MILES: Total | CAR MILES: Per Detention | CAR MILES: Per Minute of Detention |
|---|---|---

is made to vary with the traffic. At times when the number of passengers is uncertain a train of six cars is kept at the terminal. The rear cars are closed and as the front ones fill up the rear ones are opened one by one to accommodate the new

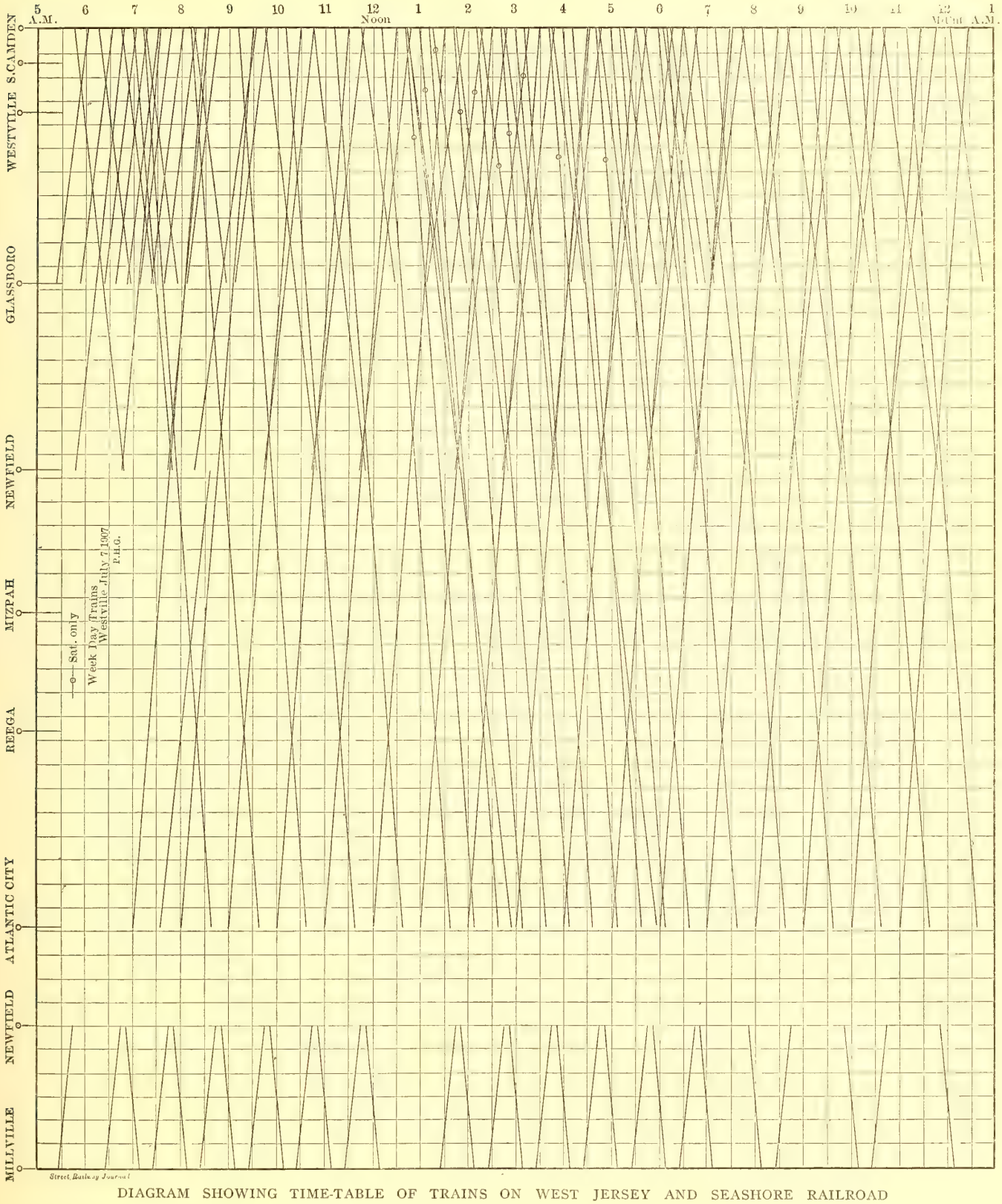


DIAGRAM SHOWING TIME-TABLE OF TRAINS ON WEST JERSEY AND SEASHORE RAILROAD

arrivals. The length of trains consequently varies from one to six cars. During July the average length was 3 cars.

The whole schedule is made up of four different sets of runs, express service between Camden and Atlantic City, through trains between Camden and Millville, local service between Camden and Glassboro and local service between Atlantic City and Newfield.

For regular trains a system of numbers has been adopted such that the numbers distinguish electric from steam trains, and also indicate the service the train is in and to an extent the time of leaving the terminal. Electric trains are numbered from 1000 to 1700. Numbers from 1000 to 1200 are reserved for Camden-Atlantic City express trains; 1200 to 1400 to Camden to Millville; 1400 to 1600, Camden to Glass-

boro; and 1600 to 1700 to Atlantic City and Newfield trains. Eight numbers are reserved for each hour. This allows for eight trains out of one terminal per hour without changing the numbers of trains already scheduled. For example, the first train out of Camden in the morning is No. 1017 at 7 o'clock. The number of the 8 o'clock train is 1025 and the 9 o'clock one 1033. A train leaving near the half-hour has a number four greater than that of the train leaving the hour preceding. Extra trains take the number of the head car in accordance with the custom of numbering extra steam road trains from the locomotive number.

good indication of the amount of suburban traffic that has been established. This is all the year around travel made up largely of people going to and from their work in Philadelphia. Careful attention is being given to its development, as it holds up well throughout the year. The Camden-Atlantic City traffic is, of course, heaviest during the summer season. Last winter it fell to a point where trains were required every two hours only and usually the trains run were short ones.

TERMINALS

The only additional station facilities occasioned by the electrification was a five-track train shed at Camden adjacent to

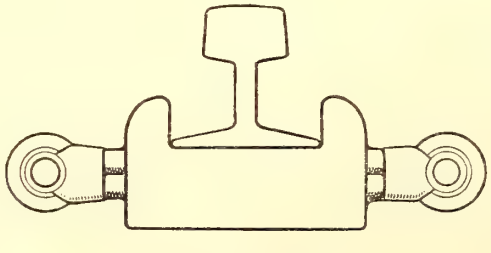
	Distance.	Run Numbers.	Intermediate Stops.	Time Out for Stops, Minutes.	Average Speed.	Time in Minutes, Average Run.	No. Trips Sunday.	No. Trips Saturday.	No. Trips Week Day.	Train Mileage Sunday.	Train Mileage Saturday.	Train Mileage Week Day.
Camden to Atlantic City	....	1000	2	..	43	90	23	21	17	....	....	2196
	64.6	and	to	..	....	..	..	..	Mon. 16	2907	2490	Mon.
Atlantic City to Camden	....	1100	5	..	43	90	22	17	17	....	....	2132
Camden to Glassboro	....	1400	..	..	26.2	41	2	21	19	....	....	....
	17.9	and	14	..	....	..	..	..	..	74	700	645
Glassboro to Camden	....	1500	..	..	26.5	40	2	17	18	....	....	....
Camden to Millville	....	1200	..	..	28.6	84	11	15	15	....	....	....
	40.1	to	22	..	....	..	..	..	..	881	1203	1203
Millville to Camden	....	1300	..	..	29.3	82	10	15	15	....	....	....
Atlantic City to Newfield	....	....	..	17	34.5	60	3	3	3	....	....	....
	34.5	1600	16		....	..	..	..	..	203	207	207
Newfield to Atlantic City	....	....	..	21	32.3	64	3	3	3	....	....	....
					Total mileage					4065	4600	4251 Monday 4187

ANALYSIS OF TIME-TABLE OF TRAINS DURING SUMMER SEASON, WEST JERSEY AND SEASHORE RAILROAD

The table shown above gives an analysis of the time table for the summer season, and from this it may be noted that the Saturday and Sunday schedule varies from the week-day one. The difference consists primarily in increasing the number of through trains between Camden and Atlantic City on Sunday and decreasing the number of local trains between Camden, Glassboro and Millville. The increased number of trains on the through run to Atlantic City, however, is not a true indication of the increased number of passengers carried, as longer trains are run on Sunday than on week days. The extra trains on Sunday are run on the half-hour, as the regular week-day trains are run almost every hour from 7 a. m. to 11 p. m. The number of trains between Camden and Millville and particularly between Camden and Glassboro on week days is a

the steam train shed and a terminal at Atlantic City. Here a new passenger station, baggage-room and five-track train shed was built at some distance from the steam terminal.

The five-track terminal at Camden has not yet been tested to its full capacity, although in a given time the electric trains have hauled as many passengers out of it as have been handled by the steam trains in the thirteen-track terminal adjoining. The fact that no switching is necessary and that an electric train is ready to go out again as soon as it has been unloaded and loaded decreases considerably the terminal station room required. The lessening of the time at terminals results also in better use of the equipment. On July 4 about the same number of people were hauled on the electric line as on the paralleling steam road with twice the number of cars.



OPERATING FEATURES OF THE ELECTRICALLY EQUIPPED SECTION OF THE ERIE RAILROAD

The recently electrified section of the Erie Railroad consists of 34 miles of single track of the Rochester division, extending due south from Rochester through Avon to Mt. Morris. The physical features of this single-phase road are fully described in another section of this issue. In brief, however, it may be said that the road is supplied with current from the high-tension lines of the Niagara, Lockport & Ontario Power Company.

The one transformer sub-station is located at Avon, 19 miles from the Rochester terminal and 15 miles from Mt. Morris. It supplies the entire line with power and contains three 750-kw 60,000 to 11,000-volt transformers, the lower voltage being that supplied to the trolley. The car barns are located at Avon, adjacent to the sub-station. The six motor cars are all equipped with the Westinghouse system of multiple unit control.

OPERATING FEATURES

The electrical section is operated as a portion of the Rochester Division, and has the same operating officers, with the exception that the electrical features are in charge of a Supervisor of Electric Service. Under this supervisor are eight men employed in the maintenance of the electrical apparatus. As the company supplying the power delivers the current to the sub-stations the railway company is not concerned with the operation and maintenance of the high-tension lines.

The sub-station is very economical with regard to the amount of labor required to operate it. Two car-house men, who work in 12-hour shifts, one at night and the other during the day, have charge of the sub-station and each does not usually devote more than an hour's time a day in caring for the sub-station. This time is spent in frequent inspections of the station, occasional cleaning of the apparatus, and changing the chart on the recording wattmeter once a day. This recording wattmeter is used in addition to an watt-hour meter to measure the energy supplied to the road. Up to the present no systematic plan of testing instruments has been inaugurated. However, the oil used in the transformer is tested and run through a dehydrater at intervals.

Although the cars are operated over a period of only 15 hours a day, under ordinary conditions, current is left on the trolley twenty-four hours a day and the sub-station switches are not disturbed except when for some reason it is desired to cut the current off the trolley. Since the beginning of operation there have been no breakdowns of sub-station apparatus or necessity of renewing parts, and it may be said that the sub-station practically runs itself.

THE TROLLEY

The trolley line is inspected once a day by an inspector who rides over the line on a regular train. In addition once a week a more thorough inspection is made by a man who either walks over the line or makes the trip on a bicycle car. This trip is made particularly to examine the condition of the poles. The inspectors are part of the regular trolley maintenance crew of three men. These men have their headquarters at Avon, and although they work regularly only 12 hours a day, they are within reach by telephone at all hours. Practically the only trouble that has been experienced with the trolley line has been the grounding of two or three strain insulators. Not one of the porcelain insulators on the line has broken down in service.

The line crews are provided with box cars fitted with platforms on the roofs. Repairs that are not urgent are made at night. At such times the power is shut off and the repair car is hauled over the road by a steam locomotive. When the lines are to be repaired at night the linemen simply notify the sub-station man to disconnect the current. It is a fixed rule that after current is once cut off it is not to be put on again until 6 o'clock in the morning, but that it will be put on at this time unless special word not to do so is received from the linemen. To guard against possible accident the trolley is always grounded by the men working on it.

Section switches are located at five points on the line or about 5 miles apart. These switches are opened and closed by the station agents nearest them only on orders from the electrical supervisor. Up to the present time bonds have not been tested but they are examined by the regular track walkers and when found in bad order repairs are made by the regular line crew.

Steam trains operate under the trolley, but several careful examinations have failed to disclose any corroding effect on the trolley and messenger wires due to the gases from the locomotives.

CAR MAINTENANCE

The car shops at Avon themselves contain no tools or machinery, but they are located adjacent to the Avon round-house, which possesses some facilities for making repairs. However, the shops are fitted with an arrangement for changing trucks. Between two of the tracks there is a shallow pit containing a transfer table large enough to hold one truck and provided with a section of track. When trucks are to be changed the car is placed so that the truck is on the transfer table. The car is then jacked up and the transfer table with the defective truck is pushed out sideways and the truck runs off on the adjacent track.

Up to the present time there has been no occasion for extensive repairs to cars, in fact, the only work done on them, which could not be classed as inspection work, has been the replacement of contact tips and trolley shoes.

Cars are brought in for inspection on an 800-mile basis. At this time the motors and all of the control apparatus and the air motor are blown out with compressed air, the motor brushes are taken out of the holders and examined, and the electrical apparatus in general gets a thorough examination, cleaning and oiling. All of the motor bearings are supplied with oil wells in which the height of the oil can be determined. The height is gaged at each inspection and oil is kept at the proper level by additions whenever required. Journal bearings get half a pint of oil each at inspections in addition to a small amount of oil put in them each day at the terminals.

About 10,000 miles wear is gotten out of the pantograph trolley shoes. These trolleys are kept on the wire with a tension of 8 lbs., the tension being tested with a spring balance at every inspection. The shoes are lubricated with graphite and vaseline once a day. Up to the present time copper shoes have been used, but steel shoes are now being substituted. About two hours' time of one man is required to change trolley shoes.

Cars are cleaned by the mechanical department at the Rochester terminal. All the car-barn work is done by two day men and one night man, and two of these men spend a portion of their time in the sub-station, as has already been mentioned.

Some of the minor defects to cars are taken care of by two inspectors, one located at each terminal, who go over the cars at the end of each trip. They are aided in this work by detention reports filled out by the motormen and conductors. These reports are made out in duplicate, one copy going to the terminal inspector and another copy to the supervisor of electric service. Spaces are provided on them for the car number and the length, place and cause of the detention. The inspector on examining the equipment either endorses his approval of the report or sends it with a more complete account of the defect to the supervisor. In all cases the defect is repaired at the terminal if this is possible.

has been experienced because of the mixed service. As the operation of four classes of trains over a single-track line is necessarily a complicated proposition, and as the Erie conditions are typical of a vast majority of roads in the United States, a graphical timetable of the line is presented on this page. Particulars will also be given of the block signal system under which the trains operate and are passed at the different switches.

BLOCK SIGNAL SYSTEM

The electric division is protected by a positive manual block signal system operated in accordance with the standard code of the American Railway Association. There is a total of eleven



GRAPHICAL TIME-TABLE OF THE TRAINS ON THE ROCHESTER BRANCH OF THE ERIE RAILROAD

TRAINING OF MOTORMEN

Old engineers only are employed as motormen. After an engineer has made application for a position on an electric train he is given personal instruction regarding the electrical equipment by the supervisor and an instruction book gotten up especially for the equipment aids him in getting a knowledge of the apparatus. After he has become, in the judgment of the supervisor, sufficiently familiar with the apparatus, he is required to make several trips with a regular motorman and is then given a run.

SCHEDULES

Four classes of trains operate over the electrified section—electric trains which are first class, steam passenger trains or second class, through freight or third class, and way freight trains or fourth class. The only steam passenger trains run are those which continue beyond the electrical section. As first-class trains the electric cars have right of way over all steam trains. In all other cases the general rules for train operation of the Erie Railroad apply. No trouble whatever

signal stations and the blocks consequently average about 3 miles long. Some of the signal stations are located at regular way stations, and in most cases of this kind the regular agent operates the signals. The signal towers at other points are in charge of men working in twelve-hour shifts. The telephone is used instead of the telegraph or the bell signal system, for communicating between signal stations, so that there is no necessity for the tower men to be telegraph operators, and usually they are not.

All switches are electrically locked and are controlled from the nearest tower. This makes it impossible for a train to move off a siding on to the main track without the knowledge of the operator.

The operation of trains is in charge of a chief despatcher located at Rochester. He, of course, supplies the motorman or engineer with train orders on leaving, and under ordinary conditions this train is blocked through without further orders. The block operators know the schedule of the train and as the time for it approaches each operator telephones the next operator ahead, asking whether or not the block is clear. The

first operator sets his signals in accordance with the reply, and if the block is clear the second one sees that the stop signal is set for opposing trains. The signals, however, automatically return to the stop position. Trains off schedule are blocked through in the same manner. The telephone is not employed in giving train orders, and where it is necessary for any reason to give orders of this kind, they are received by the motorman or engineer and conductor at regular way stations from the telegraph operators at these points.

The term "positive" block signal system carries with it the idea that only one train will be admitted to a block at a time, and does not permit of the free use of "permissive" orders whereby a train may be permitted to follow another one into a block before the first one has cleared the block. Permissive orders are given only by the chief despatcher, and are given only in case of wreck or some very unusual occurrence. When they are given, a detailed account of the circumstances by which they are occasioned accompanies them.

All block signal operators are required to keep block sheets of the usual form which gives the times of the passage of the trains together with the train numbers.

TRAIN SERVICE

The daily electric train mileage is approximately 500 miles on week days and 400 miles on Sundays. On week days one train makes six and another four round trips between Mt. Morris and Rochester. A third train makes one round trip between terminals and in addition two round trips between Avon and Mt. Morris. On Sunday the two trains operated each make three round trips between terminals.

The schedule is somewhat irregular, but on week days it approximates a two-hour service for twelve hours a day. The run between terminals, 34 miles, is made in one hour and twenty minutes. There are six regular stops and in addition twenty-two other signal stops. The steam trains which make only the regular stops are scheduled at approximately the same speed as the electric trains.

The electric trains vary from one to four cars in length, but in ordinary service one and two-car trains are run. Two-car trains are usually made up of a motor car and a standard steam coach as a trailer. Longer trains contain two motor cars. In general it may be said that the length of trains varies with the traffic, for at terminals trailers are kept behind motor cars and are either left behind or coupled up as the service requires.

The train crew of single cars consists of a motorman and conductor, but two-car trains carry a brakeman in addition, and a brakeman is always carried when there is baggage to be handled.

The notable feature in the operation of the electrical division is the few men required to operate and maintain the electrical apparatus. The alternating current sub-station, of course, eliminates a great deal of labor, as does also the absence of trouble on the line or with the car apparatus.



OPERATING FEATURES OF THE FIFTY-NINTH STREET STATION OF THE INTERBOROUGH RAPID TRANSIT COMPANY

The Interborough Rapid Transit Company operates two generating stations, one at Fifty-Ninth Street and North River, for the subway system, and another at Seventy-Fourth Street and East River, for the Elevated lines. As superintendent of motive power of the Interborough system H. G. Stott has charge of both stations, and the engineers immediately under him divide their time between the two. The same general practice is consequently followed in the operation of both plants except where different practice is necessitated by differences in design. The operating features of the Fifty-Ninth Street station are therefore representative of the Interborough Company's central station practice.

The construction of this station was described by John Van Vleck in a contributed article in the Street Railway Journal of Oct. 8, 1904, so will not be taken up here. It is sufficient to say the station is built on the unit system. Each section consists of twelve boilers, two reciprocating engine driven units, two condenser equipments, boiler feed pumps and smoke flue systems. This sectionalizing system is carried out for the five sections installed, with the exception that one of the reciprocating engine units is substituted by three 1250-kw turbines.

COAL

Pennsylvania semi-bituminous coal is used exclusively and is bought and delivered under printed specifications which require that it be delivered by water in self-trimming lighters containing at least 700 tons. According to the specifications, "Coal must be a good steam, caking, run of mine, bituminous coal, free from all dirt and excessive dust, a dry sample of which will approximate the company's standard in heat value and analysis as follows:"

Carbon	71	per	cent
Volatile matter	20	"	"
Ash	9	"	"
Sulphur	1.50	"	"
B. T. U.	14250	"	"

Samples for analysis are obtained from each lighter by taking a quantity from each weighing hopper. The bulk so obtained is crushed and quartered successively to about ten pounds and placed in a box. Other bulks obtained while the lighter is being unloaded are treated in a similar manner, and finally the entire bulk obtained is crushed and quartered to a two-pound sample. This is afterwards pulverized and submitted to chemical analyses by the company's chemist. The analyses are made in accordance with the standard adopted by the American Chemical Society, and the results of the analysis made each day are sent to the station on special blanks at the end of each week. Samples for moisture determination are taken from the sample bulk before it is finally crushed and quartered.

The price to be paid by the company varies from the contract price in accordance with the moisture b. t. u., ash, sulphur and volatile matter values as shown by analysis. Roughly, one cent per ton is deducted from or added to the price for each variation of 50 b. t. u. below or above the standard value. Deductions are also made for excessive amounts of moisture, volatile matter, ash and sulphur.

One of the two coal handling plants consists of a movable electric hoisting tower on the dock, containing a crusher and weighing apparatus. A clam shell type bucket of 44 cu. ft. capacity, operated by a 200-hp motor, elevates the coal from the lighters to the crusher. The other coal handling plant is entirely steam driven. After being weighed the coal falls on belt conveyors and is carried to the bunkers. Seven men are required to operate the plant at a rate of 185 tons per hour.

The bunkers usually contain about 7500 tons. The station is operated on 2.38 lbs. of coal per net kw-hour output. The bunkers are cleaned out thoroughly once in four months, and very little trouble has been experienced from fires in them. When fires do occur the coal is drawn and burned out as fast as possible. An arrangement for transferring coal makes it possible in the event of fire or other emergency to take that from any one bunker and distribute it to all of the boilers.

BOILER ROOM PRACTICE

The boiler installation, which consists of sixty 600-hp Babcock & Wilcox water-tube boilers, is on one deck. All are provided with Roney automatic stokers. Ashes are discharged into hoppers underneath the furnaces, and thence into ash cars on the basement floor. Sturtevant fuel economizers are located on the floor above the boiler room and over the rear end of the boilers.

The boiler force consists of one water tender, two stoker operators and two assistant stoker operators to every set of eight boilers. During the day the second assistant engineer is in charge of the boiler room, and there is in addition a watch engineer for each watch. The boiler room force, as well as all the men of the steam department, work in eight-hour shifts, the changes being made at 8 a. m., 4 p. m. and 12 midnight.

The high peak loads and the periods of very low loads necessitate the number of boilers in service and the rate of firing these to be varied greatly during different portions of the day. To provide for the irregular demands for power the number of boilers required to be kept in reserve and to be kept banked is rather large. Usually the monthly report shows the number of banked boiler hours to be approximately half the number of service hours, and in addition the number of reserve hours is near one-third that of the service hours. An idea of the coal consumption occasioned by the irregular firing may be obtained from the fact that a banked boiler requires 150 lbs. of coal per hour. The reserved boilers, of course, require considerably more.

The irregularity of the load moreover allows the boilers to be fired at their most economical rating, which is the full load rating, for only about six hours in twenty-four. During the peak load they are fired 35 to 50 per cent above rating, and during the early morning hours they are just kept alive. Over a twenty-four-hour period the average rate of firing for the active boilers is about 80 per cent.

Firing conditions will be considerably improved by the installation of a duplicate set of stokers under the rear of the boilers. The installation is now being made, and when completed the boilers may be fired during the peak load at double their rated capacity. This will, of course, decrease the number of banked and reserved boilers required.

Draft on the fires is controlled by dampers placed in each boiler uptake. The automatic feature of these dampers has

been discarded, and they are now regulated by hand. Attempt is made to keep the draft at .25 in. for a boiler working under average conditions, as it has been found by a long series of experiments that with the coal used this gives the most economical results. The dampers are not changed, but the furnace doors are closed when a boiler is banked or reserved. The draft of .25 in. is cut down about .05 in. by the drop in the economizers.

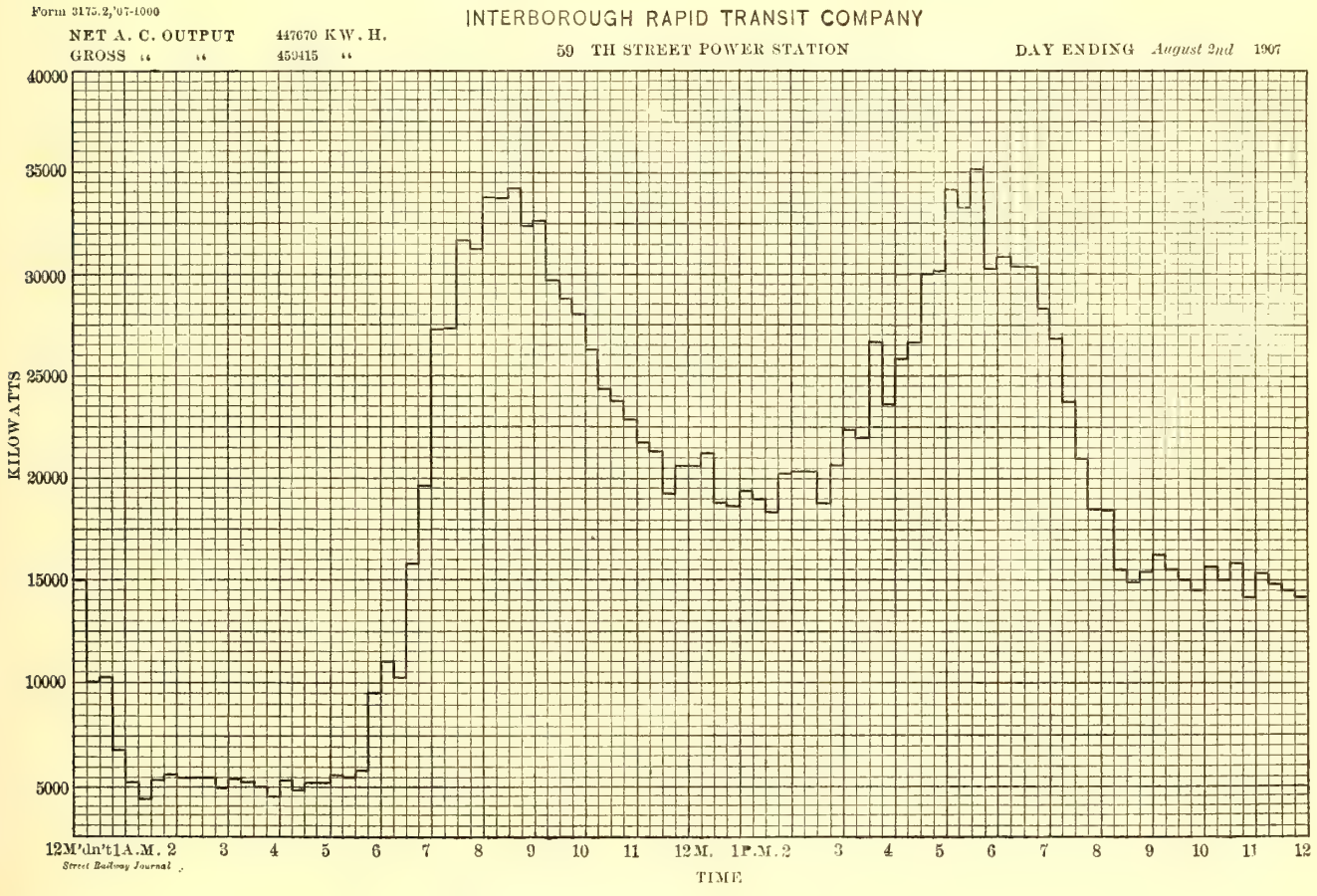
Flue gases leave the boiler at about 480 degs. and the economizer at approximately 320 degs. A CO_2 recorder installed has connections to all of the boiler uptakes, and the analysis of the gases shows from 10 to 14 per cent of CO_2 under normal conditions. Indications as high as 17 per cent have been made for all-day periods.

As a check upon the firemen and as a precaution against loose sediment. At such cleaning the fires are allowed to go out 12 hours before emptying, so that the boilers are practically cool when flushed. The boilers are never blown down, as frequent washing removes the necessity of doing so.

When the station was erected forty-eight boilers were equipped for hand firing, arrangements being made, however, to install automatic stokers should it be deemed advisable. The fact that hand firing with anthracite coal did not permit the boilers to respond to the sudden fluctuations of load was largely responsible for the abandonment of hand firing altogether.

FEED WATER, ECONOMIZERS AND CONDENSERS

All of the condensers are of the barometric type, and all of the boiler feed water is obtained from the city mains. Untreated water is used, but it is probable that chemical treat-



TYPICAL WEEK-DAY LOAD OF 59TH STREET POWER STATION

smoking chimneys a man stationed on the dock watches the smoke stacks, and when smoke is observed notifies the firemen of that section of the boiler house by means of an electric signalling system, and they at once remedy the cause. The watchman sends in his report on a special blank, which gives the time the stacks were observed to be smoking and also the names of the stoker operators on each watch.

The exterior of the boiler tubes are blown off with steam every watch, or, in other words, at eight-hour intervals. The interior of each boiler gets a general cleaning once a year, and this requires the time of two men for four days. The deposit on the tubes, which is largely calcium sulphate, varies from practically none in the bottom portion up to a coating of ⅛ in. thick on the top rows of tubes. An air-driven turbine tube cleaner is employed in the work. In addition every two months the bottom rows of tubes and the mud drums are cleaned, and at intervals of three weeks the boilers are emptied and enough feed water is injected into them to wash out any

ment will be adopted. This treatment will, of course, eliminate to a great extent the mechanical cleaning of the boilers.

Water from the city mains is piped into open type feed water heaters and thence into storage tanks, and from the tanks it is fed through the economizers to the boilers. The feed water heaters add 50 degs. to the temperature of the water, which is received from the mains at about 60 degs., and the economizers add about 100 degs., so that the water is fed into the boilers at about 210 degs. The efficiency of the economizers, it may be seen, is rather high, and reduces the coal consumption approximately 10 per cent.

Automatic regulators on the boiler feed pumps keep the feed line pressure at about 20 lbs. above the boiler pressure, and the feed to each boiler is regulated by the water tender.

The economizers are arranged to be operated either in multiple or series. The customary practice, however, is to operate them in series or to make all water for a unit of three boilers pass through all of them in succession, as by so doing

† Form 3157—1, 1903—500

Interborough Rapid Transit Company.

MOTIVE POWER DEPARTMENT.

DYNAMO CLEANERS REPORT, ... 190....

1st Watch ____ M. to ____ M.

2d " ____ M. to ____ M.

3d " ____ M. to ____ M.

APPARATUS.	1	2	3	4	5	6	7	8	9	10	11	12	13	
Main Alternators	X													1st Watch
									X					2d "
					X									3d "
Turbo Alternators														1st "
														2d "
														3d "
Exciters											X			1st "
														2d "
														3d "
Conveyors, Motors									X					1st "
					X									2d "
														3d "
Blower Motors														1st "
														2d "
														3d "
														1st "
														2d "
														3d "

APPARATUS	1	2	3	APPARATUS	1	2	3
Battery Charging Sets				Coal Hoist Motor, Generator			
Booster				Hoist Motor			
Machine Shop Motors				Trolley Motor			
Large Crane Motors				Boom Motor			
Small Crane Motors				Crusher Motor			
Auxiliary Transformers				Lapping Machine Motor			
Lighting Transformers				Compressor Motor			
				Ash Locomotive			

MATERIAL RECEIVED	MATERIAL USED
Rags	Rags
Waste	Waste
Kerosene	Kerosene

MISCELLANEOUS.

DYNAMO CLEANER'S REPORT

the velocity of the water in the tubes is so high that the scouring effect on the tubes tends to keep them clean. If, under heavy loads, too much pressure is lost by this series operation they may be thrown into multiple by opening and closing proper valves without interrupting the feed to the boilers. The interior of the tubes are cleaned once a year and accumulated dust is drawn off through the lower soot doors once a month.

Condenser water is obtained from North River through concrete flumes. These terminate below the low-tide level,

† Form 3179—1, 1903—1000

Interborough Rapid Transit Company.

MOTIVE POWER DEPARTMENT.

____ Power Station.

COAL TOWER REPORT.

____ A. M. ____ P. M. ____ A. M. ____ P. M.

NAMES	HOURS	STOPS DUE TO	HOURS	MINUTES
		Bucket		
		Cables		
		Crusher		
		Hoist Machinery		
		Trolley		
		Scales		
		Conveyor No.		
		Shifting Tripper		
		Dumper No.		
		Motors		
		Shifting Boats		
		No Coal Hoisted		
		Hopper No.		
		Oiling		
		Main Conveyor		
		Cross Conveyor		
			HOURS	MINUTES
Tons of Coal Hoisted.....				

Laborers ____

Full Boats at Dock ____

Partly Full Boats at Dock ____

Empty Boats at Dock ____

Boats Received ____

Boats Removed ____

REMARKS

COAL REPORT

♦ Form 3196—4, '05—2,000

Interborough Rapid Transit Co.

MOTIVE POWER DEPARTMENT

____ 190

H. G. Stott, Esq.,

Superintendent Motive Power.

Dear Sir:

Following is the smoke report of the ____ Street Power Station, for the 24 hours ending 12 P. M., ____ 190

STACK No. 1		STACK No. 2		STACK No. 3		STACK No. 4		STACK No. 5	
A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.

STOKER OPERATORS AND WATCHERS.

Stack No. 1—12 to 8: ____

8 to 4: ____

4 to 12: ____

Stack No. 2—12 to 8: ____

8 to 4: ____

4 to 12: ____

Stack No. 3—12 to 8: ____

8 to 4: ____

4 to 12: ____

Stack No. 4—12 to 8: ____

8 to 4: ____

4 to 12: ____

Stack No. 5—12 to 8: ____

8 to 4: ____

4 to 12: ____

Respectfully yours,

STOKER'S REPORT

† Form 3159—3, 1904—500

Interborough Rapid Transit Company.

MOTIVE POWER DEPARTMENT.

Inspection of Oil Switches at 59th Street Power Station.

____ 190....

			Condition—Oil Pots	Condition—Mechanism
ALTERNATOR No.	Generator Switch	○ ○ ○		
		○ ○ ○		
	Outer Selector	○ ○ ○		
		○ ○ ○		
	Inner Selector	○ ○ ○		
		○ ○ ○		
ALTERNATOR No.	Generator Switch	○ ○ ○		
		○ ○ ○		
	Outer Selector	○ ○ ○		
		○ ○ ○		
	Inner Selector	○ ○ ○		
		○ ○ ○		

OIL SWITCH REPORT

so that no trouble is occasioned by blocking of the intake with ice. The screens at the river end of the flume are raised and cleaned once a day by three men, who spend about one hour in the work.

The average vacuum carried is 27¾ ins. The temperature of the condenser water, which is supplied in the proportion of about 45 to 1, is about 45 degs. in winter and in summer 60 degs. In summer the temperature of the discharge is approximately 110 and in winter 100 degs. The condensers require no cleaning whatever. The pumps are started against a head of about 45 ft., but the vacuum in the condensers reduces the effective head to about 15 ft.

OILS

The practice of requiring oil furnished to conform to a specified formula of ingredients has been abandoned, partly because good and bad oils sometimes showed ingredients so nearly in the same proportion that chemical analysis did not indicate the difference. Results are now specified, and a certain wear and appearance of the bearing are required.

The engine bearings are flooded with oil under about 30 lbs. pressure from a central oiling system containing about 10,000 gals. The amount circulated per hour varies with the number of engines in service, there being 200 gals. circulated per hour for each large unit operated. About 50 gals. of oil are lost out of the system per day, some of this being drawn off in filtering the oil and the remainder being lost in leakage.

The oil, after being filtered through canton flannel bags, is passed slowly through a tank provided with barriers, which necessitate it flowing first to the top of the tank and then to the bottom. The finer impurities are precipitated to the bottom of the tank. This precipitate and the water carried into the filters with the oil are cleaned out each day. The bag trays are made in duplicate so that the oil may be diverted from one to the other, while the bags of one tray are being cleaned. The bags are washed each day in the power house laundry.

TURBINE PRACTICE

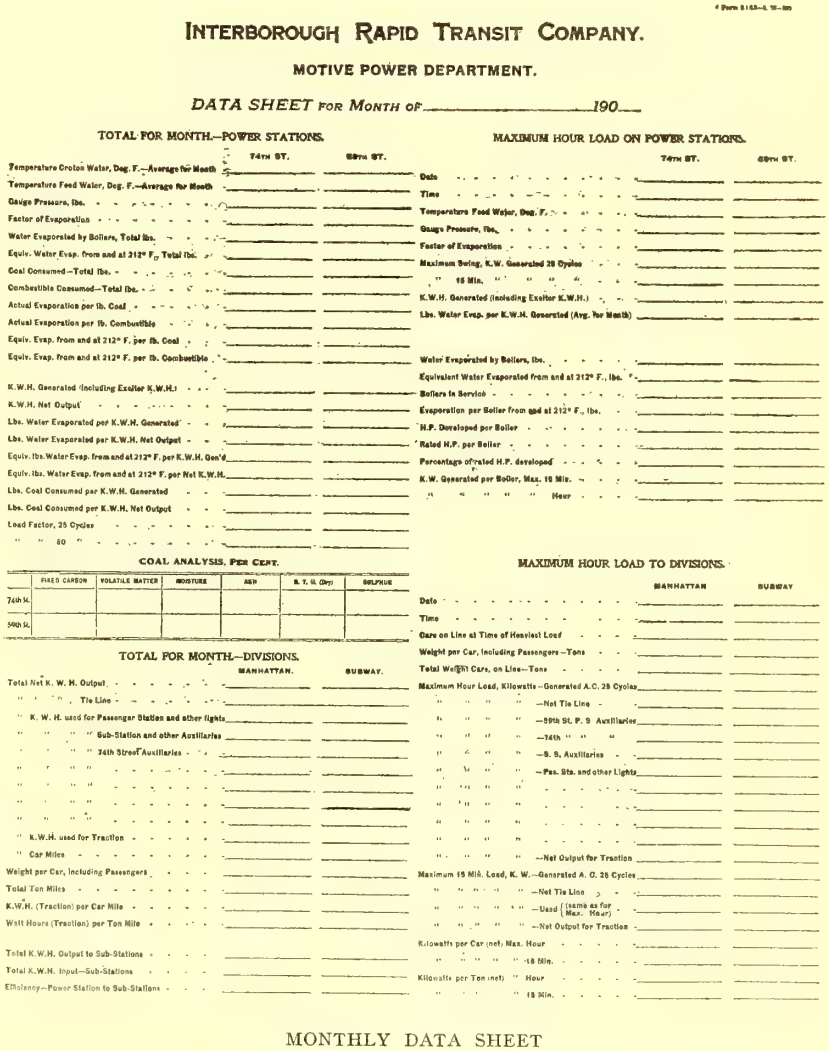
The station is provided with three 1250-kw Westinghouse turbo-generator units used for lighting the subway. Maintenance cost of these turbines and of those in the Seventy-Fourth Street station of the company, in comparison with the reciprocating engines, show ten to one in favor of the turbines. In arriving at these results actual maintenance figures were taken, and those for the turbines were multiplied by the proportional capacity of the reciprocating engines to turbines. The operating force required per kw capacity for the turbines is about one-fifth that required for the reciprocating engines. It is the practice to open up the turbines and examine the blades at intervals of six months. The only duplicate parts of the turbines kept in stock are some governor parts.

The average load factor on the turbines in the Fifty-Ninth Street station is only about 75 per cent of full load, and the maximum overload carried is about 50 per cent. To determine their most economical loading, overloads up to 70 per cent have been carried on the turbines, and at this load the best showing was made. Further loading was prohibited by the heating of the generator.

About one-half hour is required to warm up a cold turbine, but as valve leakage usually keeps them warm they can be started up and gotten under load in an emergency in about five minutes. The reciprocating engines have the advantage with respect to time required in starting, as it is the common practice to get them under load from a standstill in two minutes, and it has been done in 45 seconds.

SWITCHBOARD

The control and instrument boards are located on the second gallery above the engine room floor, and speaking tubes, telephones, red lights and whistles are employed as means of communication between the men in the gallery and the engineers and floor men. When a unit is to be started the engineer is usually called to the telephone by a whistle and given the necessary instructions. After the engine has been started the switchboard operator informs the engineer that the generator has been cut in by closing the circuit through a red light on the engine. Each engine, moreover, is provided with an indicating wattmeter which enables the engineer to note the load. One engine is kept ready for any emergency and is indicated by a metal sign hung on it. A special whistle signal signifies that this engine is to be gotten up to speed as quickly as possible, and when this signal is given the engineer gets the engine ready for load without any further instructions. After the engine has been started the emergency sign is transferred to another unit.



INTERBOROUGH RAPID TRANSIT COMPANY.

MOTIVE POWER DEPARTMENT.

DATA SHEET FOR MONTH OF _____ 190__

TOTAL FOR MONTH.—POWER STATIONS.

	74TH ST.	59TH ST.
Temperature Croton Water, Deg. F.—Average for Month		
Temperature Feed Water, Deg. F.—Average for Month		
Gauge Pressure, lbs.		
Factor of Evaporation		
Water Evaporated by Boilers, Total lbs.		
Equiv. Water Evap. from and at 212° F., Total lbs.		
Coal Consumed—Total lbs.		
Combustible Consumed—Total lbs.		
Actual Evaporation per lb. Coal		
Actual Evaporation per lb. Combustible		
Equiv. Evap. from and at 212° F. per lb. Coal		
Equiv. Evap. from and at 212° F. per lb. Combustible		
K.W.H. Generated (including Exciter K.W.H.)		
K.W.H. Net Output		
Lbs. Water Evaporated per K.W.H. Generated		
Lbs. Water Evaporated per K.W.H. Net Output		
Equiv. lbs. Water Evap. from and at 212° F. per K.W.H. Gen'd		
Equiv. lbs. Water Evap. from and at 212° F. per Net K.W.H.		
Lbs. Coal Consumed per K.W.H. Generated		
Lbs. Coal Consumed per K.W.H. Net Output		
Load Factor, 25 Cycles		
" " 60 "		

COAL ANALYSIS. PER CENT.

	FIXED CARBON	VOLATILE MATTER	MOISTURE	ASH	B. T. U. (Dry)	SULPHUR
74th St.						
59th St.						

TOTAL FOR MONTH.—DIVISIONS.

	MANHATTAN.	SUBWAY.
Total Net K. W. H. Output		
" " " Tie Line		
" K. W. H. used for Passenger Station and other lights		
" " " " Sub-Station and other Auxiliaries		
" " " " 74th Street Auxiliaries		
" " " "		
" " " "		
" " " "		
" K.W.H. used for Traction		
" Car Miles		
Weight per Car, including Passengers		
Total Ton Miles		
K.W.H. (Traction) per Car Mile		
Watt Hours (Traction) per Ton Mile		
Total K.W.H. Output to Sub-Stations		
Total K.W.H. Input—Sub-Stations		
Efficiency—Power Station to Sub-Stations		

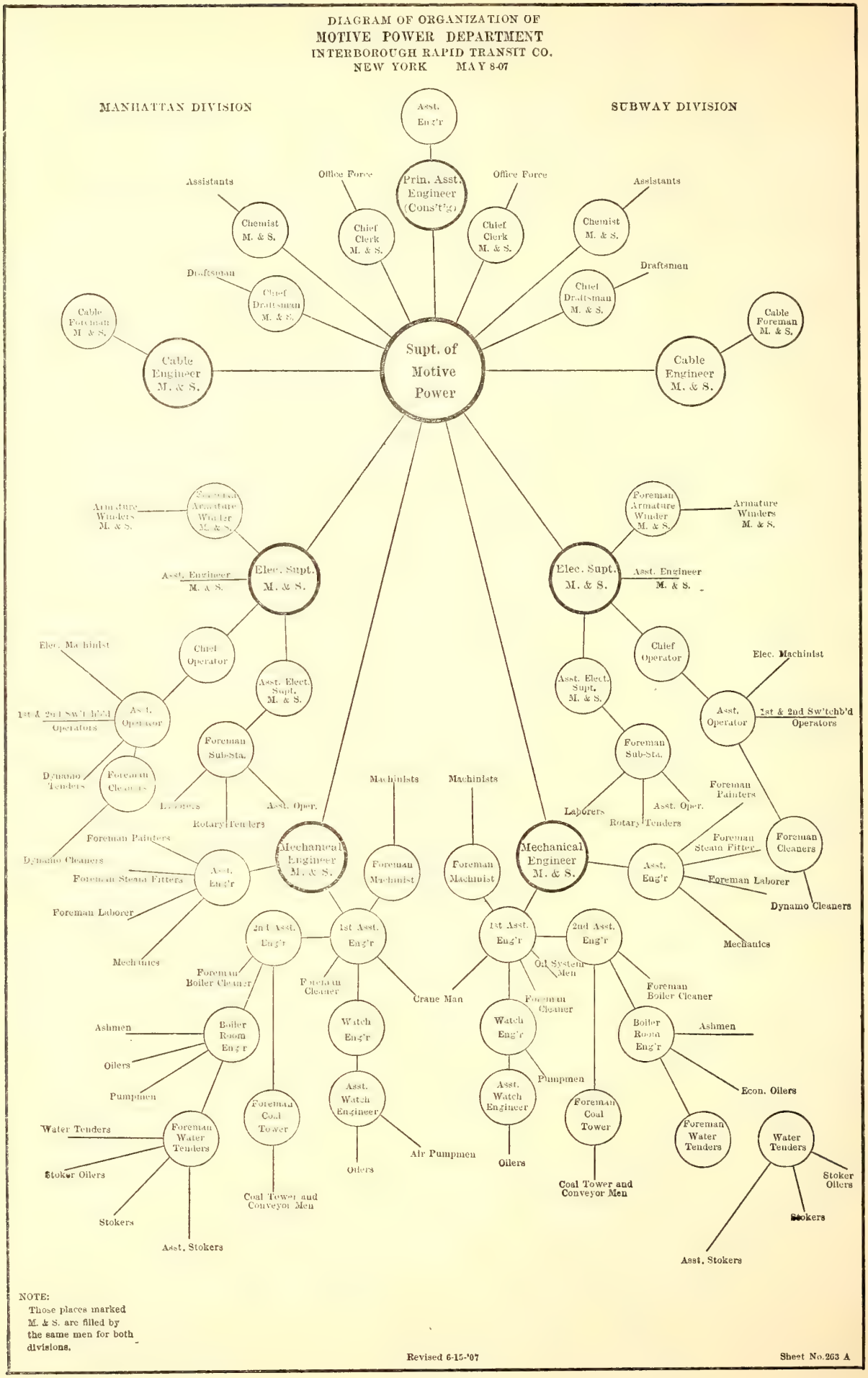
MAXIMUM HOUR LOAD ON POWER STATIONS.

	74TH ST.	59TH ST.
Date		
Time		
Temperature Feed Water, Deg. F.		
Gauge Pressure, lbs.		
Factor of Evaporation		
Maximum Swing, K.W. Generated 25 Cycles		
" " 15 Min. " " " "		
K.W.H. Generated (including Exciter K.W.H.)		
Lbs. Water Evap. per K.W.H. Generated (Avg. for Month)		
Water Evaporated by Boilers, lbs.		
Equivalent Water Evaporated from and at 212° F., lbs.		
Boilers in Service		
Evaporation per Boiler from and at 212° F., lbs.		
H.P. Developed per Boiler		
Rated H.P. per Boiler		
Percentage of rated H.P. developed		
K.W. Generated per Boiler, Max. 15 Min.		
" " " " " Hour		

MAXIMUM HOUR LOAD TO DIVISIONS.

	MANHATTAN	SUBWAY
Date		
Time		
Cars on Line at Time of Heaviest Load		
Weight per Car, including Passengers—Tons		
Total Weight Cars, on Line—Tons		
Maximum Hour Load, Kilowatts—Generated A. C. 25 Cycles		
" " " " —Net Tie Line		
" " " " —59th St. P. S. Auxiliaries		
" " " " —74th " " "		
" " " " —S. S. Auxiliaries		
" " " " —Pas. Sts. and other Lights		
" " " "		
" " " "		
" " " "		
" " " "		
" " " " —Net Output for Traction		
Maximum 15 Min. Load, K. W.—Generated A. C. 25 Cycles		
" " " " " —Net Tie Line		
" " " " " " —Used (same as for Max. Hour)		
" " " " " —Net Output for Traction		
Kilowatts per Car (net), Max. Hour		
" " " " " 15 Min.		
Kilowatts per Ton (net) " Hour		
" " " " 15 Min.		

MONTHLY DATA SHEET



Street Railway Journal

DIAGRAM OF ORGANIZATION OF MOTIVE POWER DEPARTMENT, INTERBOROUGH RAPID TRANSIT COMPANY, NEW YORK

Special precautions are taken by the men inside the station and those outside to insure against injury to workmen on the high-tension apparatus. Before working on a high-tension switch or cable it is tested by means of a ground wire provided with a long, high-tension fuse on the end of a stick. The fuse protects the apparatus and the workman in the event of the line being alive. Afterwards the line is well grounded, both at the station and sub-station, and these grounds are not removed until the sub-station operator and the switchboard man in the power station are properly notified by the linemen.

The switchboard is in a comparatively clean place, and it is only necessary to brush the dust off the parts once in about two weeks. At six-month intervals it is cleaned thoroughly. One man in the power station gives all his time to the inspection and maintenance of switches, which are inspected every day, and every two weeks they are gone over carefully. The oil pots are opened and inspected after every short circuit or blow out, but otherwise these are left without attention for a year. Reports of oil switch inspections are made on special blanks, upon which the oil pots of the switches are indicated by circles. When pots are inspected the corresponding circles on the reports are marked. These inspection sheets are kept on file by the chief operator.

Switchboard instruments are calibrated and taken care of by the company's regular testing department. Wattmeters and other important instruments are calibrated and corrected once a month, while the less important ones, including feeder ammeters, are tested at three-month intervals. All of the instruments are tested on the switchboard in their regular position. The switchboard in the power station is so arranged that a spare panel may be substituted whenever the instruments of one section are to be tested.

STORAGE BATTERIES

One battery is installed for exciting the generators in emergency, and another smaller one is provided for operating the oil switches and other control apparatus. One man gives all of his time to the care of these batteries. They are overcharged once each week, and during the remainder of the week they are brought down about 15 points in gravity. Pilot cell readings are taken every hour, and each week voltage and specific gravity readings are taken of each cell. A duplicate of these readings is sent to the storage battery manufacturers. Water for the batteries is distilled in the power station. The generators are usually excited from motor generator exciters across which the large storage battery is floated. In an emergency the battery will continue to excite the generators for about two hours.

REPAIR METHODS

A machine shop is located on one of the galleries, and all of the repairs are made by the station repair force. A winding room is provided for making armature and field repairs. Spare armature and field coils are kept for the larger generators and for the auxiliary motors, of which there are about 150 in and around the station. A very heavy stock of repair parts are kept in the store room. For engines the parts carried include spare pistons, rods, valves and in fact a sufficient number of parts to equip an extra unit.

HANDLING SUPPLIES

On the 10th of each month the motive power department makes a requisition on the general store room of the company for operating supplies required for the following month. The materials are then delivered to the store room on the first of the following month. For those required within a week's time special emergency requisitions are made. All supplies are received at the power station by the storekeeper, and store-house orders are made on him as they are required.

ORGANIZATION OF OPERATING FORCE

The mechanical and cable engineers, the electrical superintendent and all those operating men who report direct to Mr. Stott fill similar positions for both the Manhattan and the subway divisions. In general it might be said that the mechanical engineer has under him all those men concerned with the operation of the station from the coal to the generators.

In addition to having charge of the generators and all of the electrical apparatus in the stations the electrical superintendent is responsible for the maintenance and operation of the high-tension feeders and the sub-stations. The first assistant engineer, who is under the mechanical engineer, has immediate charge of the operating room, and the second assistant engineer under him has charge of the boiler room and coal handling.

The chief operator under the electrical superintendent is held immediately responsible for the operation and maintenance of the electrical apparatus in the station. The switchboard force under the electrical superintendent consists of a chief operator, three assistant operators and a first and a second switchboard man. The assistant operator is on duty during the day watch only.

POWER STATION LOGS AND RECORDS

The greater portion of the operating data kept by the several departments is used to make up a monthly data sheet, upon which are entered all items of vital importance, including pounds of water evaporated and pounds of coal consumed per kw-hour, evaporation of water per pound of coal, total kw-hours generated and maximum loads and load factor for the month. This monthly sheet is made out in such a manner that the results of the Seventy-Fourth Street and Fifty-Ninth Street stations may be readily compared. Many of the data for it are gotten from the summary of power station daily logs, which is made up from the boiler-room daily log, the engine-room log and the electrical log. In most instances the data on these three logs are compiled from subsidiary record sheets.

The watch engineers in the boiler room keep record of and report on special blanks the number of active, working and banked boilers each hour. For every 24-hour period, ending midnight, the station engineer submits a report giving a summary of the reports of the three preceding watches on boilers, and also gives the amount of water taken from the mains, the amount of coal received, consumed and quantity in the bunkers, quantity received at the dock during the day and the quantity at the dock. Figures regarding coal are obtained principally from a report made out by the foreman of the coal tower which in addition gives the duration of stops of the coal handling apparatus and the causes. The daily boiler-room log is made out by the boiler-house clerk from the several data sheets referred to. On this log is also given the temperature of the boiler feed water each hour.

Data regarding the operation of the engines are entered by the watch engineers directly on a yellow daily log sheet, from which a white copy is made for office use. This log shows the periods of operation of the different engines, the steam and vacuum pressure and the condition of the oil tanks.

The engine room and boiler room daily logs are not made out as much in detail as they would be, were it not for the fact that in each room there is kept a log book in which all important events are entered. On the daily electrical log is entered the readings taken at 15-minute intervals of each of the main generator wattmeters, and from these the daily load curve is plotted. Hourly readings of the output of the generators and of the amounts generated and used by the exciters and auxiliaries are also entered on it. Finally a summary is made showing the total output, total consumption for station operation and net output.

ELECTRICAL EQUIPMENT OF MAIN LINE RAILWAYS IN EUROPE

By Philip Dawson, M. Inst. C. E.

The electrical equipment of main line railways is a subject which appeals with great force not only to the railway authorities throughout the world, but always, perhaps with even greater force, to engineers and manufacturers.

The interest which such papers as that of Messrs. Stillwell and Putnam, as well as Mr. Sprague's criticism thereof, have excited, and the heated discussions they have caused, clearly prove the actuality of this important and vast field. Moreover, the amount of work already completed, under construction or contemplated, must convince even the most skeptical that the era of the electrical equipment of railroads on a scale thought impossible a few years ago is not very far remote.

Railways or railroads, as differentiated from tramways or street railways, originated in the old country, just as the latter originated in the United States. Hence the views held on this side of the water must necessarily carry considerable weight, and may therefore prove of interest to your readers on both sides of the ocean.

Reference has already been made by the writer in previous articles in this journal to the general headings under which railway electrification in different countries may be considered. It may be of interest to again review some of these headings and discuss them in the light of work which is now actually proceeding or has been determined upon.

The three we will mention, although obviously only two need be seriously examined in the present case, are:

(1) Railways which, through local conditions, are compelled to equip electrically within a given area all classes of traffic and service.

(2) Railways which find it advantageous to adopt electric power, in consequence of special local conditions, such as cost of fuel, gradients, and the existence of water power, for some or all of their services.

(3) Railways which resort to electrical equipment of suburban portions of their systems in consequence of tramway competition or insufficiency of existing lines and termini to handle current requirements.

The first of the above three cases requires few, if any, remarks, as obviously railways which are compelled to abandon steam have no other alternative but to adopt electric traction. Suffice it here to cite some examples of such cases, as for instance, the New York Central and New York, New Haven & Hartford railroads, so far as the electrification of their New York ends is concerned; the underground and tube railways all over the world; Alpine tunnels, like the Simplon, etc.

In all these cases no arguments in favor of electric traction were required. They were furnished nearly twenty years ago when the system which was to be adopted for hauling trains on the City & South London Railway was finally settled upon. Nothing has happened since to vitiate the decision the directors of that pioneer company came to so many years ago, to use electric traction, then only in its infancy.

The far more interesting cases which have to be discussed are those in which arguments have to be put before the railway authorities, of such a nature as to be absolutely convincing to shrewd men of business, that the great capital expenditure required by the introduction of electric traction is justified by the benefits which are certain to accrue in consequence of its introduction, and that no equally efficacious and cheaper means exist at present, or are indicated in the near future, for obtaining similar ends. It is only if such arguments are forthcoming and can be demonstrated to be sound and capable of proof, that railways can be expected to adopt that method of haulage to which electrical engineers look to confer such boons, both on the traveling public and on the owners of the railways, be they a body of shareholders or a Government.

It must be borne in mind that in the present instance it is intended to consider only the problem of the conversion of existing steam roads to electrical haulage, and not the proposition of the construction of entirely new railway systems. It will be evident that if a good case can be made for the replacement of steam by electricity on existing lines, that "a fortiori" it would be of greater advantage in the case of new lines, where no scrapping of expensive plant or alteration of existing methods would prove necessary.

The theoretical advantages, as they might be called, of railway electrification as well as those which have been deduced from calculations, have of late been much before the public. Suffice it as an example here to refer to Messrs. Stillwell and Putnam's paper so recently published in the columns of this journal. It may, therefore, be of interest to examine this fascinating problem, which is so full of promise for the future of the electrical industry, in the light of what has been either actually carried out, what is now under consideration, or what responsible railway authorities are seriously contemplating, and to investigate the causes which have brought this about, as well as the arguments which have been successful in causing steam railways, which are the most conservative bodies in all countries, to adopt entirely new methods.

The first case which will be considered is that in which it is intended to convert a long distance main line from steam to electric haulage, and perhaps the most interesting at present in contemplation is the electrification of what is known in Germany as the Eifel Bahn. The route of this line is shown on Plate XLIX, on a map prepared specially for this article.

Other cases which are also of considerable interest, but in which the reasons for conversion are more obvious, owing to expensive fuel and plentiful and cheap water power, or to other local conditions, such as difficulty of ventilation of long tunnels, will next be considered.

THE EIFEL BAHN

The Eifel Bahn extends from Cologne to Treves and is 112 miles long and double track. It passes through what is known as the Eifel, a bleak mountainous high volcanic plateau, seamed with rocky gorges, and situated between the rivers Rhine, Moselle and Roer. This plateau extends over a length of about forty-five miles, and is some twenty-five miles wide. The nature of the land traversed has resulted in the line having, for a railway, many severe gradients. The line starts at an elevation of 120 ft. above the sea at Cologne, and passes the watershed at a height of 1815 ft. fifty-two miles from Cologne. It then descends to Treves, which is 435 ft. above sea level. As will be seen from the map, a short distance beyond Treves there is the very important coal and iron

field of the Saar, while on the other side and close to Cologne there are other large and important coal and iron districts. The mineral and other freight traffic between these two important industrial centers of Germany is of great volume. Two railway systems connect these rich districts; the one along the valley of the Rhine via Coblenz, the other the Eifel line now under consideration. The former line is already overcrowded with traffic, both passenger and freight; the latter has so hilly a profile that the most powerful existing steam locomotives can only haul small trains under uneconomical conditions. Careful calculations have convinced the Prussian State Railway engineers that the use of electric locomotives combined with the adoption of the single-phase system will not only produce considerable economy in operation, but will also enable trains a thousand tons or more in weight to be hauled, a thing which with present methods is quite out of the question.

It is with this end in view that Dr. Eichberg (whose name is so intimately connected with the Allgemeine Electricitaets Gesellschaft's successful single-phase work in Europe) has recently completed several 25-cycle, 350-hp, single-phase motors (see Plate LII), and a locomotive to be fitted with such motors and gear driven is now nearing completion at the works of the Allgemeine Electricitaets Gesellschaft in Berlin.

The overhead construction for a railway of this description can be of the cheapest character, and probably a line pressure of 10,000 volts will be adopted, the current being transmitted to static transformer substations at from 30,000 to 40,000 volts. Power will probably be furnished by two generating stations, one of which will probably be erected in the neighborhood of Cologne on the lignite coal fields which are to be found there, and which can be exploited in a most economical manner, as the lignite is in a very thick bed and can be got at directly by excavating from the surface without the necessity of sinking any shaft. The motors, which have only six poles, are fan-cooled, which method, given a large locomotive cab and the necessity of a locomotive driver, offers no difficulty. By this means astonishingly favorable results have been obtained, as shown by the following figures:

Brake H. P.	R. P. M.	Horiz. Effort in Kgs.	Efficiency in per Cent.	Power Factor in per Cent.
205	600	1400	81.5	90
368	425	3550	89.5	94.5
395	400	4000	90	94.5

This motor, thanks to its design and forced ventilation, is capable of giving continuously 250 hp, a very valuable feature considering the sort of work it will be called upon to perform. The gear ratio is 1:4.15, and the maximum horizontal pull at starting can reach 4500 kgs. The locomotive is being fitted with wheels 1400 mm in diameter, and the actual results which will be obtained with it will no doubt be watched with the greatest interest by all railway engineers throughout the world.

So much for this very interesting decision of the progressive Prussian Government railway authorities to electrify a main line railway—a decision caused by the necessity of hauling heavier loads than could be done by steam and at more economical rates, notwithstanding the cheapness of fuel and the practical absence of any available large water power. The conditions obtaining in this case are particular, and no general deduction can be made as regards the probability of electricity replacing steam under ordinary working conditions. At the same time it is a great step forward and there is little doubt that the results obtained will be of the greatest practical value to railway men throughout the world.

We now come to the consideration of other causes—and one can even say more easily comprehended causes—for replacing steam by electricity, such as expensive fuel and plentiful water power—conditions which exist in Austria, Switzerland, Italy and Sweden. In many cases it is not only the abundance of utilizable water powers, but also the great difficulties of proper ventilation of long tunnels, which have caused the governments of these countries to study the subject of electrification seriously.

SWITZERLAND

The Swiss have appointed a special committee of experts who have reported on the whole subject of railway electrification throughout the country, and the Oerlikon Company has equipped the Seebach Wettingen line near Zurich with its well known single-phase system, with a view to the Government acquiring experience from actual results. The Government itself is acquiring water powers all along the route of the St. Gothard, which will probably be one of the first main line railways in Switzerland to be converted to electric traction. Here again the difficulty of ventilating the St. Gothard tunnel has materially influenced the Swiss railway authorities in their decision. Switzerland may be looked upon as one of the pioneers of main line electrification with high pressure alternating current, for it was the Swiss who were responsible for the historic Burgdorf-Thun line equipped many years ago by Messrs. Brown and Boveri.

ITALY

Italy must not be overlooked as one of the pioneers of main line railway long distance electrification, for the Valtellina line, worked on Ganz's concatenated three-phase system, is world-famed, and the Milan Gallarte Porto Ceresio line is too well known and has been too often described to require any comment here. At the same time the results obtained on these lines, as well as the very serious question of tunnel ventilation, the great cost of fuel and the presence of water power, have influenced the Italian Government in its decision to increase greatly the extent of electrically operated main line railways, and the Government has consequently authorized the expenditure of $10,000,000 for immediate electrification of several important lines.

The Valtellina line, the electric operation of which now terminates at Lecco on the lake of Como, is to be extended south as far as Milan; furthermore, lines connecting the Valtellina system with the town of Bergamo are to be electrified, naturally on the already operating Valtellina three-phase system. The roads, so far as their passage through the Apennines is concerned, between Milan-Genoa and Turin-Genoa, are to be electrified, and electric traction is to be introduced on the Mont Cenis tunnel. The electric operation on the three-phase system installed by Messrs. Brown and Boveri on the Simplon has been so successful that it is proposed at once to extend it to Domodossola, and eventually to Milan. The existing Gallarate third-rail line is to be extended to Arona and Laveno on the Lago Maggiore.

The passage of the main line from Milan to Florence through the Apennines, when again the tunnel question crops up, is also to be electrified between Pistora and Poretta. Two other lines, which are electrified for other reasons, due to heavy traffic, which will be discussed later in this article, are in the neighborhood of Naples.

It will thus be seen that Italy is already pledged to electric railway traction on a very considerable scale, but unfortunately on many different systems, all of which are being extended, the authorities apparently not having come to any definite conclusion as to what system is most advantageous to fill their requirements.

SWEDEN

Last but not least we must consider Sweden, and here one cannot but admire the business-like and scientific methods with which here, no less than in Germany, the problem has

been approached by the chief engineer of the Swedish State Railways, Robert Dahlander, and his able assistants. The first point to settle was the general advisability of electrification, and a careful study has convinced the Swedish Government that owing to very costly fuel and the presence of large and numerous waterfalls, electricity offers great advantages. Calculations show that there would not be a very great financial benefit due to electrification, but the fact that the Government would be relieved of the necessity of importing foreign coal was a great feature in the decision generally to electrify all the Swedish railways. A careful and thorough study convinced Mr. Dahlander that the only system which would meet his requirements, and which indeed would be of utility to Sweden, was the single-phase system. That important point decided, he proceeded to equip a few short sections of line round Stockholm, and to acquire motor equipments of various makes, purchased for this purpose one locomotive equipped with Westinghouse single-phase motors, one locomotive equipped with Siemens-Schuckert single-phase motors and two motor coaches, each equipped with two W. E. 115 single-phase motors from the Allgemeine Electricitaets Gesellschaft.

He has carefully studied the results and has convinced himself that for his purpose an economical and simple overhead and transmission system is essential; and his experiments have shown him that with the single-phase system such a line can be very readily and economically installed, and that, provided proper precautions are adopted, no interference with telegraph or telephone circuits need be apprehended. Indeed there is no other engineer who has collected so much valuable and important information in this direction as Mr. Dahlander, and it is to be hoped that the very interesting information and data which he possesses may shortly be made public by him for the benefit of the engineering profession. Suffice it to say that his experiments, carried out for over a year, have satisfied him and his Government that the electrification of many, and eventually of all, of Sweden's railways is desirable; and the necessary steps have already been taken to acquire the requisite water powers, so that the electrification of all the Swedish railways is now a thing of the near future.

In the foregoing the case of general electrification has been considered and a few of the causes have been cited which may eventually bring about the electrification of entire railway systems.

GREAT BRITAIN

We will now consider the conditions which obtain in Great Britain and ascertain how these differ from those already investigated and see how far, at present, electric traction promises to replace steam. We shall also consider the principal causes which may be expected to bring about such a transformation. In this connection it must be carefully borne in mind that whatever systems are discussed, it is only in connection with the electrification of existing lines of our main line railways, since new constructions might very likely present factors which might render advisable a different system from that which would prove most suitable in the case of the electrification of an existing system; moreover, the discussion only applies to British lines which are, or will be, governed by Board of Trade rules and regulations, and which must be operated by existing railway officials, and therefore as far as possible meet with their approval.

Considering general conditions that obtain in Great Britain, it will at once be seen that no such circumstances exist as have induced the Prussian Government to electrify the Eifel Bahn. All our lines are practically level and straight—in fact, perhaps too much so—and consequently enormously expensive. There are no water powers to speak of, in any case none are available, and the cost of fuel is relatively low. Neither do we suffer, except so far as the Mersey tunnel and Metropolitan, District and tube lines are concerned, from the difficulty of ventilation experienced in Austria, Italy and Switzerland. Neither are there any lines now in existence in this country which, as in the case of the New York Central or New York, New Haven & Hartford Railroad, have had electrification forced upon them by law. But there are other causes quite as important which are no less certainly compelling our railway companies to adopt electric traction for at least a portion of their systems, although by no means on such an extensive scale as Messrs. Stillwell and Putnam would have us believe will be the case in the United States.

Let it at once be stated that the only portion of railways on which present experience would indicate that electric haulage would be beneficial are the suburban lines in and around our great cities, and the interurban connections between large cities which are near each other and between which there exists a very heavy and frequent train service, such as between Manchester and Liverpool, Leeds and Bradford and other similar cases.

The two principal reasons which will compel our railways to action are (1) the very serious financial losses due to electric tramway competition, which in the case of one railway alone—the London, Brighton & South Coast—amount to over £30,000 per annum, and (2) the constant growing demands for a frequent and rapid suburban train service, resulting both from the increase of population and the education which the public has received in rapid transportation, from electric tramcars, motor omnibuses and tubes. These considerations definitely prove the desirability—yea, necessity—of increasing the net profits, or at least of finding some means of counterbalancing the losses the railways are suffering due to competition from other modes of rapid transit, and of increasing their carrying capacity and speed of their trains without incurring undue and excessive additional capital expenditure.

It is apparent therefore that it is to increase present facilities rather than to reduce actual total working expenses that railways will enter into the path of electrification, and experience has shown that when that path is once entered there will be no retreat. Conditions in London as well as in most of Britain's great cities, are practically unfavorable to the railway companies, as the tramways are nearly exclusively operated by the municipalities at fares so low as in many cases to threaten serious losses to the rate payers, among the largest of which the railways themselves are numbered. Fortunately for the railways, municipalities are gradually awakening to the fact that fares may be made too low, and the railway shareholder can therefore hope that a better time may be in store for him, provided the railways introduce electricity on their suburban systems.

Owing to the short distance between stations—on most London suburban lines this distance is well under one mile—the average speed of local trains is between 12 and 14 m. p. h., and in consequence of the overcrowding of existing lines and termini as much as half an hour or more may have to elapse between two local trains. On the other hand, the London County Council tramways frequently give a five to ten minutes service and operate at an average speed of 10 m. p. h., or only very little slower than the railways. Hence it is not surprising that passengers prefer a crowded tramcar rather than to miss a train and to have to wait over half an hour for the next, and then to travel at a speed perhaps not 20 per cent greater than that of a tramway.

All London main lines end in termini, a fact which conduces to delays, as some six minutes must elapse after the arrival of one train before the platform at which it arrived again becomes available for another. Electricity changes all this, as

it will enable a platform to become available for the next train in two instead of six minutes, a saving of four minutes for each suburban train. Furthermore, it will enable an average traveling speed of from 20 to 25 m. p. h. to be obtained, as compared with the present 12 to 14 miles speed. In other words, the use of electricity, taking into consideration the small proportion of long distance trains to local ones, will practically result in doubling not only the average speed of local trains, but also in doubling the carrying capacity of existing lines and terminal facilities. What this latter point means can be gathered from the fact that the enlarging of one of London's big termini has cost approximately $6,000,000 and that there is a large number of such termini where enlargements even at a much greater cost is practically impossible.

COMPARISON OF OPERATING EXPENSES AND OTHER RESULTS OF ELECTRIFICATION

Having shown the reasons which are inducing railways to decide on the electrification of their suburban lines, the question of operating expenses becomes important and may conveniently be considered at this juncture.

It is practically impossible to compare directly the cost of electricity and steam per train mile and obtain anything like satisfactory results, for the reason that the introduction of electrical haulage on a suburban line will at once alter the size and type of train adopted, and in all probability lead to shorter train units being used and run at more frequent intervals than was the case with steam.

Furthermore, whereas for suburban service there is very little difference, as far as steam locomotive costs are concerned, in hauling a train having a capacity of, say, 250 passengers, as compared with the cost of hauling a train seating, say, 700 passengers, with electricity on the multiple unit system, a unit train, say, of three cars, once adopted, would according to requirements, be made up in multiples of three and the cost per train mile for locomotive power would be practically strictly proportional to the number of units of which a train is composed. Still, it may be interesting to compare some published results on the train mile basis for steam and electricity on the same road.

The Mersey Railway is the only one of what may be called main line systems which has been completely electrified in this connection and working for a sufficient number of years so that figures are available to warrant fairly accurate conclusions being drawn from the results obtained. It is also a good example to quote, since electricity superseded steam on a given day when the whole system was converted from steam to electric haulage. There is little use in considering the increase of traffic resulting from electrification in this case, because the line when operated by steam gave a fairly rapid and frequent service. It is a short distance traffic line, and there existed no particular reason why electricity should largely increase the traffic.

But the financial results as regards cost of operating and the cost of locomotive power per train mile operated by steam and electricity, as well as the cost of maintenance of permanent way, fully bear out the expectation of those engineers who have made electric haulage on railways a serious study. The figures show that with the increased speed which electrification renders possible, with slightly smaller and therefore more convenient train units, the train mileage can be enormously increased without increasing the total operating costs, and that notwithstanding the very much larger train mileage, the repairs of permanent way do not, as might be expected, increase, but are rather lower in their total annual cost than when steam is the propelling power.

The following table affords a highly interesting comparison of steam and electric operation on the Mersey Railway for the years 1901 and 1905, respectively:

Items.	1901 with Steam.	1905 with Electricity.
Locomotive cost per train mile in pence..	13.653	6.29
Train lighting and cleaning per train mile in pence	1.665	0.580
Repairs and renewals of carriages and wagons per train mile in pence	1.719	1.075
Train miles run	311,360	829,898
Total expenditure	£64,662	£69,036
Maintenance of permanent way	£6,055	£3,793

The total gross receipts for the half year ending June 30, 1901, were £38,327, while those for the half year ending June 30, 1906, were £47,129, or an increase of 23 per cent.

Another comparison of Mersey figures is between the year 1901, operated by steam, and the year 1906, operated by electricity, which entirely confirms the figures given in the previous table; thus, in 1901 the total expenditure, including everything, was £64,662, the train mileage being 311,360 train miles; in 1906 the total expenditure, including everything, was £70,930 and the train mileage 829,188 train miles. It will thus be seen that an increase in train mileage of 167 per cent increased the total expenditure by only 10 per cent.

In comparing the cost per train mile of steam and electricity it must be borne in mind that steam trains were, on the average, composed of seven cars, having a capacity of 350 passengers. Now, when operated by electricity, according to the time of day, the number of cars per train varies from two to five, and the average seating capacity of an electric can be taken as 55 passengers, as compared to the average seating capacity of steam cars of just under 50 passengers.

These figures clearly demonstrate the great benefit which railways will get by electrification of their suburban systems. It shows that they will, owing to the high rate of acceleration, be able greatly to increase the average speed, and therefore the number of trains, and thus to utilize better the existing facilities, both as regards tracks and termini. Consequently they will largely augment their earning capacity without increasing their present total working expenses. And as Mr. Aspinall (the general manager of the Lancashire & Yorkshire Railway) has always maintained, the object of electrification is not so much to decrease the expenditure of a railway company as to increase its earning power. Nothing but a greatly accelerated and more frequent service can enable them to hold their own, and it is only electric traction that will provide this acceleration. That frequent and rapid service does, in most cases, provide an efficient remedy is clearly shown by the satisfactory results obtained both in the case of the Lancashire & Yorkshire Railway and of the North Eastern Railway. The latter is a particularly good example, because the electric lines between Newcastle and Tynemouth suffer from the most acute tramway competition. Notwithstanding this fact, the profits are considerably greater now on this railway than they were in the days before there existed any electric tramway competition. This is clearly shown in the following table:

NORTHEASTERN RAILWAY ELECTRIFICATION RESULTS.

Items.	Half Year Ending 1903. Steam Operation.	Half Year Ending 1905. Elec. Operation.	Percentage of Increase.
Gross earnings	£129,000	£151,000	17.1
Running costs	£42,761	£47,779	11.7
Ratio of costs to receipts..	33.2%	31.8%	....
Loco. costs per train mile..	14.5d.	6.75d.	....
Passengers carried	2,844,000	3,548,000	24.8

In reading the above table it must be borne in mind that

the figures given as running costs for steam operation, are, if anything, too low. An exact figure is unobtainable owing to the difficulty of differentiating between the costs for local service and the total locomotive costs for the whole service. But even on the supposition that the comparison is a fair one, it affords a most satisfactory proof of the advantages to be obtained from electrification, particularly in view of the fact that electric tramway competition has very largely increased of late, which shows that the electrification of the railway has, therefore, not only enabled it to hold its own but also to increase its traffic.

Having thus considered the actual results as regards working expenses which are obtainable and authenticated, it may be interesting to study some figures specially compiled for London conditions and in which an attempt has been made to compare on a similar basis the cost of operating a service under similar conditions.

EXPENSES UNDER LONDON CONDITIONS.

Items.	STEAM—Cost per train mile, 7-car train, with seating capacity of 520 passengers.	ELECTRIC—Cost per train mile, 3-car train, with capacity 210 passengers in London.
Fuel or current	6.96d.	5.00d.
Water, oil, waste and stores	0.90d.	0.09d.
Maintenance and repairs	3.41d.	0.85d.
Wages	3.25d.	1.58d.
Lighting	0.85d.	included in current.
Total	15.37d.	7.52d.

Ratio of locomotive costs of electricity to steam 48.5 per cent (including current and capital charges on conduction and distributing system).

From the above table it will be seen that on the train mile basis the locomotive costs for electric traction, maintenance and capital charges in electrical distribution included, are less than half the cost per train mile if operated by steam. Against this, however, would have to be placed the fact that the capacity of the steam train is more than double that of the electric train under consideration. But there is the additional important consideration that the costs given for electric service are for an average acceleration more than double that obtained with steam, and consequently that the average speed of traveling with the electric train is nearly double the maximum that the local steam trains, with present stops, can attain.

It must be borne in mind that it would be impossible with steam haulage to increase effectually the speed of these local trains. To make a fair comparison, one must take as the average speed for electric trains the same speed as that of the present steam trains. On that basis the same number and power of motors that are required to drive the three-car train as given in the previous table, would be amply sufficient to operate a seven-car train, and if the trailer and rolling stock were the same as that at present in use with steam haulage, the carrying capacity of the train should easily equal that of the present steam trains. The table previously given would then very closely represent the comparative cost of operating by steam and electricity under the same conditions.

From this it will be seen that, when compared on the same basis, the cost of hauling suburban trains by means of electricity is less than half that of operating by steam, with the additional advantage already cited thrown in, of the saving of time effected at termini, owing to the use of motor cars and multiple unit control.

But there remains another and most important factor to take into consideration, and that is the better use of the seating capacity per hour if run by smaller and more frequent trains instead of fewer and more capacious trains.

COMPARISON OF SYSTEMS

Having thus briefly considered the present state of electric traction in Europe and the various causes which are operating in the minds of those who have brought about the present condition of affairs, it may be interesting briefly to consider the various systems now in existence, and the reasons which have caused the single phase system to occupy so important a place in the minds of European as well as of many American railway engineers.

The three systems which are now under consideration and have been practically adopted for railway work are:

(1) The continuous current motor { Low tension 600 volts. / High tension 1000 to 2000 volts.
(2) Three-phase motors.
(3) Single-phase motors.

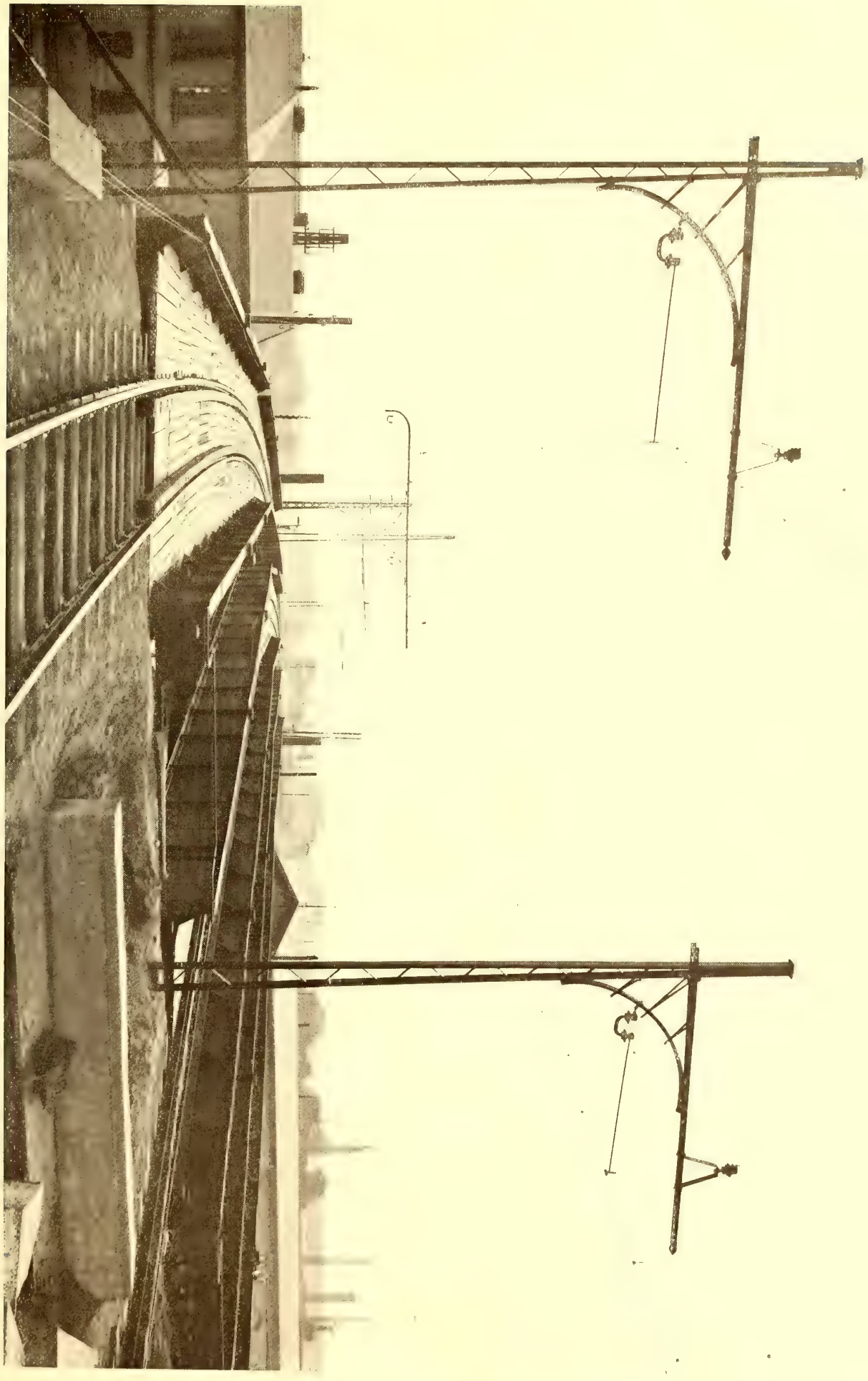
As far as the first of these is concerned the standard low-tension motor has been so fully developed and has proved so satisfactory that nothing further need be said in its favor.

As regards the second, or three-phase system, it has been introduced with satisfactory results on the Valtellina line and on the Simplon, but so far all those who have had to decide when electrification of suburban systems was in question have not found it advisable to adopt it and little therefore need be said of it here, so that the only two systems which require serious consideration or which need be compared are the continuous current high-pressure motor constructed up to 1000 volts and claimed as possible and useful up to 2000 volts pressure, and the single phase low-pressure motor.

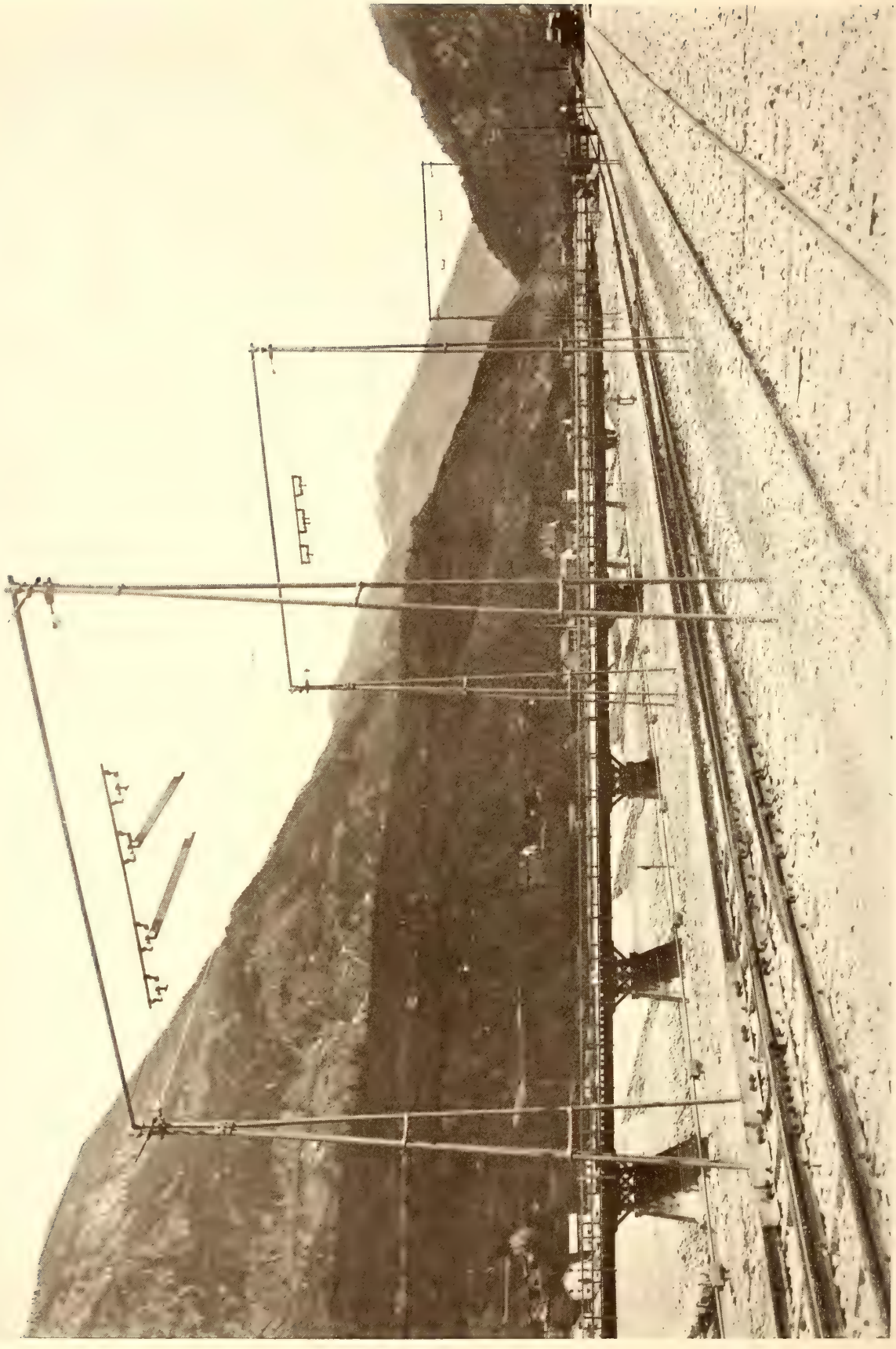
The fight over these has raged so hotly in America that it is unnecessary to reopen it here; suffice it to recapitulate briefly the reasons which have weighed with those railways which have adopted electric traction on the single phase system, and to consider the weight of those objections which are so frequently brought up against single phase motors.

In this connection it is instructive to remember that one of the chief engineers of the Prussian State Railway, Herr Geheimer Baurat Wittfeld, after the most careful investigation, and having only in view the best interests of his railway, decided on the adoption of a single phase system for the suburban line of Hamburg Ohlsdorf Blankenese. An order was consequently placed for fifty-four two-car trains with the Allgemeine Electricitaets Gesellschaft of Berlin, each train being equipped with three W. E. 115 motors, and an order for six similar trains, each equipped with two Siemens-Shuckert single phase motors, was placed with the Siemens-Shuckert Werke. Furthermore, it is this system which the Prussian Government has adopted for the Eifel Bahn. Robert Dahlander, the chief engineer of the Swedish State Railway, also, after most careful research and investigation, has decided upon the single phase system for the Swedish Government railway electrification. As regards Switzerland, it is this system with which experiments are being carried out on the Seebach Wettingen line with a view to its adoption on the St. Gothard. In Italy the position is different, but in that case the greatest portions of the work there under consideration are extensions of lines equipped before the single phase motor came into the field or had been made a practical success. The Midland Railway in England has also adopted single phase for the experimental line it is now equipping, and the London, Brighton & South Coast Railway, after the most careful investigation on the writer's part, is installing it on the first portion of its suburban system, now being equipped with Winter Eichberg single phase motors.

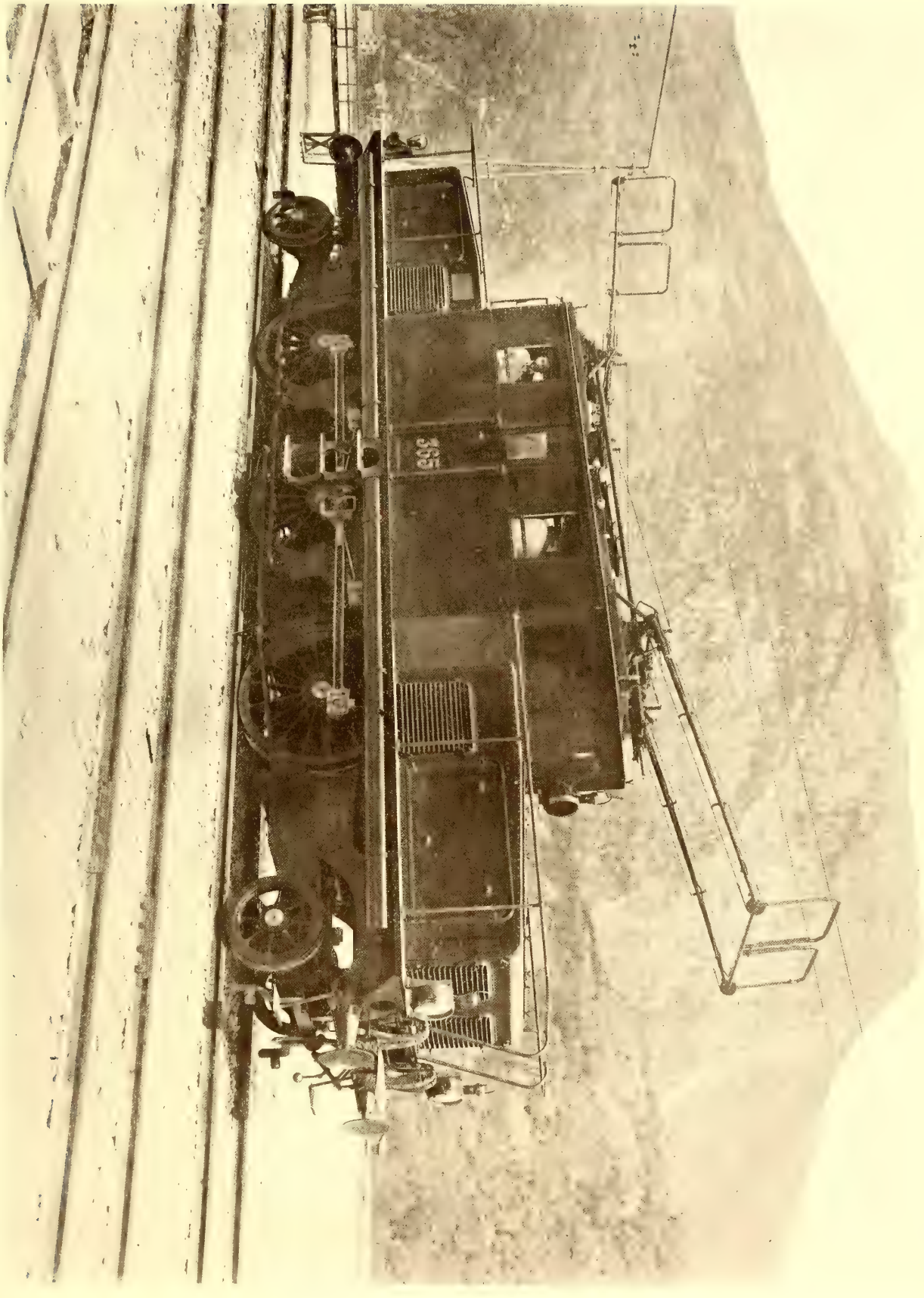
The only serious objection brought by its detractors against the single phase motor is the additional weight and consequent additional cost of a single phase equipment as compared with the equivalent continuous current equipment, and the



HAMBURG-ALTONA BLANKENESE OVERHEAD CONSTRUCTION



SIMPLON TUNNEL RAILWAY—OVERHEAD CONSTRUCTION AT BRIGUE END OF LINE



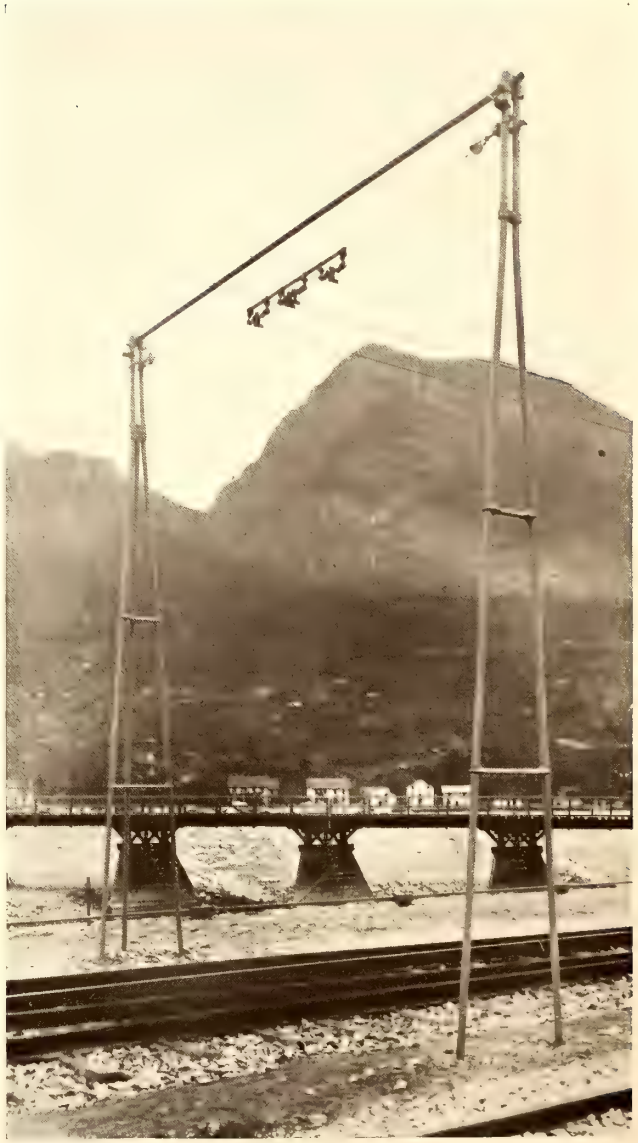
BROWN-BOVERI ELECTRIC LOCOMOTIVE USED IN SIMPLON TUNNEL



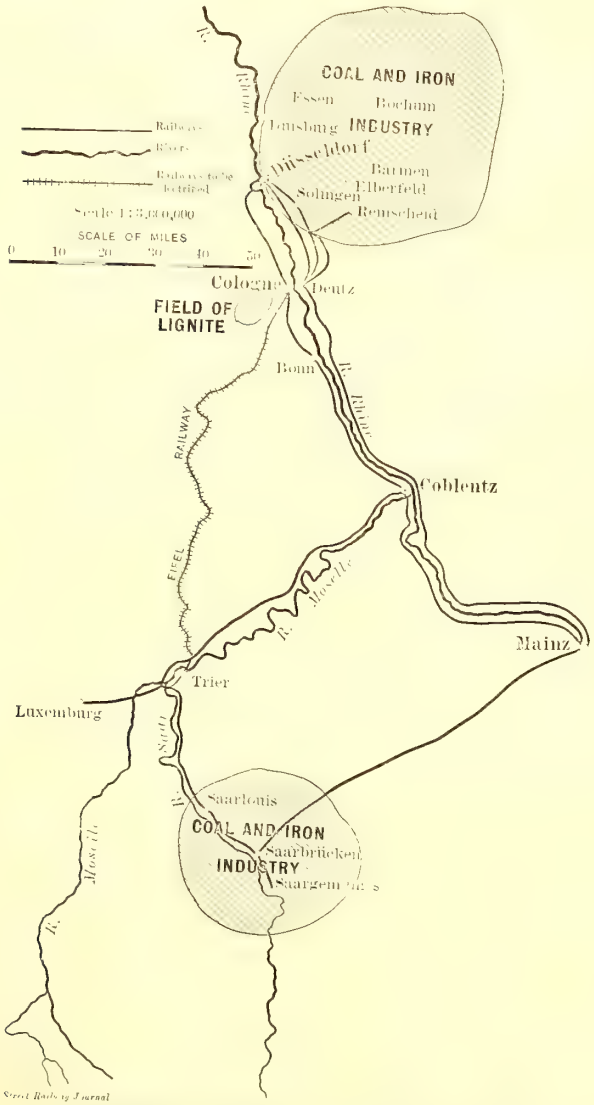
VIEW OF OVERHEAD CONSTRUCTION ON SWEDISH STATE RAILWAYS



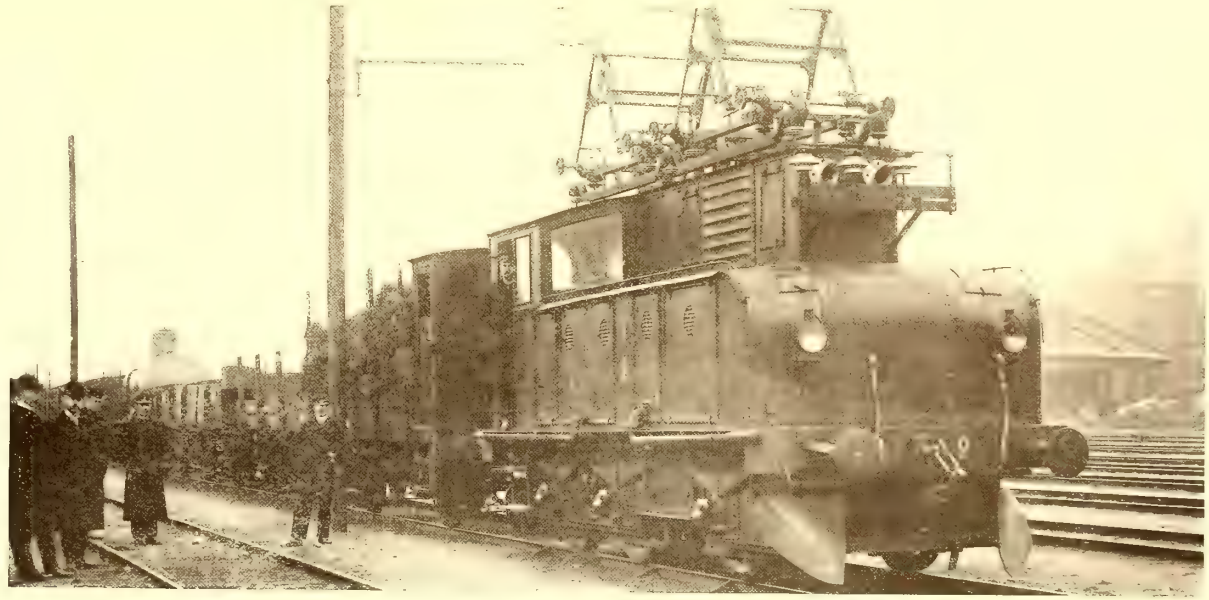
WESTINGHOUSE ELECTRIC LOCOMOTIVE WITH OERLIKON OVERHEAD COLLECTOR HAULING TRAIN ON GOVERNMENT RAILWAYS AT STOCKHOLM



SIMPLON TUNNEL—THREE-PHASE OVERHEAD CONSTRUCTION AT BRIGUE END OF THE LINE



MAP SHOWING ROUTE OF EIFELBAHN, GERMANY

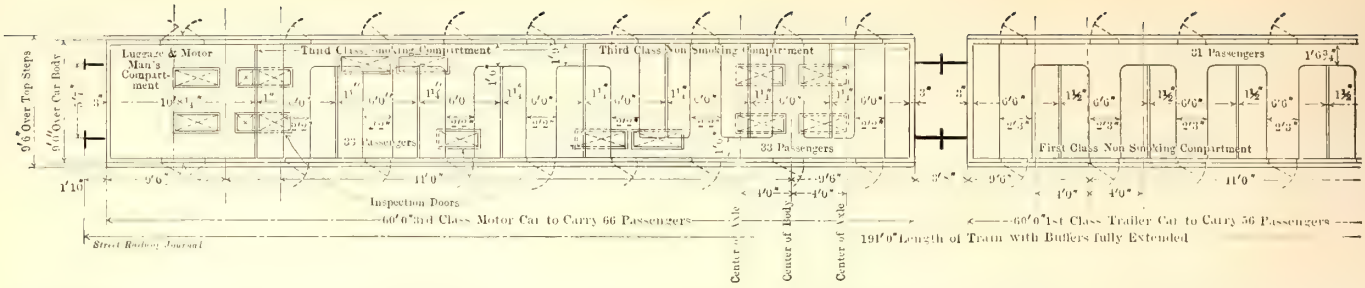


SIEMENS-SCHUCKERT LOCOMOTIVE HAULING FREIGHT TRAIN IN STOCKHOLM



MOTOR CAR AND TRAIN EQUIPPED WITH A. E. G. MOTORS IN PRINCIPAL STATION IN STOCKHOLM

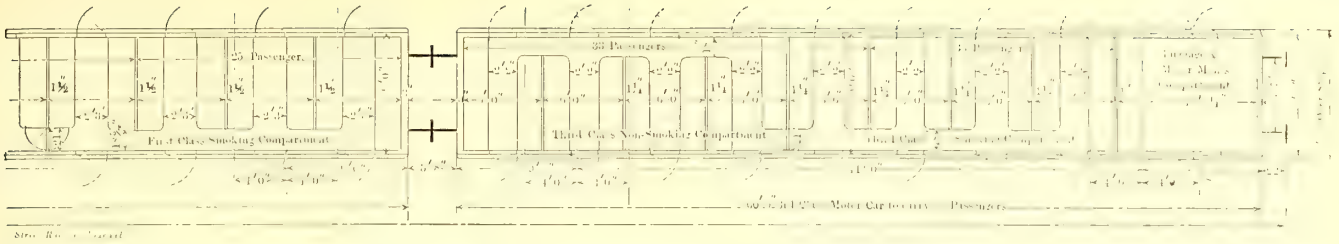
Plate L



FORWARD END OF 3-CAR TRAIN ON LONDON, BRIGHTON & SOUTH COAST RAILWAY, SHOWING ARRANGEMENT OF SEATS



OVERHEAD LINE ON THE HAMBURG-ALTONA RAILWAY, SINGLE-PHASE, 6000 VOLTS, 25 CYCLES



REAR END OF A 3-CAR TRAIN ON LONDON, BRIGHTON & SOUTH COAST RAILWAY, SHOWING ARRANGEMENT OF SEATS



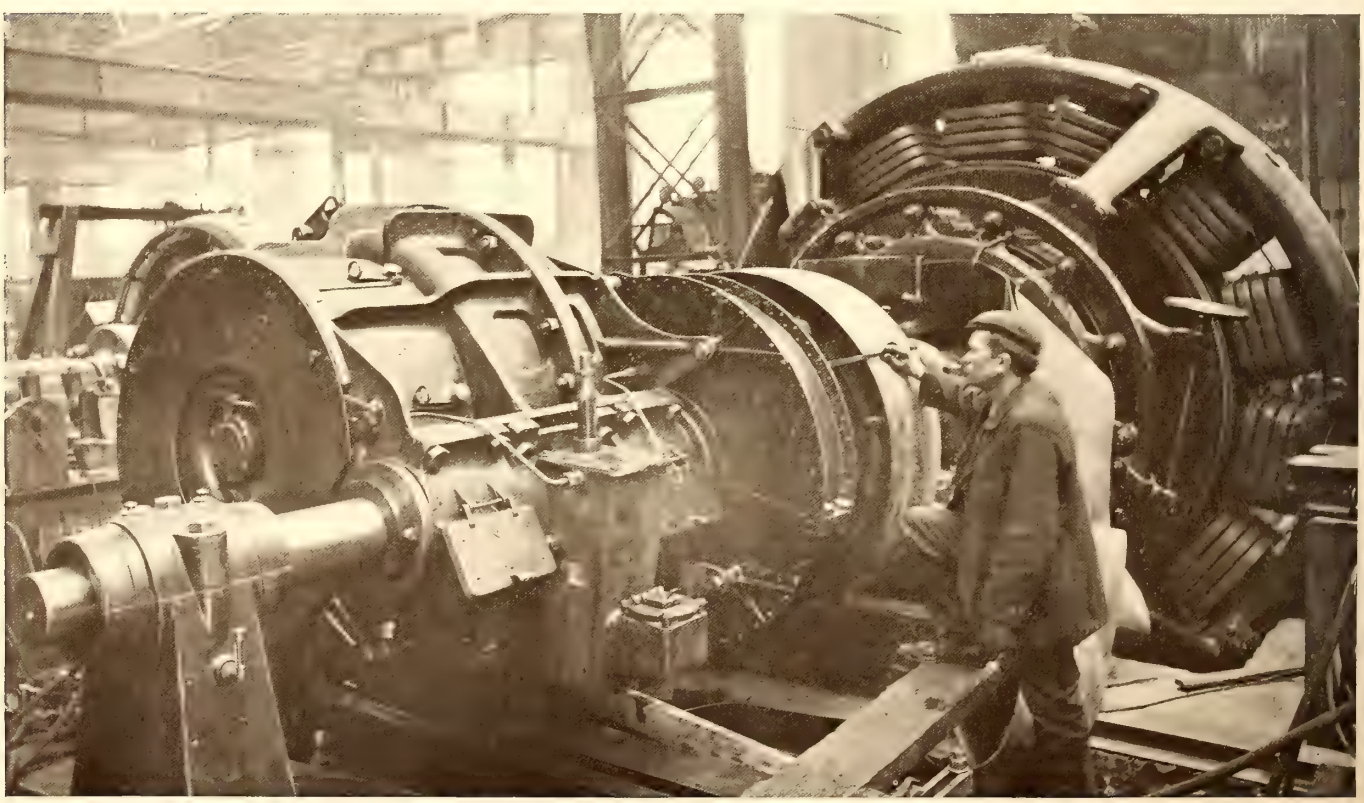
FLOOR OF HAMBURG-ALTONA SINGLE-PHASE MOTOR CAR, SHOWING HOW THE WIRING IS DONE ON THE CAR FLOORING, WHICH IS TURNED UPSIDE DOWN FOR THAT PURPOSE, BEFORE THE BODY IS BUILT INTO IT



SIEMENS & HALSKE SINGLE-PHASE LOCOMOTIVE AND TRAIN ON SWEDISH GOVERNMENT RAILWAYS



A. E. G. CAR ON THE HAMBURG-ALTONA-BLANKENESE SINGLE-PHASE RAILWAY



350 H.P. SINGLE-POLE, 25 CYCLE A. E. G. MOTOR TO BE USED ON THE EIFEL BAHN LOCOMOTIVES, SHOWN ON TEST BED DRIVING A DIRECT-CURRENT GENERATOR

lower efficiency of the motors—i. e., greater energy consumption —which its opponents claim for it.

As regards the first point, it is perfectly true that a single phase motor equipment is more costly and more heavy at present than direct current equipment, and that the former requires a transformer on the car which is not required with direct current motors.

But even granted that the enormous difference in weight which Mr. Sprague claims between d. c. and a. c. motors exists and that the cost were equally disproportionate, the difference in weight and cost would take but an unimportant place among those many and complicated considerations which weigh with practical as well as theoretical railway engineers, managers, and directors when deciding upon the system most suitable to fill their requirements. For taking the weight of a train unit at 120 to 150 tons, the difference of 5 tons or even 10 tons in weight would be unimportant when compared with traffic and management requirements. A good example of this in railway work is to be found in the weight of the cars, particularly those forming part of the most modern American trains, such as the Pennsylvania Limited, etc. What manager would think of rejecting a more useful or comfortable dining, sleeping, or drawing-room car, because it weighed 7½ per cent or even 10 per cent more than a car which in other ways is less desirable? And in this connection let it be reiterated that it is not reduction of working expenses which constitute the chief or even a very important factor in the minds of railway authorities when considering the question of electrifying a suburban line.

In the case of a suburban system, careful calculation has demonstrated that there is not much to choose as regards first cost (although what difference exists is in favor of the single phase) between a complete d. c. and a. c. installation from and including the power station, feeder distribution, conducting system, and rolling stock, provided the installation is properly carried out so as to comply with the Board of Trade regulations which obtain in Great Britain.

As regards lower efficiency, this is to a very large extent counterbalanced by the absence of regulating resistances which the d. c. system necessitates, as the voltage regulation is done by means of a transformer, instead of having the difference in motor terminal and line voltage largely absorbed by resistances, as is necessary with continuous current motors. But besides this it must be borne in mind that for any large railway system the current must of necessity, if present means are adopted, be generated as alternating current, and therefore not only the losses in transformation from a. c. to d. c., but also the extra cost entailed of operating and maintaining such substations must be added onto the d. c. motor before a fair comparison can be instituted. If this is done it will be found that the a. c. motor comes out on the whole very well indeed; in fact, many authorities maintain far better than the d. c. motor.

But it is not the object of this article to enter into polemics on what might be called "the battle of systems," but only to show that there are far greater possibilities in the a. c. system than some would have us believe. All the disadvantages and objections which d. c. enthusiasts, who appear blinded to all except their own arguments, bring up against the a. c. motor are fully known to those engineers who having no interests in any particular system have investigated simply those in existence and have adopted the a. c. as the most suitable to their own special requirements. They are fully cognizant of any weakness which the a. c. system may possess, as well as of the many very admirable features of the d. c. motor, which has continually been perfected during the past twenty years.

One of the principal advantages of the a. c. motor is the absence of a third rail and the possibility of using very high pressure in the conductors without any dangerous pressure having to be manipulated in the car, or being at all accessible either to the officials or the public. This undoubted advantage is evidently appreciated even by those who would detract from the merits of the a. c. system, as their alternative is nearly always the adoption of a d. c. motor, worked at pressures untried as yet in the practical railway field, and which would not permit the use of a third rail, which so many d. c. enthusiasts have held to be a benefit instead of a necessary nuisance at the best. In this connection it should not be forgotten that the first main line electrification in the United States, on the Baltimore & Ohio, was originally installed with overhead conductors, but owing principally to current-collecting difficulties, the method had to be abandoned in that case in favor of the third rail arrangement.

Summing up, it becomes clear that for continuous current motors to bear comparison with alternating current motors, motors of at least half the required pressure advantageous for operation and distribution must be commercially produced, leaving out of consideration many disadvantages which might accompany their adoption. Such high pressure motors would also necessitate the use of rotary conversion, or their equivalent continuous current at 6000 to 10,000 or even 15,000 volts.

All the previous remarks are not intended in the least to belittle the endeavor of those who are attempting to develop and place on a sound manufacturing basis the high-pressure continuous current motor, and two firms at least are known to the writer whose 2000-volt continuous current motor and controlling apparatus are essentially workmanlike and satisfactory. There may be a great many cases in which such a motor might with the greatest benefit to all concerned find application. All that has been attempted is to show that the single phase motor as at present constructed possesses great and real advantages which make it admirably suited to the requirements of railways working under all conditions, and just as suited to handling heavy suburban traffic as long distance traffic, to which latter field only many, particularly American, engineers would have it relegated. Fortunately for all, operations will shortly be conducted on a sufficiently large scale to enable satisfactory conclusions to be drawn from three examples of single phase main line railways whose suburban traffic is electrically handled, namely, the Hamburg Ohlsdorf-Blankenese, which is now working experimentally, and which is expected to be operating regularly by the end of this year; the "Victoria-London Bridge" section of the London, Brighton & South Coast Railway, now under construction, and which should be completed early next year; and last, but not least, the New York, New Haven & Hartford Railway. By the end of next year, therefore, some real substantial facts should be available, facts which will be most appreciated by all railway men all over the world, and which will be of great assistance to railway authorities in guiding their future actions, which, in the opinion of the writer, are intimately bound up with the electrical industry.

The recent decision to electrify the Berlin Stadt and Ring Railway with the single-phase system clearly upholds this view. The complete plan embraces some 366 miles of track. The voltage employed on the trolley will be 10,000, and motor-car trains, probably of the two-car form of the A. E. G., like those on the Hamburg Altona line, will be used. A headway of two minutes is planned and a maximum speed up to 38 m. p. h. will be reached. The first section is to be electrically equipped by 1913 and the entire system by 1920.

SOME OF THE APPARATUS IN USE ON THE CONVERTED STEAM RAILROADS

The plan of this issue, devoted as it is principally to the subject of operation, has precluded any extended reference to the types of apparatus used upon the electrically equipped sections of the steam railroads described. It is not the intention in this chapter to mention all of the equipment installed, but to give credit, so far as it has been possible to collect the data from the different manufacturers, for the electrical equipment supplied to the trunk line railways whose practice is described in this section.

THE GENERAL ELECTRIC COMPANY furnished for the electrical equipment of the West Jersey & Seashore Railroad all of the active elements, including three 2000-kw Curtis turbine generators, exciters, transformers and switchboards for supplying 33,000-volt, 3-phase current through 70 miles of double transmission lines to seven rotary converter sub-stations. These sub-stations aggregate 11,000 kw in capacity and distribute 650 volts direct current to 110 miles of third rail and 27 miles of overhead trolley. There are ninety motor cars, each equipped with two 69-C General Electric railway motors and Sprague General Electric type M multiple-unit train control system. The West Shore Railroad electric equipment supplied by the General Electric Company comprises four sub-station equipments, each containing two 330-kw transformers, two 300-kw, 600-volt, 40-cycle rotary converters and accessories; also seventeen GE-73 four-motor car equipments with Sprague General Electric multiple-unit control. The New York Central equipment supplied by the General Electric Company included thirty-five locomotives, eight Curtis turbines, four two-unit, two-bearing motor generator sets, four 200-kw o. c. transformers, 125 type M control, two-motor GE-69 equipments, 250 GE-69 C motors, eighteen 550-kw., the fifty-four 375-kw transformers for sub-stations, switchboards for eight sub-stations, power cables, circuit-breaker houses, etc.

THE AMERICAN LOCOMOTIVE COMPANY built the thirty electric locomotives for the New York Central electric division, in conjunction with the General Electric Company. The locomotives were erected at the Schenectady plant of the locomotive builder, and the specifications called for work of the same quality as furnished by the builders for the New York Central steam locomotives. As will be seen from the engravings of these locomotives, they were designed and built as far as possible in accordance with regular locomotive practice.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, the Westinghouse Machine Company, the Westinghouse Air Brake Company, Westinghouse, Church, Kerr & Company and the other Westinghouse interests were largely represented in the equipment of the railway lines described. A complete list is hardly necessary, in view of the recent dates of the publication of articles on the different roads. It might be said, however, that all the New Haven locomotives and line appliances are of Westinghouse make, that Westinghouse-Parsons turbines are used in the power stations of the New Haven and Long Island Railroads and that Westinghouse motors are used on the Long Island and Erie Railroads. A large part of the rotary converters in the New York Central sub-stations are of the Westinghouse make. Roney stokers are employed very extensively in the different power stations. Westinghouse, Church, Kerr & Company were the designing engineers and contractors for the Long Island and Erie installations and for the New Haven power station.

BALDWIN LOCOMOTIVE WORKS, of Philadelphia, built both motor and trail trucks for the Long Island Railroad and the West Jersey & Seashore Railway, and trucks for the locomotives for the New York, New Haven & Hartford Railroad. The trucks for the Long Island company are built for standard-gage track, and designed to carry a weight of 29,000 lbs. on the center pin. The motor trucks are each equipped with two Westinghouse No. 86 motors arranged for nose suspension. The wheelbase is 6 ft. 8 ins. The wheels are 36 ins. in diameter, with cast-iron centers and steel tires. The journals are M. C. B. standard, 5 ins. x 9 ins. Cast steel is used for the bolsters and centerplates, while the end frames, center transoms and spring planks are of channel iron. The bolster springs are double elliptic, 28 ins. long, and the equalizing springs are double coil. The loaded height from rail to center plate is 31½ ins. The trailer trucks are similar in many respects to the motor trucks, although they are lighter in construction. The wheel base is 5 ft. 6 ins., and the wheels are 30 ins. in diameter.

The latest trucks built for the West Jersey & Seashore Railroad by the Baldwin Works are designed to carry a load of 30,500 lbs. on the center plate. The motor trucks are each equipped with two G. E. No. 69-C motors, arranged for nose suspension. The wheel base is 7 ft. 3 ins. The wheels are 36 ins. in diameter, and the journals are 5 ins. x 9 ins., M. C. B. standard. These trucks are equipped with wrought-iron frames, cast-steel bolsters and center pins, channel iron transoms, triple elliptic bolster springs and double coil equalizing beam springs. The height from rail to center plate is 31½ ins. loaded. The trailer trucks have a wheelbase of 7 ft., with wheels 33 ins. in diameter. The journals are 4¼ ins. x 8 ins. The working loads and heights are the same as those for the motor trucks.

THE RAIL JOINT COMPANY, of New York, furnished insulating rail joints to the New York Central & Hudson River Railroad, of a "Special" Weber type. To the New York, New Haven & Hartford Railroad, the Long Island Railroad and the Rochester Branch of the Erie Railroad, it furnished standard Weber insulating joints.

THE ELECTRIC SERVICE SUPPLIES COMPANY, of Philadelphia, secured a good share of the rail bond work on the Long Island Railroad, both for the track rail and contact rail, including the bonds for the a. c. signal system. The company's total sales of rail bonds to the Long Island exceed 150,000 bonds. The entire rail bond contract of the New York, New Haven & Hartford Railroad was secured by the Electric Service Supplies Company, including the bonds required for the signal system. The total of bonds was a little more than 40,000. The Electric Service Supplies Company secured the contract for all the rail bonds of the Rochester Branch of the Erie Railroad, through Westinghouse, Church, Kerr & Company. The company also secured the contract for the special pole brackets for the catenary construction, and much of the other details of the overhead catenary work, through Westinghouse, Church, Kerr & Company. For the West Jersey & Seashore Railroad the Electric Service Supplies Company furnished rail bonds for the a. c. signal system, through the Union Switch & Signal Company.

W. N. MATTHEWS & BRO., of St. Louis, furnished Stombaugh guy anchors in large quantities to the New York Central, Long Island Railroad and Erie Railroad for the Rochester Branch. The New York Central has used Kearney cable clamps in connection with its work. The Erie Railroad has adopted the Hold Fast lamp guard, made of No. 14 B. W. G. wire, and call it the Erie Standard. Matthews & Brother have furnished the company several thousand in the past few months.

THE STANDARD STEEL WORKS, of Philadelphia, Pa., supplied the wheels and axles for the Long Island Railroad, the West Jersey & Seashore, the New York, New Haven & Hartford, and the Erie Railroad.

THE POWER SPECIALTY COMPANY, of New York, supplied the Foster superheater, erected in connection with Babcock & Wilcox boilers, purchased by the New York, New Haven & Hartford Railroad. The superheaters supplied are of standard Foster construction, the steam being taken from each drum separately and carried down through connecting pipes made of seamless drawn-steel tubing, fitted with expanded joints. These tubes lead into transverse headers, from which the steam is distributed through a series of return elements, also made of seamless drawn tubing, covered with rings of cast iron for protection against the heat. The bent portion of the tube is protected by a cast-iron jacket, cast in halves and held firmly against the tube by heavy band rings, shrunk on. The outlet header, which is directly below the inlet header, is connected with the steam pipe by means of seamless tubing with expanded joints. The entire superheater is supported from overhead, and does not rest on the brickwork or interfere in any way with the action of the boiler. No joints or hand-hole plates are so located that they will come in contact with the very hot gases. An important feature of this construction is that each tube contains an inner tube or core centrally supported, leaving an annual space between the main tube and the core, through which the steam is forced to pass, rendering the

heating surface highly efficient. No flooding is necessary in this type of superheater. Hence, there is no danger of scale forming on the inside, or of water being delivered to the engines when the apparatus is being put into service.

THE RAILWAY SPECIALTY & SUPPLY COMPANY, of Chicago, Ill,, has a large number of its Arc-Damp lightning arresters in use by the signal department of the New Haven Road in the electric zone. With the 11,000 volts, at 25 cycles, there exists an appreciable induction in signal, telephone and telegraph wires, and the company has installed metallic circuits for its signal system and has equipped these circuits with the arc-damp arresters to take care of lightning and heavy static charges. The Arc-Damp arrester is in multiple between the line and ground, and not in series with the line. There are no fuses to blow under light charges, and there is no chance of escape of the working current to ground through the fusing of any choke coil to the ground plate, or through the lodging there of drops of water or other material.

THE NATIONAL CARBON COMPANY, of Cleveland, Ohio, supplied the New York Central Railroad with Columbia carbon brushes for its generators, and to the Long Island Railroad the National Company supplied its National No. 15, Laclede and National regular brushes; to the West Jersey & Sea Shore, Partridge brushes, and to the New York, New Haven & Hartford, Columbia and Partridge brushes.

THE COLUMBIA MACHINE WORKS & MALLEABLE IRON COMPANY, of Brooklyn, N. Y., made inclines, third-rail brackets, contact shoes, frames, overhead brackets, hook bolts and nuts, and various devices for the third-rail and overhead equipment of the New York Central & Hudson River Railroad Company, Long Island Railroad, Oneida Construction Company, New York, New Haven & Hartford Railroad Company, and the West Jersey & Seashore Railroad.

THE AMERICAN CAR & FOUNDRY COMPANY (Jackson & Sharp plant), of Wilmington, Del., built two orders of car bodies for the West Jersey & Seashore division of the Pennsylvania Railroad Company. The original order was for twenty-two cars, which were shipped in May, 1906. Another order of eleven cars has just been completed. These were similar to those supplied on the first order, differing only in minor details. Both lots of cars were 46 ft. 6 ins. over body framing in length, with steel underframe. The other dimensions were similar to those for steam car construction, with the necessary changes in the vestibules to adapt the cars for electrical service.

THE OHIO BRASS COMPANY, of Mansfield, Ohio, furnished to the New York Central Railroad all the third-rail insulator blocks. These are of semi-porcelain and similar to the blocks which were supplied to the West Shore Railroad between Utica and Syracuse, which were described in the STREET RAILWAY JOURNAL of June 8, 1907. The Ohio Brass Company also furnished a portion of the third-rail bonds used on the New York Central electrified division, which were a special form of bond very much similar to the company's Type GA—Form 2. This is a soldered terminal bond for application to the ball of the rail, and is of the ribbon type with the body bent to a "U" shape, and the terminals formed by compressing the ends of the ribbons in special dies to a solid terminal, as in the case of all of the "All Wire" bonds manufactured by this company. These bonds are of 500,000 c. m. cross-section, and two are installed at each joint. The terminals were slightly recessed on the side next to the rail, which makes a somewhat better soldered union in bonds of extra large size, such as these were. To the West Jersey & Seashore the company furnished "All Wire," Type F—Form 7, compressed terminal bonds.

THE CLIMAX STOCK GUARD COMPANY, of Chicago, Ill., equipped the Long Island Railroad and the West Jersey & Seashore Railroad with its Climax clay cattle guards, which are adaptable to third-rail construction, as they can be fitted in around the jumper plugs, located in cross-overs and turnouts without special preparation.

THE AUTOMATIC VENTILATOR COMPANY, of New York, equipped all the cars used in the electric service of the New York Central & Hudson River Railroad with the automatic ventilators. The device is applied in the clerestory of the car in the space occupied by the ordinary deck-sash, and furnishes a copious supply of fresh air, as well as removing the vitiated air, odors, and smoke from the cars. It is neat and attractive in appearance, and is capable of easy application to all conditions, as is shown by the manner of ventilating the saloons in these cars, the same being connected by metal pipes with the clerestory, through which the fresh air is driven, and the vitiated air withdrawn. A noticable feature of the device is that it secures an ample supply of fresh air to all parts of the car without draughts.

THE SHERWIN-WILLIAMS standard car body color, made by the Sherwin-Williams Company, of Cleveland, is in use on the New York, New Haven & Hartford Railroad and the Erie Railroad. On the New York Central and Erie, practically all the locomotive and car equipment is finished with various products of the Sherwin-Williams Company.

THE LOCKE INSULATOR MANUFACTURING COMPANY, of Victor, N. Y., furnished its No. 600 porcelain strain insulators for 11,000 volts to the New York Central Railroad. To the New York, New Haven & Hartford Railroad, the company furnished the large 14-in. bridge insulators, and to the Erie Railroad it furnished its No. 601 strain insulator for use on the Rochester Branch. The Locke Company also has the contract for the complete equipment of high voltage insulators and the metal pins for the West Jersey & Seashore Railroad, furnishing its No. 312 insulators to the extent of about 21,000. After more than a year of service the operating department of the West Jersey Company reports that not a single insulator has failed.

THE GREENBRIER POLE COMPANY, of Charleston, Kanawha, W. Va., supplied the Long Island Railroad Company nearly all of the poles used in its overhead work.

THE HAYES TRACK APPLIANCE COMPANY, of Geneva, N. Y., reports that its derailing devices are in extensive use on the New York Central, Long Island Railroad, West Jersey & Seashore, New York, New Haven & Hartford, and the Rochester Branch of the Erie Railroad. This company understands that its derails have been used exclusively, wherever derails are required, in the territory electrified on the New York Central, Long Island Railroad, and Rochester Branch of the Erie Railroad.

THE FELT & TARRANT MANUFACTURING COMPANY, of Chicago, has its Comptometer adding and calculating machine in use in large numbers by the New York Central Railroad Company, the Long Island Railroad, and the New York, New Haven & Hartford.

DOSSERT & COMPANY, of New York, report that the New York Central & Hudson River Railroad Company has made extensive and varied use of the Dossert solderless connector in the electric zone. Up to date the company has used more than 1000 straight two-way connectors of all sizes up to 1,000,000 c. m., and of cable taps the company has used an even larger number, the sizes being from 350,000 c. m. up to 1,350,000 c. m. These cable taps were used principally in tapping off from the third-rail, in series of three, to connect by way of the structure to the overhead cables. Dossert & Company have also made for the New York Central Company an emergency jumper clamp connector, which in case of a break in the third-rail current is attached to the third-rail on either side of the break, thus preventing a tie-up of the service until the regular flow of current is re-established.

THE WILDER SNOW-PLOW & MANUFACTURING COMPANY, of Worcester, Mass., designed a special radial plow to meet conditions on the electrified zone of the New York Central Railroad. C. E. Lindsay, engineer maintenance of way of the railroad, informed the Wilder Company that their company's regular snow plow equipment could not be used here owing to the third rail, expressing his belief that the radial plow could only be used. Mr. Lindsay was especially anxious to have the wings done away with, and the sides of the plow built out to cover the third-rail. With the exception of changes noted, the plow is the same as the Wilder Company's standard Style A, size 2. The plow is further designed to take the railroad company's regular motor car wheels, axles, boxes, motors, etc. On the sharpest curves, 300 ft. radius, the deviation of the extreme point is less than 1½ ins. from the normal line on tangent, so that it may practically be disregarded.

THE W. T. VAN DORN COMPANY, of Chicago, installed on the Long Island Railroad electrical equipment, the "Van Dorn" drawbars as used in the New York Subway. The company also installed on the branch lines of the New York, New Haven & Hartford different styles of its couplings for electric service. Van Dorn couplers are also in use on the New York Central and on the Rochester Branch of the Erie Railroad.

THE CONSOLIDATED CAR HEATING COMPANY, of New York, reports that the New York Central steel cars are all equipped with the company's No. 217L type of cross-seat heater. Thirty of these heaters are used per car under cross-seats and six of the No. 203S truss plank heaters. Two of the truss plank heaters are placed in each cab, and one in each saloon. The heating equipments are arranged for four degrees of heat. All the steel cars for the Long Island Railroad are equipped with the company's panel heaters No. 205, which is attached to perforated steel riser. There are also two motormen's cab heaters, No. 192MS, one used in each cab. The heating equipments are arranged for three degrees of heat. The motormen's cabs of the new cars for the West Jersey & Seashore Railroad are equipped with the company's electric heaters, No. 192MS, two of these heaters being used on each platform. Seven of the New York, New Haven & Hartford Railroad coaches are equipped with Consolidated heaters. The New Haven Company has equipped very few cars, and these heaters are for trial. The company equipped five cars with Consolidated No. 217L type of heater, same as used in the New York Central, but use thirty-four heaters per car of this type and two No. 192W heaters fitted with wall hangers, one for each saloon; and two cars with their No. 192H type of heater, with two No. 192W heaters for saloons. The heating equipments arranged for four degrees of heat. All the cars of the Rochester Branch of the Erie Railroad are equipped with the company's truss plank heaters, No. 203S.

THE SAMSON CORDAGE WORKS, of Boston, Mass., has its Samson spot waterproofed trolley cord and Samson drab and mahogany signal cord in use on the New York Central & Hudson River Railroad, the Long Island Railroad, the West Jersey & Seashore Railroad and the Erie Railroad.

AMERICAN BRAKE SHOE & FOUNDRY COMPANY, of Mahwah, N. J., furnished to the New York Central electric lines steel-back crucible insert type shoes for the electric locomotives, and for motor and trailer brake shoes a flanged steel-back Christie type brake shoe, with expanded metal and hard inserts, and to the Long Island Railroad the company furnish Christie type steel-back flanged brake shoes, with expanded metal and hard iron inserts. To the West Jersey & Seashore Railroad the company is supplying a flanged steel-back Christie type brake shoe, "U" type, with extra face chill. This is a shoe similar to that used on the Interborough subway and elevated lines of New York City. To the New York, New Haven & Hartford Railroad the company furnished a flanged steel-back Diamond "S" shoe (expanded metal insert). For the Erie Railroad the company furnished a flanged steel-back Christie type shoe with expanded metal insert. It will be noted that all these roads use a flanged steel-back wrought lug brake shoe, and in all cases the body metal is of hard iron, which forms, in connection with inserts, a very durable and effective shoe. The steel-back flanged shoes of the M. C. B. Christie type noted herein are similar in pattern to shoes advocated for general use on electric railway equipment for 3-in. treads and over, all taking the M. C. B. Christie brake head. The flanged steel-back Christie type brake shoe is in universal use on heavy interurban equipment using the width of wheel treads of steam railroad practice, and is giving great satisfaction.

THE HARRISON SAFETY BOILER WORKS, of Philadelphia, is well represented in the different power stations through its Cochrane feed-water heater and purifier which is used in the Long Island City power station and also in that of the West Jersey & Seashore Railroad.

THE BABCOCK & WILCOX COMPANY, of New York, furnished boilers of the Babcock & Wilcox type for the Long Island City power station, and also for the two power stations of the New York Central & Hudson River Railroad Company. The Stirling department of the Babcock & Wilcox Company was the contractor for the boilers and boiler settings for the Westville power station of the West Jersey & Seashore Railroad.

THE ALBERGER CONDENSER COMPANY, of New York, supplied the condensers and the vacuum and hot well pumps for the Long Island City power station; the feed-water heaters for the power stations of the New York Central & Hudson River Railroad Company, and the condensers and pumps for the Cos Cob station of the New York, New Haven & Hartford Railroad.

THE UNITED INDURATED FIBER COMPANY, of Lockport, N. Y., supplied the indurated fiber protection for covering a large part of the third-rail construction of the West Shore Railroad and of the New York Central Railroad.

JOHN A. ROEBLING'S SONS & COMPANY, of New York, supplied a large part of the third-rail bonds for the West Shore Railroad.

THE UNION SWITCH & SIGNAL COMPANY supplied the block signal system of the West Jersey & Seashore Railroad and of the Long Island Railroad.

HENRY R. WORTHINGTON., INC., of New York, supplied the boiler-feed pumps, make-up pumps, step-bearing pumps and step-bearing water-return pumps used in the power station of the West Jersey & Seashore Railroad. The same company also supplied the condensers for the New York Central power stations.

HALE & KILBURN MANUFACTURING COMPANY, of Philadelphia, furnished the seats for the cars of the West Jersey & Seashore Railroad.

THE GENERAL RAILWAY SIGNAL COMPANY, of Buffalo, N. Y., furnished the block and interlocking systems used in the New York Central electric zone. This installation is unique in being the first which is supplied with power from a single source, as all of the track circuits, signal mechanism, line relays, signal lights, interlocking battery, charging motor-generator sets, etc., are supplied with alternating current from one transmission line.

THE ADAMS & WESTLAKE COMPANY, of Chicago, supplied the hardware for the New York Central & Hudson River and West Jersey & Seashore cars.

THE AMERICAN STEEL & WIRE COMPANY supplied the New York Central Railroad with by far the larger part of the bonds used on its third rail and running rail. It also furnished the company a large amount of 7-strand bare copper wire for 11,000 volts, paper insulated cables, accessories, telephone wire, etc. In the Long Island Railroad installation a number of Crown bonds are used on both running and third rails. The West Shore Railroad employs a great many twin terminal bonds of the company's make for both the running rail and third rail. The company also supplied for this installation bare stranded copper cable. In the New Haven equipment the company supplied some concealed bonds for the running rails and a large amount of bare and insulated cable. The American Steel & Wire Company supplied the messenger wire in the Erie installation.

THE CURTAIN SUPPLY COMPANY, of Chicago, states that its Forsyth fixture No. 86 is in service in cars on the Rochester Branch of the Erie Railroad and the West Jersey & Seashore. This is its standard Forsyth fixture which has been in service a number of years, having the adjustable and self-righting features. Upon the New York Central and New York, New Haven & Hartford cars a later type fixture is being used, namely, the Ring, No. 88.

THE J. G. BRILL COMPANY, of Philadelphia, has furnished cars for both the West Jersey & Seashore Railway and the New York, New Haven & Hartford Railway, as follows: West Jersey & Seashore, sixteen regular passenger coaches, built by the J. G. Brill Company, and twenty-two of the same type by the Wason Manufacturing Company. A more recent shipment from the Wason Manufacturing Company consisted of seven passenger cars, two combination passenger and baggage and two baggage and mail cars. New York, New Haven & Hartford, five motor combination passenger and baggage cars and twelve trailer cars for passengers only. These cars measure 31 ft. 6¼ in. over the bodies; 40 ft. over the end panels. The company also supplied the rolling stock for the electrified division of the West Shore Railroad.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, Pa., furnished elaborate storage battery systems for the Long Island Railroad and the New York Central & Hudson River Railroad.

THE STANDARD UNDERGROUND CABLE COMPANY, of Pittsburg, Pa., supplied the Long Island Railroad with varnished cloth, lead-covered cable which, with special end-bells or terminals, have been installed for an operating pressure of 11,000 volts. The New York, New Haven & Hartford Railroad Company was furnished with rubber-insulated and weather-proof braided cable for 11,000 volts operating service.

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Of this issue of the Street Railway Journal 10,000 *copies are printed. Total circulation for* 1907 *to date,* 338,050 *copies, an average of* 8245 *copies per week.*

Our Convention Issue

The STREET RAILWAY JOURNAL this week issues its annual convention number. The practice of publishing a special number just before the fall meeting of the American Street Railway Association, now the Interurban Railway Association as well, has been followed practically since this paper was established, and amounts to the presentation each year to each subscriber of a treatise on some distinctive branch of electric railway engineering. These convention issues are as voluminous as many books on electric railway subjects, but they differ in subject matter from the average engineering text-book, because they are part of a periodical; hence they are compiled from a journalistic standpoint, the basis for which is "news." For this reason each of our convention issues represents matter compiled during the previous few months, and the articles printed discuss current practice. In many respects this makes them more valuable for the active railroad operator or engineer than if the subjects were treated from the standpoint of a text-book and each subject was considered *ab initio*.

Each year the convention number of the STREET RAILWAY JOURNAL is planned along some central idea and it has been the purpose of the editors to select a topic for discussion which is particularly prominent at the time in the electric railway engineering field. Last year, as the convention was held in Columbus, great interest was felt in the development of the interurban railways in that portion of the country; hence the convention number of 1906 was devoted to a review of interurban electric railway practice in Ohio and Indiana. This year the attention of electrical engineers and railroad operators has been attracted in a marked degree to the equipment with electricity of the steam railroads of the country. No other topic has drawn such large audiences to meetings of the American Institute of Electrical Engineers, the Western Society of Engineers, the New York Railroad Club and other technical bodies where papers on this subject have been presented. Discussions on the relative merits of steam and electric power for trunk line service, of direct current and alternating current for electric railway properties, of 600 volts and 1200 volts in direct current working and of 25 cycles and 15 cycles for single-phase roads, have occupied the columns of the technical papers and the attention of scientific and engineering societies. During the past year, also, practically all of the more important installations of this kind, with the exception of the Long Island Railroad, have been put in operation. The New York Central equipment commenced a partial service Nov. 11, 1906, but steam was not entirely abandoned until July 1 last. The West Shore Railroad was officially opened June 15, and the electrified section of the Erie Railroad June 18. The New Haven service commenced July 24. The West Jersey & Seashore was officially opened Sept. 18, 1906, but as the Atlantic City season was practically over by that time the real test came during the summer which has just passed.

It has been thought from these facts that an analysis of the electric railway practice of these different companies would be particularly appropriate at this time, especially as practically nothing has yet been published on the subject.

Articles on the construction of these lines have appeared in this paper, as well as elsewhere, so that engineers are well acquainted with the engineering features of the installations as they were originally. Some changes have been made, however, since the lines were placed in operation, and these, with the method of handling the apparatus by the officials in charge, it is the purpose of this number to describe.

In most cases the electrical equipment of the lines under discussion has been carried out by engineers who received their training in the street railway field, so that the methods followed have differed little, except in degree, from those employed in the lighter railway installations with which our readers are familiar. The operation of the lines, however, has in most cases been in the hands of men trained along steam railroad lines, and they have naturally introduced methods which differ somewhat from those followed on the larger interurban railway properties. The conditions under which the service is conducted also vary from those of interurban electric railway practice, so that the exposition published elsewhere of the details followed by the different roads should prove of value to both steam and electric railway managers.

In our treatment of the subject it has been impossible to cover all branches of the work, or to describe all of the methods employed even in those branches selected for discussion, or to reproduce all of the blanks used even in these branches. Owing, also, to the comparatively recent date at which most of the installations have been put in service, reliable figures on the cost of operation could not be obtained and the managements of the different systems have naturally been unwilling to present figures which, while correct for the period during which the lines have been in service, might give a wrong impression as to future economies. Nevertheless, the articles indicate that the electric system is considered satisfactory by those roads which have adopted it and that the sections put in operation are looked upon by the different managements as precursors only to the wider application of electric power on their systems.

In conclusion an extended article by Philip Dawson describes some of the recent work in Europe and calls attention to the attitude which the railroad authorities in the different countries are now taking toward the introduction of electric power on their steam railroad systems. Outside of Great Britain, the railroads, in the countries considered, are in the hands of the Government, whereby a uniform treatment of the subject is assured. Mr. Dawson is an advocate of the single-phase system for trunk line conditions and his citations of the favor with which this system is regarded by the government authorities in Sweden, Germany, Switzerland and Italy, and his remarks about its adoption by several of the large railroad companies in England, should prove of particular interest.

With our Convention Section, we also issue a Second Section, similar in typographical appearance to our standard issues. This number will also be found replete with interest. The electrical equipment of the Rochester-Mt. Morris branch of the Erie Railroad has not been described in any of the technical papers, so that while a chapter on the subject of its operation is published in our convention section this week, another and much longer article on the constructional features of the line appears as the leading feature of this issue, and comments upon this line appear in the following editorial. In this section, also, Mr. French, engineer of maintenance of way, of the Utica & Mohawk Valley Railway, presents an instructive discussion of steel tie and concrete construction. The practice of the Indianapolis & Cincinnati Traction Company, the pioneer user on a large scale of single-phase motors, has been brought up to date. An account is given of a test of a 7500-kw turbine in New York, and other articles of interest will also be found within the covers of this section.

Single-Phase Traction on the Erie

The "electrification" of the Rochester Division of the Erie Railroad, described elsewhere in our columns by W. N. Smith, has a double interest in that the line in question is not only the first to use single-phase motors in regular railway traffic, but also utilizes for this work power transmitted at 60,000 volts from Niagara. It is the first fruit of the great cataract in the larger work of transportation. By a combination of energy and good fortune, too, the road went into operation some months ahead of the electric system of the N. Y., N. H. & H. R. R., on which work had been long in progress. It is a capital example of the easy applicability of single-phase high voltage traction to existing steam roads, leaving the freight service undisturbed, to be taken up later if desirable. The system involves many novelties and many very ingenious features of construction. To begin with the high-tension transmission line, one finds here an unusual type of construction, forming an ingenious compromise between the ordinary pole line and the tower system which has of late come into extensive use. It employs an A frame for the support of the wires, composed of two heavy cypress poles united at the top. In virtue of the extra support thus given the normal span is lengthened to 220 ft., thus greatly decreasing the number of insulators.

The lightning protection is also out of the ordinary, horn arresters being installed at every fifth pole. It is of course early to speak of the efficiency of this particular feature, but the horn arrester, although somewhat insensitive, has given a good account of itself on some of the important lines on the Pacific Coast and requires little attention, a great virtue in case of its use on pole lines. At the sub-station the lightning protection is more elaborate, consisting of three horn arresters in series, grounded respectively through a concrete column, an electrolytic arrester and a copper fuse wire. The special feature of the sub-station arrangements is the ingenious utilization of the three-phase-two-phase transformation, the two resultant single-phase currents being transmitted over the two nearly equal sections of the road to the north and south of the sub-station respectively. The actual working conductors thus fed are of No. 000 ground copper, carried by a catenary bracket construction. An interesting feature of this is that each steel bracket is permanently grounded to the rails, so that the failure of an insulator means a dead short circuit, the intention being to avoid any danger of poles burning off and obstructing traffic in case of a partial ground. Another safety precaution adopted is the abolition of practically all telegraph and telephone wire overhead crossings, such wires being taken under the track by cables. In a few cases, to which cables could not be conveniently applied, a basket

construction of guard wires has been used to obviate any chance of crosses with the high-tension trolley wire.

On the motor car the equipment consists of four 100-hp motors with Westinghouse electro-pneumatic control. Many ingenious details have been here introduced to provide for safe and certain operation. The service undertaken over the 34-mile line is based on the use of motor cars capable of handling a single trailer when desirable, at an average schedule speed of 24 miles per hour. There are 6 regular stations on the line and 22 flag stations, at some or all of which stops are to be made, so that to maintain schedule a flexible speed control such as this system furnishes is highly important. Experience has already shown that the electric trains can be made to hold the schedule rather better than the steam trains which they have supplanted. The operation of the four classes of trains employed, viz., electric, steam passenger, through freight and local freight, over a single-track road such as the Rochester branch is, involved some complications, but these have been successfully overcome.

Of the technical problems arising for solution in this plant one of the most serious was the interference produced by the current upon telegraph and telephone lines in the vicinity. On an ordinary transmission line such trouble is not formidable, for by proper transposition the inductive effects can be reduced to comparative insignificance. On this single-phase system with track return, kept in electrical instability by the shifting of the load both the electro-dynamic and electro-static effects were very noticeable, especially the latter. No suitable means of eliminating the trouble by working upon the line itself was found, but it did prove practicable to remove the baleful influence by providing the telegraph relays with fairly high resistance discharging shunts. This obviated the necessity of complete metallic circuits for the telegraph service. Such circuits are now in general use for telephone work, and if properly installed give good service, even in proximity to a single-phase line. This result is very satisfactory, since the question of interference from such systems has been a matter of no small concern. Altogether the engineering work on this Rochester division of the Erie seems to have given suitable solutions for a good many of the practical problems of single-phase teaching, and will probably lead to a freer use of the system than has heretofore been judged discreet.

Even Shifts in Power Plants

One of the first questions to be settled when a new power plant approaches completion is whether the operating shifts shall overlap or be evenly divided in respect to the assignment of working hours among employees. In some plants there is a complete change of men at the conclusion of every trick; in others part of the men leave at one time and the rest are retained until the newcomers have been at work for a longer or shorter period. There is certainly something to be said in behalf of each policy.

The plant with the complete or even shift, say of eight hours' watch, has the advantage of a certain solidarity in each of the three tricks which make up the day's run. The men on each trick grow to learn each other's ways, and if good team work is ever possible in a power plant, it ought to result from the even shift. If any of the watches are longer than eight hours in duration some of the others must be shorter, except in the case of two twelve-hour shifts per day. Overlapping tends to do away with rivalry as to records of fuel consumption. With uneven shifts, a man will each day be responsible to two different boiler or engine room foremen, which is in some cases a disadvantage on the purely personal side. It may seem ludicrous to some managers to think of consulting the personal whims of subordinate power-house employees in arranging shifts, but the fact remains that some men in a plant may get along finely with one chief on the watch, and from one cause or another fail utterly to satisfy a second superior, perhaps through temperamental differences. Theoretically all men in the employ of a just and liberal company ought to work together in harmony; practically there are great differences in the esprit-de-corps under different executives, and the even shift plan favors the coalescing of congenial elements into each watch, either through original appointment or transfer.

A clean sweep of employees as a shift changes cannot of course be made with respect to the men whose duties are not duplicated. The chief engineer of a plant is responsible for the station as a whole, in most cases throughout the twenty-four hours, so far as any foreseen routine or emergency work goes. Certain other men, like battery attendants, clerks, and repair men in the larger stations may be on duty during the day only, and these may overlap more or less without trouble. But employees like watch engineers, oilers, pump men, water tenders, firemen, coal passers, and helpers can, as a rule, be shifted together if the station routine is properly planned, with the advantage of concentrated authority and team work, and, in some cases, friendly rivalry to produce good records.

Advocates of the overlapping shift urge that if the entire boiler, engine and pump room force changes as one man, the station is liable to lose its best grip upon the load conditions obtaining at the time of transfer. They also claim that the variation of the load at different times of the day and the responsibility attending the occurrence of the morning and evening peaks demand the retention of the best men in rush hour periods. They emphasize the economy of the overlap contrasted with the employment of uniform shifts containing possibly more men in toto than would be needed if the shifts were not co-terminous.

Each plant must be considered by itself in the face of these points, and before any general decision can be reached for varied cases, we must have a more definite knowledge of the exact number of men required in relation to the number of machines in service and the load variations. Where exacting twenty-four-hour service is required, the even shift is likely to prove attractive, as in the case of an electrified steam railroad which handles a very large distributed traffic. If the morning and evening peaks are excessive, requiring many more men in the boiler and engine rooms, the overlap may pay better. Usually, then, it is a question of local conditions as to which plan should be adopted. The main point is to insure that the existing operating conditions are made clear to all successors of retiring employees, and to harmonize the work as much as possible. The matter is well worth considering in relation to the personal equation.

SINGLE-PHASE ELECTRIC MOTIVE POWER ON THE ROCHESTER DIVISION OF THE ERIE RAILROAD

By W. N. Smith.

One of the most important electric railway developments of the present year is the change from steam to electric motive power on a portion of the Rochester Division of the Erie Railroad, which took place on June 18, 1907. This is the first installation of a single-phase alternating system of electrical motive power upon a steam railroad, to go into commercial operation.

The Erie electrification can justly claim the priority of application of several important features which are of interest in connection with the discussion now prevailing upon systems best suited for steam railroad electrification. This line was the first in this country to operate electric cars on the single-phase system over the tracks of an operating steam railroad; the first in this country to use 11,000 volts working pressure commercially on a trolley, and the first instance of a single-phase traction system receiving power from a 60,000-volt transmission line.



FOUR-CAR ELECTRIC TRAIN ON ERIE SINGLE-PHASE RAILWAY

All of the construction described below, except that of the 60,000-volt power transmission line and the car bodies and trucks, was designed, executed and placed in operative condition by Westinghouse, Church, Kerr & Company, engineers, through whose courtesy the drawings and photographs were furnished which illustrate this article.

The section of track equipped is 34 miles long, extending from Rochester, over the main line of the Rochester Division, to Avon, a distance of about 19 miles, thence 15 miles over the Mt. Morris Branch. The railroad is entirely single-track, with sidings at way stations, averaging 3 to 4 miles apart. The grades are light, and the curvature for the most part quite easy, the line being relatively quite straight.

The track was originally laid with 68-lb. rails, but was relaid with 80-lb. rail, taken from another division just prior to the electrification. The road-bed is ballasted with gravel, and the joints are of the Weber type. A single No. 00 protected rail bond is applied to each rail joint under the plate, one of the advantages of the high-tension single-phase system being that the relatively small current combined with the high impedance of the main circuit renders it unnecessary to resort to heavy bonding.

The line crosses a number of bridges, the longest one, that over the Genesee River, about 1½ miles south of Rochester, being 780 ft. long and comprising seven spans. There are also through truss bridges at Rush, and at Caneserauga Creek, near Mt. Morris, and a stone arch bridge over Conesus Creek, a short distance south of Avon.

The electric service is devoted solely to passenger traffic, which is of the local interurban type. The freight service is handled exclusively by steam as heretofore, as are also the through trains operating between Rochester and Corning over the main line of the Rochester Division, a distance of about 94 miles. The steam service between Rochester and Mt. Morris originally comprised three round trips daily. The principal villages served are Avon, Geneseo and Mt. Morris, the other regular way stations being little else than cross-road stops. The population is entirely agricultural, and the Genesee Valley traversed by this line is probably one of the most beautiful and prosperous farming regions of New York State. Instead of three round trips per day, the electric service has introduced six complete round trips between Rochester and Mt. Morris, and three more between Avon and Mt. Morris.

POWER SUPPLY.

The power is generated at Niagara Falls, in the plant of the Ontario Power Company, and is transmitted at 60,000 volts, three-phase, over the lines of the Niagara, Lockport & Ontario Power Company, whose system has been fully described in former technical papers. The Iroquois Construction Company built a branch line from Mortimer, a little over 4 miles south of Rochester, to Avon, locating it

upon the Erie Railroad right of way for nearly the whole distance. The pole construction used upon this branch transmission line is of the A-frame type, using two 40-ft. cypress poles, set abreast of each other, and inclined so that their tops are framed together, the butts being joined by horizontal plank braces underground. The cross-arms consist of two 3½-in. x 6-in. timbers, 8 ft. long. The insulator pins are of cast steel, one being placed at the apex of the A-frame, and the other two bolted near the extremities of the cross-arms, so that there is an equilateral spacing of 7 ft. between each of the three wires. The insulator pins are grounded by copper wire. The neutral of the transmission system is grounded at the power station through a resistance. Lightning protection of the horn arrester type has been installed at every fifth pole. The conductors are of No. 4, hard-drawn, stranded copper cable. The standard length of span between poles is 220 ft., which is shortened at curves where necessary. When crossing over the tracks of the Erie, or other railroads, recourse is had to a special construction of No. 0 copper cables carried on steel towers, so reinforced by guys that it is impossible for a failure of the line to result in dropping the conductors across railroad tracks.



PASSENGER TRAIN SHED, ROCHESTER TERMINAL, SHOWING OVERHEAD CONSTRUCTION

SUB-STATION BUILDING.

The sub-station building is located in the Y formed by the railroad tracks at Avon, and together with the car shed, is adjacent to the roundhouse and division repair shop. The walls of the building are of brick, resting upon solid concrete foundations, the roof and floors being of reinforced concrete. The floors are supported upon steel beams, but the roof beams are of reinforced concrete, like the slabs which they support.

The building is absolutely fireproof, the doors and windows being of kalomein construction, and fitted with wire glass. The building is 39 ft. 8 ins. x 44 ft. on the outside and 29 ft. 10 ins. high from the top of the foundation to the top of the parapet. The door sills and lintels are of concrete blocks, and for architectural effect a belt of concrete blocks runs around the building, at the level of the window sills. The parapet is also topped off with a coping of concrete blocks.

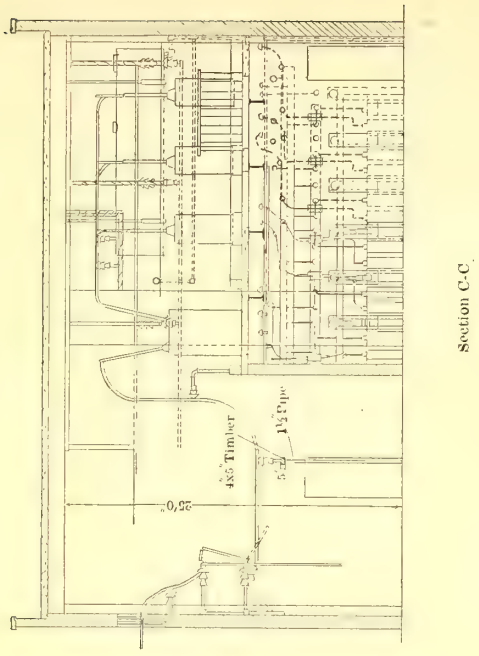
In the basement of the building are located one of the transformer oil tanks and the oil pump. The main floor is divided into three rooms, the main transformer room being 43 ft. x 17 ft., and extending the full height of the structure to allow room for the high-tension bus-bars, which are carried over the transformers. The remaining space on the main floor is divided into a high-tension room (through which the 60,000-volt wires enter, and which is the location of the high-tension circuit breakers, 16 ft. 8 ins. x 19 ft. 8 ins.) and the operating room, which is 19 ft. 8 ins. x 24 ft., where all the 11,000-volt switching apparatus and the measuring instruments are located. Directly over the operating room is a mezzanine floor, reached by an iron staircase, in which are located the 11,000-volt lightning arresters, the 60,000-volt choke coils and the 60,000-volt series coils. The high-tension connections enter through the high-tension room, which runs from floor to roof and pass through the choke coils and series coil, on the mezzanine floor, and then turn through a wide opening in the wall to the 60,000-volt bus-bars, which are located in the upper portion of the transformer room.

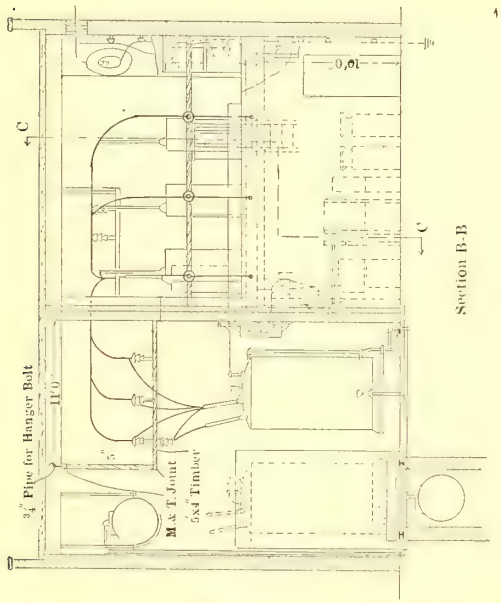
There is space in the transformer room for another transformer of the same size and there is also space in the high-tension room for an oil-insulated circuit breaker should it ever be decided necessary. The interior is painted with cold-water paint of the same light green shade that is commonly used by the Erie Railroad for interior finish.

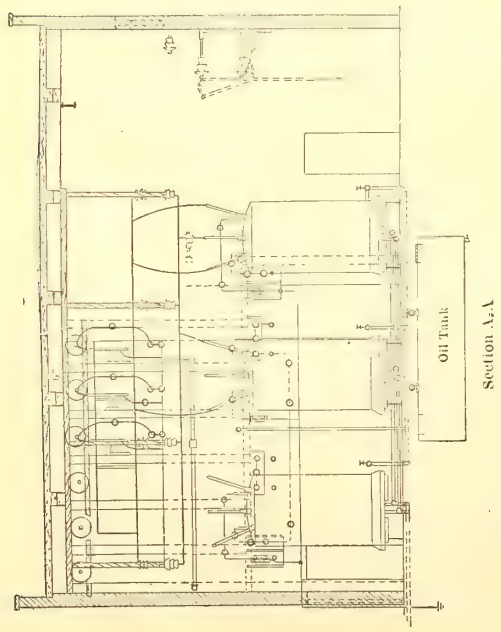
The interior lighting equipment consists of forty-seven 16-cp incandescent lamps. Heat is supplied by a simple system of Colonial wall-type steam radiators, supplied by steam from the locomotive roundhouse.

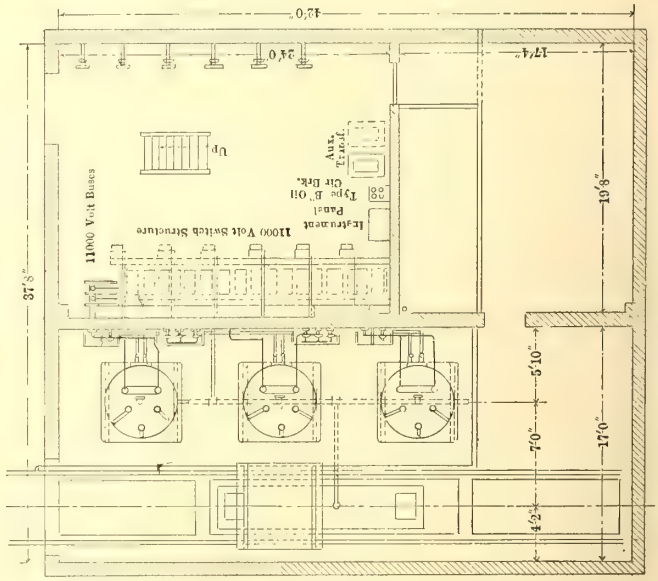
SUB-STATION EQUIPMENT.

The transmission line terminates at the lightning arrester yard in the rear of the sub-station. The arrangement of the 60,000-volt lightning arresters consists of three horn gaps, arranged one behind the other, on each of the three conductors, the first gap being 4¾-ins. across, the second 5, and the third 6 ins. A concrete column is in series with the first gap, an electrolytic arrester in series with the second and a 5-ft. fuse of No. 18 copper wire in series with the third; that is to say, between one horn and the ground. Both horns of each gap are of ½-in. round iron. Between the line and the first arrester there is a hook-type knife switch, and between the last arrester and the lead into the sub-station, there is a No. 18 copper wire fuse, in each conductor, placed horizontally upon the structure especially devised for it on top of a pole. These fuses are enclosed in wooden tubes about 5 ft. long, wrapped with torpedo twine. The entire arrangement of lightning arrester gaps, fuses

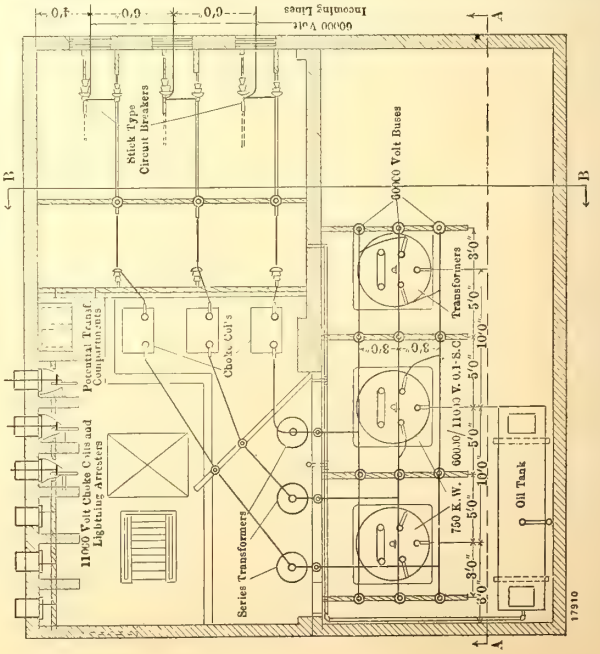








Plan Above Ground Floor



Plan Above Gallery

PLANS AND SECTIONS OF THE AVON SUB-STATION

and switches is mounted upon eighteen chestnut poles; and a suitable elevated platform, railed off and fitted with a gate to keep out trespassers, affords means of access to the apparatus when attention is required.

The three high-tension conductors enter the sub-station through glass discs held in 36-in. tile, set in the upper portion of the rear wall of the sub-station.

Within the sub-station, the wires first pass through three 60,000-volt stick-type circuit breakers, mounted directly inside of the rear wall. Thence, over bare copper conductors to the three oil-insulated choke coils, situated on the mezzanine floor, thence to three oil-insulated series transformers, also on the mezzanine floor, from which connections are taken to the power measuring instruments in the operating room. The main connections finally terminate upon a set of copper bus-bars in the transformer room, which are run upon porcelain insulators mounted on wooden cross-arms and placed at a convenient height directly over the line of transformers.

The 60,000-volt three-phase current is rendered available for single-phase distribution by means of three transformers of the Westinghouse oil-insulated water-cooled type, each of 750 kilowatts capacity. For the present installation, two transformers only are used at one time, the third being a spare. The high-tension connections are such that in case of one transformer failing while in service, its connections can quickly be taken off the bus-bars, and put on the spare transformers. The transformer windings are fitted with taps enabling the three-phase to two-phase "Scott connection" to be used. The low-tension windings can be

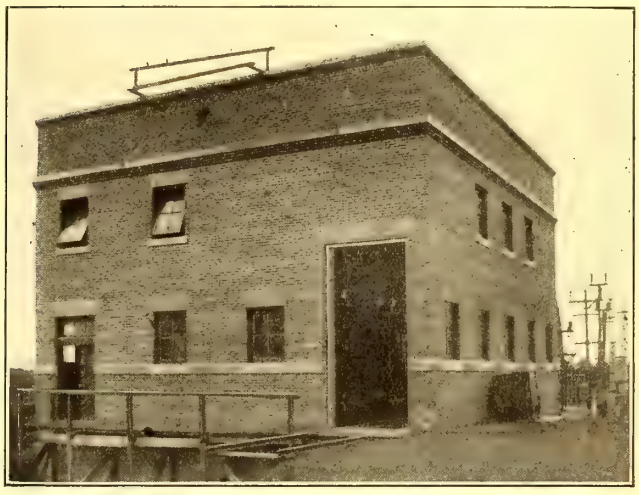


MAIN TRANSFORMER ROOM IN AVON SUB-STATION

so connected that either 11,000 volts or 22,000 volts can be obtained, so that in case it should ever be desired to transmit railway current for an extension of 40 or 50 miles, to another sub-station it could readily be done without adding transformers to this equipment. The low-tension windings also have six taps, enabling relatively small variations in the secondary voltage, if the same should be necessary to suit operating conditions in the trolley line.

One end of each low-tension winding is directly grounded to the boiler iron case, which in turn is, by means of a No. 0000 stranded copper cable, directly connected to the track return circuit.

The transformer cases are made of boiler iron, and set on



AVON SUB-STATION

a square cast iron base, which is in turn mounted on three pairs of wheels running upon an iron sub-base set in the concrete floor of the room. A track runs lengthwise of the room directly in front of the transformers, a transfer truck running upon it, upon the top of which there is another set of little wheels or rollers, which line up with those upon which the transformer cases are set. When it is desired to remove the windings from the transformer case, it is only necessary to disconnect the electrical, water and oil connections, roll the transformer off its sub-base, and onto the truck, which is then pushed to the rear end of the transformer room where it comes directly under a 10-ton hand hoist, which is able to lift any part of the transformer that repairs may make it necessary to handle.

Two cylindrical boiler-iron oil tanks are provided, each of slightly greater capacity than a single transformer. One is located in the basement directly under the transformer room, so that the oil from the transformer can readily be drained into it. The other is suspended from the concrete roof beams at the top of the transformer room, close to the side wall of the building, this being intended to act as a reservoir for distributing oil back into the transformer. The oil is pumped from the lower to the upper tank by means of a steam pump supplied from the boiler room in the adjacent division roundhouse, where steam is always available. From the upper tank oil is fed by gravity into either transformer. It is thus a simple matter to draw the oil off from any transformer if its insulating qualities are found to have depreciated, and the dehydrating, filtering or purifying apparatus can readily be employed with the aid of the pump, and the supply returned again to storage. The oil piping is of iron throughout.

The water circulation is by gravity, the supply coming from the railroad company's water tank system, at the adjacent round house, being pumped originally from the Genesee River about a mile distant. An artesian well had been opened up on the premises, but the water was so strongly impregnated with sulphur and other impurities that it was thought best not to introduce it into the copper

piping in the transformers, although the cost of such a supply would have been practically nothing.

There are three separate water-cooled coils in each transformer case, each one controlled by its own valve, so that the amount of water may be controlled as found necessary under various conditions of load.

The necessary tranformation from three-phase to two-phase, fits in very well with the natural subdivision of the electrified line into two sections, one of which is about nineteen miles in length, north of Avon, the other about fifteen miles in length, being to the south of Avon. The connections were therefore laid out to operate the sections upon separate phases of the two-phase secondary system. Either the T or V connection can be used, the latter method being employed at present. Each one of the active transformers therefore feeds a separate section.

As mentioned above, one terminal of each single-phase, 11,000-volt transformer is grounded. The middle transformer of the three is ordinarily used as a spare, and the other low-tension lead from this transformer runs to the center of a double-throw switch, whose outside poles connect separately to two low-tension bus-bars. The ungrounded low-tension terminals of the other two transformers connect through single-pole switches, one to each of these bus-bars.

The low-tension bus-bars run along the wall of the operating room, and directly beneath them are three type-E Westinghouse automatic oil circuit breakers, one on each of the two trolley feeders, the third breaker which is situated between the other two, being a spare. One pole of each of the three oil breakers is connected to the center pole of a double-throw hook type switch, by means of which it is thrown upon either bus-bar. The other pole of the oil breaker runs directly to the feeder. The outgoing lead from the middle or spare circuit breaker can instantly be thrown upon either one of the feeders, should the breaker usually controlling that feeder be temporarily disabled. This system of connections is simple, compact and flexible, and has admirably fulfilled the conditions for which it is intended.

The outgoing 11,000-volt feeders run up to the mezzanine floor directly over the operating room, where they emerge from the building through perforated glass discs, set in 18-inch round tiles. Before emerging there are tapped to them two Westinghouse low-equivalent lightning arresters, set in brick compartments, and reinforced by two electrolytic lightning arresters of the 11,000-volt type. A set of call bells is provided so that when the automatic breakers open a bell is rung in the car-inspection shed, adjoining. Also, if the temperature of any transformer runs above normal, a bell circuit connected to a thermometer in the top of the trasformer tank is similarly made to operate. The station itself does not require the continuous presence of an attendant, which is needed in the case of a rotary converter sub-station. The working force is so organized that the car-repair men are always available for manipulating the sub-station circuit breakers, and the cost of attendance is thereby reduced to a minimum.

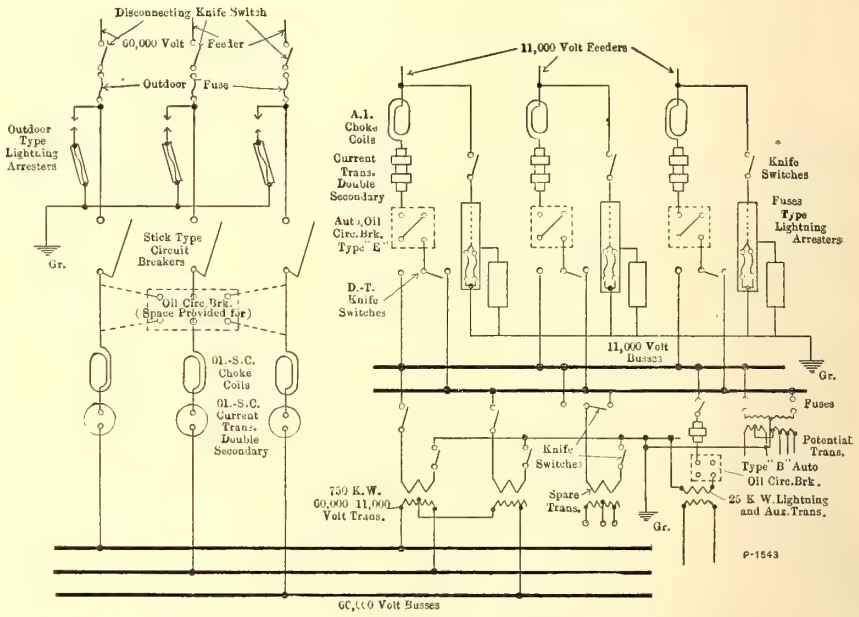


DIAGRAM OF CONNECTIONS, AVON SUB-STATION

CATENARY TROLLEY CONSTRUCTION.

The overhead trolley construction is in many respects unique. It was the first of all catenary installations to operate regularly at 11,000 volts. There were very few precedents to follow; many of the details of the overhead work are entirely original, and nearly all of them were especially designed for this installation by the engineers who executed the work.

The poles are of chestnut, averaging 25 ins. in circumference at the top, and about 42 ins. at the butt. Most of them are about 35 ft. long, but 40-ft. poles were used where the embankments were narrow and steep, and in span construction. Nearly all the construction is of the bracket type, except at the railroad yards at Rochester, Avon and Mt. Morris, and for some distance at Mortimer, where there is a siding on each side of the main track, which prevented the use of bracket construction there.

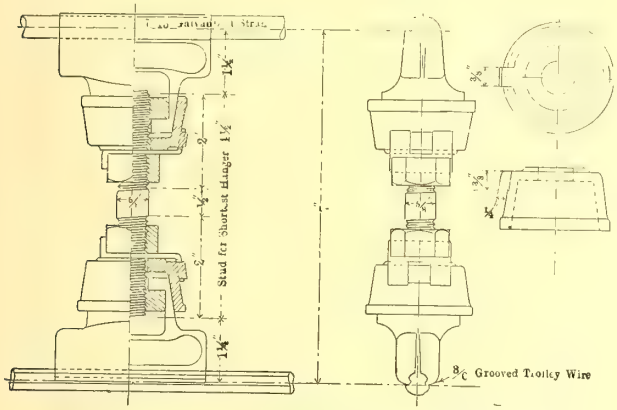
The poles are given about 12 ins. rake. The poles are tamped with cobblestones, of which plenty were available from the coarse gravel with which the road is ballasted. The ground proved very deceptive as regards the nature of the digging, much water-bearing gravel and quicksand being encountered, and oil-barrels had to be resorted to in many instances, to prevent caving in of the holes during pole setting.

The brackets are of on entirely original design, each consisting of a 3 x 2½-in. tee, 10 ft. long, the heel of which is fastened to the pole by a pair of bent straps, the outer end being supported from the pole-top by two ⅝-in. steel truss rods, instead of the single rod commonly used for bracket work. The two rods are attached about 27 ins. back from the outer end, and run one to each side of the pole, and are fastened there to a pole clamp devised for this work, which grips the top of the pole instead of requiring the bolt or truss rod to pass through it. In this way the timber of the pole is kept intact, and does not have a hole bored through it which will admit moisture and induce rot. The two truss rods are threaded at both ends, and at the upper end each one passes through a small iron casting which is in turn carried upon a bolt projecting out from the cast-iron portion of the pole clamp, like a trunion. The whole construction is extremely rigid, and is stronger and more conducive to a

long life for the pole than any bracket hitherto used. Where necessary, at switches, extra long brackets are employed, being lengthened by splicing and an extra truss rod being attached by means of a clamp, to the outer end of such a bracket, and run to the extreme top of the pole.

The insulator pins are of malleable iron, of a type specially devised for this work. The lower portion of the pin was divided and fitted closely over the flanges of the tee bracket, being provided with a single 5/8-in. bolt by means of which the lower split portion of the pin is clamped securely against the bracket. The brackets and pins were furnished to the engineers' designs, by the Electric Service Supplies Company.

The insulator is of the R. Thomas & Sons manufacture, 6⅞ ins. in diameter, and 6 ins. high, made in two parts, but of the three-petticoat type, and known as the No. 3029.

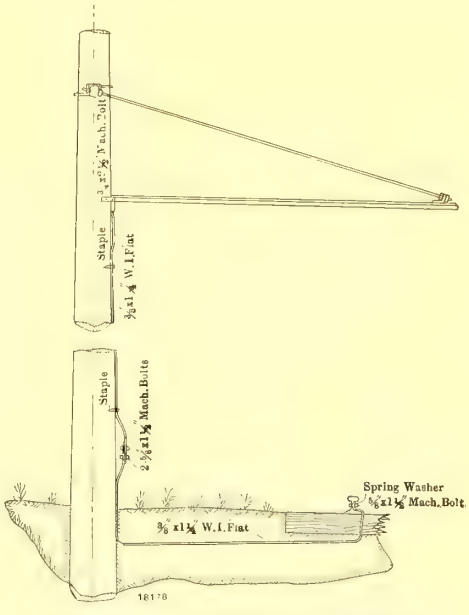


TROLLEY HANGER CATENARY CONSTRUCTION

It was designed by the engineers especially for this installation. As most of the overhead work was done during the winter months, and had to be rushed, a quick-setting cement of litharge and glycerine was used in place of Portland cement, which not only enabled rapid work in construction, but obviated troubles due to the freezing of hydraulic cement while setting.

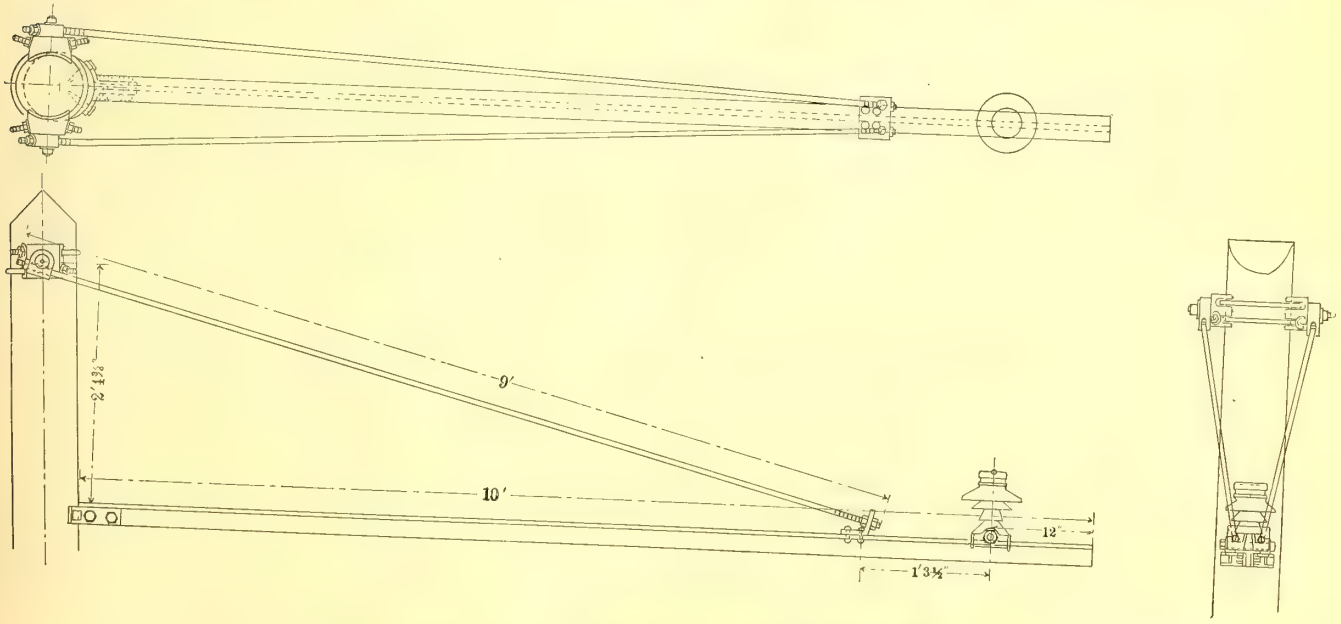
The insulator pins are ordinarily about 12 ins. from the end of the bracket, but there is 27-½ ins. space between the end of the bracket and the point where the truss rods support it, which enables sufficient variation in location of insulator to meet most of the requirements in shifting the alignment of the trolley wire on curves.

The messenger wire is of "extra high strength" steel, furnished by the American Steel & Wire Co. It is of seven strands and is 7/16 in. in diameter. Joints are made by using the so-called "open" and "closed" cable sockets, the sockets being sweated on to the abutting ends of the cables and joined by a pin connection through the eyes of the sockets. The trolley wire is No. 000 B & S grooved copper, the lengths being spliced with the usual type of soldered splicing sleeve.



METHOD OF GROUNDING BRACKET

The spans on the straight line track are 120 ft. in length, and as much shorter than this on curves as required by the radius of the curvature. The maximum deflection from the center line of the track, on curves, is 7 ins. each way. The catenary hangers were of the Electric Railway Equipment Co.'s drop-forged type, being modified by the engineers to suit the requirements. The messenger clip and the trolley

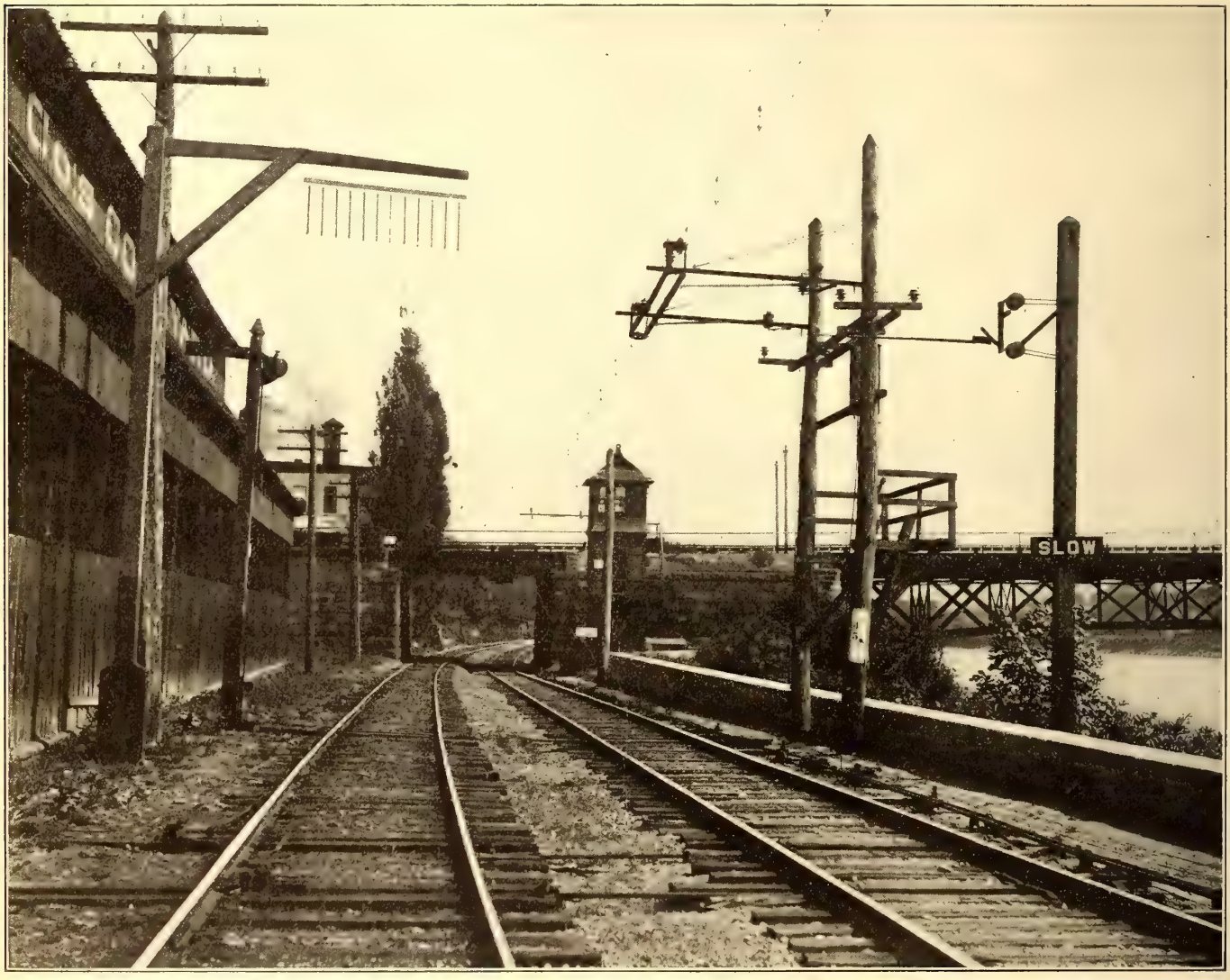


BRACKET FOR CATENARY TROLLEY CONSTRUCTION

clip are of the same type but grooved differently to accommodate their respective wires. They are joined by a 5/8-in. iron hanger-rod, with right-hand threads on each end, the longer rods being flattened in the middle to admit of bending them slightly, so as to conform to the divergence of the messenger and trolley wire near the ends of the spans. Both trolley and messenger ears are secured in position by jam nuts. This type of suspension was developed especially for this installation, and is so constructed that there is no possibility of parts coming loose and falling apart on account of vibration. It is also very quickly and easily adjustable on trolley wires. The hangers are spaced every 10 ft.

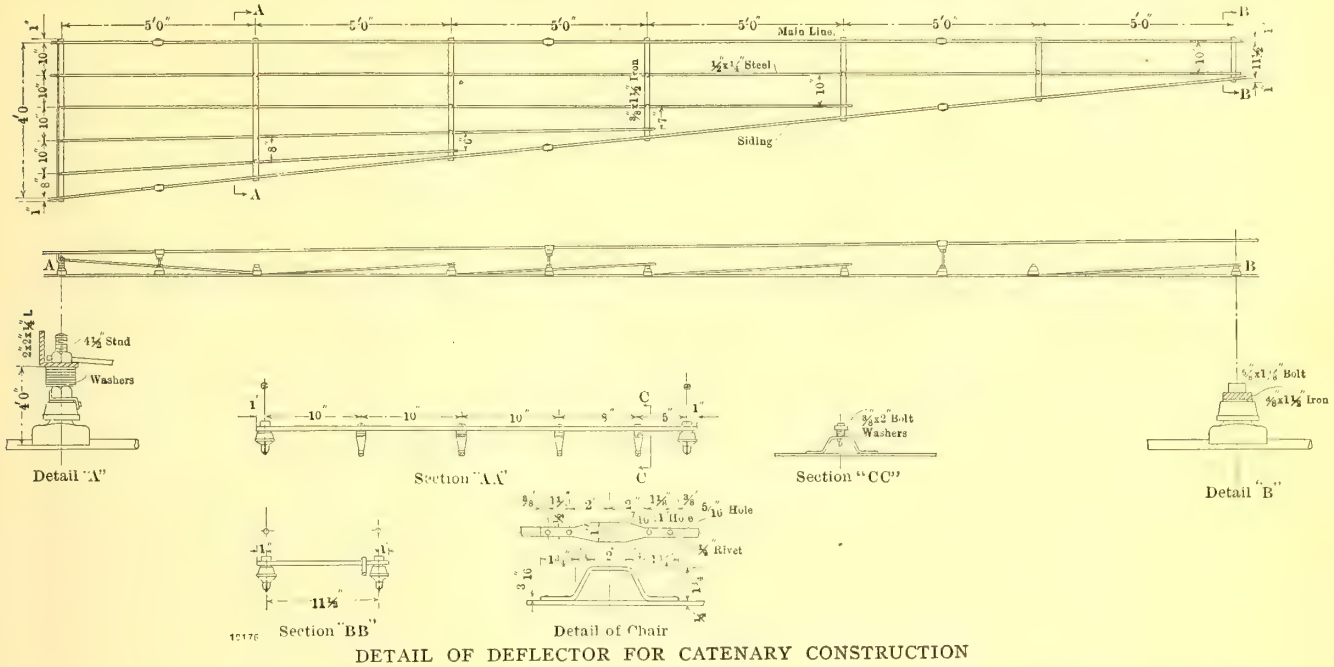
The steady strain rods are of treated wood of the Westinghouse Electric & Mfg. Company's make, and they are mounted at one side of the bracket instead of directly underneath, in order to give sufficient clearance for the pantagraph trolley on curves, where the super-elevation results in the tilting of the shoe from the horizontal. Each steady strain rod is hinged to a spool type Thomas porcelain strain insulator, which is clamped to one side of the bracket in such a manner that the hinged end of the rod is almost at the elevation of the top of the tee bracket. The method of attaching the steady strain insulators to the bracket is such that they can readily be shifted along the bracket to follow up any change in alignment of the trolley wire that may be required by curvature or for any other reason. The clamps holding the steady strain insulators are of 3 in. x 3/8 in. bent iron. The spool type insulators are cemented on to pieces of 3/4-in. pipe, through which passes the 5/8-in. eyebolt by means of which they are attached to the bent irons. Steady strains are used only on curves and turnouts and were not found necessary on tangent track.

The tie wires are of No. 9 Extra BB, galvanized telegraph wire, because it was thought best not to make too rigid an attachment between the messenger wire and the insulator; so that if a bracket became detached from the pole for any reason, its weight and the shock of detachment would tear the wire clear from the messenger and allow the bracket to fall entirely away from the wire and reduce the chance of steam railroad trains colliding with it. An accident to the electrical equipment of a railway operating both steam and electric trains, may shut down the electric service, but will not automatically place any check upon the steam service, so that accidents to steam trains must be guarded against, as a steam train might easily be wrecked by an obstruction which would automatically prevent power from being supplied to an electric train. This was one of the reasons for installing the system of "ground rods" from the brackets to the rails, which is carried out very consistently throughout the installation. Every bracket is grounded to the rail, so that an insulator failure will instantly throw off the power, as it will cause a complete metallic short-circuit. There is thus no danger of setting the wooden poles on fire, which would be possible if this precaution were not taken.



OVERHEAD CONSTRUCTION AT CLARISSA STREET BRIDGE, ROCHESTER, SHOWING TROLLEY SECTION INSULATOR, BRIDGE WARNING AND BLOCK SIGNAL TOWER

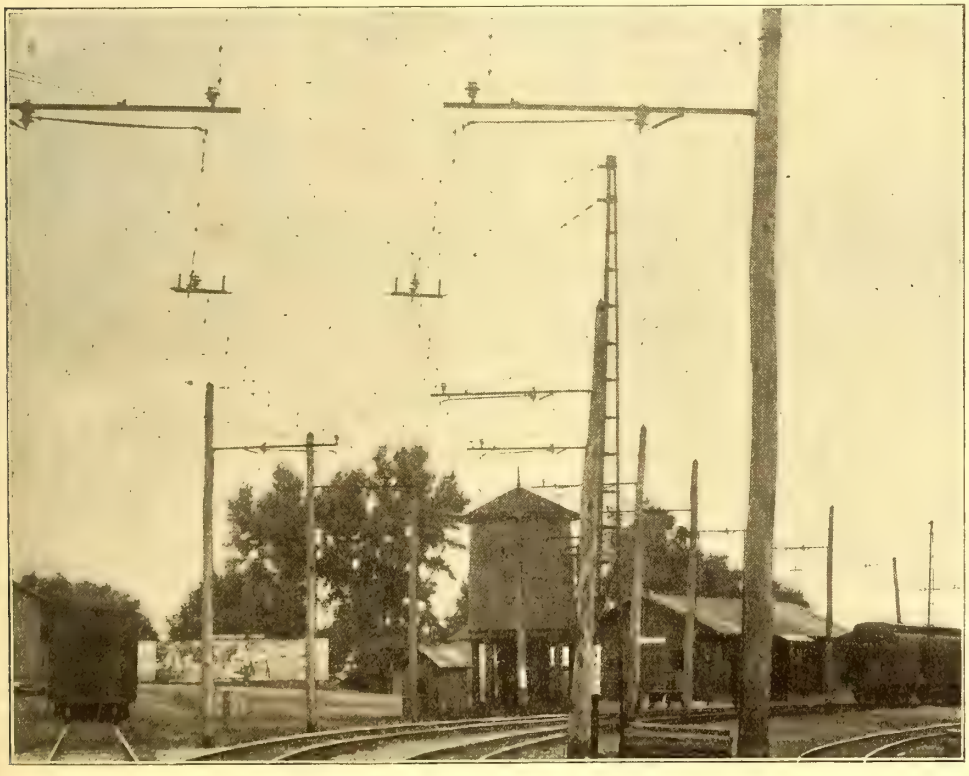
The burning of a wooden pole would not of itself necessarily cripple the electric service, but it would be quite likely to cause an obstruction dangerous to the passage of steam trains which are, of course, independent of any disturbances on the electric motive-power system. Up to the present time, however, there have been no cases where the overhead construction has caused any obstruction to the passage of the steam traffic.



DETAIL OF DEFLECTOR FOR CATENARY CONSTRUCTION

The ground rods consist of ⅜ in. x 1¼ in. flat steel, their upper and lower ends being bolted to track rail and bracket respectively.

The span construction is as nearly as possible similar to the bracket construction, and uses the same type of pin and insulator. A piece of 3 in. x 2½ in. tee about 30 ins. long is suspended from the span wire by hangers of galvanized strand cable, adjustable in length, and fastened to the span wire cable by specially designed clips, the construction forming a sort of stirrup upon which the pin and insulator are carried. The messenger wire rests upon the insulator just as in the case of regular bracket construction. This form is used, not only for spans where there is but one track, but also in the yards at Avon, and Rochester, where three or four parallel tracks are electrified. Span construction, in general, was only used where conditions absolutely required it.



OVERHEAD CONSTRUCTION, MT. MORRIS TERMINAL

The Rochester yard was a difficult piece of construction on account of the distance between supports (which reaches a maximum of 94 ft., where spanning seven tracks, four of which are electrified), and also on account of the uncertain nature of the soil which on the river bank is filled in with gravel and cinders. For these long spans, where it was impossible to use guys of the usual type (the river bank being on one side and the main highway which gives teams access for loading and unloading of freight cars on the other side), it became necessary to use self-supporting span construction, and this was done by using the "Tripartite" type of steel pole, set in concrete. This type of pole being constructed of re-rolled Bessemer steel rails, is less subject to rust, and consequently more durable than any other available type of metal pole, and all of its surfaces are always open and easy of inspection. On account of the great tensile strength of the material, there is considerable saving in weight, and the fact that it was a standardized

product, enabled quicker delivery to be made than though special riveted poles of structural steel shapes had been especially designed for these locations. The span wires consist of the regular messenger cable fitted with cable sockets sweated on at each end, the same being fastened to turnbuckles and pole collars at the tops of the poles. There are two span cables at each pair of poles, the upper one being used to carry the weight, the lower one acting to steady the arrangement and also to act as a relay in case of an accident to the upper span. Similar construction was also used at Avon, where guying of side poles was not always possible.

A very simple type of pull-off was devised for curves in span construction, and it so happens that both the Rochester and Mt. Morris yards have considerable curvature. The pull-off consists simply of a spool-type insulator, with a piece of pipe cemented through the center, this pipe being slipped over the hanger spacing-rod joining the messenger and trolley clips, thus giving an insulating connection through which an ordinary pull-off cable can be attached to both messenger and trolley wherever required. The division of the horizontal pull between the messenger and trolley wires is easily adjusted to suit the conditions, by shifting the spool-type insulator up and down the spacing rod, by inserting longer or shorter nipples of pipe underneath it. In general, when near a span wire, the messenger cable is supported rigidly on its insulator and the trolley wire needs all the side pull; but in the middle of a span the pull must be equally divided between messenger and trolley wire.

The presence of several through-truss bridges over streams and two low bridges over the Erie right of way necessitated the employment of special construction at these points, particularly at the bridge at Clarissa Street, on the outskirts of Rochester. The original clearances here were so low that the road-bed had to be excavated out and the track lowered about 2 ft., and the minimum clearance between the rails and the trolley wire being finally 18 ft. The messenger is fastened to a horizontal stool-type insulator mounted at the center of a substatial piece of turned oak, which is long enough to carry two more similar insulators, one on either side of the center one.

The steel hangers reaching down from the overhead bridge structure carry the two side insulators, so there are always two insulators in series between the 11,000-volt messenger cable and the steel work of the bridge. These insulated supports are suspended at short intervals from the under side of the steel-work of the bridge, and are further supplemented by the use of steady strains which prevent any side displacement of the trolley wire. The shortest sizes of hanger spacing rods are used in such places. Where the bridge trusses are high enough to permit it an iron stirrup is employed like that used in span work, which carries the standard form of straight line insulator, and the regular type of catenary suspension is employed.

At either side of these overhead obstructions it was necessary to provide warnings for brakemen upon the tops of freight cars, as substitutes for the warnings of hanging pieces of rope previously used. In the accompanying cut on page 657 is given a view of the Clarissa Street bridge, showing both the old arrangement of ropes and the new one, for electrified tracks, which supplanted it. It will be noted at this point only one of the two tracks is electrified and freight trains are here obliged by rule to use the unelectrified track; but to insure that the place shall be absolutely safeguarded, the electrified track is fitted with warning signs of the type shown. They consist of the well-known type of horizontal, suspended swinging wooden rod, mounted with its axis at an angle, so that it swings up as it is pushed to one side. The pantograph trolley is fitted with a set of springs on each side, one of which strikes this warning sign a blow as it passes under and instantly throws it to one side. The blow is struck upon a heavy leather strap held taut by a coil spring of steel wire in tension, the whole contrivance being fastened to the lower half of the pantograph trolley mechanism so that it is at the right height for striking the warning sign. The swinging rod is mounted upon the pole by means of insulators, effectually preventing any leakage to the ground, even though a car might stand still directly under the sign and make contact with it for an indefinite length of time.



AVON YARD, LOOKING SOUTH TOWARD STATION

Nearly all the telephone and telegraph wires which cross over the 11,000-volt trolley wire have been put underground, particularly in the case of the leads composed of only a few wires, but where the line is crossed by heavy telephone trunk lines, they have been protected by the basket type of construction, so designed as to effectually prevent a broken telephone wire from falling across the messenger or trolley wire. This consists primarily of four galvanized steel cables stretched between opposite ends of two cross arms, one placed above and the other below the wires of the intersecting telephone line, and the four cables

are joined by a basket-work of light strap-iron ribs placed at intervals of 3 to 4 feet across the whole span, forming the sides and the bottom of the cradle and effectually preventing a broken telephone wire from dropping any further. This construction was also followed in the case of an electric light line at Avon.

The telegraph department of the railroad company, in connection with the signal department, constructed a private telephone line of two copper wires between Rochester and Avon, with instruments at all signal towers and stations in the dispatcher's office, and at the sub-stations, and car shed, and master mechanic's office. This telephone system is run upon the trolley bracket poles, transposed every third pole, and has worked satisfactorily.

Lightning protection for high tension single-phase railway lines not having as yet been standardized, only a part of the line was equipped with line lightning arresters, which are of a swinging fuse gap type of construction, made by the Westinghouse Electric & Manufacturing Company. This type of lightning arrester consists of a gap one side of which is connected directly to the trolley through a No. 4 copper wire, and the other side being directly connected to the ground rod through a fuse enclosed in a tube which, while the fuse is intact, is maintained in an inclined position like a pendulum held back from its position of rest; but when the fuse is blown, a latch is released which allows the fuse tube to swing to a vertical position which shows conspicuously from the ground, and signifies to the patrolman that the fuse should be replaced. The fuse tube can then be lifted off the suspending lugs by a pair of insulating tongs made for the purpose, and the fuse renewed and replaced in a few moments.

On the other half of the line, lightning arresters were not installed. During the summer, two of the poles were struck by lightning, but the metal-work of the brackets and truss rods being entirely grounded, these poles were not damaged below the topmost point of attachment of the truss rods, which is generally not over 18 ins. from the top of the pole. In a number of instances the lightning-arrester fuses have blown, but it is not known how many of them have blown simultaneously. Although the extent to which this type of arrester is fully protective, is hardly established as yet, it can be stated that at no time since regular operation started, has any injury to the car equipment resulted from lightning, though there were several severe storms during June and July.

The trolley line is divided into seven sections—one comprising the Rochester terminal, one of the Avon yard, three sections in the main line between Rochester and Avon, and two sections south of Avon.

The sections are divided by trolley section insulators, made by the Westinghouse Electric & Manufacturing Company. They are of the overlapping type, made of impregnated wood, and are of sufficient length to insure insulation at 11,000 volts. Each section insulator is carried upon two brackets, mounted on poles spaced 10 ft. apart. As the trolley and messenger must both be completely insulated on opposite sides of the breaker, heavy strain insulators are introduced upon which the messenger is dead ended, the two insulators being connected across the gap by a heavy steel rod. This entire combination is supported upon standard insulators mounted upon the regular brackets.

One of the breakers, that opposite the sub-station at Avon, is different from the above-mentioned type, in that it is not of the overlapping type, it being necessary to absolutely separate the two halves of the trolley line in order to utilize the separate phases of the trolley current in each half.

The only feeders necessary are those connecting the sub-station with the trolley on opposite sides of this section break. The principal object of cutting the trolley into additional sections is to facilitate the locating of line trouble.

The conditions of electric traction upon this line are such that no feeder is necessary besides the trolley wire, and consequently there is no necessity for feeding the sections separately. A jumper is therefore provided at each section insulator in which is placed a hook-type knife switch that can be operated in case it is desired to cut that section out. Normally, however, the switches are closed and the effect of the jumpers is to make the trolley wire continuous.

Another detail peculiar to the catenary type of trolley construction is the "deflector"—a sort of mechanical fender placed in the angle formed by the intersecting trolley wires at switches. The type of deflector here used consists of four or five bars of flat steel, ½ x ¼, suspended by riveted hangers, from crossbars spaced five feet apart which in turn rest on standard trolley clamps fastened to the trolley wire. The particular advantage gained by this construction is that no extra tension is needed to keep the bars from sagging and getting crooked, this type of deflector being of minimum weight and entirely self-contained. They are placed in both angles of each switch. The object of the deflector is to prevent the end of the pantograph shoe, when traveling under either wire from becoming hooked over the other.

CARS.

The cars equipped with electric apparatus are six in number, and together with their trucks were furnished by the St. Louis Car Company. The electrical apparatus was installed upon the cars and trucks by the engineers at the railroad company's car shops in Buffalo, N. Y. The cars are 51 ft. 4 ins. over bumpers, 40 ft. over corner posts, and 29 ft. 4 ins. betwen truck centers. They are 8 ft. 9 ins. wide over sheathing, and 13 ft. 8⅝ ins. in height above the rail. Four of the six have two passenger compartments, the other two having a baggage compartment about 14 ft. long, and a small smoking compartment with six seats, besides the regular passenger compartment.

The bottom construction of the cars comprises side sills of 5 x 8 yellow pine, with 6-in. steel channel and fillers, intermediate sills of 4½ x 6 yellow pine, and center sills of 6-in. I-beams, with fillers. All the cars have upper and lower truss rods and needle beams of 5-in. I-beams. End sills are 8 x 6 in. oak. The flooring is double, and trap doors are fitted over the motors.

All the lower side windows are equipped with sash balances, and the interior of the car is finished in mahogany with light green veneering in the ceiling, of a very pleasing appearance. The seats are of the "Walkover" type, upholstered in dark green plush in the main passenger compartment, and in rattan in the smoking compartment. There is a continuous basket rack on either side over the windows. The end doors are of the double sliding type. The vestibule doors are of the single sliding type, and trap doors are fitted over the steps. Each vestibule is fitted with a double-acting swinging door so arranged as to form the motorman's cab, and when not so used it is folded back to completely enclose the control apparatus and brake gear, and leaves the vestibule unobstructed for passengers.

Each car is fitted with a 50-cp headlight, at each end, on top of the hood, and it is also fitted with a gong, air whistle and with the standard train air signal used by the Erie Railroad. The toilet is in the center of the car, adjacent to the partition between the compartments. The "Standard" steel type of platform buffer is used, and the regular M. C. B. coupling, air hose connections and safety chains are

provided, so that the cars can couple up to any of the standard Erie Railroad rolling equipment.

There being an open space between the abutting vestibules when two motor cars are coupled together, due to the rounded and projecting buffer beams of the platforms, this opening being nearly 18 ins. in width, which is wide enough to allow a person to fall between the cars, there were provided canvas curtains about 5 ft. high with snaps attached which enable them to be quickly stretched across the space, one on each side of the vestibule end door, so as to insure the safety of trainmen and passengers when walking from one car to another, with the train in motion.

The trucks are both alike, wheel base being 6 ft. 8 ins. The axles are 6½ ins. diameter. The trucks are of the standard M. C. B. swing bolster type, with heavy framing. The brake shoes are inside hung.

The heating equipment consists of thirty-two of the Consolidated Car Heating Company's electric heaters of the truss plank type and 450 watts capacity each in the main portion of the car, and two "No. 192 M. S." heaters in each cab.

ELECTRICAL EQUIPMENT.

The electrical equipment of the cars consists of four No. 132-A Westinghouse single-phase railway motors, with a nominal rating of 100 hp each, the gear ratio being 20.63. The suspension is of the nose type, and solid gears are pressed upon the axles.

The control system is of the Westinghouse electro-pneumatic type, and includes three distinct circuits, the high potential, the low potential and the control circuit.

The high potential circuit includes the pantograph trolley, line switch and the transformer. The pantograph trolley mechanism is operated by a pair of springs and by an air cylinder. The trolley is raised and held against the wire by means of springs against its own weight, and it is lowered by the application of air pressure to pistons working in cylinders that form part of its base. When down, it is automatically locked, and the latch of this lock can only be withdrawn by applying air pressure to another small piston which then unlocks the pantograph, allowing the springs to raise it. This trolley mechanism is so connected with the control circuit through the line relay that any interruption in the supply of high-tension current immediately causes the trolley to be lowered by applying the air to the main clinders in the trolley base.

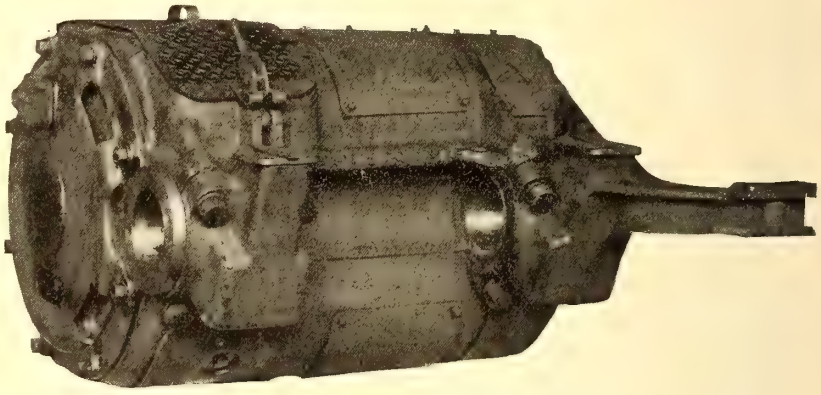
The line switch is equivalent to a main high-tension circuit breaker. It is opened and closed by air pressure, admitted by electrically operated valves. In case the supply of air is exhausted, as when the car has stood for some time unused, the line switch must first be held in mechanically by means of a handle provided for the purpose until the air pump, which can then be thrown into operation, has compressed air to about 50 lbs. pressure, which is enough to properly actuate the control system.

To raise the trolley when there is no air pressure available, there is provided a small automobile tire pump. This pump is placed underneath one of the car seats, and is connected by a three-way cock into the trolley air piping system. It enables the air-operated trolley latch to be withdrawn and power to be obtained to start the air compressor and set going the motor generator set used for charging the storage battery and supplying current to the control circuit.

The transformer is of 200 kw capacity, and is of the oil insulated type. It has three high potential and eight low potential taps, the latter running from 300 down to 110 volts, at which latter pressure current is provided for heating, lighting and auxiliary purposes.

The high-tension wiring of the car is done mainly with varnished cambric cable, drawn through loricated iron conduit. A small amount of high-grade rubber cable is used, but it is thoroughly protected with varnished cambric tape wherever there is danger of a brush discharge to ground breaking down the insulation.

In the main low-potential circuit are the switch group, the preventive coils and the reverser. The switch group is a set of air-operated switches controlled by magnet valves, all mounted in one frame. It is placed athwart the car as near as possible to the low-tension end of the main transformer. The switches of the group are all provided with interlocks, which automatically govern the connections in such a way that each switch of the group acts only when the current in the motors has reached a predetermined value, thus making acceleration automatic. Preventive coils are used across the terminals of some of the switches of the group, to prevent excessive current flowing at the instant of closing the switch. Each switch in the group is fitted with its own blow-out coil. There are two reverser switches actuated by air pressure, one for each pair of motors.



132-A SINGLE-PHASE MOTOR USED ON THE ROCHESTER BRANCH

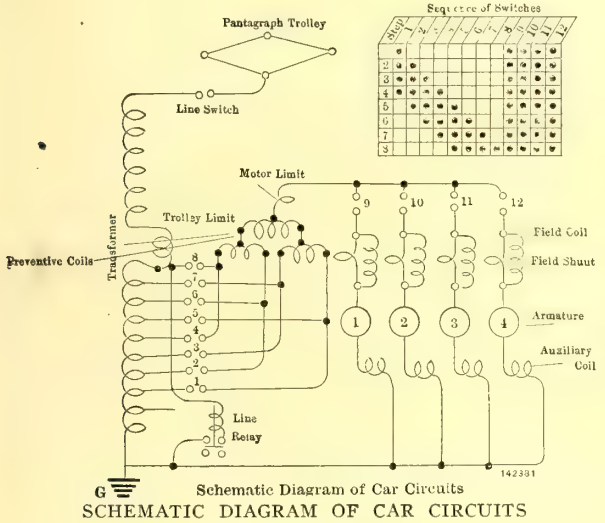
Current from the main motor circuit is led through the motor limit switch, which makes effective the functions of the interlocks on the switch group, and renders it impossible for the successive switches to be thrown in unless the limit switch is closed.

The control circuit includes a master controller in each vestibule, the train line wires and their connections to the valve magnets and interlocks, a storage battery supplying current for these wires, and a motor generator set, which is used either to charge the batteries or to actuate the control system. The master controller makes the proper connections by means of which the 15-volt storage battery actuates the valve magnets which control the action of the air-operating main contactors in the switch group, and the reversers. The controller handle is normally held in a vertical central position by springs, unless it is moved to one of the running points by the motorman. When released from the grasp of the hand it flies to the vertical position, cutting off the power, and enabling the emergency application of the brakes by means of brake relay valve alongside of it. There are two holes in the face of the master con-

troller, directly under the handle, and attached to the handle by means of a chain is a plug which may be inserted into either of these holes. The master controller is not operative unless this plug is pushed all the way into the lower hole, which closes the line switch, connects the generator and battery, and puts the brake relay valve into circuit. This is the ordinary running position of the plug. In case the line switch is opened by an overload, which generally causes the trolley to be lowered, the plug is taken out of the lower hole and placed in the upper, which action immediately closes the line switch, releases the trolley, and allows it to spring up against the wire. As soon as the power is thereby returned to the main circuit, the plug is taken out of the upper hole and replaced in the lower one.

There is a push button upon each side of the bottom of the master controller case. That on the right hand side is used for dropping the trolley and opening the line switch. When the button on the left hand side is pressed the switch group is stepped up to the last or high speed notch and remains in that position until the handle of the controller has been returned to the off position.

There are four distinct notches on each side of the controller, the first corresponding to the coasting position with



SCHEMATIC DIAGRAM OF CAR CIRCUITS

the power off, the others enabling such gradations of speed as may be desired. Reversal is effected by moving the controller handle to the opposite side of the center or dead point. If the controller stops on the dead point, as it will if released by the hand, it will immediately apply the brakes.

The motor generator set is a compact machine of about 1/6 kw, the motor being of the self starting induction type, wound for 110 volts, the generator being normally of about twenty-three volts. It is placed under one of the seats in the car and is covered by a box with removable lid, so that it can easily be reached for such small attention as it requires. It is mounted upon rubber bushings, and runs so quietly that its presence in the car can hardly be detected.

The storage battery consists of seven cells contained in a wooden box with handles, carried in an enclosed box underneath the car. No other auxiliary lines for any purpose are connected to the control circuit in order to prevent it from being disabled by accidental grounds.

In one vestibule there is located in an asbestos lined compartment enclosed with steel doors a slate switchboard panel upon which are carried all the switches and fuses for the control of the battery and motor generator set, the lighting circuits and heaters, and also the main connection from the low tension side of the transformer to the auxiliaries.

The control circuit is fitted with junction boxes, branches running to receptacles at each of the four corners of the car directly under the end sills. The jumpers for connecting the cars and the receptacles are of the 12-point type, there being twelve wires in the main control circuit.

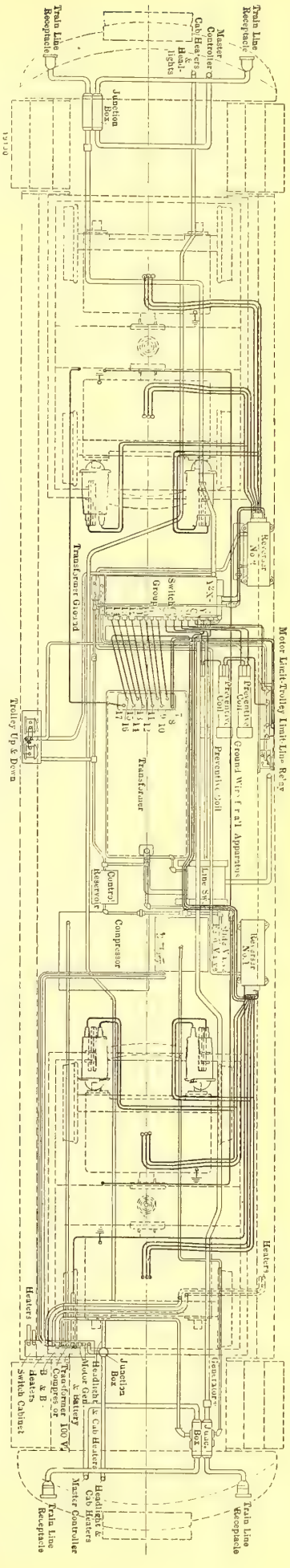
The low tension wiring between the transformer and switch group and motors is all enclosed in a boxing of "Transite," to insure its protection against mechanical injury, as the inductive effect of heavy currents at low potentials renders the use of iron conduits impossible for this part of the wiring.

The air brake and electrical equipment were placed upon the cars by the engineers at the Buffalo car shops of the Erie Railroad.

CAR INSPECTION SHED

Adjacent to the sub-station is a car inspection shed, a brick building that will accommodate four cars. It is 136 ft. 6 ins. long, 30 ft. 5 ins. wide and 20 ft. high in the clear, between the track and the bottom of the roof girders, and 24 ft. high from the top of foundation to the top of the parapet. The general style of construction is similar to that of the sub-station. It is remarkably well lighted, there being a window in each bay 6 ft. 11 ins. wide by 13 ft. 6½ ins. high. Two tracks run clear through the building, the ends of which are enclosed by rolling steel doors of the Wilson type, about 12 ft. wide and 18 ft. 9 ins. high. One of the two tracks is provided with a pit about 110 ft. long and

GENERAL ARRANGEMENT OF WIRING AND ELECTRICAL APPARATUS



4 ft. 4 ins. wide, in the clear, and 3 ft. deep from the top of the rail to the top of the convex brick floor.

The foundations consist of concrete piers, joined by heavy reinforced concrete lintels upon which the brick walls rest between the piers. The building is located on filled-in ground, and the piers reach down to a reasonable distance below the level of the original natural soil. The space around the building and between piers and underneath the floor and pit of the building is filled in with gravel and cinders.

The roof is a 4¼-in. reinforced concrete slab, supported by steel girders, slightly pitched in one direction. There are no partitions or separate rooms in the building.

A trolley hoist is provided at the rear end of the building, traveling across it on the bottom flanges of an I-beam attached to one of the roof girders. A third track, not connected with the outside tracks, runs up and down the middle of the building between the two car tracks. A transfer table is located in a cross pit situated about midway of the building, by means of which a car standing on the floor track may have a truck taken out from under it and shifted over to the center track, on which it can be run under the trolley hoist in case repairs are needed. The sides and bottom of this transfer pit are made of concrete.

The floor of the car barn, other than that taken up by the repair pit and transfer pit, is paved with second-grade paving brick, laid on sand, which was well packed down with water.

The station is supplied with light by means of seventy-seven incandescent lamps in pairs and clusters, connected up by a conduit system and steel plate switch cabinet to the auxiliary light transformer in the sub-station.

The pit is also provided with ten incandescent lamp outlets and extension plugs. No electrical means are provided for moving the cars in the station, there being always steam locomotives available for shifting the cars in and out of the building.

The inspection shed is, like the sub-station, heated by steam. The radiators are of the Colonial wall type, one being set in each bay and fed by a steam pipe passing underground through a concrete pipe trench, which also carries the compressed air piping. The latter is supplied from a steam air compressor outfit in the division repair shop. The main steam supply header runs overhead directly above the windows, and the condensed steam waste is discharged into the open air. A 4-inch water line runs completely through the building, and there is one 2½-in. hydrant at each end just inside of the door and a third in the center of the building.

The above facilities for effecting electrical repairs are supplemented by the regular division repair shops, located alongside the steam locomotive roundhouse at Avon, which are equipped with the usual complement of machine tools.

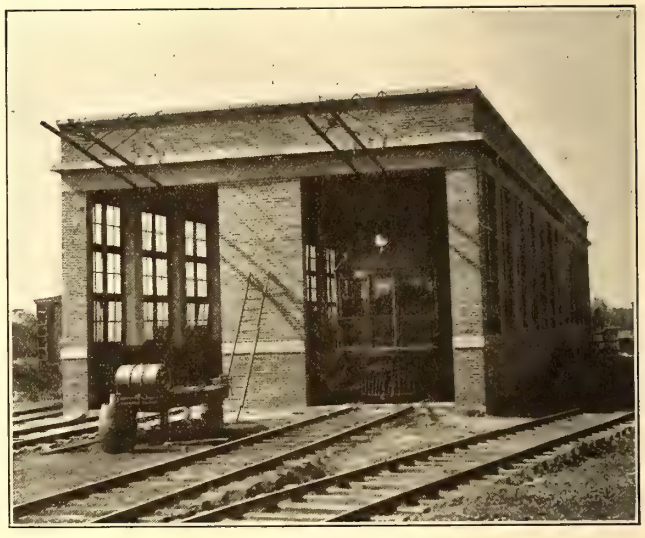
At the Rochester terminal a concrete inspection pit 60 ft. long is provided on one of the side tracks close to the passenger station.

OPERATION

The equipments above described were intended to be sufficient for operating single car trains with one stop per mile over the entire road, at an average schedule speed of twenty-four miles per hour, or to haul one trailer making stops about two and one-half miles apart at the same schedule speed. The company has furnished shelters where the public highways cross the line, there being twenty-two of these flag stations besides the regular intermediate way stations at which steam trains stop, six in all, or a total of twenty-eight stations at which electric cars may be required to stop. Practically the electric cars stop at all the regular way stations, but at only a portion of the flag stations. A single passenger coach is frequently attached to a motor car, and on some trains baggage, milk or postal cars are regularly hauled. When two trailers are hauled two motor cars are required, making a four-car train, as shown in the attached photograph. The service has proved immensely popular throughout the Genesee Valley through which it passes, and it is intended to increase the number of motor cars in order to handle the business a little more comfortably next season. It is found that the electric trains on their thirty-four miles of line can be depended on to keep to their running time rather better than the steam passenger and freight trains operating over the main line.

SIGNAL SYSTEM

The railroad company has installed a positive block system for insuring the safety of trains with the frequent headway at which they are obliged to be run upon the single-track road, which must also handle steam passenger and freight traffic at the same time. The blocks extend between the regular way stations, or if such blocks are too long, switch towers are added, making the blocks average about four miles in length from one end of the line to the other. Without going into detail it may be stated that the function of the positive block system is to absolutely prevent more than one train at a time from occupying a block. The sidings are fitted with interlocking switches controlled by the block operators in the towers or in the way stations, and the movement of trains is thus regulated with the greatest care. The towers are all connected by the private telephone line, while the way stations retain the usual telegraphic communication with the train despatcher's office at Rochester. By means of the telephone communication it is instantly possible for a train crew to get in touch with the chief despatcher and be properly located, but all train orders are transmitted by telegraph and written out on Form 31, as is the uniform steam railroad practice throughout the country.



CAR INSPECTION SHED

TELEGRAPH SYSTEM

As is well known, the single-phase trolley system causes interference with telegraph lines along the right of way, and unless both the electrostatic and electromagnetic induction are properly compensated there is always danger of telegraphic communication being seriously affected. The

static effect is particularly annoying, as it is absolutely continuous as long as the trolley line is charged, whether or not there are any cars moving. Various means were proposed and tried by the Western Union Telegraph Company for the elimination of the "static," which always causes the telegraphic relays to chatter, but the most successful thus far known is that due to the inventive genius of E. W. Applegate, quadruplex expert for the Western Union Telegraph Company, who has developed a very simple means for overcoming static interference. Mr. Applegate worked upon the theory that it was useless to try to compensate for the static, and that the thing to do was to "pacify" the instrument by additional devices. The Applegate "static pickup," for which a patent has been applied, comprises a back contact relay and a high resistance shunt. The current enters the relay 1 and 2 through a 150-ohm coil or magnet, attracting the armature *C*. When the line opens

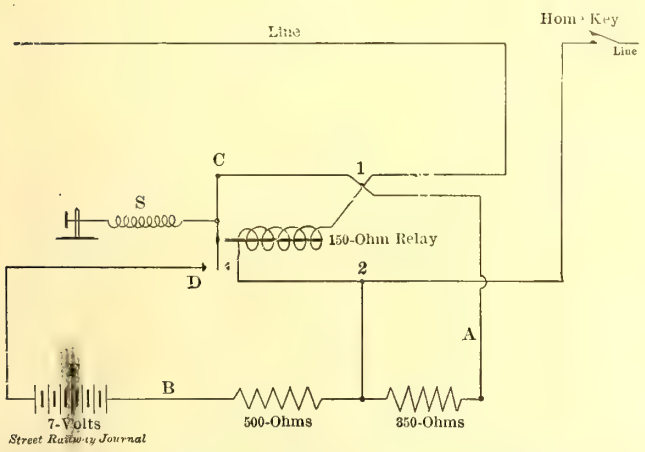


DIAGRAM OF STATIC PICKUP FOR TELEGRAPH RELAY

by any operator opening his key the armature *C* falls back and through the back contact connects points *C* and *D* by the aid of a spring *S*.

The shunt *A* consists of 350 ohms of carbon stick, and provides a better path for the static than do the magnets, pacifying the magnets to a certain extent. When the line opens and the armature connects with the back stop *C* and *D*, both the *A* and *B* shunts are in with the main line and pick up the static which escapes through shunt *A*, relieving the agitation of the armature so that it can respond to the closing of the line.

The shunt *A* robs the relay of main line battery current very materially, so that it responds to the home key sluggishly. Consequently the auxiliary battery *F* is inserted in shunt 2. When the armature *C* falls back this battery acts upon the magnets and assists their prompt response to the home key or to any other operator to such an extent that the shunt *A* does not cause noticeable drag. No matter what the line static may be these shunts "pacify" the instruments and the static is not felt.

The armature spring is adjusted high enough to overcome the wave of static that escapes *A* and *B* shunts. The aid of the 7-volt battery overcomes this adjustment and leaves the relay very prompt and satisfactory.

The resistance of the shunt *A* must be determined by the distance from the ground and battery at each end of the line. The nearer to the ground the less is the resistance of the shunt, as in close proximity to battery and ground the static is more pronounced and the effect of the main battery upon the relay is likely to be correspondingly diminished.

By this arrangement all the telegraph wires are "singled," and metallic circuits, the necessity for which was at one time pending, were discontinued, and the repeater service which they necessitated was also discontinued, and there is now a spare wire between Rochester and Mt. Morris through the entire zone of static interruption.

Speech over the telephone line is very clear and distinct, and although the wires and instruments have a heavy static charge, a few simple precautions enable it to be of great use to the operating department. It is intended to carry portable telephones upon the cars.

ORGANIZATION

The single-phase system was recommended for the electrification of this division by the Electric Traction Commission of the Erie Railroad, and after authorization by the company was installed under the general direction of J. M. Graham, vice-president and head of the construction department of the Erie.

The engineering and the construction work were carried out and the system brought into operative condition by Westinghouse, Church, Kerr & Company, who designed and erected the buildings and the catenary trolley construction, bonded the track and installed the electrical apparatus in the substation and on the cars.

The adjustment of the telegraph system was carried out jointly by the Western Union Telegraph Company and the telegraph department of the railroad company.



OVERHEAD BRACKET CONSTRUCTION MAIN LINE AND SIDING AT WEST HENRIETTA STATION

The order was given to the engineers on June 6, 1906, and although the intense activity in construction work all over the country at that time rendered it difficult to secure materials and labor promptly, the work was pushed so rapidly that about seven and one-half months later, on Jan. 22, 1907, the first official trial trip was run between Avon and Rochester. The severe winter weather thereafter prevail-

ing delayed the completion of the work until spring. During April and May the whole equipment of sub-station apparatus, lines and cars was thoroughly tried out in a course of experimental operation, which also enabled the railroad employees to become familiar with the new system. On June 18 commercial operation began and has since continued permanently with marked success.

The Erie is one of the oldest steam railroads in the country, but that it is also one of the most progressive is demonstrated by its policy of giving a thorough trial to a system of electric traction whose characteristics of simplicity in construction and economy in operation make it so eminently fitted to replace steam motive power wherever the economic conditions point to the desirability of its substitution, for the betterment of either passenger or freight service.

HANDLING FREIGHT ON THE SPOKANE & INLAND SYSTEM

Freight service on the Spokane & Inland Empire Railway was begun when the first section of the system was placed in operation a little more than a year ago, and with the opening of each succeeding extension has been extended, so that now the handling of freight is a very important branch of the company's business and plays a conspicuous part in the operation of the different lines. Properly to understand the character of this service, it is essential that one be acquainted with the territory seved and with the lines that extend from Spokane as the hub of the system.

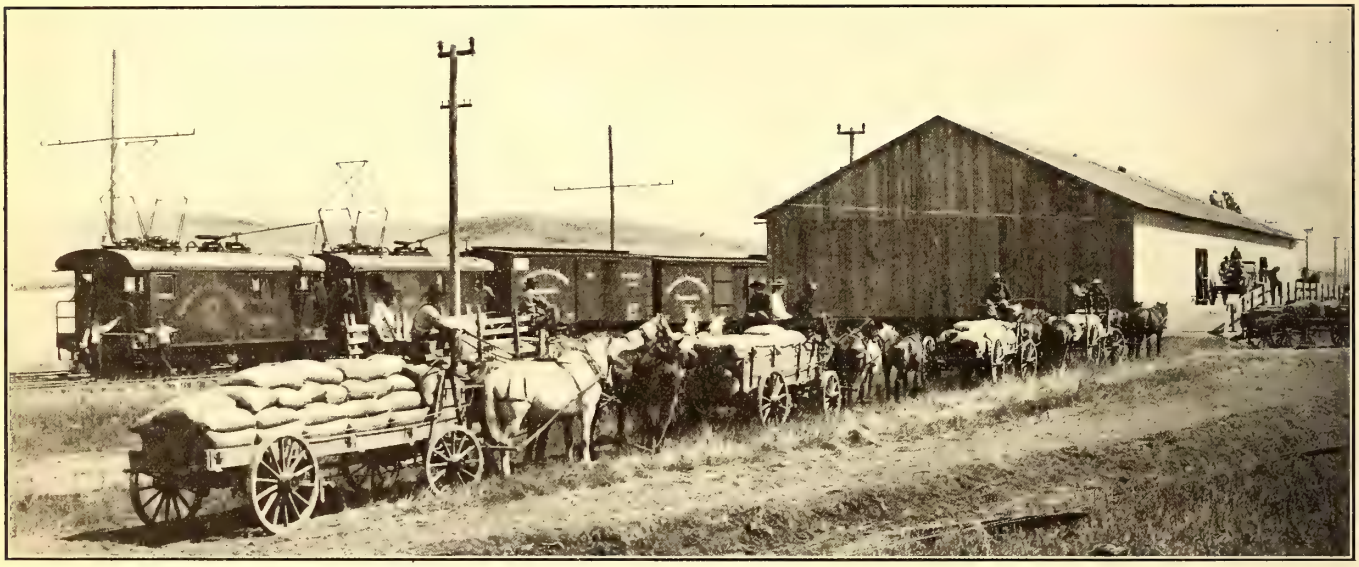
Originally incorporated as the Spokane Interurban System, the Spokane & Inland built a line south from Spokane through Waverly, Rosalia, Thornton and Colfax, and surveyed for a line from the latter city to Penawawa, Wash., and Lewiston, Ida. A branch was built, however, from the main line approximately midway between Spokane and Colfax to Palouse City, and the Y-connected system between Spokane, Colfax and Palouse City is about 106 miles in length. The products of the territory are for the most part grain and lumber. The Spokane & Inland division intersects the main productive agricultural district of the Pacific Northwest, Whitman County holding the ten-year United States record yield per acre for production of wheat, oats, barley and potatoes. Conservative estimates made of this season's crops show 10,000,000 bushels of wheat, 40,000 tons of oats and barley lying tributary to the Inland Empire System. There is now in operation a chain of thirty grain warehouses along the company's lines, and as these granaries are located every few miles the farmers find it very convenient to ship over the Spokane & Inland Company's lines.

Single-phase compensated locomotives are used for freight handling, the freight-car equipment being made up of standard freight cars such as are used on the steam lines with which the Spokane & Inland interchanges traffic. These lines are the Great Northern, the Canadian Pacific and Soo lines. The agreement of the Spokane & Inland with these companies provides for the publishing of through rates over the roads with which equipment is exchanged. The company also has traffic connections with the Red Collar Steamship Line, which plies between Coeur d'Alene City and Harrison and points on the St. Joe and St. Maries Rivers, a distance of sixty-eight miles. The Red Collar Company has four steamers in operation, besides four tugs and six barges, all for handling freight.

In this connection it is interesting to note that traffic over the Coeur d'Alene division has increased very rapidly, passenger traffic during the past year having gained 40 per cent. Freight traffic has grown even faster, jumping 75 to 80 per cent. On this division d. c. current is used, and for heavy freight hauling the locomotives are coupled in pairs, two of them being capable of hauling a train of fifteen loaded cars up a 2 per cent grade at eight miles per hour.

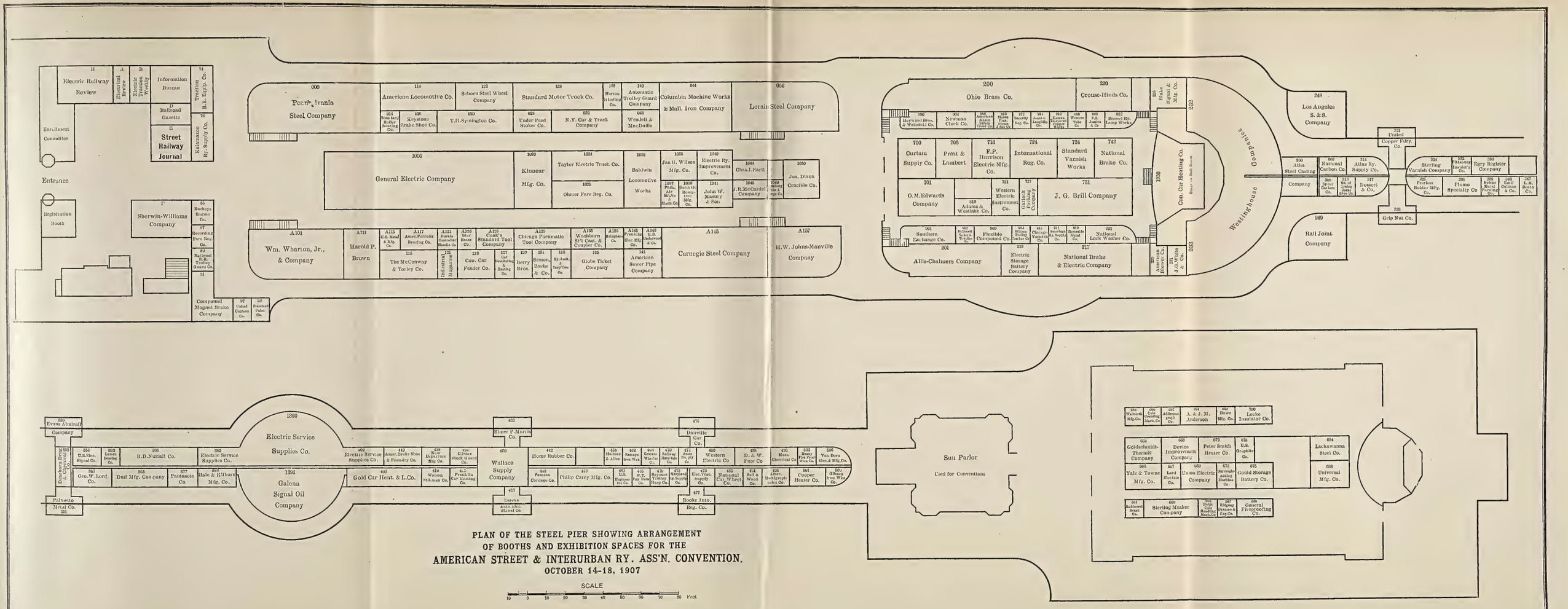
On the Spokane & Inland division, which runs in a southerly direction from Spokane, a distance of seventy-six miles to Colfax and Palouse, Wash., the company is handling freight with 50-ton 600-hp locomotives, of which it has six. These will be augmented in the near future, however, with eight 72-ton 700-hp locomotives.

The company's main freight yards in Spokane are 300 ft. x 2000 ft., and are located centrally with the Great Northern, Spokane International and O. R. & N. yards directly north, and the Northern Pacific yards directly to the south. The Spokane freight terminal, which is 40 ft. x 300 ft., is used by both the Coeur d'Alene and Inland divisions.



A SUBURBAN FREIGHT STATION, SHOWING TEAMS DELIVERING GRAIN FOR TRANSPORTATION OVER SPOKANE & INLAND





PLAN OF THE STEEL PIER SHOWING ARRANGEMENT
OF BOOTHS AND EXHIBITION SPACES FOR THE
AMERICAN STREET & INTERURBAN RY. ASS'N. CONVENTION.
OCTOBER 14-18, 1907

SCALE

10 0 10 20 30 40 50 60 70 80 Feet

STEEL TIE AND CONCRETE CONSTRUCTION ON UTICA & MOHAWK VALLEY RAILWAY SYSTEM, UTICA, N. Y.

BY M. J. FRENCH, Engineer of Maintenance of Way.

With each succeeding year, as the price of wooden cross-ties has advanced and the quality of the timber has decreased, the necessity for a more durable rail support has become more imperative. As the rolling stock of the city system has been changed from the single truck "bob-tail" type to the double truck car of 40 ft. to 50 ft. in length to meet the increased volume of travel, and as the larger and heavier interurbans have become a common sight in the crowded city streets, the track engineer has been compelled to devise a system of construction that will stand up under the severe treatment and exacting requirements now imposed upon it.

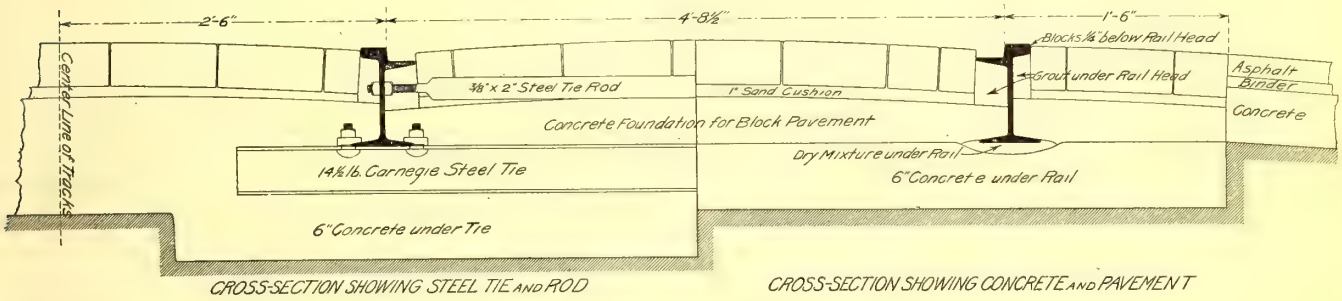
An additional burden is often imposed by the all-wise "City Fathers" in specifying in the franchise that a type of rail shall be used that all practical trackmen must admit is in its design opposed to safety in operation of cars and is more suited to the tires of the teamster's truck than to the wheels of the electric car. Then, too, the problem of laying and maintaining the specified kind of pavement is often one that in its solution calls not alone for ingenuity, but more especially for untiring watchfulness during construction, so that the chance of vibration and consequent disintegration of the pavement may be reduced to a minimum.

The cost of the old style stone-ballasted track has become appalling as wages have advanced and the quality of common labor has depreciated. With the advent of the steel tie and concrete construction some of the old problems have become easier of solution, but new ones have developed that require careful consideration.

On the city system of the Utica & Mohawk Valley Railway Company in 1905 the most approved type of stone ballast and wooden tie construction was employed with 9-in. tram head girder rails and vitrified block pavement laid on concrete. In a trench 23 ins. deep was placed 8 ins. of crushed limestone ballast, 6 ins. x 8 ins. x 8 ft. southern pine ties 2 ft. on centers were used and ⅜ in. x 2 ins. tie rods were placed at 6-ft. centers. The structure was concreted from the bottoms of ties to within 5 ins. of the tops of rails, the spaces between the rail head and base were filled with a grout of one part cement and two parts sand, and upon a 1-in. sand cushion 4-in. paving blocks were laid and grouted with Portland cement. The joints were welded with thermit. This type of construction costs $6.15 per lineal foot of single track, including all office and engineering charges.

The company has this year been using the concrete and steel tie construction with the same kind of rail and pavement at a cost of $5.45 per ft. of single track, girder rail being specified in the franchise. The ties used are the Carnegie type, weighing 14½ lbs. to the foot, 7 ft. long with a depth of 4¼ ins., a base of 6 ins. and an upper flange of 4 ins. Eight inches of excavation or nearly one-third the cost of excavation is saved in using this type of tie as compared with the wooden tie and also the expense of the entire 8 ins. of stone ballast is saved. The saving on cost of wooden ties is worth considering also. As every steel tie, with ties spaced 6 ft. on centers, takes the place of three wooden ties spaced two feet on centers, the relative cost would be $1.57 for the steel tie with four rail clips and four ¾ in. x 2½ ins. oval neck bolts as compared with 3 ties at 65 cts. each and 18 spikes at 1½ cts. each or a total of $2.22, thus making a saving of 10 1/10 cts. per foot of track.

Our work this year consisted in reconstructing with double tracks a single-track section of our Whitesboro street line over which our interurban cars running between Rome and Little Falls are operated in both directions. As we were compelled to maintain traffic on the street we decided to divide the work in sections, the first of which comprised a section 1850 ft. in length from which old 9-in. tram-head rail was to be removed, and the second section was of 7-in., 70-lb. T-rails. On the first section a temporary track of 80- lb. A. S. C. E. T-rails and wooden ties was built on the side of the street before beginning excavation. The materials excavated consisted of sandstone and cobble paving on the railroad strip, and asphalt outside with a 6-in. foundation of old concrete pavement and then earth to a total depth of 15 ins. below the top of pavement. The old paving blocks were broken with stone hammers for use in concrete at a cost of 60 cents per cu. yd. and the old concrete was broken for about 40 cents per cu. yd. The cobbles were saved for use under curb stones. On the first section the paved street was so narrow that it was necessary to finish one track to a condition ready for paving and run the cars on that before the excavation for the second track could be done. On the second section excavation was made for double tracks by lowering the old track to sub-grade and then it was thrown to one side to allow construction on the other side of the trench.



CROSS-SECTIONS OF LATEST TRACK CONSTRUCTION ON THE CITY LINES OF THE UTICA & MOHAWK VALLEY RAILWAY

The steel ties are placed on the sub-grade approximately six feet apart, the 9-in. girder rails (Lorain Sec. 95-297) are placed on these, being fastened together temporarily by standard ribbed 12 hole plates having four bolts per joint. The rails are raised from the ties to allow the ties to be moved under the tie-rod holes, spaced 6 ft. centers. The ties are then held firmly in place by a nipping bar on a block fulcrum while the standard Carnegie clips are tightened down on one rail by button-head bolts, the upper

flange of the steel tie being punched by the manufacturer to receive the button, thus preventing the turning of the bolt. The tie rods are then placed and tightened to bring the rails to gage and the opposite rails are bolted down to the ties. After lining the track approximately surfacing is done by raising the track slightly above grade on wooden blocks about 15 ins. long cut from old ties and shims split from the same material. Then the track is lowered to final grade at the grade stakes by striking the wooden blocks



SECTION OF TRACKS LINED AND SURFACED ON BLOCKS READY FOR CONCRETE

with a heavy maul, thus bedding them solidly in the sub-grade, after which the rails are lowered in the same manner to true surface throughout. Some rails are surface bent and in such cases the surfacing must be accomplished by weighting down the rail with wooden ties or large stones in case the rail is convex, the weight remaining in place until the steel ties are concreted in. If the defect is concave in form, the rail is left unconcreted at the defective portion until the concrete on either side has become set when the low spot is jacket up and blocked, after which the concreting is finished. In surfacing the track a block is placed under the rails alternating with the steel ties, but the ties are not blocked up for surfacing.

The next step in the work consists in checking up the distance between base of rails and sub-grade to insure the required depth for 6 ins. of concrete, but no backfilling is done if the depth is more than 6 ins. Then a trench having a depth of 6 ins. and width of 18 ins. is dug underneath and parallel with each tie to receive the concrete reinforcement. In this trench a dry mixture of one part cement, three parts sand and six parts crushed stone is placed, after which the mixture is thoroughly tamped under the tie with tamping picks, care being taken not to raise the track from its bearing on the wooden blocks. Often the sand or stone is damp, resulting in the mixture tamping to a very compact mass. This mixture absorbs moisture from the ground and the wet concrete placed upon it, becoming in a few days the hardest concrete in the work. The advantage in using the dry mixture is that there is no shrinkage away from the bottom of the tie in setting and the track is supported so that the blocks can be removed as the regular foundation is laid.

The foundation proper consists of a 1:3:6 mixture thoroughly hand mixed. Space on the street is so limited after the concrete materials are delivered that no room is available for a machine mixer. The sand and stone are measured in wheelbarrows, the sand and cement being first mixed to a uniform color by turning with shovels, then wet to the consistency of soft mortar. The stone, thoroughly wet, is then wheeled on to the mixing board and the aggregate thoroughly turned over. The mixture is placed by shovel as directed by the spreader and is carried well up to the tops of the ties. Two laborers thoroughly tamp the mixture against the web and under the top flanges of each steel tie. Another laborer with wooden pounder tamps the concrete to a compact level mass and another man with flat bladed shovel crowds out the concrete from under the base of the rail, leaving a space from ½ in. to ¾ in. in depth under the rail. The surfacing blocks are removed from each section between the steel ties just as the filling of concrete is brought up to them.

At this point the track is carefully looked over for imperfections in line and grade and where the fresh concrete is disturbed it is thoroughly retamped. On the following day a dry or slightly moist mixture of one part cement and four parts sand is thoroughly tamped into the space left under the base of rail on the previous day. The tampers use tamping bars and work in pairs, striking the mixture directly opposite each other at the same time, thus thoroughly filling the space with a solid mass and avoiding the slight air space that always forms from the shrinkage when wet concrete is carried up from sub-grade over the base of rail. The concrete is omitted at the joints, and where it has been found necessary to block up the joints to secure proper surface, as often is the case, the blocks are also left in place, until the concrete sets.

After the dry mixture is thoroughly tamped a second gang of concreters places the top coat forming the founda-



DETAIL OF TRACK CONSTRUCTION, SHOWING CONCRETE CONSTRUCTION WITH STEEL TIE EMBEDDED IN CONCRETE FOR PAVEMENT AND THERMIT JOINT

tion for the pavement. As one track is constructed at a time the center strip is concreted only half way and is left with a ragged edge that is thoroughly scraped and wet to secure a good bond when the second track is concreted. The top surface of the pavement foundation is worked true to templates resting upon the rails to give 1 in. crown between rails and between tracks. Between the rails of each track the concrete is brought up to within 4½ ins. of the top of tram. With a sand cushion of 1 in. and a Mack paving block 4 ins. deep the stretchers form a half groove and ease wagon wheels across the rails. The concrete in

the center strip and outside of the outer rails is kept 5 ins. below the rail heads, and the blocks on this portion are laid ¼ in. below the rail heads to prevent crushing of the blocks by false flanges on wide tired wheels.

Welding of the joints takes place after the concrete has set, the work being done substantially as described in the article published in the Street Railway Journal of Jan. 12, 1907. Every sixth joint is left as an expansion joint until the paving is completed, to insure against breakage from contraction of the rails during cool nights.

As the railway company was given the franchise on this street under the condition that it maintain the entire pavement, 36 ft. in width, for a term of twenty-five years and the new rails will undoubtedly be replaced before the expiration of that period it was deemed advisable to pave outside of the outer rails a strip only 18 ins. in width instead of the regulation 2 ft. as the entire brick strip would be disturbed in renewing the rails, it being found cheaper to take up and relay all of the blocks than to cut out the toothing and patch in again.

The railway strip is paved with one row of paving blocks laid as stretchers on both sides of the rail, the balance of the pavement being laid with blocks at right angles to the stretchers. After the pavement is swept clean and pounded to an even surface by two men with a regulation paving pounder striking upon a hardwood board the blocks are grouted in with a mixture of equal parts of Portland cement and fine quartz sand. These are first thoroughly mixed dry in a mortar box, water is added to make a mixture that flows easily and when the box is dumped the grout is thoroughly brushed into the joints with push brooms. This operation is repeated after the first flushing has settled and become partly set thus filling all joints. One barrel of cement makes sufficient grout to flush about 20 sq. yds. of pavement. When the grout has taken on its initial set the head and tram of the rails are scraped clean.

After the paving is grouted the expansion joints are welded and concrete is placed to within ½ in. of rail base. After 24 hours the dry mixture of cement and sand is tamped under the rail as in the regular construction, the top coat of concrete is placed and the joint is paved in.

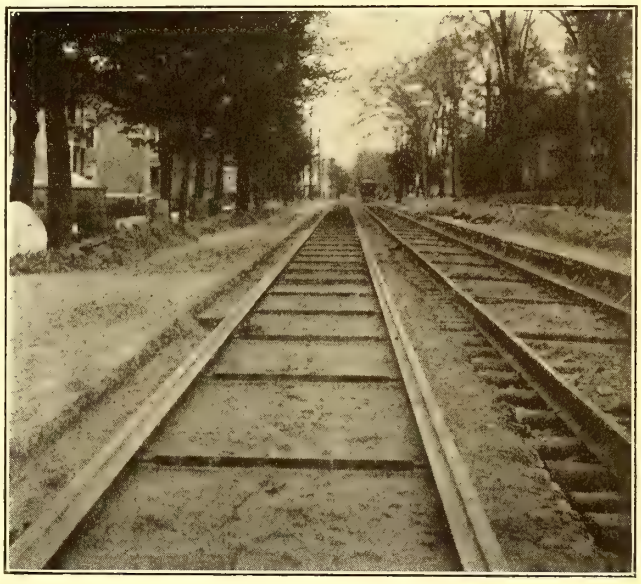
Of 281 joints welded but three were defective; in two of these the thermit did not adhere to the rail and was broken off with a sledge; in the third the rail broke outside of the weld and was rewelded without difficulty.

Standard cast-iron track inlets 10 in. wide by 4 ft. long are placed in pairs at a distance of 500 ft. apart. This inlet has a cover perforated with 46 holes in two rows 1 in. x 2½ ins. in size and the bowl slants towards an 6-in. nozzle at one end that is piped directly into the street sewer. This inlet is set with the top of grate 1 in. below tram of rail and the tram is cut away on the up-grade side for a distance of 18 ins. The paving is lowered to form a basin and thus the water is prevented from flowing past the basin on the tram of the rail. The cut edges of the trams are ground down with an electrically driven emery grinder to prevent cutting of rubber tires.

Following is a summary of cost of labor on the various subdivisions of the work:

Placing and removing temporary track, 31 cts. per ft.; excavation per cu. yd., including hauling, $1.05, or per lineal ft. of single track, 46 cts.; track laying and surfacing per ft. of single track, 19 cts.; thermit welding per joint, including labor on moulds and crucibles, $1.24; concreting per cu. yd., including dry mixture under ties and under rail bases, $1.51, or concreting per ft. of single track, 45 cts.; delivering track materials per ft. of single track, 4 cts.; delivering concrete materials, including loading and hauling of sand 19 miles by work train and breaking of old concrete and stone to use in new concrete, 13 cts. per ft. of single track; placing track basins, two basins being located every 500 ft. of single track, $8.64 per basin or 2 cts. per ft. of single track; delivery of paving materials, including loading of blocks at store yard, 11 cts. per ft. of single track; hauling away old materials, including old rails, wooden ties, scrap, old paving materials and cobbles, 3 cts. per ft. of track; cleaning up street, including removal of unused materials, broken bricks and regrading of lawns between sidewalk and curb, 10½ cts. per ft. of street; flagmen and switchmen per ft. of single track, 8 cts.; timekeeper and watchmen per ft. of single track, 5 cts.; engineering, superintendence and inspection, not including time of foremen, 9 cts. per ft. of single track. The total cost of labor per ft. of single track was $2.19.

The item of excavation seems high but as it consisted partly in breaking up and removing a section of 4600 ft.



ONE TRACK READY FOR PAVING; OLD 7-IN. T-RAIL TO BE REMOVED FOR SECOND TRACK

of "Silicia-Barytic" pavement, and old patented concrete pavement about 6 ins. thick, upon which asphalt was subsequently laid, and about 1000 ft. of Telford pavement with foundation of building stones set on edge, the cost is not excessive.

The wages paid per hour for labor are as follows: Foreman in charge, 30 cts.; track foreman, 27½ cts.; foreman on excavation, 25 cts.; concrete foreman, 25 cts.; teams with patent dump wagons, 45 cts.; with common wagons, 40 cts.; track men, welding helpers and concrete surfacers, 17½ cts.; common laborers, 15 cts.

Later we built 1500 ft. of double track construction, using Lorain Sec. 95-400, a 7-in. T-rail with 3-in. head and 6-in. base, the T-rail that is recommended by the committee on standard rails of the American Street & Interurban Railway Association for use in paved streets. We used the same type of concrete and steel tie construction on this work. The center strip is 6 ft. wide on this work and 5 ft. on the girder-rail construction previously described. Instead of using an Arthur hump block in paving against this rail on the flange side a standard Metropolitan block was used under and parallel with the head, packing the block in place with a slightly moistened mixture of one part cement and

four parts sand, using a block of wood as a tamper. A flangeway was formed by laying blocks at right angles to and with top surface ¾-in. above those under the rail head. The total cost of labor per ft. of single track was $2.207, or about 2 cts. more than the girder track construction. While there was 2 ins. less excavation in depth than with the 9-in. rail the total width of trench was 1 ft. more, due to the wider center strip and there was an average of 1 ft. extra excavation in depth on account of the readjusted grade being lower than the original surface of the street.

MAXIMUM LENGTH OF SERVICE FOR POLES, TIES AND TIMBERS

BY EDWARD J. WEIHE.

The reduction of depreciation and the cost of maintenance by securing a greater length of service for wood poles, ties and timbers, is a subject that is forcing itself rapidly upon the management of public-service properties. In justice to the future dividends of these properties, definite action can no longer be deferred, yet the busy manager and his heads of departments often find little time to sift so seemingly abstruse a problem. The writer believes he can do them no greater service than to present the facts essential to a thorough understanding of this subject.

THE STRUCTURE OF WOOD

On examining the cross-section of a tree, we notice, first, a light colored wood next to the bark, and next to it, a darker colored wood that extends to the center of the tree. The darker or heartwood is mature wood and differs from the lighter wood in that it is no longer active in the production of growth. It is much more dense; its cell-walls are thicker; its cells contain more resin and tannin and less water, albumins, sugars and starches. The lighter or sapwood is the growing wood. Each year it adds a little to the diameter of the tree by what is seen as a ring. As time passes the inner rings of sapwood become transformed into heartwood. The sapwood is, therefore, the soft, nutritious wood, full of water, sugars, starches, albumins, etc.

If a very thin cross-section of wood is held to the light, we see that each ring is made up of minute pores. If we place a very thin longitudinal section of wood under the lense of a microscope which will magnify the object examined several hundred times, we find that these pores are really cross-sections of cells that are many times as long as they are broad and taper to a point at each end. The sides of these spindle-shaped cells cohere firmly by what is called the middle lamella, and "break joints" by over-lapping each other. In this way they form the long tough fibres of wood. Such an aggregation of cells is called wood-tissue or cell-tissue. A conspicuous example of simple cell-tissue may be seen in the pulp of an orange, and gives some idea of the appearance of the microscopic cells of wood-tissue as they appear when highly magnified. In hard woods the walls of these cells are very thick as well as dense, while in soft woods they are much thinner. Differences in the strength of timbers are due to differences in the form and disposition of these cells.

Although the highest magnifying power that can be brought to bear on wood-cells fails to reveal any apertures in their walls, they are readily permeable to certain liquids. The cells must, therefore, be porous, not only in the sense of having an interior cavity, but also in having in their apparently imperforated walls, innumerable channels through which liquids may pass. The energy with which wood-cells absorb water may be gathered from a well-known fact. In granite quarries long blocks of stone are split by driving plugs of dry wood into holes drilled along the desired line of fracture and pouring water over the plugs. The liquid penetrates the wood with immense force, and the toughest rock is easily broken apart.

HOW WOOD DECAYS

Not until the epoch-making researches of Pasteur and his school was it positively understood that decay is due to low forms of plant-life called fungi. The toadstool, mushroom and bracket-fungus are familiar examples of fungi of large size, while ordinary mould and mildew are examples of the smaller kinds.

At the proper season these fungi give off clouds of microscopic, dust-like substances, as seed, called spores, and the wind blows them in all directions. These spores must have water, air, food supply and some heat in order that they may grow, and these conditions are generally fulfilled when they come in contact with unprotected wood. Once in contact, they begin to secrete a substance known as an enzyme. This enzyme has the power to dissolve its way through the cell-walls of the wood, where it converts the sugar, starch and albumin into soluble form. The spores of the fungus absorb this converted matter, and, having taken food, they grow. The single cells which constitute the spores, at first elongate and then divide by cleavage. The newly formed cells again divide, and soon we have numerous thread-like bodies instead of the original spores. This goes on with great rapidity and these threads form a net-work, called a mycelium, which invades the wood-tissue in all directions. Layer by layer the new or sapwood gives up its food elements, each year's growth of wood presenting a slightly greater barrier to fungus, until it reaches the darker or heartwood. This, as explained, contains less food and harder cell-walls and consequently the fungus makes slower, though equally certain progress, until all of the wood is consumed.

There are a great many kinds of fungi. Some confine their action to one set of food elements in the wood; while others attack certain other constituents, but all have the same general method of action.

SEASONING OF TIMBER

As already stated, there are four conditions essential to the growth of the fungi which cause decay. Therefore, if we take away either of these four essential conditions, we prevent decay. For instance, if we place wood entirely below the surface of water or several feet below the surface of the ground, we exclude one of the conditions, air, and the wood will not decay. If we take away the condition of moderate heat the wood will not decay. Below 32 degs. F. and above 150 degs. F. no decay occurs. If timber is cut at that season of the year when it contains the least amount of sap, which forms the food-supply of the fungi, its length of service will be materially increased. Likewise if we thoroughly dry the wood by proper seasoning, we exclude the water condition necessary for the fungi to grow, and the wood resists decay.

Timber seasoning is therefore a most practical method of increasing the life of both untreated and treated timber. At the same time it forms the most important preliminary step to successful chemical treatment, while its cost in interest on investment and labor is insignificant, considering returns. Furthermore, seasoning saves considerable in freight charges when it becomes necessary to ship timber

long distances. Green wood contains upwards of 50 per cent water, but when exposed to the sun and air the water rapidly evaporates, until, in its thoroughly air-dried state, but 15 to 20 per cent remains. The space occupied by the evaporated water is replaced by air, which occupies as high as 60 per cent of the bulk of seasoned wood. Seasoning results in considerable shrinkage in the contents of the cells of wood, making more space for the preservatives to enter, and the starches, sugars, albumins, etc., so dessicated, do not invite attack by the fungi.

PRECAUTIONARY MEASURES

All timbers should be removed from the vicinity of decaying wood as soon as it is cut and the bark removed. The timber should then be piled so as to allow the greatest amount of air circulation between the pieces and, in rainy districts, so that the upper pieces will form a roof. Any piece showing signs of decay should be immediately removed, as one unsound piece will infect the whole pile. Storage yards for ties, poles and timbers should have ground covered with cinders, gravel or "dead sand," and be well drained. All vegetation should be kept down and all decayed wood should be promptly removed and burned.

Seasoning increases the strength of all timber. Steaming weakens all timber. Ties should be air-seasoned from six to twelve months before chemical treatment, depending on the kind of wood used. Poles should be seasoned as long or longer, depending on diameter.

The treatment given to each piece of timber should be varied, according to its dryness. Tie timbers should be halved or quartered, treated and, when layed, turned heart side down. No trimming, framing, boring or cutting should be allowed after timber has been treated unless such parts are again treated to as much preservative as will be readily absorbed.

Dogs, pike-pole points or cant-hooks should not be used on those parts of treated poles or piles which enter the ground or water. The use of tie-plates and the adoption of screw-spikes, as recommended in Bulletin 50 of the Forest Service, will prove a great economy. No strips of iron or plates should be fastened tightly on the bases of poles as is often done to protect them from mechanical injury, as this induces decay by confining moisture in the parts so covered. If plates are necessary they should be attached in such a manner as to leave an air-space between the plate and the surface of the pole.

All of these suggestions are easily carried out, cost practically nothing and will produce a very material increase in the length of service of ties, poles and timbers.

CHEAPER TIMBERS AVAILABLE'

The following is a list of the cheaper timbers available for railway purposes:

Northern & Eastern U. S.	Central U. S.	Western U. S.
*Red Oak Family.	*Red Oak.	*Loblolly Pine.
*Loblolly Pine.	*Swamp Oak.	*True Firs.
*Chestnut.	*Loblolly Pine.	*Yellow Pine.
Carolina Pine.	Hemlock.	*Lodgepole Pine.
Hemlock.	Black Gum.	Tamarack.
Maple.	Beech.	Hemlock.
Beech.	Tamarack.	Eucalyptus.
Birch.	Cottonwood.	
Ash.		
Elm.		

N. B.—Those marked with a star should receive most consideration.

By proper treatment these timbers can be made to replace successfully the now prohibitively high-priced woods, such as white oak, longleaf pine and cedar. The red oaks and black oaks have every quality of an ideal tie when properly treated.

Most of these timbers are quite porous and take treatment readily. Loblolly pine, red oak, birch and Norway pine take treatment easily, while hemlock, tamarack, spruce and Douglas fir are among the refractory timbers. The latter, however, yield to treatment by longer heating during treatment. Dense timbers, if difficult to penetrate, are also slow to lose the preservative.

PRESERVATIVE TREATMENT

With the knowledge of what has already been said about the structure of wood and the causes of decay, we can easily see that if we can introduce substances into the wood-tissue that have a poisonous action on fungus life we shall prevent decay as long as those substances exert this influence in the wood. An effective preservative must therefore be powerfully antiseptic and its nature must be such as not to injure the wood fibers. To remain in the wood it must not be volatile or capable of being leached out by water. Furthermore, the preservative should have great penetrating power.

Going carefully over the history of wood-preserving, both here and abroad, beginning with the railway era, we are lead to the conclusion that, of more than 200 substances tried for the preservative treatment of timber, the test of time has eliminated practically all but two: coal-tar creosote and zinc chloride.

Data extending over more than fifty years show that these substances, when properly applied, will double the life or durability of wood. They are now used to the practical exclusion of all others, both here and abroad. Creosote comes nearer to being an ideal preservative than zinc chloride. The solubility of the latter in water proves a detriment for some exposures, but when used in combination with creosote this objection is overcome. The zinc chloride must be free from hydrochloric acid and iron.

The creosote, tar-oil, dead-oil or heavy-oil, as it is variously called, must be the product of coal-tar and free from any form of petroleum. Only the heaviest oils should be used. Those containing a considerable percentage of anthracene, acridine, etc., are best.

Redistillation of creosote oil, by accurately gaged temperatures, to secure that fraction of the oil which contains the greatest amount of active principles, is now gaining headway in this country and renders it possible to get the full value of this oil for application in a concentrated form.

APPLICATION OF PRESERVATIVES

There are various methods of applying wood preservatives; many require elaborate and expensive plants and for this reason are out of the question for general adoption. For well seasoned and dry wood the brush method is commonly used. This consists in applying two or three coats of the hot or cold preservative with a wire-bound brush. Dipping convenient-sized pieces in the hot or cold preservative is also productive of good results on well seasoned wood.

But for wood that is to be placed in contact with or in the ground, and particularly where partially seasoned wood only is available, what is known as the "open-tank method" of application is rapidly replacing other methods. The cost of installation brings it within the reach of every public service property, and by it poles, posts, ties and timbers may be treated economically and effectively.

THE OPEN-TANK METHOD

This method requires an open tank, made preferably of

¼-in. steel or iron and arranged so that a fire can be built underneath it, or, better still, so that it may be equipped with steam coils.

Sufficient preservative is run into the tank to cover the portion of the timber which is to be treated, and the temperature of the liquid is raised and maintained between 100 and 110 degs. C. for several hours—three to six hours generally for seasoned wood, depending on its character and condition.

We know that air occupies as high as 60 per cent of the bulk of seasoned wood. According to the familiar law of physics, air expands 1/273 its volume for every degree C. that it is heated. Consequently when we heat the timber in the preservative from about 20 degs. C. to slightly above 100 degs. C., the air in the wood expands about one-third in volume and, in forcing its way out of the wood, expels much of the moisture from the cell walls. This air rises to the surface of the hot preservative in the form of small bubbles and the moisture leaves the oil in the form of vapor.



MEMBERS AND ESCORTS OF THE ROYAL COMMISSION

After the timber has been heated a sufficient length of time the heat is shut off and the preservative is allowed to cool, or, better still, the timber is taken out of the hot preservative and submerged immediately in a tank of cold preservative. The air still in the wood now rapidly contracts and tends to form a vacuum, which draws in the preservative with considerable force, securing deep and thorough penetration. The depth of this penetration can, to a degree, be regulated by the length of time the timber is allowed to remain in the cold preservative. A lateral penetration of half an inch may be obtained in poles by this method.

For timbers too large to be transferred during treatment the plant should consist of a treating tank, a supply tank and a receiving tank. This equipment will make it possible to shorten the treatment by running out the hot liquid into the receiving tank and admitting the cold liquid simultaneously from the supply tank. The preservative can later be pumped back into the supply tank.

Given a high-grade preservative, carefully applied by this simple method to wood that has been allowed some time to season, an increased life many times greater than the cost of treatment is positively assured.

ROYAL COMMISSION OF GERMANY AT SPOKANE

The royal German electric railway commission, whose trip to the United States was noted in these columns several weeks ago, was very much interested in the single-phase system of the Spokane & Inland Railway. The commissioners were entertained in the absence of President Graves by other officers of the company, Vice-President A. L. White, Wm. F. Zimmerman, J. B. Ingersoll and F. H. Shepard, special representative of the Westinghouse Company. The party was taken in the president's special car 40 miles south to Spring Valley Junction, the round trip being made in a little over two hours. Upon the return the Commission inspected the Inland's big electric freight locomotives. A train of fifteen standard freight cars was attached to one of the electric locomotives and taken as far south as Moran Prairie on a 2 per cent grade. Several stops were made and the members of the Commission were amazed at the ability of the locomotive to stand the heavy overload without the least damage to the apparatus.

PERSONNEL OF THE COMMISSION

The Royal Commission visiting Spokane was in charge of Geheimrat Wittfeld. Other members of the Commission were Director Friedrich Jordan, of Felten, Guilleaume, Lahmayer Company; Director Emmerich Frischmuth, of Siemens Schuckert Company; Director Philip Pforr, of the Allgemeine Elektricitats Gesellschaft, and Dr. Ing. Walter Reichel, eminent engineer and professor of electricity in the Berlin Polytechnic School.

Speaking for the members of the Commission, Geheimrat Wittfeld said: "We were very agreeably surprised in Spokane and the surrounding country. It seems almost incredible that all these fine buildings could have been built and the city grown to nearly 100,000 population in twenty-five years. We have read much about the success of the new Spokane & Inland Railroad, which has been commented upon in the German press, and what we have seen here has more than repaid us for coming across the continent. The substantial and permanent construction of the road, especially the overhead work, and the completeness of detail, is also a surprise to us. Taken altogether the Spokane & Inland is undoubtedly the best equipped electric railroad of equal mileage in the world."

During the trip several of the party were photographed while standing on one of the locomotives. This photograph is reproduced herewith. The gentlemen shown, reading from right to left, are Messrs. Pforr, Wittfeld, Zimmerman, Jordan, Randall and Ingersoll. Geheimrat Wittfeld and party have already investigated the New York, New Haven & Hartford Railroad and the Erie Railroad in the East, and are now returning by San Francisco and the southern route.

IMPROVEMENTS AND EXTENSIONS ON THE INDIANAPOLIS & CINCINNATI TRACTION COMPANY'S LINES

The original Indianapolis-Rushville line of the Indianapolis & Cincinnati Traction Company now represents less than half the mileage of the lines operated by the company. The line of the Indianapolis, Shelbyville & Southeastern Traction Company from Indianapolis to Shelbyville, has been leased and this together with a 17.21-mile extension to the Rushville division and an extension of 21.24 miles to the Shelbyville line is now operated by the company. Excluding 4 miles of city track in Indianapolis, over which the cars are run to the Indianapolis Traction & Terminal building near the center of the city, the system has about 100 miles of track. The lines are operated from executive offices in Indianapolis by Charles L. Henry, general manager, through whose courtesy the following account of the improvements and extensions on the system is presented. The operating offices are at Rushville.

In addition to the construction of the two extensions that on the Rushville division from Rushville to Connersville, and that on the Shelbyville branch from Shelbyville to Greensburg during the past year the old portion of the Shelbyville line has been changed over for alternating current operation, and extensive changes in the roadway have been made to cut out sharp curves. Other improvements on the system consist in additions and changes in the power-house at Rushville, and abandonment of the old Shelbyville power-house, the construction of a cross-country high-tension line from Rushville to Shelbyville and a complete alternating current feeder system for the Shelbyville line.

A substantial brick freight station has been built at Rushville, a brick building which serves as a car house and freight depot has been erected at Greensburg and combination passenger and freight stations with living quarters

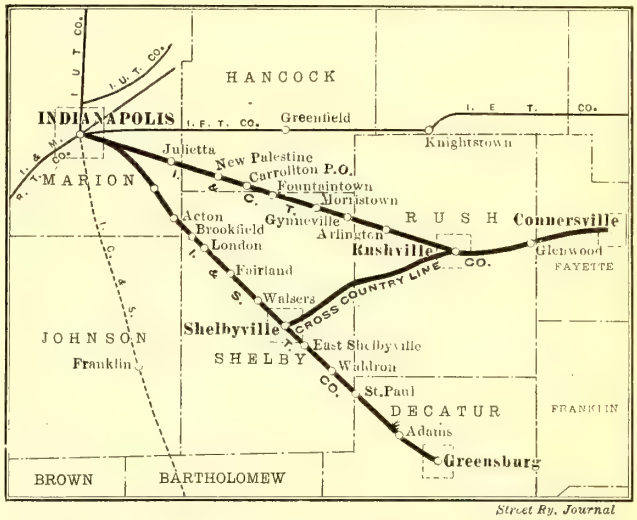


OVERHEAD CONSTRUCTION AT A CURVE ON THE RUSHVILLE LINE

for the agent have been constructed at several of the more important stations along the line.

THE CONNERSVILLE EXTENSION

Of the two extensions that to Connersville is the most interesting from an engineering standpoint, because of the rough country through which it was pushed. The heaviest grading was necessary at Williams Creek, about ten miles west of Connersville, where there was a variation in the level of the unbroken ground of 150 ft. in one-half mile. At this point a concrete arch with a 50-ft. waterway was built over the creek, and a fill 65 ft. high was made. The arch has an 80-ft. parapet wall. The fill, which was made wide enough for a double track, is about 900 ft. long and contains approximately 65,000 cu. yds. of earth. The dirt for the fill was obtained from heavy cuts at each end; the



MAP SHOWING ROUTE OF THE INDIANAPOLIS & CINCINNATI TRACTION COMPANY



VIEW ON THE CONNERSVILLE EXTENSION, ILLUSTRATING OVERHEAD CONSTRUCTION AT SIDINGS

cut at the west end being about 30 ft. deep. At another point on the line a 30-ft. concrete arch was built.

The Pennsylvania steam railway between Rushville and Connersville makes a detour to the north to avoid the rough country, with the result that the electric route is about three miles the shorter between the two towns.

The Greensburg extension of the Shelbyville line passes through comparatively level country. The only noteworthy

structure on this line is a viaduct over the Flat Rock River near St. Paul. The central portion of the steel structure is carried by two concrete piers built up to a point about 20 ft. below the track.

The Connersville extension is built on a private right of way 66 ft. wide. As in the construction of the portion of the line from Indianapolis to Rushville, the extension has been built with a view of ultimately double tracking it. For practically the entire distances a roadway 28 ft. wide has



GLENWOOD SUB-STATION ON THE CONNERSVILLE EXTENSION

been built. The cuts are 36 ft. wide at the bottom. Provision is made for double tracks with 14-ft. track centers and center-pole trolley construction.

The roadbed on both extensions is ballasted with 8 ins. of gravel under the ties, the ballast being obtained from gravel banks along the line. The ties are of white or burr oak placed two feet apart. The rails are 70 lbs. and are in 60-ft. lengths. They are laid broken.

The maximum grades on the new extensions, and these are on the Connersville line, are 3 per cent. Every advantage was taken of the topography of the country to make these velocity grades. There are no curves on them, with the result that no braking of the cars is necessary, and there is no loss of energy due to them. Vitrified clay pipe served for waterways up to 36 ins. in diameter, and cast-iron pipe was used for openings from 3 to 5 ft. in diameter. The larger waterways are of concrete construction. On the old portion of the Shelbyville line the direct-current trolley and feeder construction were entirely removed and were substituted by a bracket catenary construction practically identical with that on the old Rushville division. As on the old division an independent pole line was erected to carry the high-tension feeders to the transformer stations, and the same catenary and high-tension construction employed on both the new extensions. The trolley poles are 40 ft. high and are placed 120 ft. apart. At the top a cross arm carries four telephone wires which are transposed every fifth pole. The brackets, which are made somewhat heavier than those on the original Rushville line, consist of an angle iron with a right-angled bend for attachment to the pole at one end and a loop over which the porcelain messenger insulator is supported at the outer end. The trolley is placed 18 ft. high and is suspended on tangents from the messenger by hangers placed 10 ft. apart. The hangers vary in lengths from 11 to 6 ins. The trolley is protected by Westinghouse lightning arresters placed one-third of a mile apart and are grounded to a ¾-in. iron pipe driven into the ground. The poles of the high-tension lines are 35 ft. high and are placed 115 ft. apart.

ADDITIONS TO POWER HOUSE

In the original construction of the power station building at Rushville, two 500-kw units consisting of Corliss cross-compound engines and Westinghouse generators were installed and space was left for a third unit. In the meantime, however, the turbine has been developed and in the space left for the 500-kw unit two 1000-kw Curtis turbines will be installed. One has already been put into operation and the erection of the other will soon be completed. To the original installation of the three boilers in the boiler room five more have been added. The new boilers as well as the old ones are of the B. & W. type and are each 350-hp capacity. The first boilers were provided with natural gas burners in the front. Within the last few years, however, natural gas has failed rapidly and cannot now be depended



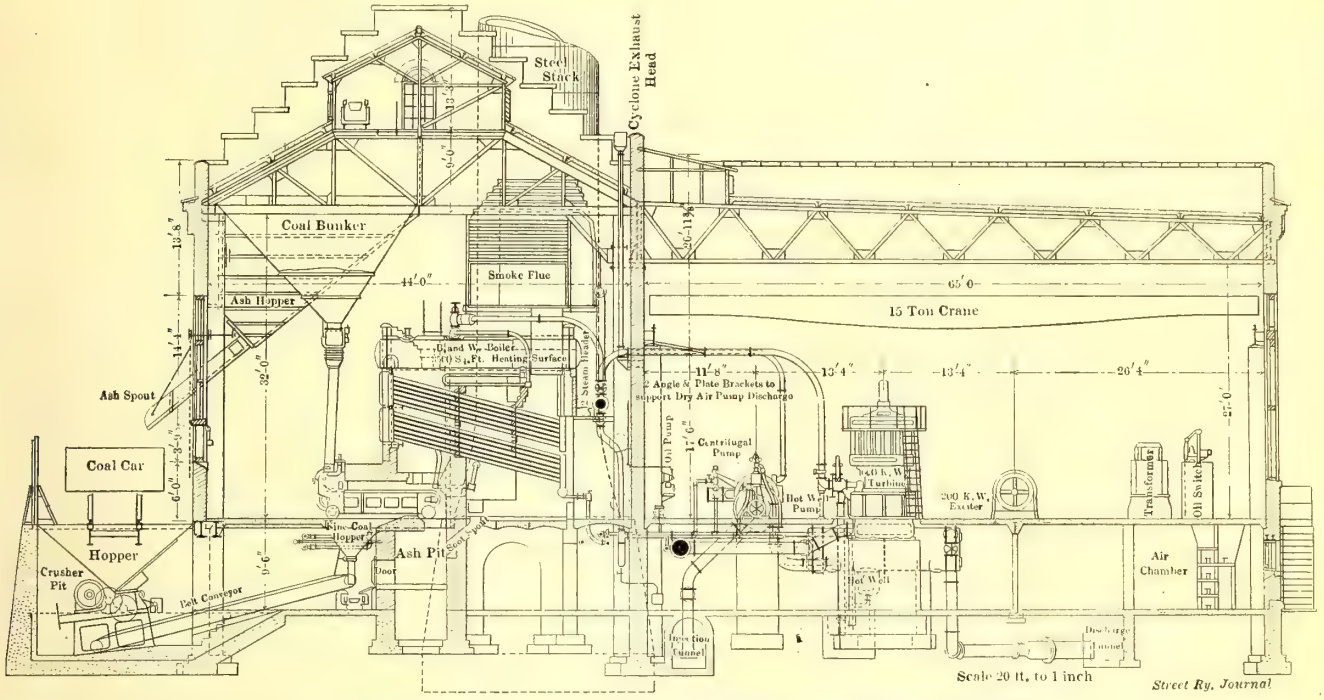
HIGH TENSION AND TROLLEY POLE LINES ON THE CHANGED-OVER SHELBYVILLE LINE

upon with certainty. The gas burners have been changed to the side of the boilers, and the new boilers as well as the old ones have been provided with B. & W. chain grate stokers.

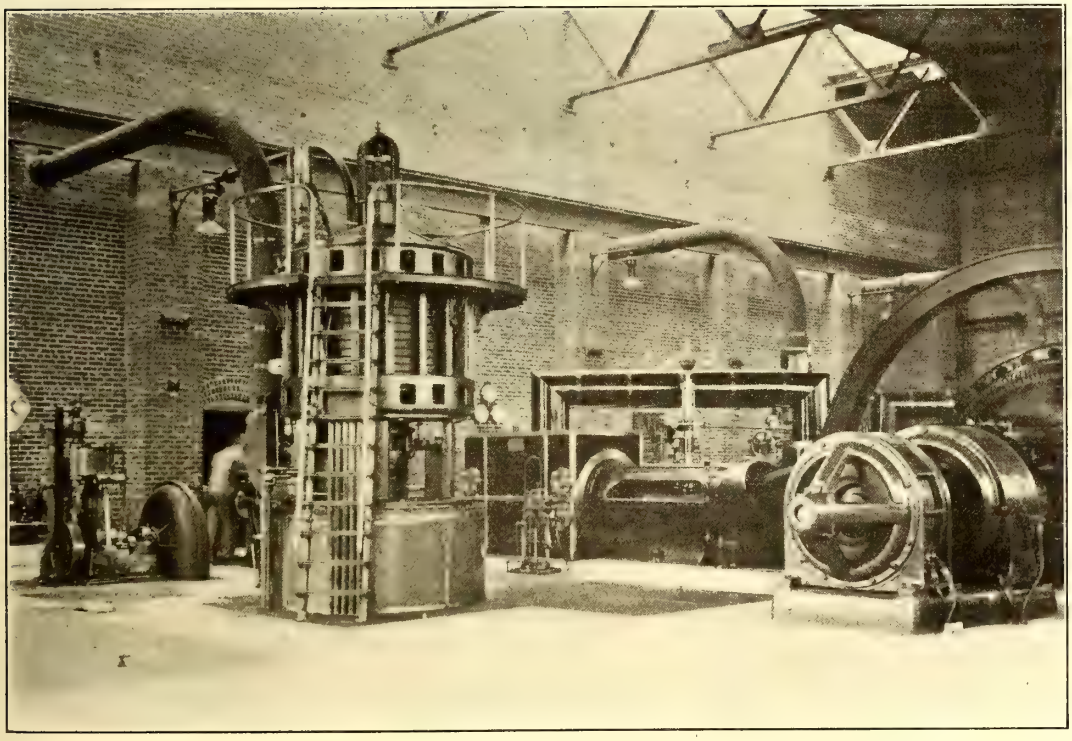
A complete coal-handling plant, including overhead storage bunkers of 450 tons capacity, has been erected by John A. Mead. A coal track runs parallel to the boiler-room wall on the north side. At a point midway of the length of the building a steel hopper is placed under the track. Be-

low this is a motor-driven crusher. A transverse belt conveyor carries the coal from the crusher to a longitudinal bucket conveyor which makes a complete loop, passing along the basement floor under the ash doors, along the end walls of the boiler room and over the coal bunkers. An ash hopper installed between the bunkers has a chute extending over the coal track outside the building and the bucket conveyor is employed to elevate the ashes from the basement and discharge them in this hopper. The coal handling plant, which is all driven by direct-current motors, has a capacity for 40 tons per hour. The turbine installed has its exhaust below the engine-room floor. The auxiliaries are all steam-driven and with the exception of the Wheeler surface condenser, are located above the engine-room floor. A 12-in. centrifugal pump driven by a vertical engine, supplies injection water from a concrete tunnel under the basement floor. The dry vacuum pump is of the horizontal type.

The hot well pump of the vertical type has its steam cylinder just above the engine-room floor. An additional



CROSS-SECTION OF RUSHVILLE EXTENSION TO POWER STATION



1000-KW TURBINE IN THE INDIANAPOLIS & CINCINNATI POWER HOUSE

motor-generator exciter set of 100-kw capacity has been provided for the turbines, and for each machine a bank of two 500-kw Scott connected three-phase to two-phase tension feeders leav- been installed.

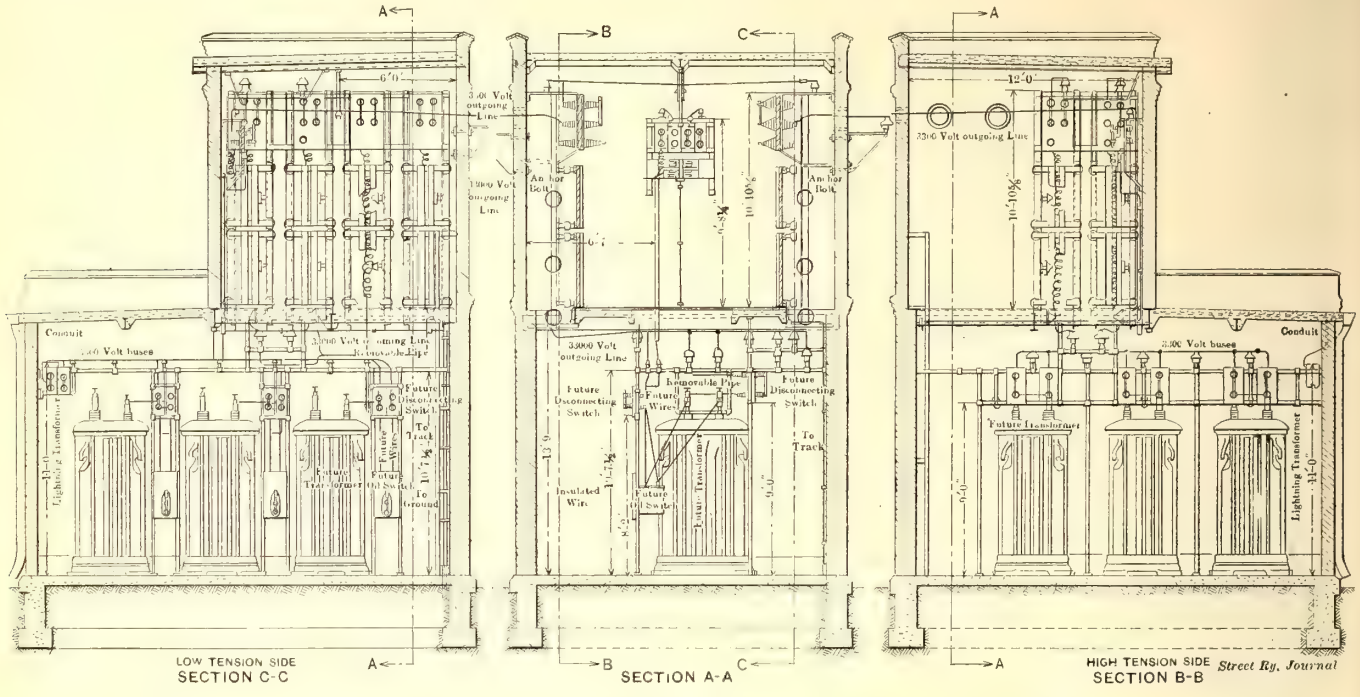
NEW HIGH-TENSION FEEDER SYSTEM

The new high-tension feeders leaving the station consist of a 33,000-volt single-phase line to supply the one new transformer station on the Connersville extensions and the cross-country line to Shelbyville, which feeds the transformer stations on the Shelbyville division. This cross-country division, which consists of a 2-phase, 4-wire line, on 35-ft. poles is about 18 miles long and follows the Pennsylvania Railroad for practically the entire distance to Shelbyville. It terminates in a switching station in the old Shelbyville power house from which practically all of the generating apparatus has been removed.

The bus-bars in the switching station are connected to

both the incoming and outgoing feeders by 33,000-volt hand-operated oil switches. The switching station also contains a complete installation of lightning arresters and a 300-kw transformer for supplying current to the Shelbyville repair-shop motors. Two single-phase lines, each of No. 4 copper, go in each direction from the switching station to the transformer stations which are located at New Bethel, Fairland-Prescott and Adams. As the alternating-current portion of the line is 46 miles long, the average distance between stations is approximately 9 miles.

The station buildings are of brick and concrete construction and are provided with steel shutters. They differ from the older stations in that the upper portions containing the lightning arresters do not continue the full depth of the buildings. The upper portions of the two stations nearest Shelbyville, those at Prescott and at Fairland, are built large enough to allow the high-tension lines feeding the more distant sub-stations to pass through them. Disconnecting transformers. Space is left for a third one whenever the service requires its installation. The transformers are connected through hand-operated oil switches to the 3300-volt buses from which the trolley feeder is taken off. This



GENERAL ELECTRICAL ARRANGEMENT OF THE FAIRLAND SUB-STATION



NEW BOILERS, STOKERS AND BUNKERS IN THE RUSHVILLE STATION



A 50-FT. CONCRETE ARCH OVER BIG WILLIAMS CREEK

double-throw knife switches are provided which permit the through lines to be either disconnected or connected to feed the intermediate stations. The transformer equipment of each station consists of two 300-kw oil insulated, air-cooled passes out the front of the building at the height of the trolley and feeds directly into it through a triple car connection.

To provide for the high-tension feeders to the trans-

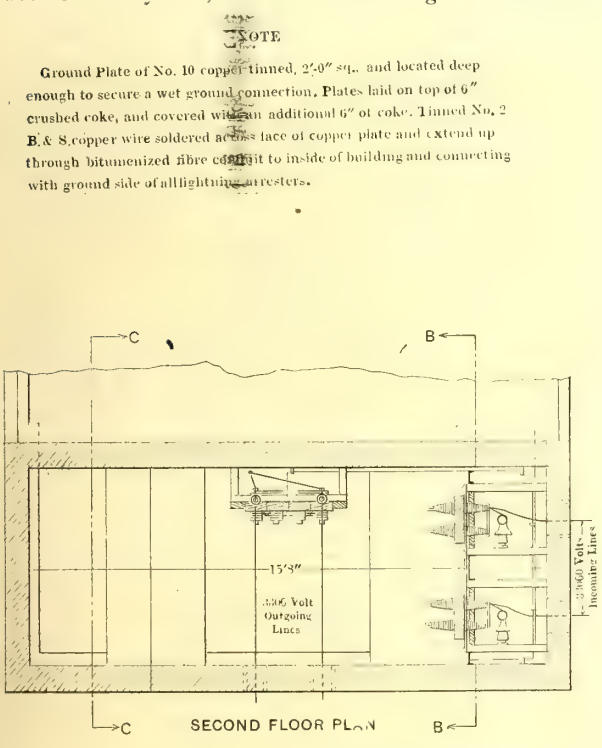
former station on the contemplated extension beyond Connersville to Cincinnati the one new sub-station on the Connersville division is built with the upper portion the same dimensions as the lower part. Provision is made for the entrance and exit of these through two-phase lines. This new station is located at Glenwood, about ten miles west of Connersville and just east of the deep fill at Williams Creek.

For operating the additional lines ten new passenger cars and four additional express cars have been added to the equipment. The new cars are equipped with four 100-hp No. 132 A a. c.-d. c. motors. All of the old motors have been removed from the old equipment and those of the new type substituted. The company now has twenty-four equipments of these new motors.

TESTING AND INSPECTION OF MATERIALS

All materials used in the work of constructing and reconstructing the lines were carefully inspected and tested. The track rails and the steel used in the power house and viaduct construction were inspected at the mills by R. W. Hunt & Company, and representatives of this company inspected the steel bridges during their construction. All the cement was tested by J. W. Moore, chief engineer of the system. Eight samples of cement were taken from each car and these samples were tested for fineness, tensile strength and initial set. In addition, the manufacturers were required to furnish mill tests of each batch.

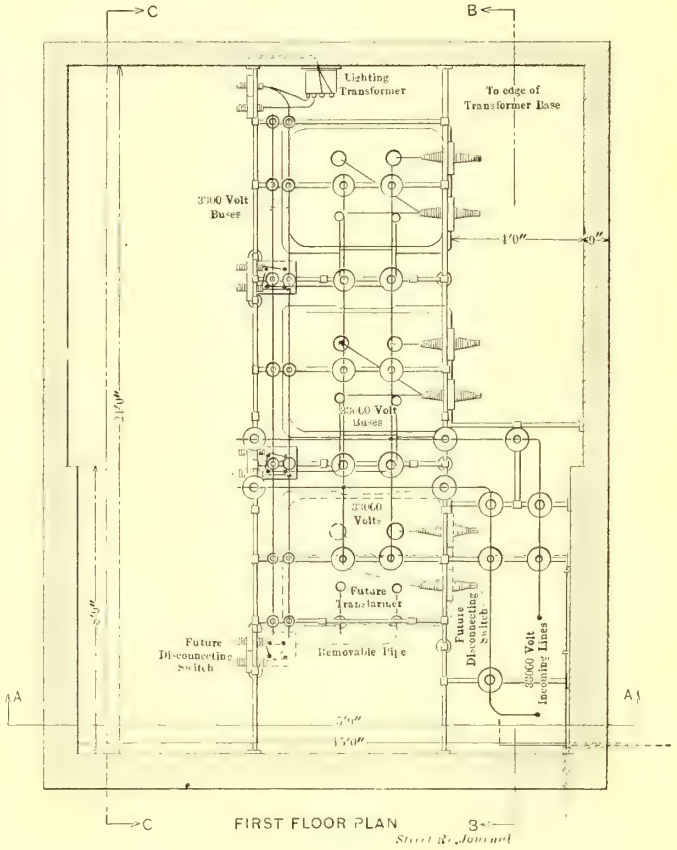
The power house improvements were made under the supervision of G. D. Nicholl, electrical and mechanical engineer of the system, who also had charge of the construc-



ECONOMY TESTS ON A 7500-KW WESTINGHOUSE-PARSONS STEAM TURBINE IN THE NEW YORK EDISON COMPANY'S WATERSIDE STATION NO. 2

The following data comprise the principal results obtained on Sept. 1, 1907, during an eight-hour economy test upon turbine No. 253, installed earlier in the year, at Waterside Station No. 2, of the New York Edison Company. This test was conducted entirely by the New York Edison Company, under the direction of J. P. Sparrow, chief engineer. The various arrangements therefor were carried out in accordance with a mutual agreement between builder and operator entered into previous to the test, and the results, as herein given, were obtained by independent computation.

The turbine unit tested is of standard Westinghouse construction throughout. It has a maximum rated capacity of 11,250 kw and was built to operate on 175 lbs. steam pressure, 28 ins. vacuum and 100 degs. superheat. Under these conditions the turbine unit was guaranteed to have a minimum steam consumption of 15.9 lbs. per kw-hour at the generator terminals, with a normal speed of 750 r. p. m. Incidentally, the electrical efficiency of the generator was guaranteed to be 97.8 per cent, exclusive of friction and



PLAN OF ARRANGEMENT OF ELECTRICAL APPARATUS IN THE ADAMS SUB-STATION

tion of the high-tension lines and the transformers stations. Sargent & Lundy were consulting engineers for the company and designed the sub-stations and the power-house extensions.

The headquarters of D. G. Edwards, vice-president in charge of traffic of the Morgan-Dolan-Schoepf electric lines, have been moved from Cincinnati to the new First National Bank Building in Columbus, Ohio.

windage, at a load corresponding to that sustained during the test. The results of the test detailed below show an economy about 7.5 per cent better than the guarantee.

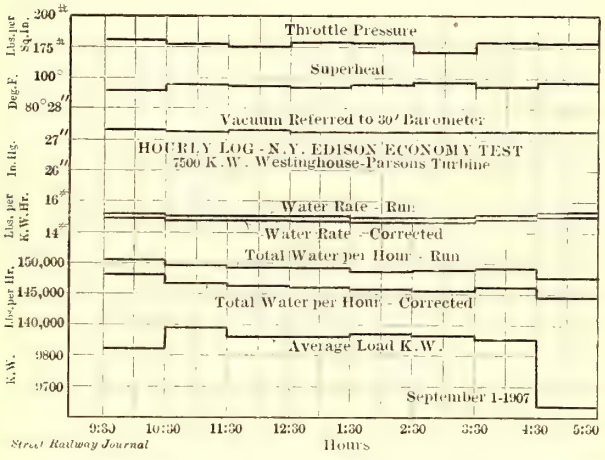
During the test period No. 2 Waterside Station sustained practically all of the 25-cycle load on the system, of which the unit under test carried practically 70 per cent, the remainder by the other turbine units in the station. This load was maintained as constant as possible by remote control of the turbine governor by the switchboard operator. Between the first and the last hours of the test the maximum

variation in load was held within 4 per cent above and below mean. During the last hour, however, the load decreased somewhat. Previous to the test this turbine unit had been running on a load of 7000 kw, which was increased to its test load ten minutse before the start.

Three-phase electrical load was measured by the two-wattmeter method, using two Weston indicating wattmeters of the standard laboratory type. These instruments were calibrated at the New York Electrical Testing Laboratories immediately before and after the test. Power factor was maintained substantially at unity, and all electrical readings were taken at one-minute intervals.

As a surface condenser was used in connection with this turbine unit, the water rate was determined by weighing the condensed steam delivered from the condenser hot well. This condensation was weighed in a tank mounted upon platform scales, with a reservoir above large enough to hold the condensation accumulating between each weighing.

These weighings of 12,000 to 13,000 lbs. each were made at intervals of five minutes. By using a loop method of connecting the gland water supply the necessity for correcting condensation by an amount equivalent to the weight of the gland water used, was avoided. A continuous gland



LOG OF TEST MADE ON TURBINE IN THE NEW YORK EDISON COMPANY'S WATERSIDE STATION NO. 2

water circuit was used entirely outside of the weighing apparatus, and all overflow from the standpipe was returned to the hot well delivery.

As the circulating water is quite salt, any condenser leakage may immediately be detected by the salinity of the condensed steam, which should be pure distilled water. On this account, condenser leakage was determined entirely by chemical analysis, employing the silver-nitrate test with a suitable color indicator. This method proved extremely sensitive, and possessed a decided advantage over the ordinary method of weighing the leakage accumulating during a definite period when the condenser is idle and under full vacuum. As samples of circulating water and condensed steam could be taken at the same time, this method made it possible to discover any change in the rate of condenser leakage taking place during the test, while the method of weighing above described provides only an average result during the period.

In this condensing plant, the delivery of the hot well pump is automatically controlled by a float valve in the interior of the hot well. This maintains the water level therein at a practically constant point, and hence no correction had to be made for difference in level of water in the hot well before and after the test.

Steam pressures and temperatures were determined close to the turbine throttle. As usual, the degree of superheat was obtained by subtracting from the actual steam temperature the temperature of saturated steam at the corresponding pressure carried at the time. All gages and thermometers were calibrated previous to the test. Both pressure and superheat were somewhat below the guarantee.

Vacuum was measured directly at the turbine exhaust by means of a mercury column with a barometer alongside for reducing to standard barometer—30 ins. This also obviates the necessity for temperature correction between the two mercury columns. During the test the vacuum was not maintained quite up to normal.

RESULTS OF TESTS

The following data represent the results of the tests, calculated for the conditions as actually run; *i. e.,* for instrumental errors only:

Duration of test	9:30 a. m. to 5:30 p. m.
Average steam pressure at throttle, lbs. per sq. in. gage	177.5
Average superheat at throttle, degrees F.	95.74
Average vacuum (referred to 30 barom.) in. mercury	27.31
Average load on generator, kw	9830.48
Average steam consumption, as tested, lbs. per kw-hour	15.15

Owing to the departure, during the test, from specific operating conditions upon which guarantees were based, it was necessary to correct the observed results by the following amounts:

Pressure (2.5 lbs. high) correction, 0.25; Vacuum (0.69 in. low) correction, 1.84 per cent; Superheat (4.25 degs. low) correction, 0.29 per cent.

These corrections were mutually agreed upon previous to the test as representative of this type of turbine. When applied to the observed steam consumption given above, the following results, representing contract conditions, are obtained:

Average corrected water rate during 8-hour test, 14.85 lbs. per kw-hour.

Guaranteed water rate, 15.9 lbs. per kw-hour.

Referring now to the accompanying log, it is interesting as a check upon the average figures above presented, to observe the results segregated into hourly periods, as shown. Here it will be noted that the load was considerably lower during the first and last hour than during the main part of the test. Neglecting, therefore, these two hours and considering only the six hours' period from 10:30 a. m. to 4:30 p. m., the results are as follows:

Average corrected water rate, 14.8 lbs. per kw-hour.
Equivalent water rate, 10.65 lbs. bhp-hour.
Equivalent water rate, 9.8 lbs. ihp-hour.

The two latter quantities are determined by applying conversion factors for generator efficiency and for internal losses.

In connection with these tests, a noteworthy agreement exists between the results noted and those previously obtained from tests of machines of similar design installed in the Manhattan Station of the Interborough Rapid Transit Company, New York, and the Long Island City Station of the Pennsylvania Railroad. At the same loads and with equivalent operating conditions the performances of the machines are almost identical. These economic results, while not exceeding in actual steam consumption the best records of European practice, yet are considered extremely good in view of the moderate operating conditions under which the test was conducted.

THE CHEMICAL LABORATORY AND THE ELECTRIC RAILWAY

During the past two or three years progressive managers have begun to realize that an intimate relation exists between the life of electric railway appliances and materials and their physical and chemical characteristics. The varying performances of different materials under the same general conditions, and the dissimilarities in behavior of even the same appliances and substances when subjected to substantially identical service tests have been shown clearly that nothing but a thorough scientific study of their physico-chemical nature in a chemical laboratory affords a certain basis for the preparation of specifications.

A highly developed organization of this character has been gradually built up in Boston during the past twenty years by Arthur D. Little, a consulting chemical engineer of that city; and as public service corporations, particularly electric railways and central stations, have received special attention from this laboratory and its staff, it is thought that a brief outline of the character of work undertaken in the electric traction field by this organization will be of interest at this time.

The offices and laboratory occupy two floors at 93 Broad Street, Boston, and the staff includes about twenty men, each of whom is a specialist in a particular field of research and practice. The organization includes eleven chemists, two chemical engineers, a bacteriologist, two mechanical engineers and two electro-chemists. Its object is to afford manufacturers, public service corporations, and large consumers generally the extensive laboratory facilities and special knowledge required for the initial control of the quality of their supplies and the most effective use of them thereafter. Experimental work, research and routine chemical work are also undertaken, thus constituting the laboratory the chemical department of the client's organization.

Perhaps the most important work thus far handled by the laboratory with respect to street railway practice is in connection with the fuel question. A coal department is a special branch of the organization, the objects of which are:

First, to furnish the client with a definite, trustworthy basis for determining what particular quality of coal is the most economical for him to buy and use.

Second, to insure by systematic inspections and analyses that the selected quality is in fact delivered.

Third, to advise regarding the most economical methods of storage and handling.

Fourth, to secure by expert control of fire-room conditions the most efficient results from the coal consumed.

To secure these results the plants are first inspected to determine conditions as to equipment, practice, and necessary limitations. This inspection includes a study of the coal or oil in use, temperature measurements, flue-gas analysis, and if necessary, complete boiler tests. The report submitted advises definitely as to the relative efficiency and actual money value of the coals used or offered, and the most effective methods of practice for each particular plant. The specifications prepared by the organization define accurately the quality of coal which will give the best results for the conditions. The quality of deliveries is controlled by inspection and analysis and the fire-room practice checked by subsequent vists and blank form records as conditions may require. The performance of grates and settings is also studied.

Under this system of control of deliveries and fire-room practice the client may reasonably expect economies equal to 10 to 30 per cent of the entire fuel account, while in connection with the purchase of coal a thorough knowledge is offered of market conditions, actual cost of production, variations in quality in different regions and mines, and records of companies as to failures in delivery. Both by analysis and by determination of the heating value of fuel samples the cost of the heat unit in the fuel supplied is figured, enabling the determination of the relative efficiency and economy of the different priced fuels. To illustrate this point random analyses of two samples of coal selling at different prices are given as follows:

	Sample No. 42,324	Sample No. 42,449
Moisture	0.94%	1.49%
Volatile	20.46	21.06
Fixed carbon	55.44	71.62
Ash	23.16	5.83
Sulphur	3.09	0.75
B. T. U. per pound of coal	11,815	14,739
Price at mine	$1.25	$1.40
" f. o. b. vessel, discharging port	3.80	4.10
Cost per 100 hp per day at mines	5.67	5.08
" " " " " " " port	17.22	14.88

Particular attention was called in this case to the high percentage of ash and low B. T. U. of the cheaper coal, which, reduced to dollars and cents, showed a difference of $2.34 in cost of generating 100 hp for one day at the point of delivery in favor of the higher-priced and higher-grade coal.

In all cases where analysis or calorimeter tests are made extraordinary care is observed in securing representative samples. An important part of the work of the coal department is, as hinted above, the scientific study of actual fire-room practice with the object of controlling the combustion processes in the best way to secure economy in fuel consumption.

Another important branch of Mr. Little's organization is the lubrication department, which is prepared to take charge of the lubrication account of any company on a yearly contract, and to assist in securing the most economical and efficient lubrication. The method is first to make an inspection of the conditions under which lubricants are stored, distributed and used in power houses and car barns; this is then incorporated in a report covering the operating conditions, together with recommendations as to any needed improvements in the methods of physical control of lubrication supplies. During the course of the inspection samples are taken of the oils and greases being used, these samples being forwarded to the laboratory for analysis and test to determine their quality and value. Should the composition and constants of these oils be not such as the laboratory would recommend, the organization drafts specifications defining the qualities of lubricants, which experience shows to be best adapted to the special requirements of the case. Purchases then made on these specifications ensure supplies of uniform quality at lowest prevailing prices. After the specifications have been submitted to several responsible dealers with requests for bids on a yearly contract, the samples are tested, the most suitable oils advised for purchase, and their use followed in the plants.

An illustration of the work carried out by the lubrication department for a large street railway system is outlined below. An exhaustive study of the lubricating conditions at 26 car houses was made with a view toward improving the

practice in the use of lubricants. The same oils were in use at all the barns, tests giving the following results:

Name	Sample No.	Gravity, Beaume	Flash Test	Viscosity	Cold Test
Journal oil	42,537	25.2	505° F.	277 at 130° F.	46° F.
Compressor	42,539	30.8	396° F.	141 " 100° F.	32° F.
Track	42,538	16.0	378° F.	224 " 130° F.	26° F.

These oils were of good quality, both in flash test and viscosity, but for winter use it would be better if the journal oil and compresser oil were 10 degs. lower in cold test.

At many of the car barns the condition of the various oil houses was not good. There was found a decided lack of care and economy in the use of lubricants. Economical methods were lacking, there were no tanks or drip pans, nor means of heating the oil houses in cold weather. The floors in many cases were covered with sand to absorb the drip oil, and buckets instead of cans were used. Some of the barrels depended upon wooden plugs in place of faucets. Wide variations in the oil consumption per car per month were found at the different car houses, as is shown by the following table:

LUBRICANTS PER CAR PER MONTH

No. Car House	No. of Cars in Daily Operation	Journal Oil, Gallons	Compressor Oil, Gallons	Motor Grease, Pounds	Gear Grease, Pounds
1	15	1.1	.66	6.6	1.66
2	12	1.2	..	4.1	1.2
3	65	3.5	.76	20.7	1.5
4	60	0.71	.9	11.2	.7
5	23	1.3	.43	6.5	3.2
6	87	1.7	.57	1.77	4.
7	17	.8	1.1	4.4	4.4
8	30	1.6	.8	5.8	5.
9	9	1.8	..	6.1	..
10	17	.7	.2	3.	.1
11	36	1.6	1.2	3.5	5.5
12	23	4.3	.8	13.	2.1
13	30	1.5	1.5	4.	4.
14	17	3.	2.	22.9	22.9
15	8	2.	..	9.3	5.
16	35	.57	..	1.4	..
17	6	1.6	.8	20.7	8.2
18	56	1.85	.47	7.6	8.4
19	11	2.3	1.0	7.6	2.2
20	19	5.2	1.3	5.2	28.5
21	21	9.5	4.75	38.1	..
22	5	1.	..	4.	..
23	19	1.5	..	20.	..
24	90	4.6	.8	2.4	8.9
25	22	1.3	.7	5.4	4.5
26	40	1.2	.5	10.	1.

The above data seem to indicate that the care given varied more than would be entirely accounted for by local conditions. All the cars used journal oil and motor grease, and the amounts ranged from less than 1 gallon per car per month to 11 gallons. Eight car barns used less than 5 lbs. of motor grease per car per month, and seven more than 10 lbs. each.

The report then discussed the cost of lubrication in detail, showing 18 cents for 1000-car miles, on the foregoing data, represented the approximate cost of lubrication based on the present consumption. It was then suggested that an exhaustive test be made in at least three barns to find out the minimum possible cost on the gallon basis as against the car-mile basis. A reorganization of oil houses was suggested as follows:

A. The larger oil houses should be provided with tanks of from 2 to 5-bbls. capacity, so arranged by means of a skidway, that the oil barrels can be rolled in over the tanks and emptied by gravity through the bung hole. Some means should be provided for heating in cold weather, either by steam heat or a small resistance coil under each tank.

B. Floors should be kept clean, and small drip pans provided to catch drips; the tanks should have key faucets.

C. Oil tanks should be provided for soaking the waste, so arranged with a tray having a perforated bottom, that the wool waste or yarn used for packing the journal boxes can be lowered into the oil and allowed to soak for 24 or 36 hours. When thoroughly soaked the tray should be lifted and the surplus oil allowed to drain from the waste before being used in the journal boxes. Elimination of some of the smaller oil houses, the systematic use of records at all car houses, and the use of oil instead of grease on all motor bearings were recommended.

The general duties of the laboratory include co-operation with purchasing agents in the preparation of specifications, testing deliveries thereunder, special studies of material which has best met service conditions or which has failed, studies of preservative treatment of ties, poles, cross-arms and the examination of special supplies, such as brasses, bronzes, bearing metals, car wheels, trolley ears, trolley wheels, rails (microscopic and chemical), iron and steel, solder, galvanized wire, copper wire, zinc, tin, metal poles, cross-arms, varnishes, paints, feed water, boiler compounds, drinking water, life coverings, belt dressings, cordage, etc. In the study of paints and varnishes the questions of specifications, analysis of samples, character of film with regard to protective ability, size and nature of pigment as influencing durability and covering power are considered, and in the study of cements chemical and physical tests are made, as well as studies of water-proofing compounds applied to cement structures. Conductivity tests of trolley wire, strength and tension tests on cables, resistances and insulating materials, and studies of d. c. and a. c. electrolysis in the field and in the laboratory are also matters within the scope of the organization. The laboratory is equipped with a large number of devices specially interesting to chemists, including a platinum-lined Atwater bomb calorimeter, coal-sampling apparatus, refractormeters, viscosimeters of several types, special facilities for carrying forward simultaneously multiple analyses and treatment, the new Ives calorimeter for matching and giving a numerical value to pigments and colors generally, electric ovens, special electric heaters designed by Mr. Little for use with inflammable liquids, paper testing machines, small motors for model apparatus, and so on in great variety. A large technical library and filing department complete the facilities of the organization.

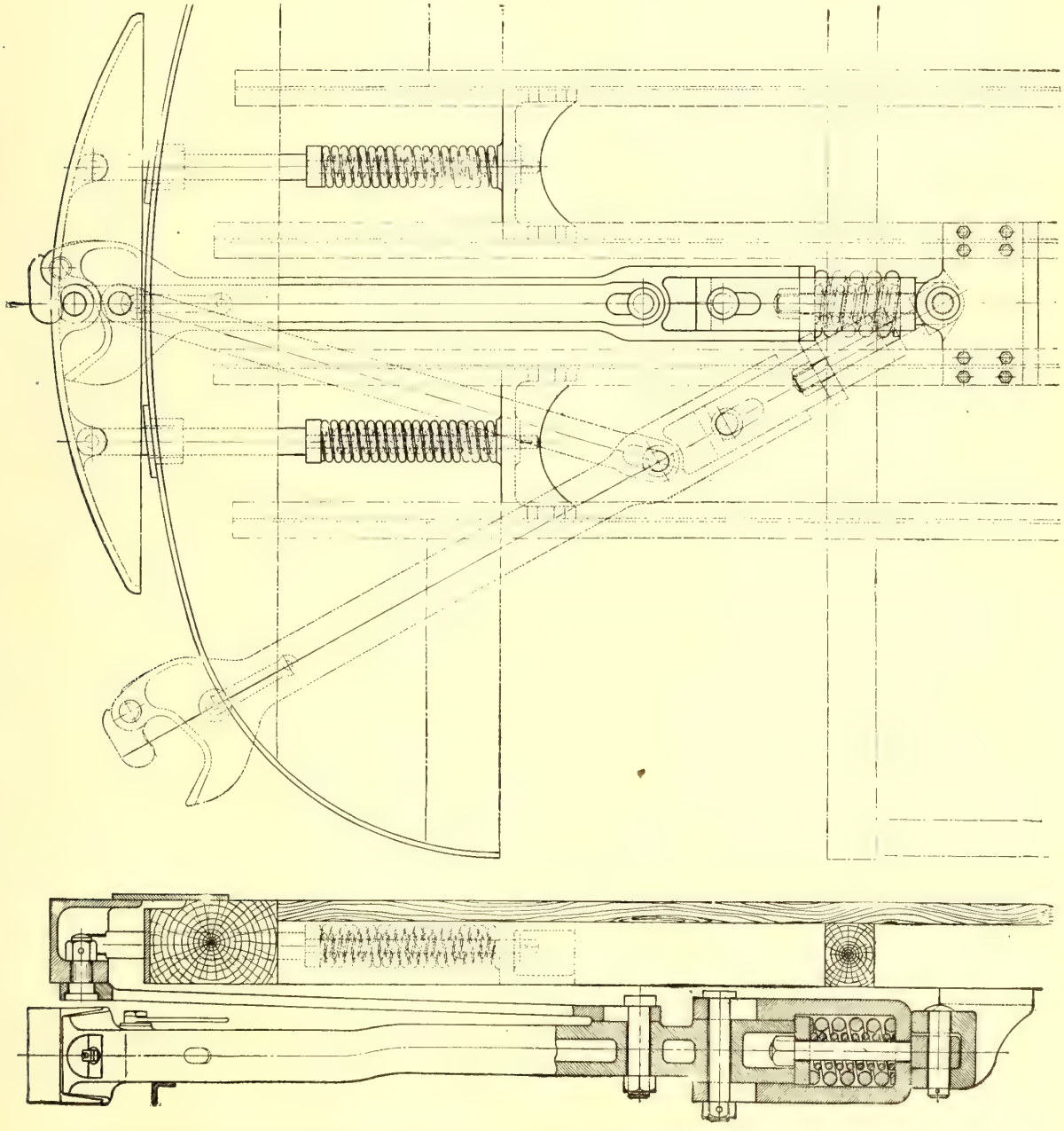
A TRUCK FOR HEAVY ELECTRIC SERVICE

Of special interest at this time is a new type of truck for heavy electric railway service designed by the New York Car & Truck Company, of Kingston, N. Y., along lines similar to those that have made for the success of this company's other products.

Briefly this truck is built on jigs, which are absolutely square, and is rigidly braced so it cannot possibly get out of alignment, with clearance and provision for taking up the wear at every point. The yokes are hand forged and machined and are provided with a channel-shaped wearing piece which protects the yoke from wear, making them practically indestructible. The truck is fitted with patented non-chattering brake shoe hangers of an approved pattern, over 5000 of which are now in operation, and it is especially adapted to use where a strong, easy riding truck is required to operate at high speed. The company now announces that it is in a position to make prompt deliveries of the new type of truck.

COUPLER FOR ELECTRIC RAILWAY SERVICE

An adaptation of the Janney M. C. B. type of coupler with radial movement, expressly designed for electric railway and interurban service, is being made by the McConway & Torley Company, of Pittsburg, as a result of the company's appreciation of the desirability of a close coupling and one which can be used interchangably with cars upon steam railroads, and as a result of the company's long experience with the Janney coupler, of which it is the sole manufacturer. The new coupler has a wide radial movement, meeting the requirements before mentioned, which is simple and easy to apply. The equipment has been worked out on the plan of using the full size M. C. B. contour coupler, but if desired, the same equipment can be made with coupler heads of the narrow gage type which are ¾ the size of the regular M. C. B. contour. It is the purpose of the company to have some model cars equipped with the coupler on exhibition at the convention of the American Street and Interurban Railway Association at Atlantic City.



PLAN AND SECTION SHOWING APPLICATION OF RADIAL COUPLER FOR ELECTRIC RAILWAY SERVICE

LOCATION OF EXHIBITS AT THE ATLANTIC CITY CONVENTION

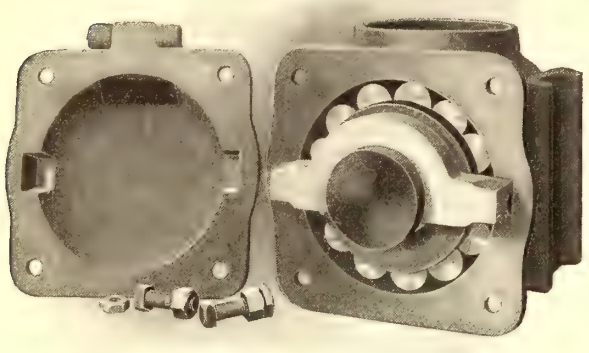
Preceding issues of the STREET RAILWAY JOURNAL have contained extended notices of the convention programme and exhibits. To enable the visitor to find the exhibits on the Steel Pier readily, a map is published on the inset supplement to this issue, showing the name and numbered location of every exhibit.

REPORT ON OHIO ELECTRIC INTERURBAN RAILWAYS

A tabulation of the reports of the interurban railway companies of Ohio, made by the State Railroad Commission, shows that the total capital stock of the companies is $115,000,000 and that the cost of the properties is approximately $171,500,000. The income of the companies for the year, in round numbers, was $5,000,000. Fifty-seven companies are operating, with a mileage of 2648. During the past year, eighty-three persons were killed and 1146 injured on the lines.

RECORD OF TWO TESTS ON A SYRACUSE CAR, TAKEN TO FIND THE SAVING IN POWER BY USING ROLLER BEARINGS

The theoretical saving to be secured by the use of roller or ball bearings has long been fully understood, but the actual benefits derived in practice are not so well known. Many tests have been made showing their value on ma-



VIEW OF ROLLER BEARINGS

chinery, but it is only recently that their use has been fairly tried in electric railway service. Some interesting results are now available regarding tests made on a trolley car in Syracuse, N. Y., for over four and one-half years. This car is fitted with the Merrick roller bearing, furnished by the Standard Roller Bearing Company, of Philadelphia. The bearing consists of a sleeve of steel which is slipped over and upon the ordinary car axle journal, without changing it in any respect, and upon which the rollers run, this construction preventing any wear whatever upon the journal. The thrust is cared for in the usual way by a "horseshoe" type of bronze thrust plate, so that no thrust is taken upon the rolls. It is simple in construction and has no parts that require special attention or care. An oil reservoir is provided into which the rollers run as they revolve around the shaft, and as they use very little oil, slight attention is required in this respect.

The great saving in power consumption is plainly indicated in the accompanying curves, covering the test run of two cars operated under practically the same conditions. The test was made on a three-mile run, which is nearly straight except for one short 90-deg. curve. Car No. 70 was equipped with roller bearings, while car No. 87 used the ordinary plain bronze bearings. The amperes and volts applied were measured by calibrated Weston meters and the power consumed included controller losses. Readings were taken every six seconds.

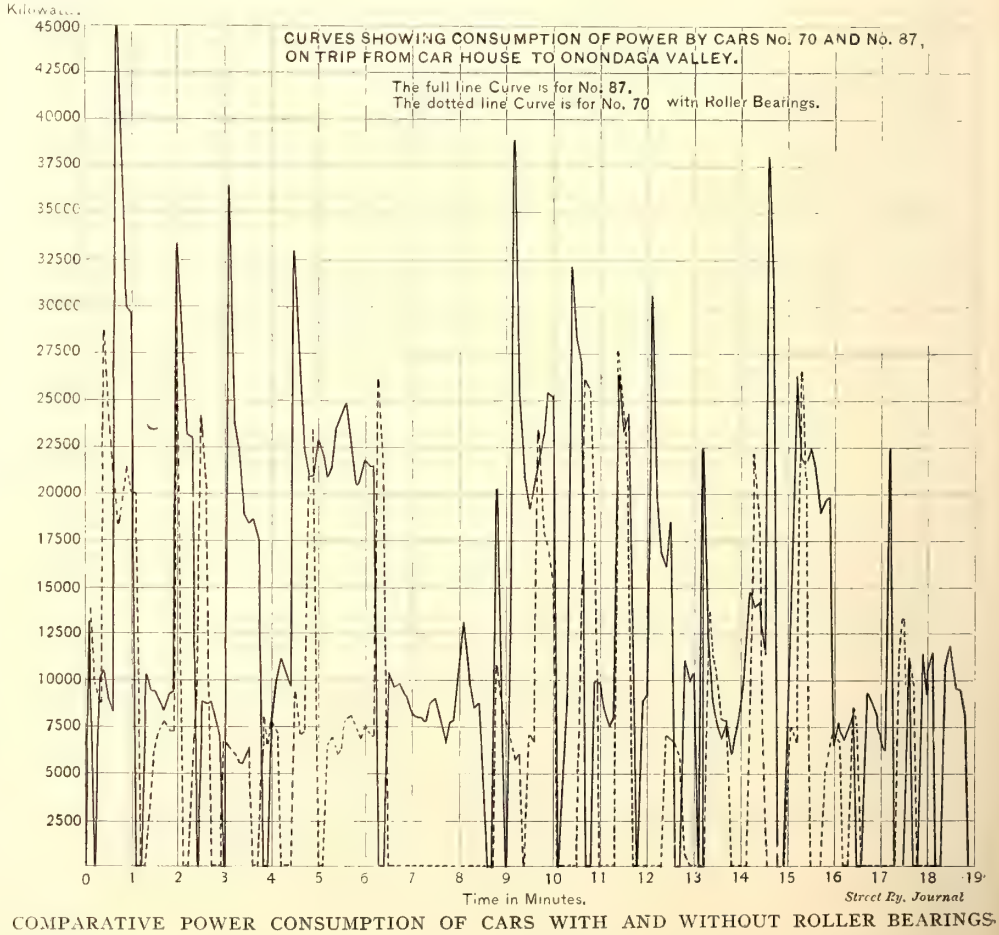
The time of runs and consumption of energy were as follows:

	Time in minutes.	Kw-hours.
CAR NO. 70.		
To valley	18.1	1.94
Return	16.7	1.16
Total time	34.8 total energy	3.10
CAR NO. 87.		
To valley	19.1	4.42
Return	16.1	2.03
Total time	35.2 total energy	6.45

The saving in power is estimated by the manufacturers to be equivalent to $260 per car per annum, in addition to which there is a very considerable saving in the wear and tear occurring on ordinary brasses. The roller bearings after running 250,000 miles show an average reduction in diameter or wear of .005 to .008 ins.

In considering the saving in power shown in the tests mentioned, other tests of roller bearings are interesting as confirming the fact that a very large percentage of power may be saved by a properly constructed anti-friction bearing. One test made by the Federal Government some time ago of an army wagon fitted with and without roller bearing axles demonstrated a saving ranging from about 52 per cent up hill to as high as 75 per cent on an asphalt drive.

It has been shown that an electric cab will run on one charge from 25 to 35 per cent further with roller or ball bearings than when using plain bronze bearings. In using shafting hanger bearings a recent test showed that eighteen heavy grinding machines, using 49 hp with the plain bab-



COMPARATIVE POWER CONSUMPTION OF CARS WITH AND WITHOUT ROLLER BEARINGS.

bitted bearing, used only 27 hp when roller bearing shafting hangers were used.

There are many advantages secured by the use of roller bearings in addition to the saving in power above noted. The consumption of oil is much less than with bronze bearings, and as the greatest saving by a roller bearing is in the starting of the load the car starts much more gradually and therefore with greater comfort to the passenger.

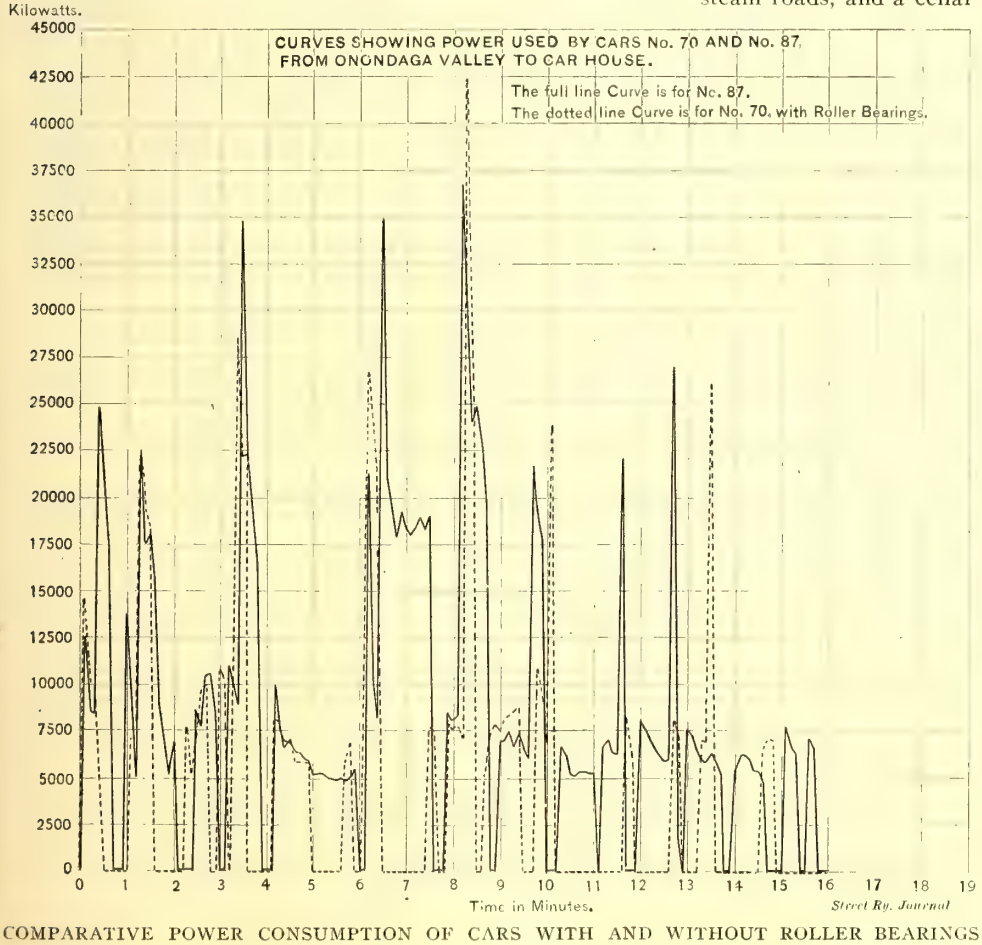
One very considerable advantage that should be taken into account in the use of roller bearings may be the adoption of motors of smaller size and consequent lower cost than are required at present. This results not only in the first cost saving, but in reduced weight of the complete car, with a corresponding reduction in wear and tear of all parts.

TOLEDO RAILWAY AFFAIRS

The directors of the Toledo Railways & Light Company will meet some time this week to take action on the semi-annual dividend. Although the company has been making money, it may be that the dividend on the common stock will be passed. Some of the directors believe that, owing to the high interest rate on money and the advisability of keeping up the improvements, it would be better to use the money for the latter purpose for the present.

CITIZENS TEAR UP TRACKS OF PEORIA RAILWAY

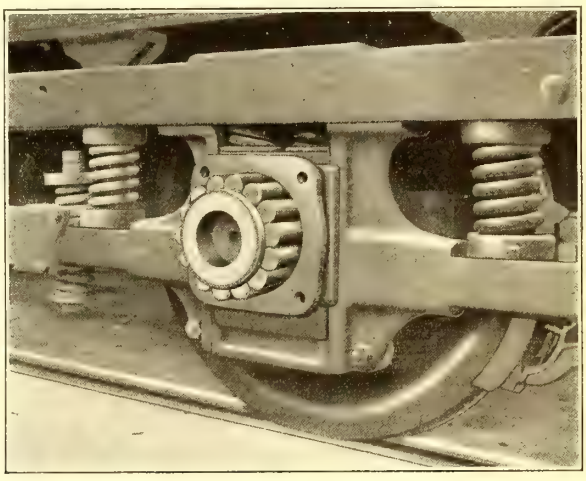
It is reported that citizens of Peoria Heights, a suburb, tore up 100 yards of the tracks of the Peoria (Ill.) Railway Company Oct. 8. The trouble grew out of a franchise, the citizens being dissatisfied with the terms offered by the company. Thirty deputy marshals are now guarding the tracks to prevent the company relaying its rails.



COMPARATIVE POWER CONSUMPTION OF CARS WITH AND WITHOUT ROLLER BEARINGS

BOSTON STREET SUBWAY CONNECTION BEGUN

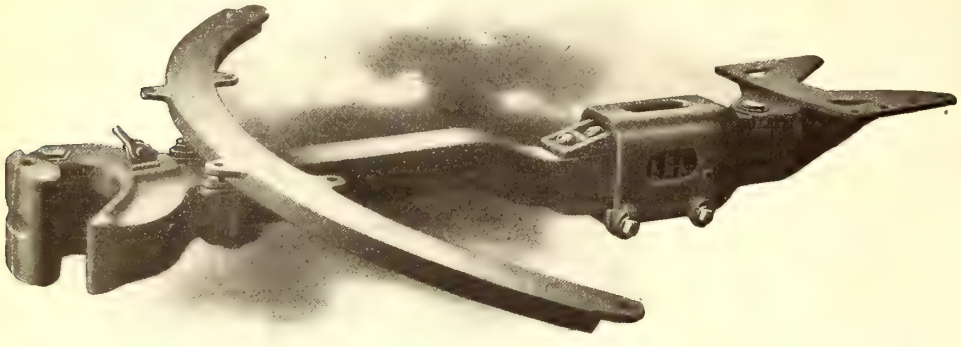
Erection has begun upon the steel structure connecting the southerly end of the Washington Street subway with the present elevated Y at Castle and Washington Streets. Two spans are in place at Oak Street, and a traveling jib crane is being erected on these in order to continue the construction by machine methods. A new masonry abutment has been practically finished to support the elevated structure where it crosses the Boston & Albany and the New Haven steam roads, and a cellar of solid concrete is completed opposite the steel already placed at Oak Street, to serve as foundation for the tracks where they leave the tunnel gradient and take the overhead level. All but two of the buildings in the path of the line have been razed, and all buildings cut through have been enclosed with a new rear wall. At the northern end of the tunnel it is probable that some special action of the Boston city government will be required to authorize the Transit Commission to take care of the heating of the City Hospital Relief Station in February, when the Commission plans to turn over the completed tunnel proper to the Boston Elevated Railway Company. The widening of the portal to accommodate six instead of four tracks will necessitate important changes in the boiler plant of the hospital, and the Commission is anxious to get a land transfer order from the Board of Aldermen which will give room for the construction of a new heating plant. The question of noise and vibration is still problematical, and the Commission feels that it is remedial only through the greatest care in construction, maintenance and operation of the six tracks beneath the building.



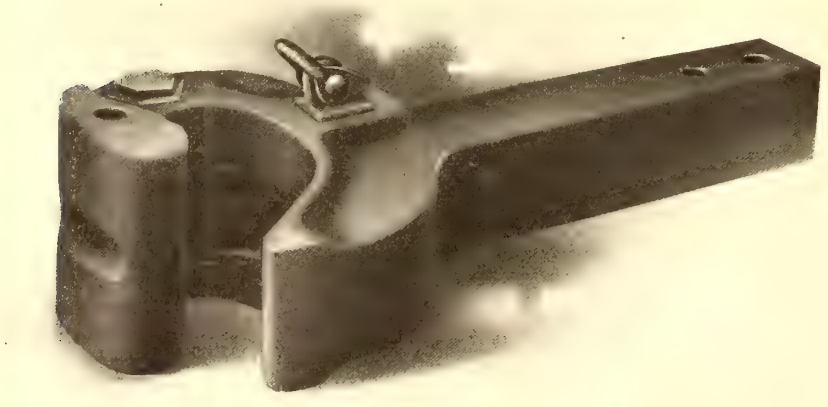
ROLLER BEARINGS ON TRUCK

A COUPLER ALONG M. C. B. LINES ADAPTED TO ELECTRIC RAILWAY SERVICE

The demand created by the extension of the suburban electric railway and the building of the long interurban road for a thoroughly reliable coupler which would permit the operation of cars on short radius curves, and the intercoupling of electric cars with standard steam railroad equipment, has resulted in the development of a number of different types of couplers along standard M. C. B. lines to meet these requirements. One of these manufactured by the Washburn Steel Castings & Coupler Company, of Minneapolis, Minn., is the subject of this article. This coupler for traction work is of cast steel, and is the result of a special study of electric railway conditions made by E. C. Washburn, of the company. In fact, the coupler may be said to have been developed as the result of a request from the Pacific Electric Railway Company to the Washburn Company to apply its experience in building steam railroad couplers to the problem that confronted the traction company. The coupler found its first use on the Pacific Electric Railway in transporting cars of the company over steam railroad lines on their own wheels from St. Louis to Los Angeles, and largely as a result of this test and trials on the company's own system has been adopted as the standard of the company.



COUPLER ALONG M. C. B. LINES FOR ELECTRIC RAILWAY SERVICE



DETAILS OF THE KNUCKLE AND LOCK OF THE COUPLER FOR ELECTRIC RAILWAY SERVICE

The coupler so evolved is known as the L-type M. C. B. coupler. Briefly, it has a standard M. C. B. contour for the head, and will intercouple with all standard equipment. The coupler and rigging are so arranged that they will swing radially about a pin, connecting them to a standard radial drawbar anchor bolted to the center sills of the car by ¾-in. bolts. The drawbar is provided with a spring yoke draft box and a spring sufficient for handling three or four cars. Whereas the standard M. C. B. steam railroad coupler is open at top and bottom, the Washburn coupler has a top and bottom wall and a bearing face on one side. In addition, a lug on the knuckle forms a bearing face on the other side of the coupler. In this way the couplers present to each other faces with considerable bearing surface, an essential with swivel draw-bars. An I-bar at the top, which rides in the radial guide and supports the draw-bar at a point 12 ins. back of the knuckle pin provides a firm support no matter what position the cars may be in on a curve of more than 40-ft. radius. In the case of the Los Angeles cars the bumpers had to be especially prepared by bolting on timber extensions to support the radial guide, thus adding to the rigidity of the frame.

Two forms of standard draft rigging have been designed for use with the coupler. In one of these the draft box is bolted directly to the car body, while in the other the swivel is placed behind the draft box and the box turns with the draw-bar. With the former the thrust does not come directly against the spring, but with the latter the buffing and pulling does come straight on it. In both types one spring enclosed in a circular draft box serves to cushion both the buffing and the pulling.

It is extremely simple to uncouple this type of coupler as an uncoupling lever, on which slides a single link for engaging the uncoupling pin, is provided bent to the same radius as the buffer plate, and so arranged that the handles are easy of access from either side, no matter what the position is of the cars on the track when the train is stopped.

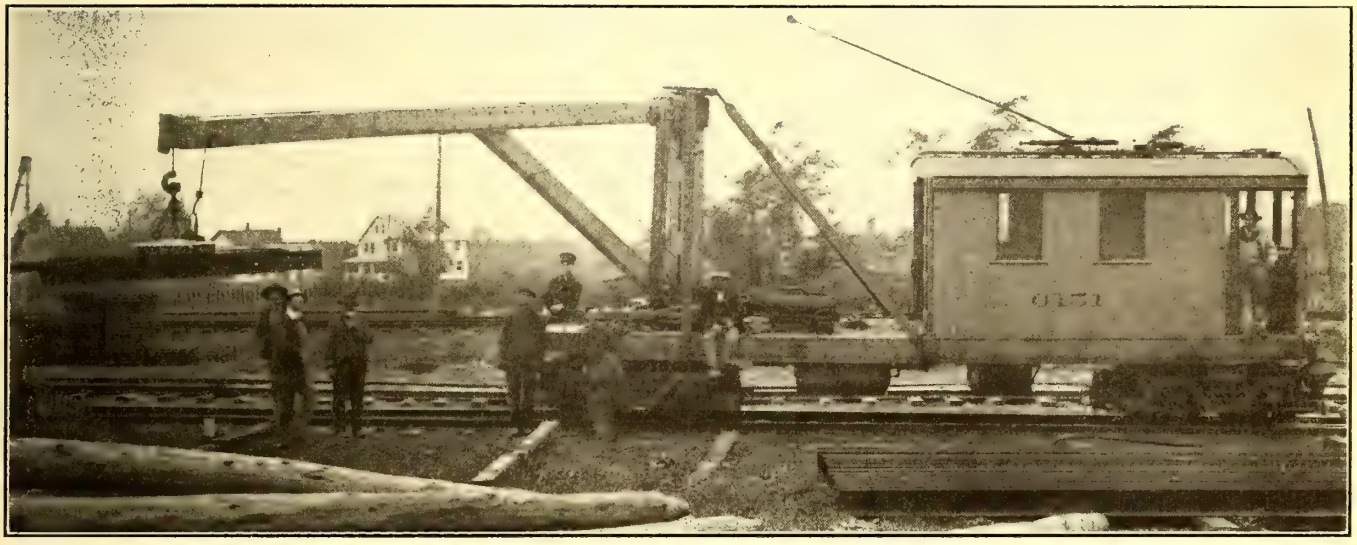
In connection with the coupler, it is interesting at this time to record that in the trip of the train of 18 cars equipped with the coupler, from St. Louis to Los Angeles, a total of 2717 miles was traversed to New Orleans and 2007 miles over the Southern Railway from New Orleans to Los Angeles. The circuitous route was taken to avoid the climb over the mountains. The train, exclusive of the engine, had a length of 954 ft., and each car weighed 23 tons. A special short line rate of 18 cents per car mile made the freight charges per car amount to $297.70.

INTER-POLE ELECTRIC LIFTING MAGNETS

Recognizing the possibilities of the electric lifting magnet for industrial purposes, the Cleveland Armature Works, of Cleveland, Ohio, inaugurated a series of experiments extending over several years, which has resulted in a lifting magnet of peculiar design, termed the inter-pole lifting magnet, two types, of which the bell magnet and the flat magnet are being manufactured in order to meet all conditions of service. The inter-pole bell magnet is used for loose detachable material, like scrap iron, turnings, borings, etc., and the inter-pole flat magnet for material with more or less flat surfaces and in larger pieces like rails, ingots, heavy castings, etc.

The inter-pole bell magnet consists of a heavily annealed steel casting which as the name implies is bell shaped. The magnetizing coils in this case are two in number, and so placed in relation to each other that they form a solenoid in two steps, separated by an iron ring and the so-called interpole. The result of this arrangement is an extremely effective magnetic field acting with greatest intensity towards the center of the magnet and altogether confined within the sphere of the bell. The coils produce a solenoid effect, so to say, sucking the material up into the bell. The outer shell of the casting extends below the under face of the outside coil and a heavy shield of non-magnetic material bridges from pole to pole protecting the magnetizing coils and also serving to increase the air reluctance between poles, thereby increasing the effective lifting power of the magnet, and enabling matter being lifted to be deposited within a certain radius and not scattered over a large surface as otherwise would be the case. Various sizes of these inter-pole bell magnets are made. The largest size is 52 ins. in diameter, weighs 4900 lbs. and consumes an average of 20 amps, at 220 volts. This magnet will lift from 1000 to 1350 lbs. of sand-cast pig, about 1200 lbs. of plate scrap. Its maximum lifting capacity for one single piece is 15 tons.

As mentioned before, the works also manufacture interpole flat magnets designed on the same principle as the inter-pole bell magnet, but essentially to be used in handling larger pieces of material like heavy castings, billets or corded pig iron, etc. The accompanying illustration shows this magnet as used on a derrick car in electric railway construction work, one of the many branches where it can be advantageously used.



INTER-POLE LIFTING MAGNET IN USE IN A RAILWAY YARD

Both types of lifting magnets are manufactured for any voltage desired, and the cable connections are interchangeable to make possible the use of either bell or flat magnet on the same crane installation. With each magnet is furnished a twin cable of sufficient length as well as an automatic "take-up" reel for same. This reel is operated by a spring arrangement entirely, independent of the crane gearing, and is usually placed on top of the crane carriage just above the hoist. The magnet itself is operated from the cage by a small circuit breaker also supplied with each magnet.

TWO NEW TRUCKS

The American Locomotive Works have recently brought out two new styles of trucks which will be shown at the Atlantic City convention. They are illustrated in the engravings on page 684.

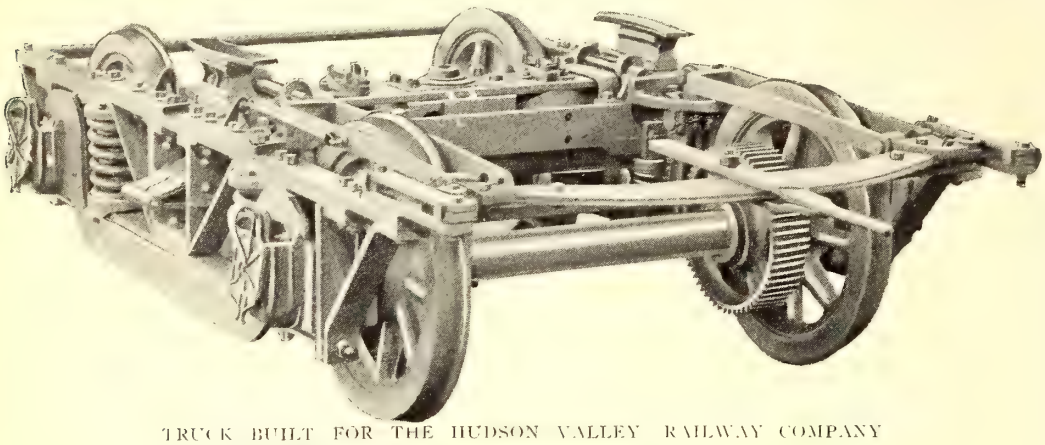
The truck shown in the first engraving was built for the Hudson Valley Railway Company. It is suitable for all types and makes of motors that are suspended inside of axles by either the rigid nose suspension on truck transom or suspension bars carried on coil springs. It may be built for any track gage, with wheel base to suit motors, and for carrying capacities at the center plate ranging from 15,000 to 16,000 lbs. This type is often referred to as the M. C. B. type of truck, because it embodies the standards adopted by the Master Car Builders' Association for high-speed trucks. The principal dimensions are as follows:

Gage of track	4 ft. 8½ ins.
Wheel base	6 ft. 6 ins.
Total length	10 ft. 4 ins.
Load carried at center plate	30,000 lbs.
Weight without motors, wheels or axles	7000 lbs.
Weight complete, without motors	10,500 lbs.
Wheels	34 ins. diameter
Axles	5½ ins. diameter
Journals	4¼ ins. x 8 ins.

It is built with a solid wrought-iron frame, channel-iron transoms, cast-steel transom gussets, swinging bolsters of the built-up type, and two bar equalizers. The transom gusses make a very rigid connection between frame and transoms, and integral with the gussets are brake hanger lugs and bearings for swing link pins, the design thereby eliminating numerous small parts that are usually bolted to the frame and transoms. The swinging bolsters are car-

ried on double elliptic springs although for trucks of greater capacities triple elliptic springs may be used. The wear or rubbing pieces between the bolster and the transom serve the double purpose of preventing the bolster from cramping or tilting in starting and stopping, and of transmitting the strains on the bolster through the transoms to the truck side frames without interfering with the free action of the bolster and springs. The coil springs carrying the truck on the two-bar equalizers are carefully calculated to suit the loads, including portions of truck and motor weights.

The details of construction are in accord with the best



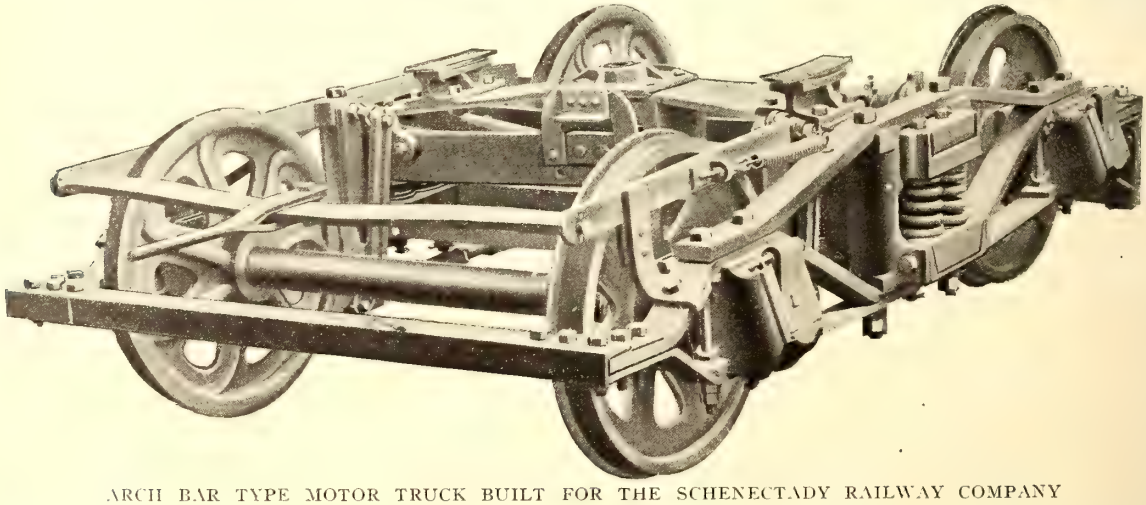
TRUCK BUILT FOR THE HUDSON VALLEY RAILWAY COMPANY

locomotive building practice. All bolt holes through frames are reamed, and bolts turned with a taper for a driving fit. All bent parts of frame are made to dies and formers. The transom channels are carried by lips or shoulders provided on the frame center braces, thus reducing the shear on the usual bolts or rivits through brace and transom. The pedestals are provided with steel plate wear pieces, tightly fitted to and covering all rubbing surfaces, and are tied together at the bottom by large bolts through the pedestal legs and iron thimble or spreader. All brake lever and hanger pins are made as large as possible to provide large bearings and are case hardened. Safety straps are provided over top of bolster, under spring plank and brake bottom connections.

The materials used are as follows: Frames, pedestals, equalizers, motor suspension bars, safety straps, swing links; and all brake hangers, rods and connections are of the best wrought iron. Transoms and spring plank angles are of structural steel shapes. Transom gussets, elliptic spring seats, motor spring seats, and swing link rockers are of cast steel. Outboard side bearings, springs, seats and caps, pedestal thimbles and brake shoes are of cast iron. Brake heads, brake connections and transom angle washers are of malleable iron. Journal bearings are of brass, lead lined. The journal boxes used on the truck illustrated were supplied by the T. H. Symington Company. The center plates and side bearings are of the Baltimore make and the wheels are Schoen.

The second engraving shows an arch bar type of motor truck built for the Schenectady Railway Company, and designed especially for freight and express service. This design has been developed with a view particularly towards strength, stiffness and simplicity, with all parts easy of access and a minimum number of wearing parts. The spring arrangement, as will be noticed, is intended particularly for strength rather than for easy riding, the former quality being the most essential characteristic in a truck of this type. As with the high-speed electric motor truck this arch-bar type is suitable for all types of motors suspended inside of axles by either rigid or spring suspension. Although the wheel base of the truck illustrated it 6 ft. 4 ins., this same type of truck may be designed with a minimum wheel base of 6 ft., and for carrying capacities at center plate ranging in weights from 1500 to 40,000 lbs. The bolsters are of the floating type carried on nests of four-coil springs at each end of bolster and seated on a heavy channel iron spring plank extending across and bolted to the bottom arch bar and bottom tie bar. The legs of the channel also bolt to lugs at the bottom of the cast-iron bolster guide columns.

The same practice in regard to workmanship has been followed in this truck as in the one designed for high speed, namely, all bolt holes through frame are reamed and bolts turned taper for driving fit and frames bent to dies and forms. Transom bars are carried on shoulders cast on the guide columns to which they are bolted. These transom bars carry the motor suspension as well as brake-hanger brackets. Inasmuch as this truck is designed for slow freight service the journal boxes are not suspended in pedestals but are securely bolted to the arch bars as on all M. C. B. arch-bar



ARCH BAR TYPE MOTOR TRUCK BUILT FOR THE SCHENECTADY RAILWAY COMPANY

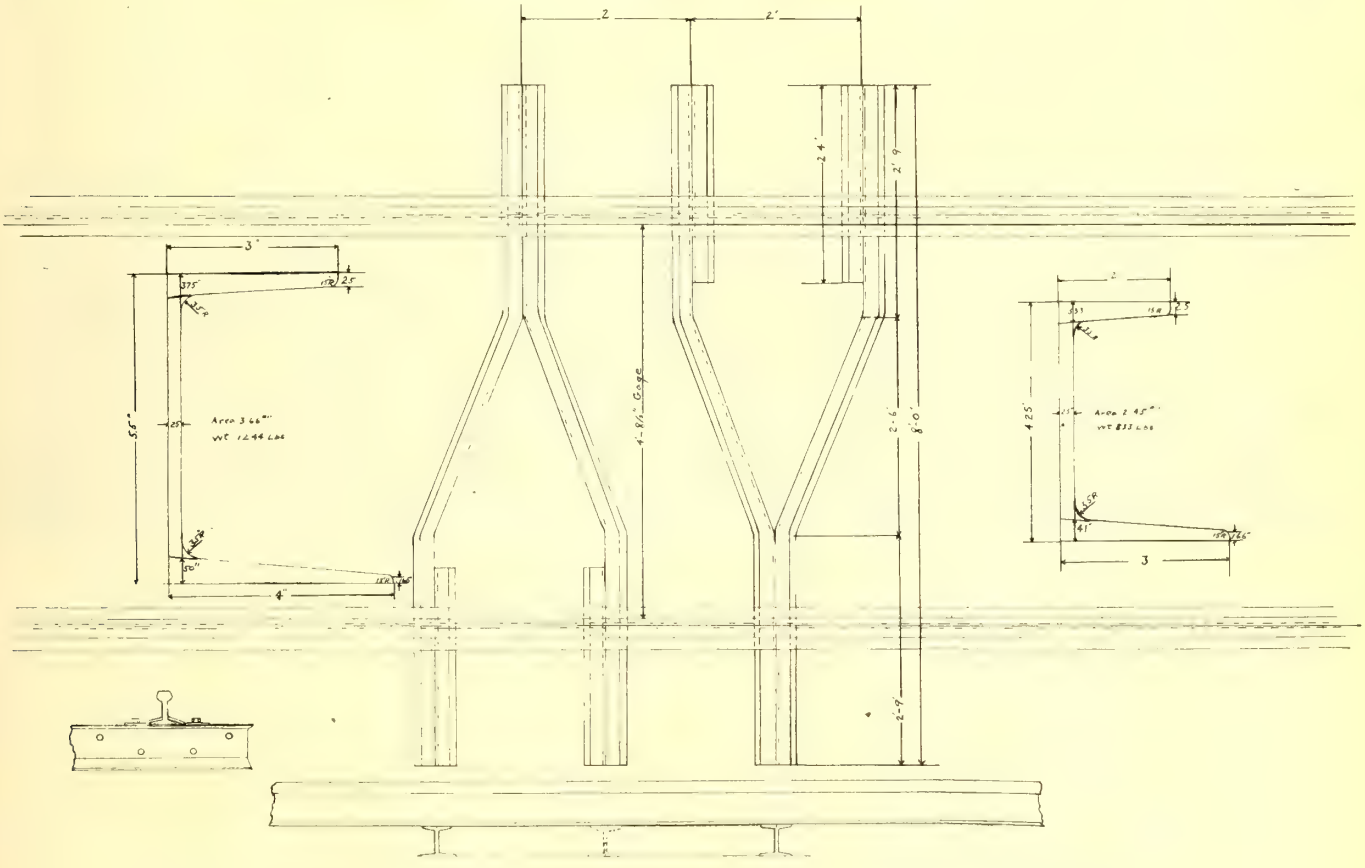
trucks. The ends of the bottom arch bar and tie bar are extended beyond wheels to receive angle iron end frame and securely bolted to same with steel plate corner gussets.

The materials used in this truck are the same as those for similar parts of the high-speed electric motor truck, and the general dimensions are given below:

Gage of track	4 ft. 8½ ins.
Wheel base	6 ft. 4 ins.
Total length	10 ft. 4 ins.
Load carried at center plate	28,000 lbs.
Weight without motors, wheels or axles	4800 lbs.
Weight complete, without motors	7200 lbs.
Wheels	33 ins. diameter
Axles	5 ins. diameter
Journals	4¼ ins. x 8 ins.

A STEEL TIE FOR ELECTRIC RAILWAY USE

The accompanying illustration shows the Benjamin steel tie for steam and electric railroads, the patents for



DETAILS OF STEEL TIE DESIGNED FOR STEAM AND ELECTRIC RAILWAYS

which are controlled by the National Brake Company, of Buffalo, N. Y. The construction of this tie is such that any longitudinal or lateral movement will be effectually prevented. The longitudinal movement is prevented by the ties being disposed in "V" shape. The position of these "V" shaped figures alternate so that the pressure of the ballast against the diagonal portions of the channel constituting the adjacent "V" shape will be in opposite directions, thus securely locking the ties. As no two bearings of the rails come opposite each other, creeping or lateral movement is impossible. Another important feature is the fact that the ties supporting one rail alternate with those supporting the other rail and no two rail bearings being opposite each other, the track is less rigid.

The construction of these ties is such that the necessary bearing surface under the rail has practically unlimited strength. Furthermore, the bearing in the center of the track being one-half the width overcomes any possibility of the tie to become center-bound. Of great importance is the mode of rail fastening. The plates or clamps being made with a shoulder adapted to bear against the edge of the base flange of the track rail, and with a portion adapted to rest on the base and extend to the web of the rail the track would be held to the proper gage in case the nut should become loose. The clamp not being more than three-eighths of an inch in thickness, it is said that the danger, in case of detailment, of the fastenings being sheared off, is overcome, as the tread of the wheel would clear the clamp and nut.

COMPLETED PLANT OF THE HOPE WEBBING COMPANY

Although the Hope Webbing Company, of Providence, R. I., has been building additions to its plant almost continuously since its inception fifteen years ago, the company found about a year ago that its facilities were inadequate to the demands made upon it for electric tapes and webbings, and it was therefore decided practically to double the old capacity. The old plant consists of five principal structures. Three of these, each 453 ft. long by 85 ft. wide, are used for weaving sheds. The other two structures are a preparing mill, built to five stories, 223 ft. x 84 ft., and a three-story structure 320 ft. long by 60 ft. wide, used for the offices, and the weaving and shipping departments. The new structures, commenced about a year ago, and now nearing completion, are on the south and west sides of the main plant. They consist of two one-story substantial brick structures with concrete foundation, each 453 ft. x 85 ft. Skylights of the latest construction are installed throughout the length of the new buildings and give the operators of the looms good light. In the old plant about 150 looms were devoted al-

most entirely to the manufacture of electric tape. In addition the looms in the new building will be devoted to the same work, so that the capacity of the company will be practically doubled. The looms to be installed in the new building will be of the double shuttle type, made by the Crompton-Knowles Company, of Worcester. They have double the capacity of the ordinary looms, so that the plant will be able for some time to come to supply promptly all demands of the trade. An extended description of the old plant was given in the Street Railway Journal for Oct. 13, 1906.

ROLLING STOCK FOR THE WASHINGTON, BALTIMORE & ANNAPOLIS ELECTRIC RAILWAY

The Washington, Baltimore & Annapolis Electric Railway is rapidly approaching completion. Among the progressive features of the line are the fine cars to be used on it. The choice of rolling stock was influenced by the condition that four classes of service will be given, as follows: High speed with frequent headway between Washington and Baltimore; high speed service between Annapolis and Washington and between Annapolis and Baltimore; local service over the main line (termed the W. B. & A.), and the cross line (termed the A. W. & B.), and excursion business in trains to Annapolis and to Bennings race track, near Washington. The last item sometimes consists of steam coaches owned by the A. W. & B., or possibly obtained from connecting steam roads. In addition to this there are also freight trains on the A. W. & B.



COMBINATION CAR FOR THE WASHINGTON, BALTIMORE & ANNAPOLIS ELECTRIC RAILWAY

Because of the different characters of service, including steam railway conditions and rolling stock, it was decided that all cars should have Master Car Builder couplers and automatic air brakes, even though such coupler makes it impracticable to operate in trains on city streets except by the use of a link or auxiliary radiating coupler. To avoid carrying several sizes of repair and maintenance parts, it was decided to have all trucks identical, except the truck springs. The motors are also alike, except in the number per car and the gear ratio. Owing to the good service necessary to compete with the steam railroads, and also owing to the fact that these cars will be for through operation, the seat spacing is unusually liberal, the seats long, with arm rests and high backs. Considerable aisle width will not be necessary for the character of service contemplated, whereas if such service were for short rides and frequent stops, shorter seats, less knee room, no arm rests and wider aisles would be preferable.

Careful attention has been given to the artificial lighting As the trolley voltage is 6600 and the W. B. & A. main line is double track 80-lb. rail, the line voltage over the entire a. c. portion of the system will undoubtedly be comparatively uniform and constant. The d. c. voltage also will be higher and more constant than is usually the case on interurban cars when operating in terminal cities. To obtain a satisfactory light for reading, and at the same time give a reasonable general illumination, 16-cp lamps are placed over each seat on small brackets extending slightly toward the center of the car from the inside of the lower portion of the deck sash. The lamps hang vertically and each bracket is provided with a holophane shade designed to give a uniform illumination three feet from the floor.

The floor of the car is covered with Greenwich, English, linoleum. The roof is covered with copper and grounded to the trucks.

The earlier design contemplated pantograph trolley for a. c. and two-wheel trolleys for d. c., the same being placed at the rear end of the car, two being required, because within the District of Columbia rail return is not allowed, and one wheel only being used when in Baltimore. The decision to use double-ended cars necessitated placing two trolley wheels at each end, and the car was designed also to carry a pantograph, but owing to results obtained by the use of trolley wheels on a. c. roads it was decided not to place the pantograph at present. Because of the foregoing, one trolley base at each end of the car has been insulated for high voltage, and later, if a pantograph should be installed, such trolley will be useful for emergencies, in addition to being in regular use when within the District of Columbia.

The general dimensions of the high-speed cars are as follows: Length of the body over corner posts, 51 ft., 1¾ ins.; length over spring buffers, 62 ft. 2¾ ins.; length smoking compartment, 12 ft. 7⅝ ins.; length general compartment, 38 ft., 6⅛ ins.; width car body, inside, 8 ft. 0.¾ in.; width over all, 9 ft. 0.¾ in.; height from bottom of side sill to top of monitor roof, 9 ft. 6 ins., and height from rail to top of monitor roof, 13 ft. 0.½ in.

The height was limited by an undergrade crossing.

The general plan comprises two end platforms with doors and steps on each side of same, with a toilet room adjacent to the vestibule of the main compartment, and with fifty seating capacity in such compartment. The smoking compartment seats sixteen. In one corner of this compartment the high-tension cabinet is placed. This cabinet contains protective and selective apparatus for the motor control circuits.

The platforms are on through sills, the floor being flush with the floor of the car. The side sills are 5 ins. x 7¾ ins., bolted to ⅝ in. x 7¾ ins. steel plate and 1¾ ins. x 6 ins. subsill. The center and intermediate sills are 6-in

No. 12.25 steel I-beams with 2⅝ ins. x 6 ins. fillers. The window arrangement is as shown by the illustration.

The ceiling is full Empire type. The interior finish is mahogany, the design being intended to furnish an exceptionally rich and attractive appearance with the fewest possible projections to catch dirt and designed to conceal shrinkage openings at joints.

The seats were furnished by the Hale & Kilburn Manufacturing Company. The reversible seats are No. 199 EE, pressed steel oval pedestal, wall and aisle ends and arm rests. The length over all of the seats is 38 ins., the cushions being 18 ins. wide with spring edge; the backs are corrugated with head roll 26 ins. high and provided with grab handles. All upholstery is in green leather.

The curtains are pantasote with Curtain Supply Company's Forsyth No. 88 fixtures, and the window fixtures are O. M. Edwards & Company's 7½ D1. All glass for side and end windows and doors is plate, and the glass for the Gothic side and deck sash is cathedral. The Gothic frames are coppered zinc.

The cars are equipped with Crouse-Hinds Type AAC, d. c. headlights, Dayton Manufacturing Company's No. 8 gravity water closets, Ham air sanders, Edwards trap-door fixtures, Dayton Manufacturing Company's Rex individual parcel racks, Knutson No. 2 retrievers, Royal fire extinguishers, Adams & Westlake No. 187 signal lamps and Peacock type C hand brakes. The Wallace Supply Company furnished most of the bronze trimmings.

The trucks are Baldwin 90-40 M. C. B. type with 7 ft. 6 ins. wheel base, weighing 14,900 lbs. each. The wheels are Standard Steel Works steel tired, cast-steel centers 37½ ins. in diameter, each weighing approximately 1000 lbs., tires 2½ ins. x 5½ ins., 4¼-in. tread, 1 in. depth of flange and 1¼ ins. thickness of flange. The axles are 6½ ins. diameter, 7½ ins. at gear seat, the journals being 5½ ins. x 10 ins. The center and side bearings are Baltimore ball bearing; the journal boxes T. H. Symmington Company M. C. B.; brakes are inside hung, shoes and heads M. C. B. type, and the brake shoes are American Brake Shoe & Foundry Company's Diamond S.

The air-brake equipments are Westinghouse Traction Brake Company's A. M. M. automatic as to the braking mechanism, but the General Electric Company furnished the motor driven compressor C. P. 52, governor M. B. and wiring. The Westinghouse Traction Brake Company also furnished the automatic air couplers. The draw bars are Gould No. 65 M. C. B. head.

The electrical equipment of each car consists of four G. E., a. c. motors, each rated at 125 hp. Each motor weighs approximately 5800 lbs. and the auxiliary equipment per car weighs about 14,000 lbs. Under and to one side of the car a commutating switch is placed for changing from a. c. single to d. c. double trolley, or vice versa, at the District of Columbia line, required because of the use of double overhead trolley within the District. Selective switches are provided to change automatically from a. c. to d. c. operation, or vice versa, at the end of private right of way in Baltimore. From the car sills transformers, resistances, contactors, motor compressors, etc., are suspended.

Nineteen cars of the foregoing type have been provided and four local cars. The latter are of the same general character of construction as the through cars, but are 54 ft. 11⅜ ins. long over bumpers, and the body is divided into three sections, made up of a general passenger compartment, smoking compartment and baggage and express compartment. As these cars will make a large number of stops, consequently not only the schedule but also the maximum speed, will be materially less than for the through cars. Each car is equipped with two motors of the same rating as those used for the through cars.

It will be noted that the passenger carrying equipment is provided mainly for through service. It is expected that for the greater portion of each day fifteen-minute headway will be required for through service, but only possibly two-hour for local service.

In addition to the above cars, two box-car type locomotives will be furnished, the electrical equipment for each being four motors, with same rating as for the passenger cars, and geared for the same speed as the local cars. These cars have two sliding doors on each side, and also end doors to permit loading of theater scenery. The general dimensions of these cars are as follows: Length over buffers, 56 ft. 8 ins.; width over all, 9 ft. 0¾in., and height from bottom of side sills to top of roof, 9 ft. 4 ins. Flat cars, box cars, etc., are provided also for general purposes.

The Niles Car & Manufacturing Company is providing all the motor cars above described from plans and specifications prepared by the Roberts & Abbott Company, engineers, Bret Harter, assistant engineer, of the Roberts & Abbott Company, having special charge of same.



REGULAR PASSENGER CAR FOR THE WASHINGTON, BALTIMORE & ANNAPOLIS ELECTRIC RAILWAY

A NEW TYPE HARP WITH FLEXIBLE HEAD

The Liberty trolley harp has been still further perfected by the manufacturer, the New Departure Manufacturing Company of Bristol, Conn., by which it is now offered in its modified form. The Liberty harp was first introduced several years ago, and marked a material advance inasmuch as it has a flexible head. The first harps were satisfactory devices, but it soon became evident that they could be improved, and after months of experimenting, the cushion shank was developed and tried out in practice. Finally, after operating successfully on a hundred or more roads the cushion harp was placed upon the market. Exhibited

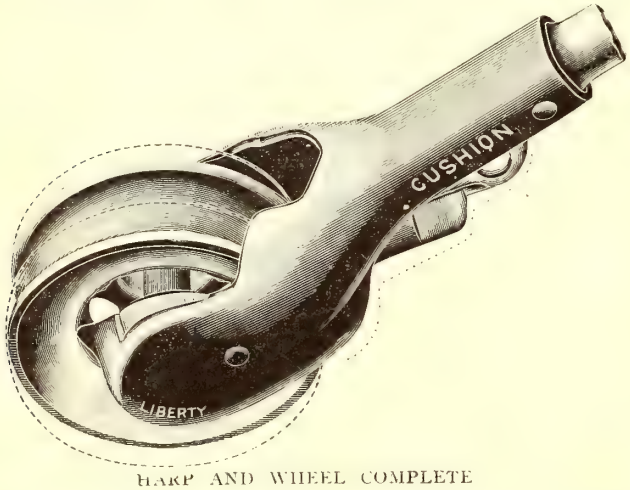
at the Columbus Convention, the harp attracted a great deal of attention. Since that time it has been still further modified, and will be shown in its new form at the convention.

The harps are practically adapted for high speed and interurban roads. The cushion, which is conceded to be the feature of the harp, consists of two steel buffer springs located in pockets in the end of the shank, the outer ends of the springs being pressed against the inside wall of the harp shank. Under normal conditions the springs hold the harp virtually rigid with respect to the shank and the trolley pole. In passing over coupling



HARP WITHOUT WHEEL

sleeves, switches, circuit breakers, block signals, and other obstructions in the transmission wires, the harp is forced down against the action of the buffer springs and instead of the pole being thrown down and the wheel leaving the wire, the springs hold the wheel tight to the wire. In this way the shock is broken by the yielding of the harp, the rebound of the wheel is prevented and retention on the wire is secured. The spring is well housed within the shank of the harp and is protected from the weather and possible accident. The harps are made in rigid and flexible head. The



HARP AND WHEEL COMPLETE

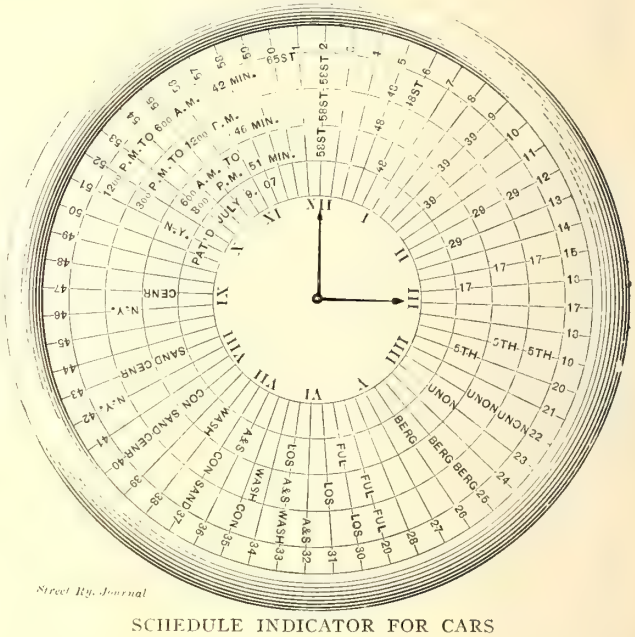
flexible head is a very simple device which allows the wheel to turn slightly, following the wire in taking curves. The wheels can be set and removed without the use of tools. Both the rigid and flexible head have the cushion shank.

The company also makes standard wheels of new metal, free from lead. A recent letter to the company from a New England railway says: "We have been using the two trolley harps and wheels which you sent us for trial and so far have found them altogether satisfactory, our men even making efforts to try to run the wheels off the wire on curves and not succeeding."

SCHEDULE INDICATOR FOR CARS

An ingenious device for giving the times for arriving at points or stations, to be carried on the front platform or in the cab of a car, has recently been invented by E. F. Reeves, superintendent of the New York & Brooklyn Bridge Division of the Brooklyn Heights Railroad Company, and is shown in the accompanying engraving. The use of a printed timetable is very inconvenient for motormen, and it is thought that if a device could be provided which is always open to inspection it would prove a great convenience.

The device consists of a moveable dial surrounding the face of a timepiece on which is set forth the route over which a car or train passes. The zero mark on the outer dial represents the terminal, and the outer dial is moved by hand until this zero mark comes opposite the minute hand on the timepiece at the minute the car should leave the terminal. The outer dial is then locked in position. After being set the device requires no further attention, as the minute hand on the watch points during the trip to the exact location on the line where car should be at all times.



SCHEDULE INDICATOR FOR CARS

This, it is thought, should greatly aid the motorman by relieving him of all calculations he is now compelled to practice in order to locate his proper position on the line, as well as the duty of frequently consulting his watch, which takes his attention away from his brake handle and controlling lever.

If desired a series of open circuits can be arranged in minute intervals to provide for a warning bell to be rung at all danger points on the line in advance of arrival, to call the attention of the motorman to a railroad crossing, drawbridge, reporting station, or other stopping point previously determined. These bell circuits would be closed by the minute hand of the timepiece, would conduce to safety in operation and can be made useful in other ways. The entire indicator is 5½ ins. in diameter and of convenient shape to drop into the coat pocket when out of service.

In the engraving shown the indicator is adapted for use on the Southern Division of the Brooklyn Heights Company, where the run is less than one hour in length. The operation of the indicator in that case is as follows: If the car is due to leave any one point, say Fifty-Eighth

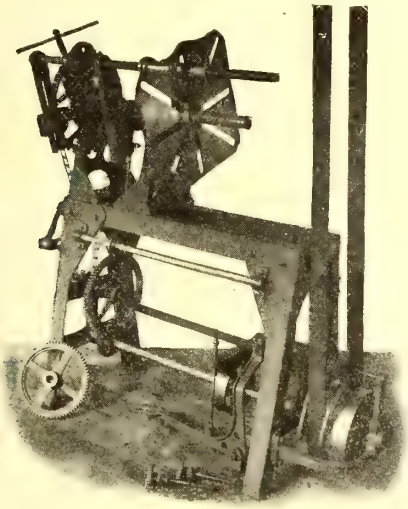
Street, on the even hour, the outside dial is moved around the face of the clock until Fifty-Eighth Street comes opposite XII. The outside dial is then locked in this position. Then as the minute hand travels around the face of the clock it will always be directed to the point on the route at which the car should be according to the timetable. When the runs are less than an hour the outside dial is divided into different sections, and when it is more than an hour the outside dial is marked with a spiral instead of a circle.

The inventor claims for his invention better intervals, less congestion at congested points, even distribution of loading, less accidents, increased revenue and no abuse in handling equipment, as the usual cause is removed.

FIELD AND ARMATURE COIL-WINDING ATTACHMENT FOR ARMATURE BANDING MACHINE

An attachment has been devised by the Device Improvement Company, of Hanover, Pa., for use with the Peerless banding machine which can be put on in a few minutes, and which greatly simplifies the winding of field and armature coils. Briefly, the device consists of a shaft and slotted face plate rigidly held down on the two heads, the shaft and face plate being driven by the clutch sprocket wheel and chain, similar to the armature in the banding operation. The same sensitive control applies, as well as foot control with positive brake for quick stopping and the two changes of speed instantly obtained by the change of gears.

Field and armature coils forms are very simple to make,



FIELD AND ARMATURE WINDING ATTACHMENT FOR ARMATURE BANDING MACHINE

and are bolted to face plate to be driven, in place of having iron centers with key way and keyed to the shaft. The slots in the face plate also facilitate any adjustments in the wire. One very prominent feature of this machine is the traveling guide wheel over which the magnet wire passes to the coil form, permitting accurate coils to be produced with ease. The hand wheel for guiding the magnet wire is adjustable according to the thickness of the field coils. The hub carrying the grooved pulley is threaded and is moved back and forward on the threaded rod, similar to the wire guide for band wire. Contrast this method of guiding wire to the hand method and the ease and accuracy will be fully appreciated. The finished field of armature coil can be removed from the face plate without disturbing any part of the machine. This machine used in connection with the company's tension machine forms a field and armature coil-winding device.

NEW EQUIPMENT FOR INDEPENDENCE, KAN.

Four semi-convertible cars for interurban service, three open and one baggage, built by the American Car Company, constitute the latest addition to the rolling stock of the Union Traction Company, of Independence, Kan., now building a line to connect Independence, Coffeyville, Caney, Meodesha and Cherryvale, a distance of 23 miles. The semi-convertible cars are of the combination passenger and smoking type. The chief dimensions of these interurban cars are as follows: Length over bodies, 34 ft. 4 ins.; over



INTERURBAN SEMI-CONVERTIBLE CAR FOR THE SERVICE BETWEEN INDEPENDENCE AND CHERRYVALE, KANSAS

crown pieces, 44 ft. 4 ins.; length of smoking compartments, 9 ft. 2 ins.; width over sills including sheathing, 8 ft. 4 ins.; height from floor to ceiling, 8 ft. 5⅝ ins.; from track to underside of sills, 36⅜ ins.; side sills, 4¾ ins. x 7¾ ins., with angles 3½ ins. x 6 ins. x ⅜ in.; end sills, 5¼ ins. x 13/16 in. The inside finish is of golden oak with ceilings of 3-ply birch. Leather seats with high backs and head rolls are furnished in the passenger compartments. The other compartments have seats of rattan of the same type. The trucks are of the No. 27-El type with 6-ft. wheel base. The 10-bench open cars which will be used for local service are 28 ft. 8⅜ ins. over the crown pieces, and are mounted on No. 21-E single trucks. Tthey are standard throughout. The baggage car measures 44 ft. over the ends and conforms to the general outline of the interurban passenger cars described.

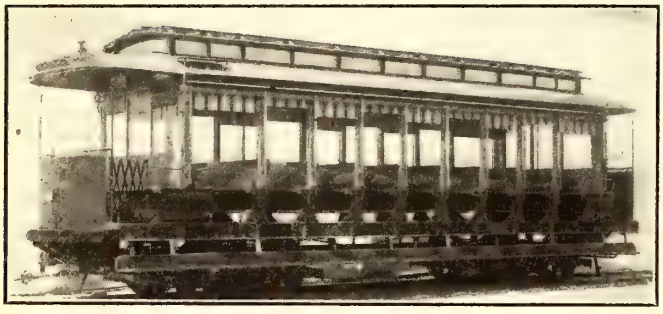
THE H. P. CAMERON COMPANY EXTENDS ITS PLANT

The H. P. Cameron Electrical Manufacturing Company, of Ansonia, Conn., finding its old plant entirely inadequate for its expansion decided about a year ago to secure larger and more commodious quarters where it could more promptly and advantageously serve its customers. A three-story building within a block of the railroad station was secured and an addition to this building has been erected and new machinery installed throughout. The first floor is devoted to stock and shipping rooms, so arranged as to give the best advantage to the handling of stock and shipping of goods. The second floor contains the machine shop. The machines for stamping and sawing commutators are placed in the center of the floor, while the machinery for the turning out of assembled commutators is arranged along the sides of the building. The third floor is devoted exclusively to the manufacture of mica insulation. The company operates its own mica mines and uses its own product in the articles which it manufactures. Although this company turns out large quantities of assembled commutators, its specialty is the manufacture of commutator segments, which are made to specification from hard-drawn copper bars. If a manufacturer prefers his segments sawed, they are sawed to ex-

act size; if stamped, dies of various types and sizes are provided for that purpose. A laminated type of segment for large generators and motors has been developed and machinery for its manufacture has been provided so that these segments are turned out in any size and quantity desired, each segment being an exact duplication of the original.

NARRAGANSETT CARS FOR COLUMBUS, GA.

The J. G. Brill Company recently shipped to the Columbus Railroad Company, of Columbus, Ga., three of its patented Narragansett type of cars, to be run between Columbus, Phoenix City and Girard, Ala., a distance of about twenty miles. The additional step on these cars, which is formed by an extension to the lower outward extending flange of the Z-bar sill, making an upper step 8½



OPEN CAR FOR COLUMBUS, GA.

ins. wide, is well suited to excursion travel and will play an important part in the transportation of the persons to Wildwood Park and similar places. The Columbus Railroad Company is one of the Stone & Webster properties, a number of which are now using Narragansett type cars.

The chief dimensions of the Columbus cars are as follows: Length over crown pieces, 34 ft. ⅜ in.; width over sills, 7 ft. 5 ins.; over posts at belt, 8 ft. 3 ins.; height from floor to ceiling at center, 5 ft. 9 ins.; side sills, 8 ins. x 3 ins. x ½ in. Z-iron. The trucks used under the car bodies are No. 27-G1 and two motors of 40-hp. capacity each are used per car. The cars have the regulation push-over seats and are standard throughout. Curtains are provided at the bulkheads, which is an usual feature. Folding gates, gongs and signal bells are among the specialties furnished by the builders.

PROPOSED PHILADELPHIA SUBWAY

The Philadelphia Subway Terminal Railway Company has received a charter to construct a subway for railroad purposes in Broad Street, from the north side of Filbert Street to a point near North Philadelphia Station, where it will connect with the Pennsylvania's Germantown and Chestnut Hill branch. It is estimated that the subway will cost from $10,000,000 to $15,000,000 and be about four miles long.

OHIO DECISION ON STREET RAILWAY CONSENTS

According to a Supreme Court decision, rendered Oct. 7, a city council has the right to give a street railway company consents for city property abutting on streets traversed by the railway line. The decision was in the case of Taylor Emerson against the Forest City Railway Company, of Cleveland, in which it was sought to declare the franchise of the company on East Fourteenth Street illegal on the ground that without the city's consent to the cemetery property it did not have a majority of the front footage on the street. The company admitted that this was true, but contended that the city had the authority to give its consent to the use of the streets in front of the cemetery property. This contention, it seems, is upheld and the ruling of Judge Beacom is sustained.

AN EMERGENCY AIR VALVE FOR APPLYING BRAKES AND DROPPING FENDER

The Consolidated Car Fender Company, of Providence, R. I., has perfected an emergency air valve designed with the idea of making more certain the dropping of the fender in all cases of an impending accident or collision. It is apparent that any cause for dropping the fender would also be a cause for stopping the car. Naturally the motorman's first thought and act in an impending accident or collision is to stop his car; in either case the fender should be down. The emergency valve applies the brakes and simultaneously drops the fender entirely independent of the regular valve. Another feature of the valve is that, its purpose being for quick stops in emergency cases, the motorman is not likely to use the regular valve to the emergency point so often, thus saving wear and tear on the brakes and the flattening of the wheels.

SEMI-CONVERTIBLE CARS ADOPTED AS STANDARD FOR GALESBURG & KEWANEE ELECTRIC RAILWAY

When the Galesburg & Kewanee Electric Railway Company placed its recent order of cars with the G. C. Kuhlman Car Company, it was the purpose of the company to secure a car that could be adopted as standard, and the semi-convertible type was finally decided upon as the best suited for a local service such as exists in and between small towns where the runs are short and the traffic light except at certain hours of the day. The initial order was for three cars of this type and R. H. Hayward, general manager, in a recent report on the performance of the new cars, states



VESTIBULED SEMI-CONVERTIBLE CAR FOR THE GALESBURG & KEWANEE ELECTRIC RAILWAY

that both management and public are well satisfied with them.

The Galesburg & Kewanee Electric Railway Company is a reorganization of the Galesburg & Oneida Railway Company, and is building an electric railway 40 miles in length of which 5 miles (the local line in Kewanee) are already in operation. The line as projected will connect Galesburg, Wataga, Oneida, Altona, Galva, Wethersfield and Kewanee, serving all told a population of about 36,000. The new cars are typical examples of single-track Brill semi-convertible cars and are standard throughout. The chief dimensions are as follows: Length over end panels, 21 ft.; over crown pieces, 31 ft. 4 ins.; width over sills including sheathing, 7 ft. 8½ ins.; size of side sills, 3⅝ ins. x 5 ins.; end sills, 3½ ins. x 8⅜ ins.; sill plates, 12 ins. x ⅜ in. Width of aisles, 22 ins.; length of seats, 35 ins. The interiors are finished in cherry, with ceilings of maple. The trucks are of the No. 21-E type with 7-ft. 6-in. wheel base.

FINANCIAL INTELLIGENCE

Wall Street, Oct. 9, 1907.

The Money Market

There has been no material change in the local money market during the past week, rates are for practically all classes of accommodations, ruling at the highest points recorded for several months past. The advance in call money rates to 10 per cent resulting from the calling and shifting of loans preparatory to the Oct. 1 interest and dividend disbursements was followed by a sharp reaction in the rate for demand money to 5 and 5½ per cent. This reaction was undoubtedly due in a great measure to the return to mercantile channels of the moneys disbursed on the first of the month, and to the intense dulness prevailing in the general security market. Time money, however, has ruled decidedly firm, and rates for all maturities extending from sixty days to six months command the full legal rate of 6 per cent and a commission, bringing the total charge to the borrowers up to 6½ per cent. Very little business, however, was reported in this branch of the market, borrowers generally being disposed to draw their requirements from the call money market. On the other hand, the banks and trust companies are not at all disposed to offer with any degree of freedom, and the small amounts of money appearing in the market come almost entirely from individual lenders. At the present writing, there is nothing in the situation to warrant the belief of any material easing off in rates for money for fixed periods in the near future. The Secretary of the Treasury continues to deposit government moneys with the national banks in this city, and at the principal interior points, and the present condition of the Federal Treasury makes it practically certain that these deposits will be increased from time to time. The demand for money at all of the principal Western and Southern points continues brisk, the shipments from this center during the week ending Oct. 5, being the largest since the beginning of the outward movement of money. The indications are that the demand from those sources will continue for some time to come, or until the grain and cotton crops have been moved. The banks have also sustained losses as a result of the excess revenues of the United States over disbursements, and on account of the collection of taxes by the city of New York.

The foreign exchange market ruled steady, notwithstanding a rather liberal export movement of wheat and cotton, but the belief in foreign exchange circles appears to be that in the near future shipments of our commodities will assume much larger proportions, and will result in a decidedly easier exchange market. The European situation continues comparatively easy. Private discount rates at London are still substantially below the official rate, but in well-informed quarters it is not expected that any change in the Bank of England minimum rate will be made in the near future, especially so as the Bank of England will probably be called upon to furnish a substantial amount of gold to finance the Egyptian cotton crop. Sentiment at Paris was also reported as more cheerful.

The bank statement published last Saturday was somewhat disappointing, inasmuch as the loss in cash amounted to $7,261,100, or about $2,000,000 more than was indicated by the preliminary figures of the week's currency movements. Loans decreased $11,283,100, due in part to the previous week's liquidation in the securities market, and to the transfers of loans from the banks to other institutions. Deposits decreased $18,490,400. The reserve required was $4,622,600 less than in the preceding week, which, deducted from the loss in cash, diminished the surplus reserve by $2,998,500. The surplus now stands at $2,648,075, as against $9,425,125 in the corresponding week of 1906, $4,286,175 in 1905, $12,636,900 in 1904, $16,577,125 in 1903, $1,527,350 in 1902, $560,025 in 1901, and $6,241,900 in 1900.

The Stock Market

It is safe to say that fully 75 per cent of the business now being transacted on the floor of the Stock Exchange is professional, and that the vast majority of recognized commission houses are virtually idle. Besides, the so-called investment firms are doing little or no business, the spurt in investment securities which followed the somewhat phenomenal rise in the New York City 4½ per cent bonds having subsided. In some exceptional instances prices have recently shown wide fluctuations, but generally speaking, the variations have been very meager, and, while somewhat irregular at times, the market has displayed wonderful steadiness in view of the dulness. Money has ruled considerably firmer, both on call and on time, the former having advanced at one period to 10 per cent, and there have been other developments in the situation which ordinarily would have caused greater or less weakness in security values. However, the liquidating movement has obviously run its course, and the existing short interest has served as a formidable backlog to the entire market.

The so-called Hill stocks have played a prominent part in the week's movements. The increase in the Great Northern dividend, and expectations of a similar happening in connection with Northern Pacific, had a strengthening influence on these stocks, and incidentally aided the balance of the list. The expectations concerning the Northern Pacific dividend, however, were not realized, and in the closing days of the week disappointment on this score had a temporarily depressing effect upon the entire list. Developments relative to the copper situation have not been particularly novel, although the reduction of the Anaconda dividend, as well as that of the Rio Tintos Company, in London, and the popular belief that the Amalgamated directors will follow a similar course, kept this phase of the situation more or less prominently in the public eye. Considering the prevailing conditions in the copper industry, and the prevailing idea that a further recession in the iron and steel trade is imminent, the shares of the industrial concerns have exhibited remarkable firmness, which is, no doubt, accounted for by the fact that in their recent sharp decline they have discounted all there is of an unfavorable nature in the situation.

Generally speaking, the local traction shares have maintained a comparatively firm tone, and at times have given evidence of an advancing tendency. This applies with particular force to Brooklyn Rapid Transit, which gathered considerable strength from the publication of the company's favorable annual report, as also from rumors of purchase of control by the Pennsylvania Railroad, and from revived talk of a probable early dividend. The announcement that the Metropolitan Street Railway, following the example of the New York City Railway, had gone into receiver's hands, had no appreciable effect on the Inter.-Met. securities, for the reason, no doubt, that all such unfavorable events have long since been discounted in the market.

Philadelphia

The intense dulness prevailing in the general securities markets during the past week was reflected to a very great extent in the dealings in the traction shares. Trading in this group was extremely light, and, while prices moved with more or less irregularity, the net changes in most instances were slight. Philadelphia Rapid Transit was the active feature, about 2,000 shares changing hands. Opening at 19¼, the price ran off to 18⅜, but at the close there was a sharp advance to 20⅛. Union Traction was strong, in sympathy with Philadelphia Rapid Transit, the stock advancing a point to 52. United Companies of New Jersey lost a point from 238½ to 237½, and Consolidated Traction of New Jersey ruled at 66½. Philadelphia Traction was dealt in at 87 and 87¼ for small amounts, and Philadelphia Company common sold at 38.

Chicago

The only development of importance in the Chicago traction situation during the week was the organization of a committee composed of bondholders of the various Chicago traction companies. It is understood that the object of the committee is to insure the co-operation of the various committees already organized, and to protect the interests of the various bondholders in the reorganization of the Chicago Union Traction Company, an early settlement of the questions at issue is looked for. The local traction issues have been very quiet during the week, and prices show material change. Union Traction common sold at 2½, Metropolitan Elevated preferred at 62, and South Side Elevated from 77 to 75, and back to 76½.

Other Traction Securities

The feature of the Baltimore traction market was the weakness in United Railway 4s, which declined from 84 to 83, on the exchange of about $45,000 bonds. The income bonds and the refunding 5s held about steady, the first named selling at 50¼ to 50, and the last named at 78; several hundred shares

of United Railway stock sold at 11½. Trading in the other traction issues was practically at a standstill. Lexington Street Railway 5s sold at 98. The Boston market was intensely dull and featureless. Transactions included Boston Elevated at 130 to 129, Boston & Worcester preferred at 60 to 59¾, Massachusetts Electric common at 12, preferred at 48 to 47½, West End common at 84, and the preferred at 100 to 98½.

Transactions in traction stocks have not been extensive on the Cleveland Stock Exchange the past week. The heaviest trading was done on Monday of this week, when 310 shares of Cleveland Electric changed hands, the lowest price of the day being an opening sale at 47¼, and the highest, a future delivery transaction, with the buyer agreeing to pay 49 in sixty days. The remainder of the trading in this security was at 47½, and at the close none was offered below 48. The previous selling price had been 49, and for some time there had been little demand for the securities. Northern Ohio Traction & Light sold in a small lot or two at 21½, but later in the week the bid price dropped to 20, with 23 asked. A small block of Aurora, Elgin & Chicago sold at 32, while the preferred was quoted at 73½ bid. One or two small transactions in Lake Shore Electric common took place at 7⅞, with 8 bid later on.

Security Quotations.

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Oct. 2	Oct. 9
American Railways	46½	46½
Boston Elevated	129	128
Brooklyn Rapid Transit	48	43
Chicago City	150	150
Chicago Union Traction (common) certificates	—	—
Chicago Union Traction (preferred) certificates	—	—
Cleveland Electric	50	45
Consolidated Traction of New Jersey	06	66
Detroit United	62¾	62½
Interborough-Metropolitan	8½	9¼
Interborough-Metropolitan (preferred)	24	24
International Traction (common)	—	—
International Traction (preferred) 4s	—	—
Manhattan Railway	116	115
Massachusetts Elec. Cos. (common)	11½	11½
Massachusetts Elec. Cos. (preferred)	47½	46¼
Metropolitan Elevated, Chicago (common)	19	19
Metropolitan Elevated, Chicago (preferred)	60	60
Metropolitan Street	34	30
North American	57	57½
North Jersey Street Railway	40	40
Philadelphia Company (common)	39½	38¼
Philadelphia Rapid Transit	18½	18¾
Philadelphia Traction	86½	86½
Public Service Corporation certificates	—	—
Public Service Corporation 5 per cent notes	92	92
South Side Elevated (Chicago)	77	76
Third Avenue	42	36
Twin City, Minneapolis (common)	92½	92
Union Traction (Philadelphia)	49¼	51

Metals.

According to the "Iron Age," the pig iron production is continuing at the recent gait. There has been a modest accumulation of stocks of pig iron in some sections, but, generally speaking, furnace yards are bare. The markets throughout the country are dull. While in some quarters a slight improvement in the volume of orders for finished material has been observed, others complain that the volume of business for forward delivery is very small.

A further decline has taken place in copper, and apparently every effort to support the metal has been given up.

A PLAUSIBLE IMPOSTOR

It has been brought to the attention of the editors of this paper that a man who was some time ago defrauding members of the mechanical, electrical and engineering fraternities in this country has recommenced operations. It is advisable, therefore, to publish his description again and warn all readers against being deceived. He is an Englishman, about 30 years of age, 5 ft. 7 or 8 ins. in height, slight build, light complexion, and has crooked teeth. He generally represents himself as the son of some large manufacturer or other important man in England, over here on business. He is very well posted as to the names of products and manufacturers on both sides of the Atlantic, is very plausible, and, as a rule, after gaining the confidence of the men upon whom he calls he tells a story about having been robbed and asks for a loan anywhere up to $100 which is intended to tide him over until he can get money from his father to whom he has cabled. Any one who will capture this man and hand him over to the police will earn the gratitude of a large number of concerns in this country that have suffered from the man's impositions.

THE SITUATION IN CLEVELAND

The Cleveland Electric Railway Company again began selling seven tickets for a quarter last Wednesday morning, without previous announcement or notice of any kind. The decision upon this point was reached at a meeting of the board of directors held the day before. A statement was prepared by President Andrews for the newspapers, in which he says that the action was taken in order that the people might become acquainted with the proposition the company has made, seven tickets for a quarter and transfers, with double transfers on the crosstown lines. Outside of the features relating to underground terminals at the public square and rapid transit lines in the various directions needed, the voters may now be able to determine the merits of the offer of the old company by experience. When the company was operating on this fare some months ago, the transfer privileges were not so liberal as those included in the offer of settlement.

While this change was being made by the old company, Mayor Johnson was on the stand in Common Pleas Court, explaining that his plan would provide for three-cent fare only within the city limits, whether on the holding plan or not, and that the suburban towns would have to fight the matter out for themselves. Where they have agreements with the old company that the fare shall be the same at all times as that charged in the city, the contract would have to be observed on the holding plan, he said, but otherwise a fare, commensurate with the cost of service, would obtain outside of the city limits.

The taking of evidence in the trial of the injunction cases against the low fare companies was completed in Judge Lawrence's court last week, and the pleas of the attorneys were made. The strong points were summed up in rather plain terms by the attorneys. Mayor Johnson came in for comparison with Lincoln and Chase, in their work of securing money for the expenses of the Rebellion, and Morris, who financed the Revolution, on the one side, and a declaration that such a comparison profaned the names of these great men on the other. The Mayor's interest in the new company amounted to fathering the enterprise and acting as general manager, according to the declarations of the Cleveland Electric attorneys, and the statement was made that no official so bound up in private corporations as he was, could act for the best good of the people, if such action was against the ultimate success of those corporations. The decision of the court is expected some time this week.

On Monday evening, Oct. 7, the City Council adopted a resolution accepting $84,488.37 from the Cleveland Electric Railway Company for the use of Central Avenue and Quincy Street after the franchises had expired. This is the amount of the award made by Secretary H. J. Davies, of the Cleveland Electric Railway, and A. B. Dupont, of the Municipal Traction Company, some time ago. The meeting scheduled for a few days ago between these men was as much for the purpose of deciding whether the company made money at the 3-cent fare as anything else. Both filed letters with the Council, giving their version of the disagreement, as did President Andrews, of the Cleveland Electric Railway, who also asked that Bion J. Arnold, the street railway expert of Chicago, be appointed as one of the arbitrators. Mr. Davies asked to be relieved from further work on the board, and Mr. DuPont said he was ready to be replaced at any time.

On Monday Congressman Burton, Republican candidate for mayor, held conferences with both President Horace E. Andrews, of the Cleveland Electric, and A. B. DuPont, of the Municipal Traction Company, in an effort to clear up a number of points in the traction situation.

Judge Kennedy, of the Common Pleas Court, has sustained City Clerk Peter Witt's contention that he has a right to bring suit to prevent the Cleveland Electric Railway from spending money for the purchase of consents and fighting the Forest City Railway Company. The court said the company has no right to buy consents on streets in which the city has not granted it a franchise. Witt's petition will be heard on its merits on Oct. 15.

RESIGNATION OF H. H. VREELAND

Herbert H. Vreeland resigned hast week the position of manager for the receivers of the New York City Railway Company, to which he was appointed last month by Messrs, Joline and Robinson. It is understood that Mr. Vreeland will be succeeded in this position by Oren Root, vice-president and general manager of the New York City Railway Company. Mr. Vreeland has not resigned his offices of president and director of the New York City Railway Company, and will still act for the company and the receivers in a consulting capacity. This was Mr. Vreeland's letter to the receivers:

Gentlemen: When you requested me to act as manager for the receivers, I felt that it was my duty without hesitation to comply and to remain in that position at least until permanent receivers were appointed. Now, however, I find that the demands upon my time due to my personal matters and to my connections with various other properties and interests are such as to make imperative the request, which I now make, that you accept my resignation as such manager.

I appreciate the evidence of confidence which was shown by my appointment, and I assure you that not only because of my official connection with the corporation, but on my own behalf, you shall at all times for yourselves and your representatives command of my services and advice along any lines which may be deemed of value to you in the difficult and complicated task which you have assumed.

The receivers' reply was as follows:

Dear Sir: We have your letter of this date tendering your resignation of the position to which you were appointed by us on Sept. 24 as manager for the purpose of attending to the physical operation of the properties in our charge as receivers under the order of the United States Circuit Court filed Sept. 24, 1907.

In accepting such resignation we beg to assure you of our appreciation of the services which you have rendered during the short time that you have been able to act with us, and shall not hesitate to avail ourselves of your kind offer to further assistance should occasion arise.

Mr. Vreeland received a hearty ovation at the annual meeting of the Metropolitan Street Railway Association, held Oct. 5 at Carnegie Hall. This is an organization of the employees of the system and Mr. Vreeland has been its president since he has been connected with the company. He referred to the official and legal complications which had arisen in the company's affairs and which made it necessary for him to give attention to matters which seemed of more pressing importance than those of operation. He said, however, that the men were well acquainted with the present manager of the property. He continued that his attitude toward the association and men would never change, and that he believed their organization the most efficient and loyal ever built up in any street railway system.

THE TRANSIT INQUIRY IN NEW YORK.

The Public Service Commission, at the hearing the latter part of last week, considered at length the details of the various accounts of the Metropolitan Street Railway Company and the New York City Railway Company.

The books of both the Metropolitan Street Railway and Metropolitan Securities were offered in evidence. The books of the Metropolitan Street Railway were opened in the spring of 1902, and the examination by the commission disclosed the names of all those who had received money from the corporation from the opening of the books down to date. The total paid to lawyers during that time amounted to $916,438.68, while the payments to Mr. Quigg for special services aggregated $217,307.77.

Mr. Quigg explained that the money received by him was used in connection with the various subway projects. Explaining how he spent the money. Mr. Quigg said:

"During the period beginning somewhat previously to the opening of this account, within which the Metropolitan interests were endeavoring to obtain the right to build and operate, or at all events to operate, a tunnel, they submitted to the Rapid Transit Commission plans for routes that were especially favorable to their scheme to give transfers from the new line of tunnel at every intersecting point with the surface lines. These plans were opposed by many other interests from time to time, or other plans were proposed by other interests that conflicted with theirs."

Mr. Quigg organized property owners' associations to help the fight, paid all the counsel fees and also circulated a petition through the East Side, which alone he said cost $50,000.

ANNUAL REPORT OF THE BROOKLYN RAPID TRANSIT COMPANY FOR THE YEAR ENDED JUNE 30, 1907

The pamphlet report of the Brooklyn Rapid Transit Company for the year ended June 30, 1907, just issued, shows the total earnings from operation to be $19,381,587, an increase of 4.92 per cent over the previous fiscal year. The percentage of operation to earnings is 59.16 per cent, as compared with 56.52 per cent for the year ending June 30, 1906. The net earnings from operation are $7,915,882, a decrease of $116,068. The amount of surplus after making all deductions is $2,002,598, equal to 4.45 per cent on the capital stock of the company. There were carried 511,839,437 passengers, an increase of 59,235,234, or 13.1 per cent over the previous fiscal year. The average gross earnings per passenger is 3.60 cents as compared with 3.89 cents for the preceding year, a loss per passenger of 7.5 per cent. The average net earnings per passenger (with no deductions for special appropriations or fixed charges) is 1.48 cents, as compared with 1.70 cents for the previous year. This deduction in net per passenger is accounted for partly by the increase of 41.2 per cent in number of transfers collected. The average number of cars operated daily for the twelve months ending June 30, 1907, is 2093, as against 1922 for the previous year, an increase of 9 per cent. The total passenger car mileage is 68,273,181, an increase of 4,615,858, or 7.2 per cent. In considering the increase in the average number of cars operated daily and the average number of passengers carried each day per car there should be taken into account the greater seating capacity of the cars placed in operation during the fiscal year ending June 30, 1907. Owing to lack of space the comparative income account and balance sheet cannot be published until next week's issue of the Street Railway Journal.

In presenting the report President Winter has gone into the details of the various improvements in quite an extended way, taking up the work separately and not generalizing. In part, he says:

"One hundred elevated motor passenger cars have been ordered for delivery in the latter part of the year 1907. These cars will be equipped with two 200-hp motors, multiple unit control and air brakes. One special steel motor passenger car has also been ordered. One hundred and forty-three-surface convertible passenger cars and thirty freight cars (ten box and twenty gondola) have been received and placed in operation. The convertible passenger cars are each equipped with four 40-hp motors and air brakes. One hundred semi-convertible closed surface passenger cars have been ordered for delivery during August and September, 1907. These cars will be equipped with two 60-hp motors. Three hundred and sixty-four passenger cars have been vestibuled. Each surface car has been equipped with an additional fare register for the registration of transfer tickets. Specifications are being prepared for 100 additional elevated and 100 surface motor passenger cars."

Four sub-stations have been completed and put in operation. Plans are under way for the enlargement of the Bridge sub-station from 6000 kw to 13,000 kw capacity, and for two additional sub-stations, each of 10,000 kw capacity.

On June 30, 1907, the combined rated capacity of the power stations aggregated 73,660 kw, an increase of 15,000 kw over the previous year, or 25 per cent. The combined capacity of the sub-stations aggregated 47,000 kw, an increase of 13,500 kw, or 40 per cent.

Contract was entered into with the city on April 26, 1907, for the operation of elevated service across the Williamsburg Bridge to Manhattan. The city has laid tracks on the bridge and has under construction the Manhattan and Brooklyn terminals and extension of the structure on the Brooklyn plaza.

The Ninth Avenue depot and repair shop building is completed and in use. The new Maspeth depot, repair shop and office quarters, with club rooms, waiting room, etc., is nearing completion. A modern two-story building is under construction on Nostrand Avenue for track and line departments.

The aggregate taxes and impositions for 1907 are $2,252,000. The only taxes in litigation at the present time are those affecting the companies' tracks and lands constituting private rights-of-way, and special franchise taxes. As to the former, there is still to be paid, if the assessments stand in full, except as already reduced by decisions of a referee, $114,100.68, and there is reserved on the books for payment of this balance when determined $173,952.42, or an excess charge, if no reduction is obtained by litigation, of $59,851.74.

STREET RAILWAY PATENTS.

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED OCT. 1, 1907.

867,401. Beamless Brake Mechanism; James B. McKiel, Marshall, Tex. App. filed July 9, 1907. A floating lever arranged between and pivotally connected to both brake and shoe levers, tension rods connecting the floating lever to the brake shoe levers and a tension rod for operating the floating lever.

867,406. Rail Bond; Lewis T. Pates, Upper Alton, Ill. App. filed Dec. 26, 1906. The bond has forked ends adapted to spread in divergent directions when they are driven into apertures in the rail ends.

867,415. Rail Bond; Frank W. Richey, Chicago, Ill. App. filed Dec. 5, 1902. The bond is made up of ribbons so bent as to avoid breakage by expansion and contraction of the rails, and pressed into copper heads.

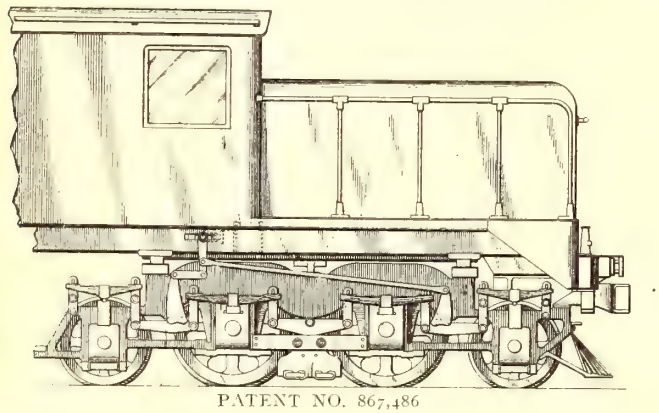
867,432. Pleasure Railway; Charles H. Smith, Chicago, Ill. App. filed Feb. 8, 1907. A gravity railway having a track with a descending course curved in one direction with respect to the direction of travel, followed by an ascending course curved in the reverse direction, and a water tank through which the track runs in shallow water, the sides of the tank having water encased in glass.

867,434. Track Sander; Joseph M. Smith, Worcester, Mass. App. filed Jan. 30, 1907. The sand drops by gravity into a casing having a worm wheel wherein which, when rotated, carries the sand to the discharge pipe.

867,448. Signalling System for Railways; Louis H. Thullen, Edgewood, Pa. App. filed June 23, 1906. Relates especially to signal systems for railways the track rails of which are included in and form part of the return path or conductor to the generator for the current employed for propelling motor cars along the railway.

867,482. Locking Mechanism for Controller Handles; Archibald S. Cubitt, Schenectady, N. Y. App. filed Jan. 2, 1906. Relates to the mechanical construction of the handle of the controller, having a locking lever depressed by a button on the handle.

867,486. Electric Locomotive; Samuel T. Dodd, Schenectady, N. Y. App. filed Feb. 18, 1907. Has driving-wheels and



PATENT NO. 867,486

idlers and means operative upon a predetermined variation of load on the driving motors for varying the distribution of weight on the wheels.

867,506. Amusement Apparatus; Otto Hermann, Philadelphia, Pa. App. filed Nov. 19, 1906. Comprises an inclined track having an outwardly and upwardly-inclined portion, and a landing so related as to cause the descending car to spring outwardly and upwardly, front end foremost, turn a complete somersault in space, and become reversed end for end, and descend on the landing.

867,528. Point Shifter for Tramways and the Like; George D. A. Parr, Leeds, England. App. filed Aug. 18, 1905. A clockwork device released by an electromagnet so as to cause successive actuations of the switch point in alternate directions.

867,533. Air-Brake System; Henry N. Ransom, Cleveland, Ohio. App. filed July 10, 1905. Details of an improved air-brake system by which the brakes may be operated either by straight air pressure controlled by an operator, or will act automatically in an emergency.

867,563. Automatic Block Signaling System; Daniel J. McCarthy, Wilkinsburg, Pa. App. filed Aug. 16, 1907. A block signal system of the type employing danger and caution signals and track rails energized by an alternating current in separate block sections. Uses alternating-current relays.

PERSONAL MENTION

MR. ANDRAL VAN has been appointed claim agent of the Houston Electric Company, Houston, Tex., to succeed Mr. M. D. Fields, resigned.

MESSRS. HAROLD WALLEM and C. F. Schrotte, of the engineering department of the Siemens-Schuckert Werke, of Berlin, are on a tour of this country, studying high-tension developments.

MR. C. C. LINES, heretofore superintendent of construction of the Beloit (Wis.) Traction Company, has resigned, effective at once, to become connected with Fairbanks, Morse & Co., at Beloit.

MR. E. W. NORRIS has resigned as chief engineer of the Newport News & Old Point Railway & Electric Company of Hampton, Va. Mr. Norris has been chief engineer of this company since the road was constructed several years ago.

MR. V. R. HUGHES, who resigned recently as chief engineer of the Pueblo & Suburban Traction Company, Pueblo, Col., to accept a similar position with the Northern Colorado Power Company, Denver, Col., has been appointed master mechanic of the American Beet Sugar Company, at Las Animas, Col.

MR. JOSEPH O'HARA has resigned as superintendent of the Aurora, Elgin & Chicago Railroad Company, with headquarters at Wheaton, Ill., to accept a position with the Washington, Baltimore & Annapolis Electric Railway. Mr. O'Hara was formerly connected with the Eastern Ohio Traction Company, Cleveland, Ohio.

MR. HARVEY M. LITTELL, recently general manager of the San Antonio Traction Company, has resigned from the street railway business to enter that of automobiles. On Oct. 1 his connection was announced with the Harry S. Houpt Company, of New York. This company is the agent for the Thomas automobiles, and has its headquarters at Broadway and Sixty-Third Street.

MR. C. L. CADLE, until recently superintendent of the Electric Railway Improvement Company, of Cleveland, has resigned to become electrical engineer with the Rochester Railways Company, of Rochester, of which Mr. E. J. Cook, formerly of Cleveland, is general manager. Mr. Cadle formerly served under Mr. Cook as superintendent of battery stations for the Cleveland Electric Railway.

MR. FRED A. STOWE has been appointed assistant to President T. E. Mitten, of the Chicago City Railway Company. Born in Chicago, Aug. 29, 1872, he graduated from the University of Iowa in 1892, and subsequently took a post-graduate course in political economy at the University of Chicago, and in law at Northwestern University, Evansville, Ill. He then engaged in journalistic work, first on the Chicago *Tribune*, and then on the Chicago *Chronicle*, on which he remained as political editor for ten years.

MR. J. C. McPHERSON, assistant superintendent of the northern division of the Pacific Electric Railway Company, has been appointed to the position of superintendent of the Los Angeles Inter-Urban Railway Company. Mr. McPherson will have his headquarters in Los Angeles, where his jurisdiction will extend over a number of the city lines and the Glendale, Tropico, Casa Verdugo and San Pedro lines. The appointment went into effect Oct. 1. Mr. McPherson has been connected with the Huntington interests for the past eleven years. Before coming to California, Mr. McPherson was connected with the Santa Fe Company, with headquarters at Albuquerque and Las Vegas, N. M. Mr. J. F. Turner, who has been superintendent of the Mt. Lowe division, with headquarters at Echo Mountain, has been promoted to the position of assistant superintendent of the northern division, with headquarters in Pasadena.

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DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

Of this issue of the Street Railway Journal 8300 copies are printed. Total circulation for 1907 to date 346,350 copies, an average of 8246 copies per week.

The Atlantic City Convention

At the time of going to press with this issue the Atlantic City convention was largely over. The three affiliated associations had concluded their sessions and the main association had got well started on its programme of papers and reports. Up to the time at which this paper is being printed, also, the weather has been ideal—a factor which undoubtedly has added greatly to the comfort of the delegates and the success of the various features which go to make up the convention in its entirety. There was a crispness in the air, especially in the early morning, as was to be expected on a clear October day, but it was tempered by the proximity to the ocean, and by the time that the delegates arrived at the Steel Pier the atmosphere had attained a comfortable, almost balmy temperature. It would be a trite remark to say that the convention as a whole was the most successful in the history of the association. This, however, was the general verdict of those who attended the meetings this week of the American Street & Interurban Railway Association.

The exhibits as usual constituted a most important feature of the convention and as a whole constituted the greatest display of electric railway apparatus of various types which had ever been collected together. The previous exhibition at Columbus had, of course, set a precedent which was difficult to excel. Nevertheless the total space occupied by the exhibits of the past week, according to the records, was greater than that in the double quadrangle of Ohio State Fair buildings last year. The fine display of cars at Columbus was lacking, owing to the impossibility of providing for rolling stock on the pier, but several end sections of cars were shown, and on a siding arranged from the Virginia Avenue trolley tracks a fifteen-cycle, single-phase locomotive was exhibited and served as a substitute for the several passenger cars shown at Columbus.

Of course the continuance of clear skies made the exhibit what it was. In this the association was fortunate. A period of rain, such as experienced last June at the time of the M. M. and M. C. B. conventions, would have marred seriously this feature of the convention week. It is the possibility of this contingency which has an important bearing upon the desirability of Atlantic City as a meeting place. On the other hand, the three other desiderata of a convention city—good hotel accommodations, accessibility and opportunities for devising a satisfactory entertainment programme—were unexceptionable. The fact of the matter is that with the present size of the association and of the exhibits as a whole, very few cities in the country possess all the facilities required by the association. Atlantic City is lacking only so far as exhibit accommodations in case of wet weather is concerned. This fact is realized by the local interests, and while the absence of a closed exhibit hall did not interfere with the pleasure of anyone, during the progress of the Atlantic City convention the importance of making such provision for future years is one which cannot be too strongly emphasized.

Coming now to the more serious part of the week's work, we do not believe that anyone could find fault with the programme arranged for the convention of the different

associations. This was practically the first meeting of the various bodies under the new conditions, because the work last year had necessarily to be largely devoted to organization, but the results fully justify all of the work undertaken in reorganization.

The space at our disposal this week and the date of closing our forms prevent an individual discussion here of any of the papers and reports of committees other than those presented before the Engineering Association. Both the Claim Agents' and Accountants' associations, however, had an excellent list of papers, and each accomplished all the work expected of it. The programme of the American Association was particularly rich in interesting topics. The fear at one time felt by some that if the subjects comprised within the scopes of the different affiliated associations were referred to them there would be none for the main association to discuss, was proved to be without foundation. Questions of organization, public relations, promotion of traffic and the proper policy to pursue in other departments of the industry are so numerous that many meetings could be held without exhausting those which could profitably be considered. Under the direction of Mr. Beggs, who made an ideal presiding officer and whose wealth of experience permitted him to draw examples from his own roads upon different points under consideration, the meetings of the American Association were productive of the greatest value. The presentation of the reports and papers at the concluding sessions of this association are deferred until next week.

The Report on Standards

The importance of establishing standards for those parts of the railway equipment which are capable of being brought to uniformity was emphasized in the annual address of Mr. Beggs to the American and to the Engineering associations, as well as in the annual address of President Adams. The subject is not a new one, as reports on the subject have been presented to the main association at least four times in its history. Two years ago, however, it was decided that the importance of accomplishing something definite in this direction warranted further work along lines different from those by which the subject had previously been approached. The task was taken up by the Engineering Association, and its committee has been engaged upon the work ever since. Last year's report chronicled progress, but this year concrete recommendations upon axles, journals, journal boxes, brake shoes and wheels were presented for the consideration of the association. As readers of this paper know, meetings of the engineering committee on standards have been held during the past year. At these meetings the subject has been carefully discussed with representatives of the makers of the various kinds of equipment. Formerly each manufacturing company and each operating company was very much a law unto itself as to the size and type of the equipment installed. During the year, however, it has been found possible to reconcile the conflicting claims, requirements for space on the axle and the demands of existing apparatus. The main recommendations which the committee expected to embody in its report have been a matter of common knowledge for some weeks on account of the reports of the meetings of the committee which have appeared in the technical press and when presented at Atlantic City appear to have met general approbation. The fact that they were not very radical is evinced by the condition discovered by many delegates that the standards recommended correspond very closely to those at present in use on their roads. In some cases the correspondence was identical, in spite of the fact that the designs of the committee were not patterned after those of any one road, but were constructed to be in harmony with the other requirements as disclosed during the investigation.

Neither the committee nor the association look upon the report at Atlantic City as a finality in the work of standardization. It was offered and accepted as a beginning only, but as a foundation upon which further work could be based and continued in the future as far as the needs of the street railway companies in the country require. The association wisely decided, therefore, to continue the committee on standardization, the composition of the committee to be left to the incoming administration.

The work done in the direction of standards will be useless, however, unless the companies avail themselves of the recommendations and employ them in the future so far as they can. On this point the committee can do nothing except in individual instances. It rests with the roads themselves whether they will enjoy the benefits which will accrue from that uniformity in dimensions which has frequently been advocated on the floor of the convention or whether they will permit the present condition of affairs to continue. The standard forms will undoubtedly be cheaper and more easily procurable than odd patterns, and the difference in cost and promptness in delivery should grow greater with each additional company which adopts the suggested standards. There is, therefore, every inducement to concerted action along these lines.

Report of Committee on Maintenance and Inspection of Equipment

The report of the committee on maintenance and inspection of electrical equipment is most interesting, both as a compilation of current practice on many roads and as to the recommendations which are made as to time and method of inspection and overhauling. As regards the mileage versus the time basis governing inspection, the committee recommends the former, although a large percentage of the roads reporting are governed by the latter. The mileage basis really appears to be much more rational, and probably is not adopted more generally on account of the clerical labor made necessary by it, although this comparatively slight additional expense would seem to be well warranted.

It would seem from the data accompanying the report that most companies are inspecting and overhauling some equipment too often. Controllers are an example, as the committee suggests that all types of control be given a thorough overhauling but once in 60,000 miles. However, those roads which inspect at shorter intervals than this probably do not give the controlling apparatus the thorough overhauling which is believed desirable by the committee. Not only the time, but the method, must be well chosen for the best results. The subject of "day or night inspection" was taken up, both in the paper and in the discussion, with

an evident leaning of the committee toward day inspection, although this point brought out considerable discussion on the floor of the convention.

Car wiring, trolleys and safety devices are other topics considered in the report. Armature repairs have been given careful attention by the committee, which opens the subject with proper consideration of the question of motor temperatures in operation, evidently in the belief that motors are too commonly operated beyond their capacity. This discussion of the cause before recommending remedies for the effect is commendable.

Taking up the causes of commutator and brush holder troubles, the committee averages replies from various parts of the country, showing that 42.6 per cent of this trouble is charged to fast feeding of controllers and 18.2 per cent to poor brushes. As preventatives for the first cause, the report recommends the use of automatic current limiting devices, where possible, and in all cases a thorough and persistent attempt at the education of motormen, who may err through thoughtlessness or lack of knowledge of the harmful effect of fast feeding of the controller. In regard to the quality of brushes to be used, there appears to be a wide difference of opinion, the subject seeming to be one on which some further time might well be spent possibly in connection with experimental tests, toward a bringing together of the differences in present practice.

The Reports on Turbines Presented at the Convention of the Engineering Association

Of the four papers on subjects relating to prime movers which were presented at the convention, three had particular reference to the steam turbine. The three steam turbine papers were presented by engineers representing three manufacturers and two types of turbine, but were not written along similar lines, so that a comparison between the types and designs is not possible with these papers alone as text. Mr. Chilton's paper deals with construction details, with special reference to the Parsons type of turbine as manufactured by the Allis-Chalmers Company. He explains clearly the difference between the impulse and the reaction turbine, the Parsons turbine being a representative of the latter class. After a general description of the Parsons type the author goes into a detailed description of the method of attachment of blades, the protection of bladetips and the arrangement of the balance pistons in the design of this type as manufactured by his company. He recommends a steam pressure of about 150 lbs. as being the most economical in the operation of turbines, stating that a greater saving may be effected by the use of a small amount of superheat than by increasing the initial pressure above that amount. He remarks that an increase in pressure to 175 lbs. results in a gain of but 2 per cent in steam economy, an additional 3 per cent being gained in an increase to 200 lbs., against which should be placed the increased cost of piping, boilers and possibly of the turbine itself. He brings out the point that a higher vacuum is not required with turbines than with reciprocating engines, but that the turbine can utilize high vacuum to better advantage. The difference in economy within the range between 6 ins. and 3 ins. absolute terminal pressure is approximately 5 per cent per inch, the rate of increase of economy proceeding at a greater ratio as the terminal pressure goes below 3 ins. The use of superheated steam increases the economy, but the increment of saving becomes smaller as the superheat is increased, the reduction in steam consumption with 50 degs. F. superheat approximating 7 per cent, with 100 degs. F. 10 per cent and with 150 degs. F. 12.5 per cent.

The title of Mr. Kruesi's paper is "Curtis Turbines in Railway Service." In his introduction he mentions the severe character of railway loads, especially in connection with interurban and heavy traction systems operating relatively few cars on infrequent headway, and the peculiar adaptability of the turbine to such loads, while maintaining a high economy. The results of three recent tests on Curtis turbines are given. The test of a 9000-kw turbine by the Commonwealth Electric Company, of Chicago, showed water rates of from 12.9 to 13.6 lbs. per kw-hour on loads ranging from about 50 to 150 per cent of the rating. This the author mentions as representing the "highest attainment this far reached in the generation of power from steam." He shows that steam at the pressure and superheat employed in the three tests referred to and expanded to 1.5 ins. absolute terminal pressure would give an economy of 9.27 lbs. water per kw-hour in a theoretically perfect engine or turbine with a generator of unity efficiency, and that the turbine in these tests has attained an efficiency of 76.4 per cent of that theoretically obtainable, which "indicates that we are approaching the practical limit of perfection in the production of power from steam." On the subject of the rating of turbine generators Mr. Kruesi points out that while generators for engines have been designed with an overload capacity of 50 per cent for two hours only, generators for use with turbines should be designed to operate continuously at a larger proportion of the maximum output of the turbine. On the subject of pressure, vacuum and superheat, Mr. Kruesi's statements agree with those in Mr. Chilton's paper. In the matter of superheat the suggestion is made that much of the trouble which has attended the use of superheated steam is due to the want of elasticity in the parts affected, it being probable that water may exist under certain conditions with superheated steam, the resulting variations in temperature, due to the spraying of heated surfaces being enormously increased thereby. Changes in design of pipe fittings, valves, boilers and superheaters to care for this factor are suggested in order to permit of higher degrees of superheat. Improvement in economy arising from better vacuum is mentioned as that most easily attained, and an improvement in condensing equipment the easiest manner in which to lighten the duty on the boilers.

Mr. Bibbins' paper deals especially with a particular design of station which is a recent development in steam turbine power station work. Plans for the Fort Wayne & Wabash Valley Traction Company's Spy Run station were described in our last year's convention issue, Oct. 13, 1906. This station has been completed and in operation for some months, and the features of its construction and operation are described in the paper before us.

The station handles a combined railway and lighting load, as is fairly common with companies of its character. The author shows the manner in which the lighting load makes up for the early morning deficiency in the railway load, the latter usually falling off in the evening as the

lighting load increases, and although the two systems are independent as to generators and turbines, steam is supplied to meet the average load of both systems, resulting in a much more effective working of the boiler capacity. Relating to this subject of improvement of efficiency with betterment of the load factor, the author presents curves showing the effect of the load factor on operating costs under the conditions obtaining at Fort Wayne. These curves show that an increase in low load factors brings greater increase in efficiency than a corresponding increase in higher load factors. A description of the Fort Wayne station is given, embodying as features peculiar to its design a two-story building, with generating machinery on the second floor over the boilers, allowing simple, short and direct steam piping, with continuous upward slope from boiler nozzles to turbine throttles and barometric jet condensers entirely below the exhaust outlets of the turbines. While the remaining features of the design are those commonly found in stations of approximately this capacity—7000 kw—yet there is an absence of engineering "frills" for securing the highest possible efficiency, this being compensated for by lower capital cost. This low first cost, as well as the small area of station per kilowatt capacity, are the two important features of this type of station as brought out by the paper. The general arrangement, that of turbines and generators on a second floor above the boilers, accomplishes the second—small ground area, while it aids materially in the first—low cost. The cost of the building is certainly low—$10.97 per kilowatt, figuring the ultimate capacity of 8500 kw. It is shown that with larger boiler units a more compact arrangement might be made, while it is quite possible that with a demand for stations of this type a boiler could be obtained giving a narrower battery. The arrangement, while an ideal one for steam piping requirements, is also conducive to low cost of piping, this charge being about $2.50 per kilowatt. Economizers were not considered necessary on account of the low cost of fuel. Mechanical stokers are used, both to provide forcing capacity and to reduce labor cost, the present saving in labor being estimated at about $16 per shift of twelve hours. Barometric jet condensers are used, the condenser head being suspended beneath the turbine. A vacuum of 26.5 to 27 inches at full load is maintained in warm weather, the cost of the condensing equipment being only about $2.50 per kilowatt, including pumps and piping. The turbines are of the Parsons type, part of the generators being 25 cycle and part 60 cycle, for the railway and lighting load, respectively. The exciters are direct connected to the turbines, and while adding 2.6 per cent to the cost of the main generating unit, represent a saving of 20 per cent as compared to the cost of independent exciting units. The operating costs, considered strictly alone, are not especially low, but are expected to reduce with the better load factor which will be the result of contemplated extensions in the traction lines. The labor cost is fairly low, being 0.12 cent per kw-hour at present. Taking into consideration, however, interest, taxes and depreciation, the total power cost, including these items, is quite low, being 0.79 cent per kw-hour with the present load factor of 24 per cent. Curves are presented showing that with 33 per cent load factor this total cost will be reduced to 0.57 cent, and with a possible load factor of 50 per cent to 0.41 cent per kw-hour. This low total cost of course is possible due to the very low cost of the completed power station, which is shown to be but $66.25 per kilowatt, exclusive of land. Interest and taxes are taken as 7 per cent, while a sinking fund of 4.2 per cent, equivalent to 6.43 per cent depreciation, is allowed in figuring total cost of power.

The paper submited by Mr. Bibbins before the Engineering Association included a chart and table, showing data on the Fort Wayne station in comparison with that on twenty-two other stations, including five engine-driven stations, the remaining seventeen using turbines both of the Curtis and Parsons types. Particular reference is had to compactness, the Fort Wayne type appearing quite favorably in this respect. The lengthy appendix referred to is published in the Street Railway Journal with the rest of the paper.

Mr. Bibbins' paper is quite interesting in giving actual construction and operating details on this departure in power-station design. The further operation of this type of station will be watched by engineers with considerable interest on account of its relatively small ground area and low first cost, either of which factors may be most important in the design of the power station. The discussion of the gas engine papers presented at the Atlantic City convention will be taken up later.

The Track Meeting at the Convention

Several very interesting phases of track maintenance were suggested by Mr. Wilson's paper on "Care of Electric Railway Tracks," presented at the engineering association meeting Tuesday morning. Heretofore the superintendent of way of an electric railway has usually been content to spend all of his appropriation in keeping the track itself in good shape. But Mr. Wilson suggests that his work should extend to include making the right of way pleasing to the eye by the removal of rubbish, weeds and unsightly objects. The suggestion is a timely one to right of way men who are in the habit of allowing old ties or timbers and other objects which have passed their period to lie scattered along the right of way wherever they may have been thrown by section gangs. An occasional period of general cleaning up, during which bonfires are made of such objects, would probably draw favorable comment from passengers. At any rate such cleaning periods would cost very little. Of course, the work of beautifying the right of way should be carried out on a more extensive plan on suburban lines or lines to outlying pleasure parks. The discussion showed that several companies were giving this matter considerable attention.

According to Mr. Wilson great difficulty is experienced by the maintenance of way man in getting the proper kind of labor for track work. The discussion emphasized the fact that in cities the lowest grade of foreign labor is frequently the only kind available at the prices paid by street railway companies. And it was the universal opinion that the character of the labor was most important in track maintenance. The only solution to the problem seems to be to pay a little more than do others for similar work, or to offer inducements such as car fare or employment for a longer period during the season.

The suggestion to make men feel that the company be-

longs to them and that they are an integral part of the organization is a good one. When this can be done the company stands better chances of getting more efficient labor, no matter what class of work it may be.

The discussion indicated a decided tendency toward the use of machines in track construction and repair work wherever they could be employed to advantage. But there are sometimes objections to machinery on the part of the city authorities. One member stated that the use of a concrete mixer had to be discontinued because horses were frightened by it.

Present conditions of high wages and an inferior grade of labor probably warrant the use of machinery where under normal conditions the work could be carried out to better advantage by hand. If present conditions continue no doubt manufacturers of apparatus will be called on to develop a more extensive line of tools for track work. It was generally conceded that the use of machinery tended to make the work more exact than when the judgment of the foreman is depended on.

For securing uniform practice among the different division foremen the use of specifications and drawings was urged. This suggestion could he used to advantage in practically all phases of electric railway work, and it is in line with the idea expressed at another meeting that definite rules for the inspection of cars be drawn up and distributed to foremen.

Heavy Electric Traction Abroad

Mr. Dawson's paper on European electric railway practice in our convention number is one that should be taken to heart by American railway men. Certainly there has been plenty of enterprise in this country in electric traction, but it has been pretty steadily directed along certain somewhat conventional lines. The typical American road of the more important kind has been an interurban line operating fast and powerful motor cars, and occasionally trailers, employing standard d. c. motors supplied from an ordinary trolley car system, or, more rarely, from a third-rail. Only very recently in a few cases have the canons of standardization been violated to the extent of taking up traction with alternating currents and at voltages that promise something like reasonable economy of distribution. On the Continent, however, things have moved more rapidly and considerable headway is being made. The most striking point in European practice so far is the uniformly favorable view that is being taken of single-phase traction. Of course there are successful d. c. suburban systems, as in and about London, and successful three-phase systems, as in case of the Valtellina line, yet the foreign engineers seem at the present time to have been pretty thoroughly converted to single-phase ideas. Here there is a heavy pressure of conservatism bearing all the time in favor of apparatus already standardized, whether it happens to be the best suited for the purpose or not.

There is too strong a current tendency toward "catalogue engineering" to permit the prompt acceptance of even useful and important innovations. Abroad there has always been so considerable a proportion of special work that novelties as such are feared neither for their technical nor for their commercial effects. One of the most interesting cases which has recently arisen is the electrification of the Eifel railway just undertaken by the German Government and fully described by Mr. Dawson. The motors in this case are on the Winter Eichberg system, and we note with interest that they are for operation at twenty-five cycles, no necessity having been felt, apparently, for the extremely low frequencies advised by some American engineers. To judge from the figures given, artificial ventilation and great skill in design have been united in these motors to good purpose. Certainly an efficiency of 90 per cent and a power factor of 94.5 per cent, both at a stiff overload, leave little in these directions to desire. On the face of things a single-phase motor must always suffer from sources of inefficiency from which d. c. motors are free, yet by care the losses can be kept within very moderate bounds. As Mr. Dawson very properly remarks, a little extra weight in the equipment is of small account if one thereby gets the desired results. The investigations of the Swedish Government into the electrification of the State railways has led to the choice of a similar system there, and the conclusions will certainly be strengthened by the operation of the single-phase lines now working in this country.

So far as these are concerned, it must not be forgotten that the New York, New Haven & Hartford single-phase work has been under singularly unfavorable conditions in that the terminal work proper must be d. c. and hence the locomotives are greatly complicated by the necessity of using and controlling both kinds of current. Were they relieved of this necessity the equipment would be very much simplified and the results would unquestionably be more satisfactory. Both foreign and American practice indicate that the single-phase traction motor in some form or other is to be an important factor in future railway work. Mr. Dawson goes so far as to hold that it is well suited not only to long distance work, but to heavy suburban traffic, in which hitherto d. c. motors have had the field quite to themselves. It should be pointed out in this connection that the conditions in such case are not quite the same in England and in the United States on account of the effect in the former country of the somewhat drastic board of trade restrictions. The decision in favor of single-phase traction on the Berlin City and Ring Railway is a case more in point, although the five years allowed for the completion of the first section may see striking changes in apparatus and methods. The progress thus far made seems very favorable for the single-phase system, to which there is every reason to look for large further improvements. The high voltage d. c. system which is being tried both here and abroad with fair results has yet to show capacity for voltage high enough to put it fairly into competition with a. c. methods. Mr. Dawson's somewhat favorable comment on existing 2000-volt d. c. traction motors leads one to believe that considerable progress can be made along this line. Yet working voltage is steadily rising, and so long as d. c. motors are compelled to operate via rotary converters they will suffer a rather serious handicap. This much is certain, that the electrification of main line railways is getting near at hand and that the next few years will see much progress made.

PAPERS READ AT THE ATLANTIC CITY CONVENTION OF THE AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION

WHERE MAINTENANCE ENDS AND DEPRECIATION BEGINS

BY J. H. NEAL,
Auditor of Disbursements, Boston Elevated Railway Company.

Depreciation accounting is almost entirely dependent upon estimates and uncertain elements; two features, and two only standing forth as positive factors. The first is that values are continually diminishing in practically every creation by man, and the second that maintenance is but a partial replacement of such impairment. Strictly speaking, therefore, depreciation begins before maintenance is necessary; not where maintenance ends, and as a matter of fact there is no absolute line of demarcation between the two such as the title of this paper might imply. Custom, however, has caused certain meanings to become attached to each term which it is well to recognize to facilitate discussion.

Supercession and appreciation will purposely be omitted from consideration in this paper on account of the limitations of the subject. Maintenance is generally understood to be the ordinary repairs and renewals necessary to keep property in operative condition. Depreciation is usually defined as "ultra wear and tear" or such deterioration as may not be provided for by maintenance. Obviously the extent of the latter is controlled by the former, although, to be sure, no amount of maintenance can entirely replace the deficiency.

Efficient management, among other qualifications, implies the ability to determine approximately the point where expense of ordinary repairs becomes abnormal and consequent renewal or substitution necessary. On the other hand, the essence of successful accounting for depreciation lies in the degree of accuracy with which the probable life of property is determined. At a glance then it can be seen that these problems are analogous, and that the same means must be adopted for the solution of either the one or the other, both requiring the establishing of a point where maintenance should end.

A careful analysis of the first nine accounts of our "Standard System" no doubt materially assists in forming judgment as to the economy and efficiency with which a property is being maintained. That is what they are for. Beyond question, however, something more than this is needed, for it is easy to show low maintenance cost for a period of years at the expense of the life of the property, and equally easy to unwisely expend large sums in maintaining equipment that should be discarded.

Of course, it may be said that, if depreciation reserves were established, these in conjunction with maintenance accounts would render the situation complete. However, this is not at all the fact. Rather the rate of annual charge for depreciation is often determined from accounts which involve the erroneous conditions mentioned above, with possibly others.

Method No. 1. Equal proportion of original cost.		Method No. 2. Percentage on diminishing balance.	Method No. 5. Annuity system at 5 per cent. interest.		
Original cost	$12,000.00	$12,000.00	1st annual deposit		$678.52
Charges first year	900.00	2,095.20			
Value second year	11,100.00	9,904.80	2d deposit	$678.52	
Charges second year	900.00	1,729.38	Interest	33.92	712.44
					$1,390.96
Value third year	10,200.00	8,175.42	3d deposit	$678.52	
Charges third year	900.00	1,427.42	Interest	69.54	784.06
					$2,139.02
Value fourth year	9,300.00	6,748.00	4th deposit	$678.52	
Charges fourth year	900.00	1,178.20	Interest	106.94	785.48
					$2,924.50
Value fifth year	8,400.00	5,569.80	5th deposit	$678.52	
Charges fifth year	900.00	972.48	Interest	146.21	824.73
					$3,749.23
Value sixth year	7,500.00	4,597.32	6th deposit	$678.52	
Charges sixth year	900.00	802.68	Interest	187.45	865.97
					$4,615.20
Value seventh year	6,600.00	3,794.64	7th deposit	$678.52	
Charges seventh year	900.00	662.53	Interest	230.75	909.27
					$5,524.47
Value eighth year	$5,700.00	3,132.11	8th deposit	$678.52	
Charges eighth year	900.00	546.86	Interest	276.21	954.73
					$6,479.20
Value ninth year	4,800.00	2,585.25	9th deposit	$678.52	
Charges ninth year	900.00	451.37	Interest	323.95	1,002.47
					$7,481.67
Value tenth year	3,900.00	2,133.88	10th deposit	$678.52	
Charges tenth year	900.00	372.55	Interest	374.08	1,052.60
					$8,534.27
Value eleventh year	3,000.00	1,761.33	11th deposit	$678.52	
Charges eleventh year	900.00	307.51	Interest	426.71	1,105.23
					$9,639.50
Value twelfth year	2,100.00	1,453.82	12th deposit	$678.52	
Charges twelfth year	900.00	253.82	Interest	481.98	1,160.50
Value for salvage at end of twelfth year	$1,200.00	$1,200.00	Total amount of fund at end of 12th year		$10,800.00

Note.—Methods No. 3, No. 4, No. 6 and No. 7, are not subject to illustration in this manner.

TABLES ILLUSTRATING THE APPLICATION OF THREE OF THE SEVEN COMMON METHODS OF CARING FOR DEPRECIATION

The seven common methods of charging depreciation are enumerated below, together with a practical illustration showing the application of a few:

1. Equal proportion annually of original cost.
2. Fixed percentage on gradually diminishing balance of original cost.
3. Fixed percentage on gross earnings.
4. Fixed percentage on net earnings.
5. Annuity system.
6. Periodic revaluation.
7. Proportion of betterments charged to operating.

The following statement shows exactly the same final results by using different methods of charging off depreciation on track valued at $12,000, the supposed life of which is twelve years, allowing 10 per cent for salvage at the end of that time:

None of these methods in themselves can assist in establishing the point where maintenance becomes uneconomical. In fact, they are nearly all based on an estimate as to where this point occurs. Whether or not their results are useful, depends entirely upon how nearly actual practice approaches the degree of maintenance calculated in the first place.

But it is not the province of this paper to discuss the advantages or disadvantages of these methods. All are more or less effective under proper conditions. One thing is certain, however, that with the single exception of "periodic revaluation" each is constructed upon a basis which the progress of time and events must surely change, and as the navigator checks by celestial observation his reliance upon the compass, so the executive must frequently adjust the means which he adopts to conditions as they actually exist, or error and confusion will surely result.

Revaluation is in most cases impracticable, at least with frequency; therefore to effect these adjustments, to establish probable life and to supply the element missing from our conventional bookkeeping accounts, continuous consideration must be given to the physical changes which take place. It is in the light of such detail only that a proper display of the relations between maintenance and depreciation can be obtained, because of the wide divergence in the character of equipment and the governing conditions.

It is often a source of surprise to scientists and inventors when suddenly they discover right under their noses some little thing for which they have long been searching. They wonder why they have not seen it before. It appears that this may prove to be the case with many in their consideration of depreciation.

No department head can intelligently conduct his work without a mass of detail which furnishes exactly the information desired. The man who repairs the motors must have a knowledge of the frequency and causes of breakdowns which interrupt travel or require large expenditures. The man in charge of tracks must study the life of ties, timbers, rails, frogs, etc. The man who produces power must know when the boilers or steam piping, etc., become a menace to safety, maintained though they may be. So right through the line, one and all are endeavoring to establish the very point at issue.

None of these men are so bold, however, as to be willing to commit themselves as to what rate of depreciation would be proper, taking all kinds of track, or all kinds of motors, or all kinds of power house equipment together. They wish to particularize. Permit them to do this, and the competent men can make exceedingly accurate estimates.

Just so with the general proposition. The pith of the matter is subdivision. Certainly it is not wise to trust to the generalization of others. Each property is a problem in itself and should be governed by matters of facts obtained mostly from its own experience.

Nothing demonstrates this so clearly as opinions expressed in our trade journals, together with a review of the practices pursued by a large number of English and American companies. Authorities can be found on each and every one of ten general divisions, advocating an annual charge varying from 1 to 10 per cent. Such differences are of tremendous importance when a large railway is considered and naturally cause confusion and doubt.

There is no reason to fear the detail which subdivision involves. Once a list is established it only remains for the auditor to watch and adjust it in combination with department heads. Naturally, some extra time and trouble is required, but why should we expect to control so important a matter by a single table of some dozen items culled from the statements of others? Standardizing accounts is one thing and standardizing rates of depreciation is certainly another.

On every road in existence there are conditions which furnish extremes. On one road, one extreme might prevail, on another the opposite extreme. If all the roads in the country were united, then one method and one rate would accomplish good results. Individually, however, each must look out for itself.

In conclusion, it may be said that corporations, like living things, increase their strength and vigor in proportion to the effort that they put forth. Now, the very effort of establishing, as perfectly as possible, the relations between maintenance and depreciation is productive of excellent management and an excellent understanding of the value and capacity of the property.

On the assumption that the title restricts such freedom, many features of interest and indeed importance have not been touched upon, nor concrete examples cited; the writer simply advocating the policy of "each road by itself, each subdivision by itself and each changing condition by itself"; giving due consideration to the experiences of others, but adopting their details only where circumstances are determined to be exactly similar.

AMUSEMENT PARK ACCOUNTS

BY FRANK J. PRYOR, JR.,
Comptroller The American Railways Company, Philadelphia, Pa.

The signal progress in the development of summer amusement parks within the past few years requires that attention should be directed toward the codifying of the construction, equipment and operating accounts. The picnic grounds, depending upon the natural scenic beauties and the single attraction of the horse or man power merry-go-round, easily within memory, have given way to the combination of an improved, picturesque landscape, dotted with attractive buildings, and the addition of amusement features to meet the constant and increasing demand of the public. The development is in the direction of an extensive scale which involves considerable outlay of capital. The amusement park is a recognized feeder to the street railway system. Properly conducted and keen to popular requirements, the park business is gradually turning, in its ultimate results, to a profitable investment.

The active season covers a period of about fifteen weeks, wherein is tested the foresight of the management, which in the other portion of the year has been engaged in providing future entertainments for park patrons and which, until the test, are more or less of a problematical venture. The expenses of the up-keep of the property during the closed season are none the less worthy of careful consideration, so that in the combination of the two classes of expenditures, analysis is of prime importance in determining quickly the profitable or unprofitable termination and the guarding of a rigorous and prudent economy.

The valuable report is the one which exhibits in requisite detail the records of the financial operation and such can be easily made applicable to park accounts. After all the operation of any property is based upon comparative results, and with an acceptable classification of the operating expenses, the accounting task is somewhat simplified.

It was the practice in our company to apply the total expenses in each year to an account entitled "Park Expense," and offset by the income arising from the rent of privileges, admission fees and other miscellaneous receipts. The expenses and income from the theater were placed to the account "Theater." As the requirements demanded, the various items of expenses in the two accounts were analyzed and the cost of operating each amusement or attraction was ascertained. The effort was extravagant in time and labor. To keep abreast of the patronage the expenses grew in each successive year and the necessity for the further sub-divisions of the general accounts was recognized.

As a possible aid to those interested in the subject the scheme of classification now followed is submitted:

CLASSIFICATION OF ACCOUNTS FOR AMUSEMENT PARKS.

CONSTRUCTION AND EQUIPMENT ACCOUNTS.

Account No. 1.

ORGANIZATION.

Includes all expenses in connection with the organization of the company.

Account No. 2.

ENGINEERING AND SUPERINTENDENCE.

Includes all expenditures for service of engineers and their attendants while engaged upon preliminary work and upon permanent improvements, and the expenses incident to such work.

Account No. 3.

REAL ESTATE.

Includes the full consideration for the purchase of real estate and all expenses in connection therewith, such as cost of conveyancing, recorder's fees, commissions, etc.

Account No. 4.

BUILDINGS AND GROUNDS.

Includes full cost of all buildings, and the interior electric wiring therein, fences, dams, bridges, culverts, walks, driveways, water and sewer systems, and the original grading of the grounds.

Account No. 5.

LANDSCAPE GARDENING.

Includes the first cost of additional trees, shrubbery and plants, the labor of planting, and the preparation of the lawns.

Account No. 6.

FURNITURE AND FIXTURES.

Includes total cost of all furniture and fixtures placed in the buildings and of revenue-producing articles, such as boats, bathing suits, moving picture machines, etc.

Account No. 7

PARK FURNISHINGS.

Includes cost of benches, swings, waste cans and all other articles from which no revenue is obtained.

Account No. 8.

PARK EQUIPMENT AND TOOLS.

Includes cost of harness, carts, gardening and farming implements and tools of all kinds necessary for the up-keep of the property.

Account No. 9

ELECTRIC PLANT.

Includes cost of electrical apparatus and materials for the control, registration, transmission and use of current; overhead lines, conduits and electrical devices of every sort, interior wiring of buildings excepted.

Account No 10.

INTEREST AND DISCOUNTS.

Includes the payment of interest during the period of construction; the discount or premiums arising from the sale of securities for construction.

Account No. 11.

MISCELLANEOUS.

Includes cost of all other expenditures not especially provided for.

OPERATING EXPENSE ACCOUNTS.

Account No. 12.

MAINTENANCE OF BUILDINGS AND GROUNDS.

*Includes expenditures for labor and materials necessary for the repairs and renewals of all buildings, fences, bridges, dams, culverts, walks, driveways, water and sewer systems.

Account No. 13.

MAINTENANCE OF LANDSCAPE GARDENING.

Includes cost of preparing the grounds, the setting out and care of, or the renewal of, all plants, shrubbery, trees and lawns. The cost of seed, fertilizers, etc., should be charged to this account.

*The cost of materials includes freight and cartage.

Account No. 14.

MAINTENANCE OF FURNITURE AND FIXTURES.

Includes cost of labor and materials for the repair and renewals of furniture and fixtures in all buildings and of revenue-producing articles, such as boats, bathing suits, etc.

Account No. 15.

MAINTENANCE OF PARK FURNISHINGS.

Includes cost of labor and materials for the repair and renewal of non-revenue producing park furniture, located upon park grounds, such as benches, swings, waste cans, flagpoles, flags, bunting, etc., fire buckets and extinguishers.

Account No. 16.

MAINTENANCE OF PARK EQUIPMENT AND TOOLS.

Includes cost of labor and materials for the repairs and renewals of gardeners' tools, hand tools of all kinds, carts, harness, gardening and farming implements.

Account No. 17.

MAINTENANCE OF ELECTRIC PLANT.

Includes cost of labor, materials and tools necessary for the repairs and renewals of all electric apparatus, including pole lines and other appurtenances. This account to be charged with all expenses of operation and distribution of the power and light circuits.

Account No. 18.

PURCHASED POWER.

This account should be charged with all expenditures for power purchased from the manufacturing plant. This account to be credited with all current sold by the Park Company.

Account No. 19.

POLICING AND CLEANING OF GROUNDS.

This account should be charged with the wages of watchmen, janitors and laborers in the care of the buildings, and the removal of refuse and waste paper from the grounds and paths; also the cost of policing the park.

Account No. 20.

BAND CONCERTS.

Includes all payment for the services and the expenses of bands engaged for concerts. Receipts from the sale of seats should be credited to this account.

Account No. 21.

SPECIAL ATTRACTIONS.

Includes payments for extraordinary free attractions, such as balloon ascensions aërial acts, displays of fireworks.

Account No. 22.

WAGES OF MISCELLANEOUS AMUSEMENT EMPLOYES.

Includes wages of attendants, other than cashiers, engaged in the operation of amusements, such as the carousels, toboggans, scenic railways, etc. In reporting such disbursements the name of the amusement is to follow the classification of the account.

Account No. 23.

MISCELLANEOUS AMUSEMENT EXPENSES.

Includes cost of all materials which enter into the operation of all amusements controlled by the company. In reporting these expenses the name of amusement is to follow the classification of the account.

Account No. 24.

PARK EXPENSE.

Includes expenditures of park operation not otherwise provided for.

Account No. 25

THEATER EXPENSE.

Expenditures with the general classification noted are to be reported with the following sub-divisions:

a. Wages of theater employes. To include wages paid stagehands, ushers, ticket-sellers and doortenders.
b. Wages of musicians. To include salaries paid to the orchestra.
c. Wages of performers.
d. Tickets, programs and music.

Account No. 26.

RESTAURANT.

Expenditures with the general classification noted are to be reported with the following sub-divisions:

a. Wages of employes. To include wages of chef, kitchen help, waiters, etc.
b. Provisions. To include cost of meats, vegetables, provisions, general stores, etc.
c. Supplies. To include cost of cigars, liquors, soft drinks, etc.
d. Music. To include salaries paid to musicians and rental paid for musical instruments.
e. Other expenses. To include all other expenses not otherwise provided for.

Account No. 27.

SALARIES OF MANAGER AND CLERKS.

Include salaries paid to the park manager, clerks and cashiers at various amusements which are operated by the company.

Account No. 28.

GENERAL OFFICE EXPENSE.

To include the cost of office supplies, blank forms, public telephone service, telegrams, newspapers, subscriptions and such other miscellaneous administration expenses not provided for.

Account No. 29.

STABLE EXPENSES.

Include the cost of feed, horse-shoeing and care of horses.

Account No. 30.

ADVERTISING AND ATTRACTIONS.

To include the salary and expenses of the advertising agent, the cost of dodgers, posters, all printing and advertising matter

in connection with park affairs; also the cost of posting and distributing; donations and prizes for the purpose of attracting the general public, lodges, societies, etc., to the use of the park.

Account No. 31.

DAMAGES.

To include all payments made in settlement of damage claims, also all expenditures in connection therewith.

Account No. 32.

RENT OF LANDS AND BUILDINGS.

To include rentals paid for all park buildings and grounds.

Account No. 33.

INSURANCE.

Includes payments of premiums for fire and casualty insurance.

Income Accounts

Separate accounts to be opened for each revenue-producing building or amusement operated by the company, and credit the gross receipts from the same.

Rentals of Privileges.

Credit the account with all income from concessions.

The aim in devising the titles was simplicity, and touches upon the essential features only. In classifying disbursements, the title "Park Expense" is noted, and then follows on the significant numeral of the sub-account. Upon the general ledger the one account ("Park Expense") is active and the integral items are transferred to an auxiliary distribution book, and from this the monthly report is compiled.

A liberal and judicious issuance of job orders has enabled us to ascertain the cost of all construction and the extraordinary maintenance accounts. When any construction work is authorized, the order number is entered on the ledger, and the recurring charges entered until the completion of the job, then the cost is transferred to the proper construction account.

It has been suggested that it is not within the chartered rights of a street railway company to operate an amusement park. In a number of states a park company obtains its privileges to conduct business under a legislative concession, and if not incorporated, the title to the property cannot be held in the name of the railway company because of the restriction that such real estate is not used in the operation of the road; therefore the net expenses of the park are not properly an operating expense of the railway company, but should be treated as a deduction from income.

An academic discussion will produce arguments for and against the application to "Advertising and Attractions" as provided for in the classification of electric railway accounts, but the fact must be admitted that the intention in the establishment of such parks is for the purpose of inviting traffic. The railway company is benefited to the extent of the increased earnings, and the excluding of a part of the expense which influences its income is destroying the relationship between the gross earnings and the operating expenses. The expenses in question should not be considered an obligatory payment in the sense of a fixed charge.

The exorbitant and almost prohibitive premium for fire insurance, and in some cases the inability to place the risk, in part due to the situation of the park beyond the city water service; the character and transitory use of the buildings, their exposure to the elements, and loss of popularity from year to year in the amusement features, should be an adequate argument in the setting aside of a depreciation or accrued renewal fund. Such a fund should be maintained by periodical payments, and as the accumulation reaches a sufficient amount it should be converted into interest-bearing securities, so that in the event of a necessity, the company possesses current funds available for the replacement.

MECHANICAL DEVICES AND OTHER OFFICE APPLIANCES

BY F. E. SMITH.

Auditor for Receiver Chicago Union Traction Company, Chicago, Ill.

The substitution of machines for manual labor, and in the case of the computing machines for metal work also, has become so general it is fitting that the matter be taken up by our association, which stands for all that improves the conditions in the accounting departments of street and interurban railways. It will be conceded that any device which will permit the accountant to decrease the expense of his work, without impairing its efficiency or to increase the volume of statistics which he may prepare for the heads of departments without increasing the salary roll materially, is worthy of general adoption. The value of a statement showing the earnings per car-mile and the number of passengers handled on any route is very greatly diminished if the facts it contains are not given to the operating department early enough on the day following the date for which the statement is made to permit that department to make adjustments of the schedule which may be necessary to meet the altered conditions. If there are machines that will assist to that end is it not in the interest of good railroading to adopt them?

While it has been the policy of our Association to refrain from advertising the product of any particular manufacturer, it was the idea of the writer that an article of this kind would be valueless to members unless the name of the manufacturer of the machine were given in connection with the description of its work. This idea having been endorsed by your president, the names of manufacturers will be given, but it is not intended that this mention shall constitute an endorsement of these particular machines as the best; it may well be that the writer has not had some of the best machines brought to his attention.

TYPEWRITERS.

Typewriters are in such general use that any description of them is entirely unnecessary, and it is the purpose to describe only such special features as have come under my notice that facilitate the work, and those machines that seem particularly adapted for some special purpose.

Several makes of machines, among them the Remington, Elliot-Fisher and Fay-Sholes, now have an adding-machine attachment that will pick up the sums written upon the typewriter when in certain positions and accumulate them upon a register. I understand that the Underwood Company also has an attachment invented by Messrs. Wilson and Neal, of the Boston Elevated Railway Company, that has not, as yet, been put on the market. In these machines the figures upon the adding device are in plain view of the operator, who can write the total when desired and set the machine back to zero. The register, where but one is attached, is usually placed so it is controlled by the ten spaces at the extreme right of the scale, but one of the machines on display at the last Office Appliance Exhibition at Chicago, the Wahl "Adding and Subtracting Attachment" to the Remington typewriter, was so arranged that five or six or even more of the adding devices could be attached at the same time and as many sets of figures written and added simultaneously.

I have discussed with the representatives of both the Remington and the Elliot-Fisher Companies the idea of having them design a register that would add in hours and minutes instead of in dollars and cents, to be used in writing the totals of our pay-rolls. By using two of the devices, one register that would add in hours and minutes, and another that would add in dollars and cents, the operator could fill in the two on the typewriter and have footings of both at the bottom of each roll that could be readily proved. Of course, if there were more than one rate per hour on the page, a separate total of the hours at each rate would have to be made, and then the sub-totals made into one footing. I have not followed the matter and nothing has come of it, as yet, so far as the Remington Company is concerned, but I have been advised by the Elliot-Fisher Company within the last few days that it is prepared to deliver just such a machine as described and to guarantee its work.

Another convenient device is one which, by the use of a two-colored ribbon, permits the insertion of red figures in statements by simply pressing a lever. By the use of the tabulator assurance is given that the figures will align properly without the operator stopping to count the spaces. Another device insures the striking of several sheets of paper at the same distance from the top.

Of the typewriters that are particularly adapted to specific work, we use a book-typewriter, made by the Elliot-Fisher Company, of Chicago, which sells for $175. This machine is so constructed as to permit of writing in bound books. The table upon which the book rests is divided in halves, either of which can be lowered, so that when the book is opened, both pages are at the same height and present a flat surface to be written upon. We use this machine principally to enter the records of the stockholders' and directors' meetings and the results are eminently satisfactory. Those who have had to pore over old

records written in longhand with no marginal index, looking for some resolution hidden away among a mass of other matter, know what a tedious job it is. You will be blessed by your successors who in the years to come will have to go over the records you are now writing, if you will get and use one of these or a similar machine.

The same company also makes a billing machine that we have used until quite recently in preparing pay-rolls, and so far as the machine work was concerned it was perfectly satisfactory. The advantage of using this machine on this class of work is that the entire sheet is in view all the time, and skipping from one name to another is accomplished about as quickly as the eye can catch the required name. By the use of the two-colored ribbon, overtime, or time for which other than the regular rate is to be paid, can be inserted readily in a distinctive way. This machine is also particularly well adapted for writing on cards, which, when written on an ordinary typewriter, are quite apt to retain part of the curl they get from passing through the rollers. These typewriters cost $165 or more, according to the width of carriage, and the adding devices are $30 additional for each one. On a 24-in. carriage, eighteen registers may be placed which will permit the adding of that number of columns.

ADDING AND LISTING MACHINES.

Next to the typewriter, the adding and listing machines probably are the most helpful of any of the mechanical devices. There are many reliable machines on the market, each having some special feature to recommend it. We have three different makes and find them all useful. Two of the styles add but do not list. One of them is called the "Rapid Computer" and is sold by the Rapid Computer Company, Benton Harbor, Mich. The price is $25. This machine is a very small affair that can be held in one hand or placed on the page from which the figures are to be taken, and we find it very convenient, particularly for cross additions. There are many persons who are good at addition when the figures are arranged under each other but who simply cannot add crosswise mentally. Such persons would find this machine quite a help.

The other non-listing machine is the "Comptometer" made by the Felt & Tarrant Manufacturing Company, of Chicago, which sells for $150 or more according to the number of columns. This is, I think, the pioneer in the field of adding machines and I doubt if one can be made to equal it for speed when no printed list is required, nor do I see how its speed as a multiplier can be equalled, since one can multiply by as many figures at a time as can be reached by all the fingers. An expert can prove his work by going over it a second time more quickly than it can be done once on ordinary machines. Some of the largest concerns in Chicago use these machines to check the work done on the listing machines.

Of listing machines we have four styles, made by the Burroughs Adding Machine Company, of Detroit, that add dollars and cents and are used by nearly all the clerks; then we have two that add numbers, that is, there are three figures to the right of the dividing comma which we use in checking our registers. For register records the closing numbers are taken each night from all the registers at each car-house whether used that day or not, and the differences in the footings as compared with the previous night have to be accounted for. Instead of listing the opening number each day, we retain the slips of the previous day. We have two machines that add in hours and minutes and use them to check the pay-rolls by the time schedules.

The latest machine we have has a motor attached. It has fifteen banks of keys, the five banks at the left being cut off so that if desired they list but do not add. We use this in listing checks and vouchers where we want the numbers as well as the amounts, and find it a great time-saver. By means of an attachment operated very quickly we can make two sets of additions, one of five columns, and one of ten. Another manipulation allows us to use the fifteen columns in one total. We are very much pleased with the machine. The Burroughs machines cost from $250 to $600 each.

We also use in our office a calculating machine made in Switzerland, called the "Millionaire," which multiplies and divides very rapidly. We can multiply ten figures by ten figures in about ten seconds. As the process for multiplying is the more simple, if we have any number of amounts to divide by the same divisor, as, for instance, to obtain earnings, expenses, etc., per car-mile or car-hour, we find the reciprocal of the divisor and multiply. This is the only machine that has come under my notice which, by setting the dials, will multiply by any number from one to nine with one turn of the crank, and it is that feature which accounts for the speed with which it may be operated. The "Millionaire" is handled in the United States by W. A. Morschhauser, No. 1 Madison Avenue, New York, and sells from $250 to $475.

The slide rule is so well known that it needs no extended description, and there are many who think it is the most convenient of the many devices used for calculating.

We use two addressing machines made by the Addressograph Company, of Chicago. One has the names and addresses of the stockholders, and we can easily address one thousand envelopes an hour; this machine costs $45 without the cabinet, which varies in price according to capacity. On the second machine, we have the names of the employes and print our pay-rolls from it. This machine costs $55. The names are on plates so fastened as to make chains; the plates link together very easily and a name can be taken out or inserted in a few seconds. We can print the names of 4,500 trainmen in about three hours. Being able to do this we can postpone getting out our rolls until the day before they are needed, and have our list correct at the start. Companies operating electric light plants in connection with street railways will find these machines of great value in getting out their monthly bills. A later style of the Addressograph has the names on plates, which are placed in a vertical magazine and are withdrawn from the bottom one by one as the machine operates.

For checking the extensions to pay-rolls we use a "Morse Rotary Wage Scale" made by the Chas. R. Morse Manufacturing Company of Chicago. These range in price from $25 and upward for a machine, that checks up to 100 hours at 50 different rates, to $40 for a 200-hour, 120-rate machine. Our device consists of two cylinders with the rates we use printed in a line around the surfaces and four scales of hours, 50 to a scale, running across the cylinders. Suppose the rate per hour to be 23½ cents; by revolving the cylinders until 23½ came within the scales the amount due from one hour to two hundred hours would show at a glance. The device can be operated very quickly and we have found it absolutely reliable and a great time saver in checking.

For circular letters to foremen or other employes, and for statements when we want more than a dozen copies, we use an "Edison Rotary Mimeograph,'" made by the A. B. Dick Company of Chicago. In this device a stencil is cut by a typewriter on paper especially prepared for the purpose, which is then fastened to a drum and inked. The printing is done simply by revolving the drum and can be accomplished as rapidly as the operator is able to feed the paper into the machine. We use this also in getting out several forms for our own office which we use in quantities so small as not to warrant having them printed. A short time ago our operator made one hundred copies of six sheets, each letter size, closely written in less than two hours.

These devices cover all we use in our department, except the numbering stamps for numbering vouchers, lot cards, etc. At our car shops we use three recording time clocks, each with a capacity of two hundred names. They were made by the International Time Recording Company of Binghamton, N. Y., and cost, with racks for cards, $175 each. Each employe has a number on a rack that contains this card. When he comes in the morning he takes his card and inserts it in a slot and pulls a lever. This prints the time of his arrival. He then puts the card into the proper compartment in another part of the rack, which shows he is in the shop. On going out at noon he inserts the card in the machine again and the time of his going out is printed. The same thing is repeated after lunch. The differences between the entries of time printed represent his time for the day. At a specified hour at night the clock automatically changes, so that any slips printed after that hour are in red and over-time can be readily seen. The cards are balanced with the slips showing how the men were employed, that have been turned in by the department foremen.

In the treasurer's office a machine is used to prevent the raising of checks more than a small amount by printing and perforating a line reading *"not over ..... dollars"* changing the amount every ten dollars.

In preparing pay envelopes the treasurer uses a cash tray so arranged that one coin of a denomination is taken from a compartment into the hand by slightly pressing on the bottom

of the compartment. A mechanical cashier more modern than the above referred to will be mentioned later.

The foregoing devices comprise the machines in use in our offices with the exception of various punches used for perforating papers for various files and for canceling coupons.

One of the most useful of devices, though it is in no sense a machine, is the "Smith Index Tag" made by Chas. C. Smith, Exeter, Neb. The tag consists of a steel clip bound with leather, which is printed on or which has a paper label that may be written upon. We have the tags printed with the names of our car and power houses and use loose sheets held in binders to record the distribution of stores. At the close of each month the sheets are taken out and filed and the tags used on new set of sheets. On card indexes they are very convenient. The range in prices and styles of these tags is so great I will not attempt to name figures. The tags are handled by stationers and price lists can be had of the manufacturer on application. It may not be out of place to add that the manufacturer is in no way related to the writer.

For filing correspondence we use what is styled the "vertical" file, which takes an ordinary letter on edge without folding. We have four drawers; one for correspondence received from other officials of the company; one, for that received from outside persons; one, for letters that originate in our office to other officials, and one for letters from us to outside parties. All correspondence is numbered and card indexed and carbon copies of all our letters and answers are attached, so that all the correspondence to and from persons on one subject is found under the same number.

We believe in the use of cards and loose leaf devices and use both quite extensively. A journal is seldom used after the entries for the month are closed. Why then have to handle a heavy book month after month when twenty or twenty-five sheets are all that are needed? We have answered this question by using loose leaves held in a spring cover while being used, and transferring them to a permanent binder when the month is closed.

For a general ledger we use a loose leaf book with inserts, and run the accounts across the page instead of down. The headings read as follows:

Accounts.....1906	Month of..... 06			
	J. E.		J. E.	
Balances	No.	Debits	No.	Credits

The figure columns are repeated across the pages. Each full page has room for three months' entries and the insert has three on each side, so that each set of leaves lasts a year. At the end of the year they are put into a permanent binder.

Our voucher record is of the loose leaf pattern with half of the sheets cut ¾-inch short at the bottom and the alternate sheets cut ¾-inch short at the top. This permits us to add the first page and enter the totals at the bottom of the next sheet; the second sheet is added up and the totals entered at the top of the third sheet, and so on. This saves carrying footings forward, and is one of the greatest labor-saving devices we use. Any one who cares to do so will find samples of these sheets in the Association's collection of blanks, they being those of the United Railways of St. Louis and the Chicago Union Traction Company. I am indebted to F. R. Henry, the Auditor of the United Railways of St. Louis, for letting me know of this device.

Our treasurer uses a loose leaf cash book. This permits our department and the outside auditors to use the back records without interfering with the current work.

This, I believe, completes the list of such machines and devices as have come under my personal observation through use.

One of the best duplicating machines I have seen is the "Gammeter Multigraph" made by the American Multigraph Company, of Cleveland, Ohio. This consists of two parallel cylinders, one containing metal types that are readily passed to the other cylinder and set up as a letter or form. The machine has a scale across the top showing the order in which the types are to be found on the type cylinder. As the cylinder is revolved an index moves along this scale. When the letter wanted is reached the machine is stopped and by pressing a lever one type is passed to the other cylinder. The action is quite rapid, very much more so I think than can be had by using a pair of tweezers. The work done on this machine is exactly the same in appearance as that on a typewriter, and, in addition, electrotypes can be made and fitted to set up on it so that practically any kind of work can be done on this machine that could be done on a small printing press. The price of the machine and equipment is $250.

I have recently examined an attachment to a typewriter made by the Goldberg Calculating Machine Company, of Chicago, that would be particularly useful in billing or voucher work because amounts added in one column may be transferred to a second column and the act of transferring the figures throws them out of the first column. To illustrate: There are three amounts of which it is wished to make a sub-total, like:

$45.00	
29.50	
18.75	$93.25

At the conclusion of writing the three items the total $93.25 is shown on the register; the typewriter is moved to the position for the second register to act and as the figures 9, 3, 2 and 5 are written they disappear from the first register one by one and it is set back to zero and the machine is ready for other sets of figures in the inside column, say..... $50.00

25.00 $75.00

Grand Total $168.25

The act of writing the 168.25 on the typewriter sets the outside register back to zero and the machine is ready for a new bill. This feature appears to be very valuable. At present this machine can only be attached to the Fay-Sholes typewriter, and the price of the register is $75.

The most remarkable machine I have seen or rather that I have seen the work of, as the inventors are not ready yet to show the machine, not having obtained all the patents desired, is one that is being prepared in Chicago and is called the "Carlin Calculator." When on the market this will probably at first be adopted by banks, more especially as it is estimated that it will reduce the number of bank bookkeepers one-half when in use. I have seen some of the work done upon the machine and the following is a sample:

Adams & Co.,					
La Salle St.					7,392.30
					306.25
272.98	6.73	75.00	.56		
67.50	26.43	4.00	73.95	527.15	
					7,171.40

The amount 7,392.30 is the balance of the account at the commencement of business and is printed in red. The item 306.25 is a deposit and is printed in black while the amounts of the checks entered are totaled and the total printed in red and the new balance carried in red to the outside column, 7,171.40. What the machine really does is to work backward when the total of the checks is printed in red and the total stands at 6,865.15, which is 7,392.30 less 527.15. Printing the deposit 306.25 in black reverses the mechanism and it adds to the total then in the register. The machine adds perpendicularly and horizontally at the same time and automatically subtracts figures written in red from both totals. Should the sum of the reds exceed the sum of the blacks in either the line or the column, the result will be shown in red and will be the amount of the excess. I know of no other device that begins to do as much as this and when it is placed on the market I have no doubt will find a ready sale.

For those who prefer a tissue impression of their original letters to a carbon copy we think the copiers that hold the blank paper on a roll and produce a copy by running the letter and paper through rollers like a wringing machine, are more rapid than the copying-book and press. After the copies have been made the paper can be cut into uniform lengths and filed as would carbon. Yawman & Erbe, of Rochester, N. Y., The Reneo Company of 88 Reade Street, New York, and the Rotopress Company of Marion, Ind., make machines that do this work. The only objection I have heard urged to this method of copying letters is that the character of the letter-book as a book or original entry is destroyed, and that in offering copies of letters as evidence in court it may be necessary to call as witnesses nearly the whole office force. The same objection would apply to any loose leaf book of original entry.

The Library Bureau of Chicago, makes what it terms "omnibuses," which are book-racks or voucher trays mounted on rollers that can easily be rolled to and from vaults or from one room to another. One of these could be filled up to hold the books required by the general bookkeeper and rolled to a position convenient to the desk and the books kept on the roller

shelves when not actually in use. Another rack could hold the voucher register and the trays for current vouchers and both would be stored in the vault at night.

The same company fits up vaults and offices with either steel or wood shelving that can be adjusted with regard to the space between shelves, so that all the space of a vault can be used to the best advantage.

The Patten ticket destroyer is an arrangement of parallel knives so set that the tickets drop from a hopper and pass through the knives and come out cut into shreds. One of these machines was in use at Lynn, Mass., at the time the writer was connected with the Lynn & Boston Railroad, and we never found that a ticket had passed through the machine and not been so completely destroyed as to render its further use impossible. This machine is, or at least was, made by the Patten Machine Company, of Salem, Mass. The Rand Avery Supply Company, of Boston, Mass., has a machine that does similar work.

There was exhibited at the Columbus convention last year a ticket counting machine that attracted a great deal of attention. The machine is the invention of W. A. Gibbs, General Manager of the Indiana, Columbus & Eastern Traction Company. The writer was unable to examine the work of the machine, but a complete description of it may be found in the *Electric Railway Review* of October, 1906.

The Cleveland Electric Railway Company uses a ticket counting machine made by Robert Kimball of Cleveland, Ohio, and is much pleased with it. These machines are not on sale, but may be obtained on a royalty. They can count 20,000 to 25,000 per hour. The device is very compact and is mounted on a standard that comes up through a can in which the tickets are dumped when counted. The Cleveland Electric Railway Company reports that it gains time by having two persons (usually girls) work together; one takes off the rubber bands from the bundles while the other operates the machine. "The underlying principle of the machine is to segregate the tickets from packs or bunches and distribute them uniformly opposite numbered spaces where the eye can readily detect any discrepancies."

Two very useful machines for the cashier's office are made by the Brandt Cashier Company of Chicago. One is called a "Payer," and it consists of a small cabinet with rows of keys marked from one to ninety-nine. In front of these are compartments holding coins of the different denominations. Upon the pressure of any of the keys the sum represented drops out in the least number of coins that will make it. This machine is particularly useful in making up pay-rolls as the money can be dropped directly into the envelope. The other machine, called the "Changer," by the pressure of one key gives the difference between the number pressed and the other sum at which the machine may have been set. The only mental work required is the striking of the proper key. This machine is particularly useful in offices of gas and electric light companies where bills are paid over the counter. The price of each machine is $150.

W. R. Gaither, auditor of the South Chicago City Railway Company, has invented a device for keeping time, which, I think will become popular when put on the market and used. It is operated in connection with the wide carriage Burroughs adding machine. Two paper-carrying rollers are attached to the rear of the carriage; one supplies and the other receives the paper, which has been printed and ruled, as the work progresses. When the work for the day is complete the paper is reeled back, the carriage set over a space and is then ready for the next day's posting. A space sufficient to allow two rows of figures is allotted each name, and additional spaces if more than one rate is to be used for the same man. The time for the day is printed by the machine on the top line and (having previously put into the machine the time from the start of the pay-roll period up to the current date) the total of all time including the current date is posted on the second line. In other words, each man's time is accumulated from day to day, so that when the last day is entered the total time is entered immediately below it. As the total time is set down from day to day the machine clears itself. There are so many complications about the rolls for the company which I represent that I have not been able to give the machine the trial to which it is entitled, but if any accountant who is interested will take the matter up direct with Mr. Gaither at South Chicago, Ill., he will arrange for a trial of the machine that I feel quite certain would lead to its adoption. A more complete description of the device will be found in the Street Railway Journal of March 16, 1907.

Another good thing is the Wahl "Adding and Subtracting Attachment" for the Remington typewriter. The totalizers or registers are mounted on a truck, the movement of which is governed by the typewriter. They pass over what the makers call the actuating mechanism, and any figure keys on the typewriter that are pressed when these two parts are in conjunction are carried into the register and accumulated. The printing of the totals clears the registers as in similar devices. I am very much pleased with the work done by these machines, and hope to have at least one in the office before long. The Wahl Adding Machine Company, Great Northern Building, Chicago, publishes an interesting circular describing the machine. A No. 7 Remington typewriter, with a tabulator and one of the Wahl attachments with a capacity of seven figures, sells for $250. Additional totalizers of the same capacity are $70. For each additional figure wheel $5 additional is charged.

For keeping a record of piecework or of employes whose time is to be split up on several jobs, I think the Perry time stamp, made by the Perry Time Stamp Company, of No. 19 South Jefferson Street, Chicago, is a very convenient device. The price of this device has been reduced from $25 to $15. I have seen the work it does and can recommend it. the stamps have been adopted in a great many of the large industries of the country, which should be a good recommendation if anything further than mine is required.

Another device which it seems to me would be a very valuable adjunct to the claim department particularly, is the "Commercial Graphophone." This consists of a dictating machine that is talked to through a speaking tube, and a transmitting machine that talks back. The price of the first is $75 and of the second, $65. To complete the outfit one should have a shaving machine to redress the cylinders, and a supply of cylinders that cost $25 per hundred. These will be furnished by the seller; the purchaser has to supply someone to use the arangement who has a voice and a flow of language. It seems to me that in preparing briefs, one lawyer could keep two or three typists busy and they need not be stenographers. These machines are manufactured by the Columbia Phonograph Company, of New York, London and Chicago. Each cylinder will hold from 1,000 to 1,600 words spoken at a rate of from 90 to 100 words a minute. This is equivalent to about two full pages legal size paper, single spaced.

Another machine that I believe to be a good one, is the "Ensign Electric Adder, Multiplier and Divider," made by the Ensign Manufacturing Company, 24 Milk Street, Boston, Mass. I did not see the company's advertisement until too late to investigate the machine, but the description is interesting.

For binding all kinds of loose sheets satisfactorily, and that to my mind includes provision for removing a single sheet quickly if it is wanted, I think the Tengwall devices are excellent. I have used some for over nine years, and they work just as well now as the day they were received, though they were opened every work day during that time. They are made by the Tengwall Company, No. 1411 East Ravenswood Park, Chicago.

Before closing this paper I wish to recommend to the members two publications that I take, in which most of the new office helps are advertised. One is *System,* published at No. 151 Wabash Avenue, Chicago, and the other is *Office Appliances,* published at No. 303 Dearborn Street, Chicago.

I also wish to urge upon members interested in this branch of our association the desirability of attending the various Office Appliance Expositions that are held in large cities. It will be well worth while. I go every year at least once, and am always amply repaid for the time spent. Let me repeat what I said in the opening of this paper. I have no doubt failed to mention many machines that may be as good, if not better, than some of those I have seemed to advertise, but they are such as have not come under my observation, and if such makers feel in the least slighted. I apologize now for not having received their literature.

Besides the exhibit of the Twin City Rapid Transit Company, mentioned elsewhere in this issue, the Boston Elevated Railway Company exhibited in the convention room on the Steel Pier a very fine map of its system and connections. The Boston company also had mounted a frame containing a small map of the central part of its system and pictures of scenes along the lines.

PAPERS READ AT THE ATLANTIC CITY CONVENTION OF THE AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION

THE CLAIM AGENT OF TO-DAY AND HIS WORK

BY. H. K. BENNETT,
Claim Agent, Fitchburg & Leominster Street Railway Company.

The claim agent of the present day is probably the most mistaken individual from the standpoint of the general public, who exists in the professional world, and in some instances he is almost as much misunderstood by the interests which he represents. By this I mean that many of our railway boards of directors do not fully comprehend what it means to stand between the public of to-day and a flourishing corporation of any size. I mean nothing disparaging by this statement, and will endeavor to show just what I mean by this peculiar sense of misunderstanding, as I present the various phases of a claim agent's duties.

In the first place, this is a most strenuous era in which we exist, and while this is perhaps a recognized fact there does not go hand in hand with the recognition, the full understanding of what coping with advanced intelligence means. By this I assume that we have for the foundation of a claim agent, a man of intelligence backed by a body of officials who realize the responsibilities of such a position, and stand ready to aid and assist in any way they can to bring about desired results in the department which the claim agent represents, or rather is. No one man can overcome single handed the almost insane prejudice that exists against a corporation viewed from the standpoint of the general public, if he is hampered in his work and not given a reasonable latitude to work in without restriction. I contend that if a claim agent cannot work out the many problems that he has to contend with without too much red tape, he has lost just so much from the start; he loses self-control and the power of determination, and in the end is a failure. No man should aspire to a claim agent's position until he knows he has the power of dissecting men's minds, and determining at once the proper remedy to apply. A claim agent's calling is as much like what it is pictured as two extremes can possibly be.

To the minds of many his position is one which tends toward dwelling on contentment and peace; his pathway is strewn with roses, and he is one who has only to speak and due attention is given. He is seen walking about with a sort of satisfied manner, fairly well dressed, perhaps, and with an air of being a little lower than the angels. The reality is a terrible awakening from this picture, as you all well know, but how are we to bring the minds of these deluded individuals to our way of thinking?

A claim agent, I contend, should have all the faculties which go to make up an energetic man; eyes that see veritably everything, even through imposition and fraud; ears that listen as well, and a tongue that remains silent until necessity brings it into play, and then it speaks in no uncertain tone. His brain is always revolving case after case which he is trying to make the most out of, thinking all the time if there is not some atom of evidence lurking somewhere that he can get hold of to further the desired ends. He may have on hand a dozen cases in all stages of incompletion, from the one which is already listed for trial, to the one of a few days or hours ago. All these are in his mind, and as he shuts his eyes, there is the endless procession flitting before his vision with kaleidoscopic effect. When you see him apparently taking life easy, as it is wont to be put, be not deceived, for if he has brains (and that is already assumed) he is thinking out problems the answers to which are always matters of speculation. I apply the foregoing to the claim agent as he should be, but perhaps not always as he really is.

The claim agent of to-day, if he is such in deed as well as in name, stands closer to the general public than any other official of the company which he represents; he is the bulwark, the buffer, the go-between between the coffers of his company and the greedy maw of the people; he is in a class by himself, and the head of no other department stands for more than does this same individual. His work may not show on the surface and his coming and going be heralded with a blare of trumpets, but it is there just the same. His office should not be an abiding place, but he should be, and I believe is, out among the people working quietly but effectively to tear down the bug-a-boo curtain of prejudice that exists. He is more than the mere cog in the machine which can be replaced at a moment's notice. I contend that he is a machine by himself.

Go with him to the claimant who was injured yesterday if you please. He finds him perhaps dwelling in squalor or riches, surrounded by the pleasures or miseries of life, and into each particular case he must fit like a glove and without friction. He must adapt himself to all surroundings and be as much at home in the kitchen of a tenement house with all its disagreeable features, as in the drawing-room of the "400." His tact must never give out, and by the gentle but persuasive use of it he must, I contend, to be the success that is demanded of him, be able to bring within the fold those who misguidedly persist in ranking all corporations as robbers of the basest sort. He must keep cool, meet flaming argument with good, everyday common sense, stand abuse without flinching, up to a certain point, agree sometimes even if it does go against the grain a little, but in the main issue be firm and positive. Give and take is a great game, but practiced in claim work is a winner. There is a chance of spoiling a good case by being too stubborn, and the claim agent must be able to see in advance whether or not his giving in even a little is to work to his advantage in the long run, or whether it will establish a precedent that will work the opposite.

You may say this is spreading it on a little too thickly, and placing the claim agent on a pedestal before which all must bow; far from such an idea, and if by chance I do place too high a standard upon you and your work, remember it is better to aim a little too high than to fall short of the mark. I am not writing of impossibilities, but possibilities; not dealing with fancies, but facts; not trying to immortalize but to infuse into you, if there be any who think that a claim agent is not a veritable being and worthy the respect of all with whom he comes in contact, the never dying flame of courage and persistency, and give each and every one of you something to take away with you, so that your blue days will be filled with a self-satisfying thought that life is worth living, and that you are appreciated. I have used the word "professional" without any apology, and do not believe there are any who will take issue that we do not belong to that worthy class and, as time goes on, I think this fact will be universally recognized.

Not long since, when the manager of a large railway corporation was shown the monthly statement of his claim agent, the remark was made by him that he could remember when in one year the total amount expended for claims did not exceed $20. So right here we have the first reason why a claim agent is misunderstood, the natural greed of the people in general, aided and abetted by shysters who use the cloak of the law to cover their acts. In those days when such a small sum was all that was needed to square accounts with the feelings of some individual, the spirit of "soakism" had not been developed, but surely as the sand running from the hour-glass, just as sure was the seed being sown, and the claim agent of to-day reaps the harvest. Only with the rapid advance of both steam and electric railways did the need of a claim agent present itself to thoughtful managers, and with this onward movement, trouble began. With the extension of lines came the inevitable factions; one wanted the road to run by his house and the other by his property. So the seed of discontent was sown, and the beginning made for future trouble inasmuch as one faction would always be ready to take the part against a railway. The public began to awaken to the fact that the railroads had come to stay and once given franchises had a power that could not be broken, and then they began to call themselves easy for giving something away for nothing.

Hence the need of a claim agent to pacify and coddle, if you please. These people and their offspring are the very people that we are called upon to deal with to-day, to placate and leave

with a shake of the hand and a friend made for the corporation. Just a little different now from the days of fifteen or twenty years ago, when it was a question of give and take, fair prices and a oneness of purpose; a corporation that was willing to provide transportation, and a public that accepted it in the spirit in which it was given. In those days trifling accidents connected with cars were of little consequence and treated as such; if a woman accidently fell down her cellar stairs or tripped over an obstruction in her yard, there was no thought of suing a railway for damages just because one ran within speaking distance of her home. To-day, such a one would appear within twenty-four hours with a half-dozen witnesses to back her up, and claim some conductor started his car while she was getting off and injured her for all time to come. There were no lawyers in those days who laid awake nights and had their runners by day seeking all kinds of cases just for the sole purpose of mulcting a railway corporation. So if I set our standard just above the average calling in what further I have to offer, do not say that I am placing you on a plane higher than our ambitions should reach.

A claim agent of to-day should be a past master of his calling; should have a general knowledge of law and its application; should have an extensive acquaintance with all classes; should be a student of human nature and have a knowledge of how best to approach those who have a grievance. He should maintain a confidential relation with the general public. The witness to an accident of to-day may become the claimant of to-morrow, and much depends upon how he is used when being interviewed as a witness what his disposition will be as a claimant and your success in handling him as such. There is a way to get along with everybody and leave a sweet taste in their mouths, so to speak, and once you have solved the "how," do not let go of it, for you have found, if not the perennial spring of life, an adjunct that will help you out of many tight places. It is just as easy to make a witness fairly hate you and be antagonistic toward the interests you represent, as it is to make him a friend that will prove such in the final issue.

A claim agent can be clever in handling witnesses, but he must not overdo it. He may meet with a rebuff when he goes for a statement, but he must tactfully refuse to be put off, using some argument that will fit to bring about the desired ends. For example, you go to Mr. B. and ask him regarding an accident which he personally witnessed and perhaps near his place of business. Mr. B. is found, the state of weather is decided to your mutual understanding, the agent meanwhile keeping his eye open for a chance to get down to business, and when the moment arrives, places the matter before him in a very quiet but forceful way. Mr. B. immediately "freezes" to all outward appearance, and informs you in no uncertain tones that "he will be hanged if he will help the old road out." Continuing, he says, "Do you know, young man, it was only last summer that one of your cars smashed up one of my teams, and some smarty comes here and offers me $10 to settle the bill, and did I settle? well, I should say not." You immediately run over past events in your mind, remembering of course, as you all do, the incidents that are constantly happening, and inform Mr. B. that it was not one of the cars of the company which you represent, but one of another line which crossed your company's track at the place the accident happened. This, of course, has a tendency to smooth his feelings somewhat, but still he refuses to give you any information. Then you go at him somewhat in this fashion: "Do you remember, Mr. Brown, the old saying relative to placing yourself in some other person's place? Just for once I wish you would assume that you occupy the position I do, and let me for the sake of argument imagine a case similar to the one at issue; you are running a store; your driver leaves your horse unhitched one day while he is delivering goods; the horse runs away; a little child in the road is run over and injured; you find on inquiry that some boys started the horse by throwing apples at him, but as this is only a rumor you set out to find an actual eye-witness, and after some delay you find that I am that person; you come to me and I pointedly refuse to have anything to do with the matter. What would you think of me? Our relations now are identical with the position assumed." Nine times out of ten you win, and by nothing but pure simple tact used at the right time.

In this searching for evidence, do not always be particular as to the quality, for you are supposed to hear everything that is to be offered whether it is to your advantage or not, and should a statement be given detrimental to your case, do not refuse it, for if you do you create the impression that you only want one side and the chances are your witness will give this information to the other side. On the other hand, if you listen to all he has to say, the chances are he will consider you are perfectly fair and frank in the matter and will not give the matter further concern. In your eagerness, therefore, to present the best possible case, do not let it be said that you left out any statement because you are prejudiced; better a little adverse testimony than the effect of having it cut and dried. Juries are queer at best, but they tire of repetition and from personal experience I know that too much sameness of testimony inclines the average jury to consider that the case is bolstered.

So I repeat, get all the statements you can, good, bad and indifferent; take what is offered, and then let your attorney do the rest. Never resort to trickery in getting statements; be frank and manly; make yourself known. Realize that you are, for the time being, representing a big corporation, and that you must so conduct yourself as to be a credit to it and yourself, without regard to the quality and character of your informants. Make the acquaintance of as many people as possible, both high and low. Learn their individual preferences and tastes, their habits and associates. Some day this fund of information will count for something. A. knows B. and B. knows C., and thus the endless chain, for where you know ten the door is open to ninety more. A sneak is about the worst creature imaginable, and many a man has been turned down good and hard just because he tried to mislead some well-intentioned person, by claiming to be that which he was not. If you do this, some day it will come back to you from an unexpected source and prove a blow that may lose a good case for you.

When it is settled without dispute (or rather with one) that a case is going to trial, then is the time that you must get down and dig. You must gather a preponderance of undisputed facts, not only from those you know are connected with the accident as witnesses, but from others as well. Show, if possible, negligence wholly or in part on the part of the plaintiff, presenting this evidence in a firm and decided manner. Your witnesses must be unprejudiced; the more non-residents the better. Remember your average jury is composed of every-day men from all walks of life, and they must, like the man from Missouri, "be shown." Doubtless some one of them has at some time or other had trouble with a railroad, and you can safely wager he is going to tell all about it when he gets into the jury room. If not personally interested himself, some relative has had litigation with a railway corporation, "and they haven't done anything since," is the way one juryman related his experiences. You are up against a hard proposition, and the only way you can expect to win out is by presenting a clear-cut mass of undisputed evidence from witnesses of a standard calculated to impress a jury. If you cannot do this your labor has been in vain. I find too often that employees are rather inclined to enlarge upon matters, going into explanations, rather than confining themselves to the question, and offering suggestions while testifying under cross-examination. Jurors as a rule, I am convinced, do not give employees' evidence much weight. They say at the outset that they must be predisposed to give favorable evidence in order to hold their positions. Witnesses of the employé class should be cautioned about saying too much; urged to stick to the question at hand, answering "yes" or "no" wherever possible and letting it drop there. They must not be too insistent on being absolutely right if there is any doubt in the matter; on the contrary, ever ready to admit possibilities. You will find, I think, that this prejudice will gradually be wholly eradicated as time goes on if such methods are adopted. There are instances, of course, where it would "be easier for a camel to go through the eye of a needle," than for a corporation to win a case, but there are exceptions, and these exceptions are acquired only by educating the people to a realization that a corporation is not an oppressor, but rather stands for the best interest of all.

It was but a short time ago that my sensibilities were severely jarred and I have hardly recovered. In a case where eye-witnesses to an accident stated that the claimant was entirely to blame for an accident, I thought it was an act of decency and confidence to go to her counsel and show him what he was up against. Judge of my surprise when, after a few minutes' conversation and a partial showing of what I had to offer, the aforesaid counsel opened up on me with a masked battery, so to speak, and told me in good, old-fashioned English that it

was an easy matter for me or any other railway representative to go out and get statements suitable for the company's interests, and that we had people along various parts of the lines in our employ who were paid agents to make statements favoring the company. This is an example of what we have to deal with in Massachusetts, but let it be said in justice to the rest of the legal fraternity, that this was an exceptional case, and the first time that I have known of an attorney of standing, or otherwise, to digress so far into fancy from the trodden paths of truth.

So acute is the desire to obtain all the information that a railway may have in regard to their accidents, that an attempt was made in the Massachusetts Legislature last winter, and which I am glad to say did not avail, to pass a bill requiring all railway corporations to file with the State Railway Commissioners a list of all their witnesses to accidents. You can easily see what the result would have been had such a bill become a law, and that the bill was in the interests of the so-called shyster lawyer. If this provision had become operative, a railway company might just as well invite lawyers to the scene of every accident and leave all questions of settlement in their hands without argument.

As a newspaper man for many years, I was compelled to keep a scrap book containing all important matters which daily passed through my hands, and I wish to impress upon you the same necessity of doing this as a claim agent. All items concerning your railroad, whether or not they are of interest to your particular department or not, should be carefully recorded, for sooner or later they will stand you in good stead. All accidents in various parts of the country where names are given I consider invaluable, for you cannot tell whether or not these persons have just claims or not, and the day might not be far distant when you might run up against these very same people. Local accidents especially, and I do not refer to the railroad class entirely, for it is not an unusual occurrence to have injuries received in shop or mine foisted on you as coming directly from a street railway accident. Together with this scrap book should be kept an index of the names as recorded, and it is a simple matter to run over this. If you have your man recorded, the rest is easy.

The use of a camera I have found to be invaluable, both at the time of accidents and after. Word of mouth may fail, but a photograph is undisputed evidence of the first water.

One other duty of a claim agent I believe to be invaluable, is the inspection of cars for defects. While this, of course, comes under another head as a rule, there are many minor matters overlooked for which the head of that department cannot be responsible. By this I mean such matters as loose screws, absence of rubbers on the backs of seats, leaving screw heads exposed where a passenger can easily catch a ring, and perhaps seriously injure himself; loose running boards, steps and other minor parts with which you are all familiar. Anything that can better the service should not be overlooked. The old saying, "An ounce of prevention is worth a pound of cure," is very applicable to our line of work.

It does a great deal of good to ride with the men and watch how they perform their duties, and a word of praise or criticism at times is entirely in line with our work. In fact, everything and anything that can lead to the desired end—perfection—should be watched with the closest attention. If it is within your province to prevent accidents, you are more valuable to your employer than to be simply able to dispose of the claims as they arise.

I have doubtless wearied you with a repetition of facts already well known to yourselves, but I trust there may be some who will feel a little more the responsibilities with which they are entrusted, even as I do in writing what I have. Let me urge upon you, in summing up, the absolute necessity of being always on the watch for every straw which blows your way and can be used for good; get to the scene of an accident as soon as possible, assist any and everybody, even if the liability is all in your favor, for you lose nothing in the long run; disabuse the minds of the public in general of the idea that a corporation is against instead of for them; play fair and square, say what you mean and mean what you say, no more, no less. Firmness has done more in cleaning up undesirable cases than anything else.

In closing, let me say that I have tried to set forth some of the principles of an ideal claim agent, and briefly alluded to some of his daily tasks; that, when putting down these facts for your perusal and consideration, I have not been sitting in front of a mirror. Would that I, myself, was one-half the claim agent I have pictured, but in presenting these few facts, I have tried to depict the ideal without being able to lay my hands on one, helping myself and, at the same time, hoping to aid others to oil up the rusty places and push the standard a little higher, so when we have laid down the reins, others may take them up and continue on to a more successful career.

THE SELECTING AND TRAINING OF INVESTIGATORS AND ADJUSTERS FOR THE CLAIM DEPARTMENT

BY ELLIS C. CARPENTER,
Claim Agent, Indiana Union Traction Company

This is a subject that the writer feels is one to which he cannot do justice and should have been assigned to someone of broader experience. Inasmuch as our worthy secretary has been so insistent, and one of the first qualifications of an adjuster should be loyalty, I have consented to take a look at the subject from our viewpoint, not with the idea of being able to instruct those who may listen to the reading of this paper, but more with the idea of contributing something on the subject, trusting that it will be followed by a lively discussion in which there will be an exchange of ideas and out of the whole there will be much benefit.

Let us look at the investigator first. I assume it to be the duty of an investigator, in pursuing the investigation of accidents and matters incident thereto, to secure reliable and accurate information and develop a state of facts from which the adjuster, or head of the claim department, may determine what should be done in the particular case under consideration, and whose statements, where necessary, will be verified by sworn testimony.

To do this, what are some of the qualifications which a successful investigator should possess? He should be loyal to his department and the interests of his employer. He should be of pleasing address and sufficiently familiar with the English language to be clear in his statements. In some localities where there is a large foreign population, he should also be able to speak whatever language is spoken by the class of people with whom he is expected to deal. His penmanship should be legible and his spelling correct, although in securing evidence and taking statements of witnesses, the best results are obtained by using the peculiar expressions of the witness and putting the statement as nearly as possible in the witness's own words, being careful to make it clear as a whole. He should have a spirit of fairness in his manner and dealing that will win the confidence of the persons with whom he comes in contact, together with frankness and sincerity in seeking information. his countenance should be open, with the ability to look his man squarely in the eye, without wavering, but with a softness of expression that will at once tend to put him on easy terms. These will be sufficient to successfully deal with fully three-fourths of the general public.

But what of the other one-fourth? Among these latter will be found persons of all ages, types and nationalities, and with all the peculiar characteristics with which peculiar people are endowed. It is the latter class (if we may so class them) that taxes the ability of the investigator. In order successfully to meet and secure information from such, we will suggest some other characteristics and conditions that will aid the investigator in his work. His countenance should be pleasing, his personality attractive, with a sufficient force of character to command the respect of others. His manner should be considerate, not officious; willing, if necessary, to listen to a tale of woe by a proper show of sympathy or a pertinent remark in a humorous or other vein, to turn the mind of the witness in the proper channel and guide his thoughts along the right line without apparent effort. His sense of humor should be sufficiently developed to appreciate a story when told by the other fellow, so as to enable good terms to be established between the parties, but sensible enough not to let his own humor run rampant.

He will find many persons who are critical and faultfinding, but after the criticism has been made or the faults (either real or fancied) pointed out, he will seldom find it necessary to flatly contradict it, although he may know it to be wrong, but he can indicate some of the troubles of a motorman or the things which harass a conductor, appealing to the sympathies of his man, by putting him in the conductor's place and seeing what he would do under like circumstances.

He should be able to adapt himself to circumstances and surroundings to such an extent as not to appear to be above the

level of the person from whom he seeks information. He should be sufficiently capable in his judgment of human nature to discern the side of his man easiest of approach and warm up to him in the quickest way. He should be sufficiently advised upon the subject under investigation to know what he is looking for and recognize it when he sees it, without embodying, in procuring statements of witnesses, a vast amount of immaterial or irrelevant matters. This comes, however, only after careful study and considerable experience. There are persons who are hard workers and conscientious, who do not have sufficient capacity to distinguish between a supposition and a positive statement, an opinion or a statement of fact, and whose investigations, when supposedly complete, do not contain sufficient information upon which to predicate a theory of denfense or to know, with any certainty, how an accident occurred, or who is responsible.

His honesty should be above question and likewise his morals. He should be clean of speech, correct in his personal habits and as neat in dress as circumstances will permit, but care should be used not to overdress in dealing with the poorer and middle classes. His temper should, at all times, be under control, but a glance at his face should reveal to the other fellow a goodly quantity that is held in reserve for emergency. In rare instances a quick, sharp outburst of the right proportion will bring your man up with a halt and then you can lead him on at will, but men, as a rule, can be led far easier than driven.

I know of a case, however, where an investigation was being made which involved some valuable information from the department of the master mechanic of a certain road; the master mechanic failing to appreciate either the importance of giving the information or the grit and activity of the investigator, threatened to thrash him if he bothered him any more. Suffice it to say the matter was determined then and there, the information secured by the investigator, while the doctor ministered to the needs of the master mechanic, who nursed a very sore head. In the case in point, the proper remedy was administered, but I am glad to know such cases are rare.

The investigator should, as these various phases indicate, be above the average in his judgment of human nature, so that he may use his own weapons in firing the rightly proportioned shot in the right way at the bull's-eye of his subject. He should not overlook the fact that information is sought largely from disinterested persons, and that they are conferring a favor on him, and due appreciation should be shown.

I am well aware that all investigators do not have all of the various characteristics referred to, but in the selection of men for this work as many of them as possible should be possessed, combined with a liberal allowance of good, sound horse sense, which will carry a man over many a rough place and enable him to be a success in this work.

You cannot lay down a set of inviolable rules which are applicable to this work on account of the varied personalities and conditions with which the investigator comes in contact. He should be allowed wide latitude in approaching and dealing with men in his own way, but keeping in mind three things: First, secure facts as accurately and intelligently as possible; second, be fair and frank in his dealings, thus making friends; third, take his leave always in such a way that he may, if necessary, see his party again.

As to the successful adjuster. Most of what has been said of the investigator is applicable to him. As the adjuster's work brings him in contact with that phase of human nature that is not only willing but desirous of getting something for nothing, he must be a person of a more positive character, who is capable of meeting all classes of people in a pleasant way, commanding their respect and at the same time maintaining his own. He must be be able to act quickly, say "yes" or "no" as the exigencies require and have the ability to discern the psychological moment to a close deal. He must read his man as he goes, and talk to him either directly or through a second person, for there are times when a side remark to some one else will soak in and be more effective than a direct statement to the claimant.

He must be familiar with the legal phases of his work to command the respect of the legal representatives of claimants and not be trapped or made to fear a case that is close, but he must be able to discuss the case intelligently, where necessary, and put his opponent on the run.

He must have some knowledge of anatomy, the muscular and nervous systems of man, and be able to impress claimant with his ability to read symptoms and diagnose real conditions, and where necessary to meet attending physicians or others and by asking intelligent questions elicit information regarding real conditions, and not be imposed upon by fictitious statements.

The adjuster, many times, must take up the investigation of expert evidence and meet attending physicians and by the grasp of the subject shown by intelligent interrogation, he is less likely to be dealt with unfairly. If he has reason to believe this to be the case, he can manoeuver his case so as to secure whatever additional physical examinations he deems necessary by his own physician, or he can commit the attending physician in a written statement regarding the claimant's condition. The latter method will be far more favorable when a compromise seems pending, than the testimony of the physician will be in court, and which will be quite handy to confront the physician with during the trial, should he give testimony at variance with his signed statement.

It pays handsomely to be friendly with the physician. One of the most effective ways to secure his friendship is to protect him in his bill for services to the claimant. The money, in this way, is paid direct to the physician by the company and he is more likely to serve the fellow who pays the bill. What does it matter to you if you allow an extra ten dollars to the physician, if he helps you save a hundred or so in a settlement? Isn't it a good investment?

In my opinion, it is good policy, so far as possible, to close a case pleasantly, having it understood by all parties concerned, and leave the matter in a friendly way. Seed sown in this way is sure to be harvested later by the friends of satisfied claimants being told to deal directly with the adjuster, instead of through attorneys, should they have a grievance to adjust.

In a large percentage of the cases, the adjuster must take the initiative and yet be on the defensive. In liability cases, where attorneys have not been employed, he must seek his party, grasp conditions instantly upon meeting and master the situation in his own way. No one can tell him just what to do, for he deals largely with persons with whom he has had no previous acquaintance. Opinions are formed, conditions created, settlements made or foundations laid for settlements upon the instant. The adjuster must be able to tell, from the manner in which he is received, whether or not he should strike at once at the proposition or use his ability to create better conditions. That person does not live who can intelligently direct me how to meet and deal with someone with whom he has no acquaintance, and I am sure I would not be egotistical enough to attempt to direct someone else by giving specific directions for such individual cases. The adjuster must care for and deal with them in his own way, meeting contingencies as they arise, his success being measured by the results he is able to attain.

There is no department of the railway service that is so likely to be brought in contact with every other department as the claim department. This being true, both the investigators and the adjusters should conduct themselves in a manner to keep the good-will and respect of the other departments by not catering to any particular department or individual, but dealing fairly with all. Be sure you are right before making a positive assertion, fixing the blame for an accident, permitting it to rest just where it belongs. In other words, save your company and not any particular department. When such a reputation has been established, your judgment will be recognized, and your opinion sought by the proper officials of your company.

I would not know where to look for a more congenial, courteous or whole-souled set of fellows than among the investigators and adjusters of this association. We all have our own cares and pleasures in our everyday work and we should be stronger therefor. Let us all work together to strengthen the association, better the railway service and protect our companies from fraudulent claims.

THE POLICY OF THE CLAIM DEPARTMENT TO THE INJURED EMPLOYE

BY R. H. SCHOENEN,
Claim Agent, Lehigh Valley Transit Company.

The laborer, the employe of a street railway if you please, is his own worst enemy. He is the victim of conditions which are, speaking collectively, of his own making. To him is measured out a stated amount of the wealth of the land in exchange for the commodity which he has for sale, his services. He naturally seeks to obtain the highest price. The employer, the capitalist, is the custodian of the accumulated wealth of the land. He, too, seeks to obtain the best bargain

he can, and, alas! too often is guilty of gross malfeasance in his trust. Human nature is aspiring. We would not be human if we did not aspire to higher walks of life socially, and depraved indeed is the man who does not aspire to higher ethical ideals. The employe has his aspirations. He seeks to draw more largely upon the accumulated wealth of the land and so often he is led to resort to methods which, if not downright dishonest, are, to say the least, disreputable.

The employer, capital generally, is representative of the highest culture, intelligence and refinement, and means to be and is, usually, honest and fair in dealing with the employe. Now it is no serious indictment against the employe to intimate that the employer is fairer in his dealings with the employe than the employe is with the employer. Reverse the condition of education, culture and training and you doubtless would reverse the positions as to fair dealing. The nearer we approach common ground, which means the employe must be lifted by education and training toward the level of the employer, the less liability is there that friction will exist, the stronger will be the confidence the one in the other.

Confidence means content, lack of confidence means discontent, and all the resultant evils bred in the minds of the ordinarily discontented employe.

The management of the street railway, as represented by the chiefs of the various departments, should always be such as to inspire confidence. The claim department, probably, of all departments finds it more difficult to inspire confidence, and especially when dealing with the injured employe. The policy dare not be too liberal, else the result will be to destroy rather than to inspire confidence, and in the end lead to gross imposition upon the company. Let the employe once feel that his remuneration for injury will equal or exceed his regular wages and his indisposition is likely to be extended indefinitely, with often times positive injury to himself and a demoralizing effect upon his fellow employes. This does not necessarily mean an effort to defraud the company. Nothing is more real than imaginary injury. On the other hand, it has a very wholesome effect to be brought at times face to face with the hard necessities of life, and what at first seems a hardship is afterward looked upon as a gracious act. Cases may be cited where injured employes have been allowed to work along at their regular work when able, and when not able paid regular wages upon doctor's certificates, that were really sick, delusionary, for months and even years. Yet, when patience was exhausted and it seemed better to risk a possible lawsuit than to continue indefinitely a condition so demoralizing, it was found that the injured employe was soon able to perform his work regularly without any lost time and in a satisfactory manner. It was simply throwing him upon his own resources as to the future, and his mental activities started in another direction. This condition may be brought about by the advice and harangue of a friend or relatives, or perchance the injured employe has been sought out by one of those "ambulance chasing lawyers" and is the victim of his intrigues.

Many employes carry accident insurance or belong to beneficial societies or at times both. An injury in itself slight may return them much more than their regular wages, if able to collect benefits from these societies and settle with the claim department for their injuries. It often takes the combined efforts of the claim department of the company and these societies to prevent fraud being practiced. It is well to ascertain to what beneficial societies your injured employe belongs, if any, and see what benefits he may be drawing from them.

Again, too harsh treatment of the injured employe is likely to engender a malicious feeling which tends to destroy confidence in the company and its management generally. This in the end lends energy, especially where you are dealing with organized labor, to certain socialistic ideas which seem to be sweeping like a great wave over the country, until we hear of laws and court decisions from all quarters, always in favor of the employe as against the employer. It would seem that to employ a man to work for you would be to enter into an insurance contract with him in case of his injury by accident, no matter where the liability lay, or how much property loss the employe may have caused by his carelessness.

Pennsylvania, at the last session of its legislature, passed a very liberal law looking at it from the employe's standpoint. It has yet to come before the courts for its proper interpretation before we can judge of its true significance. President Roosevelt, if properly reported, in his Georgia Day speech at Jamestown, placed himself far to the front on this line.

It is essential first of all before dealing with the injured employe to determine the liability, who was primarily responsible for the accident. If the injured employe has contributed by carelessness or otherwise to the accident this fact should be given consideration in settling, and all evidence tending in that direction should be well established, and clearly and explicitly stated. The injured employe should be given to understand, and very clearly, that what he is likely to term an illiberal settlement is illiberal only to the extent that he has himself contributed to the cause of injury. If the injured employe is free from fault and the injury is not the result of the carelessness of some fellow employe, the settlement should be most generous, even to full remuneration for the injury sustained. Where a fellow employe has contributed to, or is wholly to blame for the accident, the treatment should not be so liberal. Probably half remuneration for injury sustained would be liberal enough, unless the fellow employe is one to whom is delegated a certain amount of authority over him, and it was in obedience to this authority exercised, that the injury was sustained. Then, in that event, the injured employe should be given the same consideration as the employer who is wholly faultless. It is very hard at times, and often almost impossible, to determine whether the employe has contributed to his injury. In such cases the employe's record should be examined and if it proves to be good, he should have the benefit of the doubt. If, on the other hand, his record is poor or shows him to have been habitually reckless or careless, though not sufficiently so as to cause his dismissal, the company is entitled to the benefit of the doubt and settlement should be made accordingly.

You can readily see, and no doubt have experienced, the difficulty in establishing an inflexible rule for this class of settlements. One rule, however, should be strictly adhered to; no injured employe should be allowed to return to his regular work until he has given the claim department a release in full. To assist needy employes it often happens they can be given something they can do that will help them along until such time as they will be able to take their regular work, but before they take their regular work they should sign a release. A release thus given eliminates them from the pensioner's pay-roll and places them again on their merits. It is often necessary to assist needy injured employes by advancing them or their families certain amounts on account. These advances should only be made to prevent actual want and should be well within the settling limit.

INSTRUCTION OF EMPLOYES IN ACCIDENT WORK

BY F. W. JOHNSON,

Assistant General Claim Agent, Philadelphia Rapid Transit Company.

In developing the subject of this paper, the speaker will not attempt to enlarge upon the advantages possible from work of this character. Many of the members of the association, doubtless, are working out ideas in this direction, and attention, therefore, will be directed more particularly to a consideration of various methods by which instructions of this nature may, to the best advantage, be prepared and imparted to the men on the cars.

Before proceeding to a discussion of the subject-proper of the paper, it is possible that attention may profitably be devoted at this time to several matters of a nature preliminary to the actual work of instruction.

In considering the matter of instructing employes of street railway companies in the work of preventing accidents, and of the proper handling of accidents, it is well to recognize the fact, first of all, that each step in the work must be governed somewhat by the local conditions surrounding each individual company, and, because of this fact, it oftentimes is advisable to adopt slight changes in the method of procedure, as between one community and another. This minor detail, however, should not be allowed to overshadow the all-important fact that, taken as a whole, the accident situation is much the same the country over.

We find different laws and different ordinances in different localities, it is true. But it is equally true that we find the same prejudiced jury in the South that we have to contend with in the North. In whichever direction we travel we meet with the same old collision of cars, the same old team accidents and the same old premature starts. The un-

reported accident and the disinclination of car employes to secure adequate witnesses to their accidents appear to figure prominently in all quarters.

Thus it is that, while local conditions should be given careful consideration in determining the scope and character of the work of instruction, it should also be remembered that the difference between one locality and another oftentimes will lie in a difference of the methods of procedure than in the fundamental principles of the work.

Hand in hand with the problem, which of the two departments, the claim or the operating, is the better qualified to conduct an educational campaign of this nature, oftentimes travels a fear upon the part of some that friction may develop between the two departments if the former is allowed to enter upon this work. Such a possibility is supposed to center about a division of authority in the eyes of the employes.

Taking up the first point, the writer, for many substantial reasons which lack of space forbids giving in detail, is strongly of the opinion that of the two departments the claim or accident department is by far the better adapted for the work.

Several observations bearing upon the second point may not be amiss at this time. The possibility of a division of authority in the yes of the employes is something that must, of course, be avoided. Discipline demands that they should look to but one source for their orders. For this reason, the writer favors the carrying on of the work of instruction by the claim department through the operating department, so to speak. In other words, though the material is prepared by the claim department, and is imparted to the men on the cars by representatives of the claim department, it should be only the mouthpiece of the operating department, so far as appearances are concerned.

Also would we touch briefly upon the seeming lack of confidence with which the officials of some companies approach the matter of issuing printed instructions to their employes, governing accident work. This timidity appears most often in an expression of fear that matters of this sort may be brought into court in the trial of damage cases against their company.

The writer has little hesitation in saying that he is of the opinion that this very fear, expressed in this very manner, has proven a very considerable factor in the past in bringing about the extremely unfavorable conditions with which many of these same companies are contending at the present time. It may be good business policy to keep the conductors, motormen and inspectors of a street railway company in the densest ignorance of the best interests of their employers in the handling of accidents, but the writer has yet to be convinced of that fact.

Let the question be asked in all fairness, "What possible injury can be done to a defendant company, taking the situation as a whole, by the introduction of matter of this sort, in the occasional trial of a case in court?" Granting that such a procedure does add a few hundred dollars to a verdict now and then, the injury thus sustained is pitifully insignificant in comparison with the benefits received in other directions.

Let us say, for instance, that a certain company has issued printed instructions to its employees, cautioning them against allowing their cars to collide, or against starting their cars prematurely while passengers are boarding or alighting. What possible injury is to be done to the company's interests if these cautionings are brought into court?

If the facts themselves prove the collision, or the premature start, the damage has already been done, for the liability has then been established. The worst that can be said of such instructions, if properly compiled, is that they are evidence of a determination upon the part of the company to transport its patrons with as great a degree of safety as possible.

But, it may be argued, it is in the closely contested cases that the introduction of matter of this sort might work to a company's disadvantage. The answer is: "Prepare your instructions with this very object in view. While cautioning your men so word the instructions that the burden of responsibility, regardless of court decisions, is placed squarely upon the party injured. Make the law fit your instructions, and the average plaintiff's attorney will hesitate somewhat about swinging a double-edged sword of this character before a jury box, for it cuts both ways."

Shoulder what little damage may be inflicted from this direction. You will be getting at the other fellow by a decrease in serious liability accidents, by an encouraging decrease in your unreported accident column, by a gratifying increase in the average number of witnesses secured per accident, and, finally, by a corresponding increase in the number of favorable verdicts in the courts.

Before entering upon the work of instruction it is well that a general plan of campaign should be mapped out, based upon a thorough knowledge of local conditions and requirements. Such a course will assist materially in securing intelligent, concerted action upon the part of all those engaged in the work. Also the suggestion is made that the field of action should be restricted somewhat. In other words, study in advance the weak spots in the company's armor, determine the types of accidents which occur with the greatest frequency and which are proving the most costly to the company, note the chief weaknesses of your men in their work of handling accidents, and examine the records to ascertain what particular sections of your territory have proven unusually productive of serious accidents in the past.

By keeping to the middle of the road, so to speak, and by concentrating the fire of your batteries upon the more important types of accidents, it doubtless will be found that the men will more readily grasp your ideas and put them into actual service. In short, do not confuse the mind of the average two-dollar-a-day conductor or motorman by attempting to make a claim agent, surgeon or expert accountant out of him.

Coming to the actual work of instruction there is presented the choice of placing matter before the men in the form of oral instruction, or of printed instruction, or of making use of both of these means. In determining this point one should be guided somewhat by the experience of the past, and opinions doubtless will differ somewhat as to the better method to pursue.

The writer personally favors the employment of both oral and printed instructions. By means of oral instruction it is possible to reach practically all of the men of a company, some, of course, to a greater degree than others. It must be accepted as a fact that few conductors or motormen can sit through a good, earnest accident talk without learning something new regarding the handling of accidents. By this method, also, it is possible to drive instructions home to some men whom you could not possibly hope to reach to advantage through the medium of printed instructions alone.

Of the two methods that of oral instruction unquestionably is the more effective. It positively will gain ground all along the line. But as street railway employes are prone to forget, the problem immediately arises, "How may ground gained by oral instruction be retained?"

Supposing that we consider first the frequency with which talks of this nature may be advantageously held. Opinions again will differ somewhat upon this point. The suggestion may be advanced, however, that too frequent accident talks must of necessity cover much of the same ground, and will eventually dampen the interest of the men in such meetings. On the larger systems the writer is of the opinion that two talks a year to the entire body of employees will be found sufficient, provided that some method is devised for keeping in touch with the men in the interim. Hold the first talk, for example, late in the spring, after the extra summer men have been broken in and before the heavy summer riding commences. The second talk might be held to advantage during the fall months, before the usual run of winter accidents begin. On systems of less magnitude, where the employes can more readily be gathered together, it is quite possible that several talks throughout the course of the year could be held to advantage, bearing in mind, however, the suggestion hereinbefore mentioned.

Taking up the matter of printed instructions, the writer strongly favors the employment of this method as a secondary battery, designed expressly for the purpose of holding ground gained by oral instruction. This method affords a means for incessantly pounding away upon suggestions advanced in the accident talks, and likewise provides an ideal medium for keeping in close touch with the men on the firing line, provided up-to-date methods of communication are adopted.

This calls to mind the printed instructions regarding accident work usually contained in the company rule books. The average rule book is monotonously complete in its details, and if any claim agent fondly imagines that his conductors and motormen are going to sit up late at night, after a hard day's work, faithfully studying the dry, tedious instructions set forth in the depths of these rule books by the aid of tallow candle and dictionary, he is doomed to be disappointed. Accident instructions are, of course, essential to the completeness of a company rule book, but a lot of dry, unwieldy, ponderous regulations of this sort and in this form leave much to be desired, if one is looking for results.

Necessarily, if printed instructions are to be of material assistance in the work, they should be constructed along live, interesting, up-to-date lines. Instructions that were issued no later than last month to counteract an epidemic of collisions of cars will not apply to the numerous unreported accidents which we are experiencing this month, nor to the avalanche of premature starts with which we may be inundated next month.

In considering the matter of placing printed instructions in the hands of the men upon the cars it is possible that a brief description of the issuance of weekly accident bulletins, with which the writer is somewhat familiar, may prove of interest.

The accident bulletins are issued regularly each week, one of them being handed personally to each conductor, motorman and inspector, generally upon pay-day. They are printed upon a good quality of white paper, in good readable type, and are designed with a view to presenting an appearance of neatness and attractiveness. These bulletins are practicable for almost any line of instruction. They deal entirely with the accident situation, giving advice, suggestions and warning applicable to the types of accidents occurring during current issues, or which are anticipated during the various seasons. They are couched in short, sharp language, plain and to the point, and, as nearly as possible, are written in the simple, every-day language of the men themselves.

A few timely suggestions governing the issuing of accident bulletins may prove of assistance to those in search of new ideas along this line.

Write your bulletins on good, broad-gage lines and in language plain, direct and forceful. Discard the dry, stilted, rule-book style of getting down to facts. Avoid sermons, sarcasm, ridicule, disagreeable personalities and dry-rot. Devote part of your efforts to the work of preventing accidents and part to the proper handling of accidents. Be versatile in your choice of subjects and original in your manner of handling them. Opening paragraphs should be of sufficient interest to arrest the attention of the reader. Make the bulletins always optimistic in tone—always working for a still better showing next month. Drive a single point home solidly, rather than confuse your readers with a number. Use the bulletin to call attention to serious accidents throughout the country—explaining the cause of the mishap—then follow it right up with your warning. Cite instances of employes discharged for carelessness or indifferent work—but finish strongly with appreciative words for those who are doing their best for you. A word of encouragement now and then helps many a man who has been down on his luck to get back onto his feet. Throw some individuality into your work—your enthusiasm may prove contagious with the men whom you are striving to reach. Be fair and just in your relations with the men. Remember that it is human nature to feel pleased with a word of commendation in appreciation of particularly faithful work, and never lose sight of the fact that your most powerful allies in the work of preventing accidents, and of the proper handling of accidents, are the well-meaning, hard-working men on your cars.

HOW I MANAGE BAD CASES

BY HARRY P. VORIES,

Claim Agent, Pueblo & Suburban Traction & Lighting Company, Pueblo, Col.

We have taken it that the subject presupposes a case where the injury is severe, the company liable and the claimant disposed to demand more than is just. The case may be one where there is no injury, at least no apparent injury, yet, the proof of this fact is hard to establish. There may be a case where the injury is an honest one, yet the claimant is disposed to exaggerate his or her injuries. In any one of these cases, I have the injured party sent to a hospital that will treat the company fairly.

I take the usual precaution of bringing the motorman and conductor before me, and make a thorough investigation of the case. I interrogate them and cross-question them as if they were antagonistic to the company; in short, I do everything that can possibly throw any light on the question. I take a detailed statement from each of them and file it with the records in the case. I immediately send the company's surgeon to investigate the case, and ask him to make all inquiry as to how the accident happened and to procure a verbal statement from the party. He makes to me a full report of the injury, which is, of course, filed with the case. I use the card system in getting the names of all witnesses that can be obtained. I have my assistant investigate all the circumstances of the case at once. Every witness who saw the accident is carefully interrogated and his statement reduced to writing and sworn to.

It often happens that the witnesses who were close say that they did not see the accident and have no statement to give. I have my assistant tell these people that it will seem that he has not done his duty unless he gets some statement from them, and if they do not know anything, if they will kindly say so, it will put him right with the company. This prevents them from testifying against the company in case of suit. It often happens that a witness is a workingman and is antagonistic to a corporation, but if he is informed that it will assist the motorman and save his job, the information can be obtained. I confer then with the legal department, if in doubt, and by the time I have all this information the party is ready to see me, and I am ready to see him. I never tell anything but what I believe to be the truth. "Corruption wins not more than honesty."

I try to be fair, and more than that, I try to convince persons that I am their friend and that I am going to treat them fairly. I endeavor to find out as much concerning the life of the claimant as possible. I manage to find out the State where he was born, where he has lived, his religion and politics, his misfortunes and physical health. After I have done these things, I talk about things that are pleasant to him. I try to create a fellow feeling between us. If he is from the South, I tell him I have lived there; I find out if he or his people were in the late war between the States; I find out whom he or they were under, what battles they fought, if he served from Bull Run to Appomattox; I tell him that I had a brother who was a follower of the fortunes of Lee and Jackson. If he is from the North, I tell him my father was a Union man; that the Confederates "borrowed" his horses, and that they no doubt met on many a field. If he is from my State, I talk of things that will make him know that we have many things in common. If he is from Missouri, I tell him that is not such a bad place; that I had to go there for a wife and ought to be the last man to say anything against the State. I tell him the story that the Kansas man tells on Missouri. That once a Kansas family was moving to Missouri; they had everything on the wagon ready to start, but they could not find their little boy, but looking into one of the rooms, they found him down on his knees saying his prayers, that he ended up with "Good-by, God; I am going to Missouri." The Missourian said: "That is correct, but you haven't punctuated it right. What the boy really meant was, 'Good! by God! I'm going to Missouri.'" Such things may seem trifles, but trifles make perfection and perfection is no trifle. They make the claimant feel that you know him, appreciate him and are willing and anxious to aid him, which I always am. He feels kindly to you, that you are one of his people. He will more easily see things as you do. If he is honest, you are able to reason with him as to what he ought to receive. Ask him what he thinks he would like to pay if he were called upon to pay for a similar accident. I tell him what I have always paid in such cases that are worse than his. You gradually get his ideas reduced to something that is fair and right. I then tell him that the company is opposed to my settling such claims unless it is upon a fair basis, that personally nothing would give me more pleasure than to pay him a large amount, that it is always a pleasure to help people. This is true, and I make him know it is true, but that I have a duty to perform by the company. I cannot aid him at the expense of being unjust to my company. That I have two to satisfy, him and the company. That I cannot do my full duty if I am unfair to either.

He is made to understand all this. If he is reasonable, I am generally able to settle with him without threats, which I never employ. If he will not settle at this time, I tell him that I am sorry he does not see the matter as I do. I suggest to him that if we take the best view of it for him, he will have to give from a third to a half to the lawyer, and by the time that is done he is not as well off as he will be if he accepts my proposition. I tell him there is the "law's delay," that it takes from three to four years to get a decision in the Supreme Court and if the case is reversed and comes back for trial, it may be that all of us will be dead before the case is finally decided. It is rarely that the honest man will stand out for something he thinks unjust when he considers all these things. It often hap-

pens that the claimant comes to the office in a very angry mood. He is determined to have the matter settled at once. A check must be written out for him in some exorbitant amount before he leaves the office. I am told that some judge or former Congressman, or Senator, or other great legal light is just waiting to be engaged and that the amount sued for will be much larger than he now asks. In such cases I pursue the Fabian tactics, I play for delay. I convince him that I should not be required to pass on the matter instantly, that all he wishes is a "square deal," and while it may be that all he says is true, I should be given time to investigate. I have always made this so reasonable that I have never been denied this request. After the matter has dragged on for some time, I report to him that, while he may be entitled to something, I cannot pay the amount he demands without consulting with the general manager. I endeavor then to compromise somewhere between the amount I have offered and what he demands, but am never in a hurry to pay more than what is just and fair. Procrastination may be the "thief of time" and it is surely the savior of the company against dishonest claims. If I am still unable to compromise with the claimant, I tell him to think the matter over and come to me again and we will see if there is not some hope of a settlement. It is often true that he comes back before finally commencing suit, and we confer, and he reduces his demand and I increase my offer and the matter is settled. If there is no hope of settlement on a basis that is fair and right, I tell him then to begin suit. After the matter is in suit, it is often true that an adjustment is made on a basis of more than what I had first offered. We have never yet made an effort at compromise and failed, where the jury gave more to the claimant than our offer.

THE CLAIM DEPARTMENT AND WHAT SHOULD BE DONE TO MAKE IT MOST EFFECTIVE

BY CHARLES B. HARDIN,
Claim Agent, United Railways Company, of St. Louis, Mo.

No department occupies the manager's mind to a greater degree at the present time than the claim department, and what should be done to make it most effective. And well may he think of a department whose expenses equalled almost eleven million dollars last year, and is increasing at an alarming rate from year to year, and for which not a single tangible asset remains with the company. Yet we all know that if it was not for this expense, judiciously handled, almost all the income that we do not already spend, would be absorbed by the sheriff in the satisfaction of judgments.

The intent of this paper is to state out of my own experience certain things that have been beneficial to me, and to suggest other means which I hope may be beneficial to you and me, if we can persuade our managers to adopt them.

The claim department should be governed by a man who has absolute authority as to the employment of the men who go to make up the personnel of that department. This is necessary, because in no department of the road are the demands for absolute loyalty to the company and strict application to business so great, and the head of the department cannot guarantee the manager the proper fulfillment of these demands if the men feel that they are not strictly accountable to the claim agent for the results they get. Few changes should be made, and the men should be encouraged to remain, for only by experience can a man become a successful claim man. It is a business that cannot be learned in a correspondence school. The members of the claim department should be well paid, and made to understand that the salary is not limited to a certain sum, if the proper results are achieved; that there are no eight-hour rules in existence; that they are on duty twenty-four hours a day, and subject to call at any time. The manager, however, should not be too close in his allowance of men for this department. To get the correct facts about an accident quickly is your constant endeavor, but you cannot do this at all times if your men are always overcrowded with work.

There should be at least one female investigator in every claim department. She can get information that a man cannot get, and in investigating cases of injury to women she is invaluable. You will also find it advantageous to have some men whose connection with the department is not generally known. Many persons are averse, for various reasons, to giving information to known representatives of the claim department, yet will talk freely to an apparent stranger. What you want is correct information upon which to base your judgment. If you then err, you may be excused. If, through lack of effort, you do not get the correct information, and make an error in judgment, you should be blamed most severely.

The men should be assigned in rotation to duty from 6 o'clock p. m. up to midnight, or later if the traffic holds up, to look after the accidents that occur during these hours, but arrangements should be made whereby two or three other members of the department can be reached without delay, should an occasion arise, such as a car collision, or a car jumping the track, where the night man cannot see the injured parties at once. This can be done by designating certain members each evening to remain at home, or in close touch with their telephones. Their services may not be needed, but the claim agent can retire at night with a more comfortable feeling in his breast if he knows that, should a serious accident occur, he can reach a sufficient number of his men instantly to assist him in properly taking care of it.

Every member of the claim department should have a telephone placed in his residence, and if he does not voluntarily have it placed there for the convenience of his family, it should be installed at the expense of the company. You will find it very beneficial to have adjusters, and investigators, call up the main office at an hour designated when they leave the office. In this way you are always in close touch with some outside member of the department, and know just when you can get hold of any particular member.

In the adjustment of claims against the company, do not assume the attitude of a Shylock toward the claimant. Try to look at the claim from the claimant's standpoint, as well as your own; in this way you will better serve your company, because when the matter is presented to the jury later on, it is an equal chance at least that it will view the case from the claimant's standpoint. The settlement of liability claims should be effected as soon as possible. Educate your men so that they can form, from the injured party's own statement, a good idea of the company's liability, or the probability of a judgment being rendered against it if the case should be taken to court. If he absolves the company, he should get a release; if he is uncertain as to what would be a fair settlement, or the injured party demands more than he thinks the company should pay, he can make a plausible excuse to get away for a while to communicate with you over a telephone, and receive further instructions. I believe where the injured party's statement makes a case for the jury, and there is a bonafide injury, a settlement on reasonable terms should be made, for we all know the direction in which the jury's sympathy leads. This is particularly true in cases of injuries to women. The liability of a large judgment for a small injury is ever present here, and the superior courts rarely cut down the amount of a judgment, and even less frequently reverse one, in favor of a woman on account of excessiveness.

A special effort should be made to close up serious injuries to minors, as the statute of limitations does not begin to run against the cause of action until they have reached their majority. This may be so far in the future that the probability of making a successful defense must be greatly discounted. Some may think the plaintiff labors under the same disadvantage, yet my experience has led me to conclude that the burden rests upon the defending public service corporation to prove it is not guilty. The calling of the attention of your men to the court decisions in ruling cases in certain classes of accidents, and seeing that they become familiar with them, will aid them very much in forming correct conclusions as to the liability in similar accidents.

The new conductors and motormen should be sent to the claim department for instructions in relation to accidents and accident reports, or should be specially instructed by the employment agent. In addition to this the claim agent should give occasional talks to the men at the sheds, and point out to them the many difficulties under which he labors, and impress on them the important relation they bear to the claim department. Try to make them realize that an accident is a serious thing for the company, and that when one does occur, they must get witnesses. What a cold chill comes over the claim agent when the report of a serious accident comes to his desk and he finds the names of only one or two witnesses turned in by the crew. Many conductors and motormen seem to think they are expected to interest themselves in accidents and get witnesses only when the accident occurs on their particular end

of the car. They should be taught that it is as much the concern of the one as the other, regardless of on which end of the car the accident occurs, and the employees who come upon the following cars should also interest themselves in getting witnesses.

The anti-corporation fever is so rabid in my state that you cannot successfully defend a plain case of suicide with but two witnesses, proof of the *corpus delicti* being sufficient to overcome that many. The crew involved in every serious accident should be brought to the claim office and personally interviewed by the claim agent, and a statement complete in detail taken. This will often open up lines of defense hitherto unknown. Every superintendent should take an active interest in the operation of the claim department, and work constantly to keep the number of accidents down to the minimum. He should bring every employee who has an accident of any seriousness into his office and have a heart-to-heart talk with him, endeavoring so to impress upon him what a serious thing for the company an accident is, that he will not have another. Nothing is so demoralizing to the employees as to let them become impregnated with the idea that "accidents are bound to happen." He should particularly impress upon them the necessity of making a truthful report when an accident does occur, and failure to make a report should result in the instant discharge of the derelict employee. No claim presents so perplexing a phase as the one unreported and the most stringent measures should be adopted by the management to keep these down to a minimum.

The success of handling an accident case depends more upon an early knowledge of its occurrence than any other one thing. The employees should be frequently impressed with the importance of this. We have all our accidents, as well as every other class of trouble, reported to our central telephone exchange, from which they are immediately distributed to the different departments affected. The private telephone service should be extended over the entire system by the management as soon as possible. The use of public telephones is sometimes slow and dangerous; not only are the conductors and motormen frequently at a loss to find one, but what they have to say in reporting the accident is heard by outsiders, and often results in the knowledge getting into the hands of the "ambulance chaser" much to your sorrow. Then the giving of instructions to your men is attended with more or less danger over a public telephone.

We have found a well organized and well equipped medical department very beneficial to our company. It is located on the same floor as our offices. The chief surgeon, or one of his assistants, is always there and can make any examinations desired by the claim department of claimants who come to the office. We have learned, however, that it takes careful watching to keep the amount of its labor within reasonable bounds. The inclination to call up the company surgeon and have him come to see their injuries, especially where his services were free, was too often acted upon, and we found we were giving about $2,500 worth of free treatment a month. In addition to this, we had to take into consideration the bill of the family surgeon when negotiating a settlement, so we have eliminated the subsequent treatment, except in special cases, and confined the work of the medical department to giving first-aid and making special examinations.

However, in addition to this work, our medical department treats all injured and sick employees. In this way the treatment of the injured is distributed among the different outside members of the medical profession, thereby doing away with some feeling of jealousy. You will make a costly mistake if you do not make every effort to conciliate the outside surgeons. "Suggestive therapeutics" was never more in evidence than it is to-day, and an unfriendly surgeon can manufacture a typical case of traumatic neurasthenia, the nemesis of the claim agent, from the slight shock attending the overhead breaker blowing. We all know that the surgeon's bill is the last bill paid by the injured, and frequently is never paid.

You will find it beneficial to send a man to see the attending surgeon, get him interested in your side of the case by assuring him he will be taken care of if a settlement is made, and see that he gets his pay if a settlement is made. We almost invariably agree upon a specified amount in cash and the payment of the attending surgeon's bill by the company, and have the bill sent to my office from which it is paid by voucher. I have found that the surgeon is as much, if not more, interested in collecting his bill than is either the patient or the company, and the positive assurance from you that he will get his money as soon as you get a release, will assist you materially in obtaining what you want. You must be consistent in this, for, however many times you have protected the surgeon in the past, the failure to do so once, and he thereby loses a bill, will cause him to forget all you have done for him in the past and result in his next case going instantly into the lawyer's hands, who, of course, looks after the surgeon's interests.

You will find that it will assist you in keeping a line of the doctors to have a card system. Have a card for each doctor. Place thereon the name of every case handled by him, the final disposition of it and the name of the attorney, if one gets into the case. Also note thereon the name of every case in court in which the doctor testifies as an expert. This information will be found valuable in aiding you to decide what to do in his cases, and if he has testified several times against you, it may be useful to your attorneys in cross-examination. The same record should be kept of attorneys presenting claims.

However closely you may settle your claims, or careful you may be in declining them, you will have some lawsuits to defend, so cultivate and maintain the most cordial relations with the legal department of your company. There is a disposition on the part of some lawyers not to take up claims with the claim department, but to bring suit, and then take up the question of settlement with the legal department. Everything should be done by you and the legal department to discourage this practice. We all know that a dollar looks larger to us than it does to our lawyers. Have an understanding that no final action looking to the disposal of a pending claim, suit or judgment shall be taken without consultation with you. This will enable you to keep in closer touch with every important phase of your business, and to give that department the benefit of some knowledge you may have of the matter that does not appear in the papers. It will also give your department a higher standing among outside lawyers. This may also be increased by refusing to settle with claimants if they have engaged reputable lawyers, unless they will settle with and dismiss their lawyers, or make a settlement through them. Occasionally this may cause you to pay more money, but it pays in the long run. This rule of conduct does not apply in dealing with "ambulance chasers," who should be settled with only when you cannot settle with their clients; that is, if you want a settlement; and in claims presented by this class of lawyers, if there is a doubt of liability, it should always be resolved against the claimant. You should by all means so conduct your department and have your own acts support it, that the general public will recognize that they can get a fair hearing, and fair treatment if there is cause for filing a claim against your company. This does not mean that you should make a settlement of every claim presented, but endeavor to establish by your investigation the exact manner in which the accident occurred, and then if you decide not to settle the claim, explain to the claimant why you refuse, and while he may not agree with your conclusions he will, in a majority of cases, give you the credit you deserve.

Remember at all times that yours is an honorable calling, and by your conduct you can acquire and maintain that standing among your fellow-men that will redound beneficially to your company, and be a source of great personal pleasure.

QUESTION BOX OF THE AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION.*

Q. 1.—Is medical expert testimony beneficial in litigation? If so, why? If not, why?

I do not think it is beneficial for the reason that expert testimony can be purchased by either plaintiff or defendant. However, it is necessary to controvert the testimony of the experts of the plaintiff, but its effect on a jury is confusing and I think of very little value.—Atlantic Coast Electric Railway Company, Asbury Park, N. J., Geo. B. Cade, claim agent.

No. Because either side can always secure reputable physicians to testify contradictory to each other.—Connecticut Valley

*Abstract.

Street Railway Company, Greenfield, Mass., J. A. Taggart, superintendent.

Yes, as in any case it enables the trial attorney correctly to determine whether or not the injuries claimed resulted from the accident; if they did not, to object intelligently to the testimony relative thereto, and if this objection be overruled, to present the question as error on review. In a case in which there is no controversy as to the facts it is especially useful as it gives the trial attorney something to argue before the jury as regards the injuries, without which he would be obliged to remain mute.—Chicago Union Traction Company, Chicago, Ill., H. C. Bradley, adjuster.

Yes. In many cases, by high-class medical evidence you are able to show that the ailments claimed by plaintiffs were not caused by the accident.—Chicago City Railway Company, Chicago, Ill., R. S. Rowley, claim agent.

As a general rule I would say no, but conditions arise in certain cases which make it necessary to use expert testimony. —Cleveland Electric Railway Company, Cleveland, Ohio, W. F. Weh, claim agent.

Yes. If the expert has a standing within the knowledge of the jurors, he might be believed, because the expert and the family physician never agree.—Scranton Railway Company, Scranton, Pa., Stephen Dwyer, chief claim agent.

Expert testimony is an expensive luxury and my opinion is that it does not pay, especially if a corporation uses the same expert in all cases, although there might be cases where it would be advisable. But if the expense of the expert was added to the amount of the claim made and given to the claimant, instead of to the expert, in my opinion, money could and would be saved.—The Denver City Tramway Company, Denver, Col., Sam C. Dorsey, claim agent.

Yes, to a certain extent. A little of it goes a great way. Too much of it is tiring and confusing to the average jury. A good, plain statement of facts by a recognized reputable physician is as good as a dozen experts and costs less.—Fitchburg & Leominster Street Railway Company, Fitchburg, Mass., H. F. Bennett, claim agent.

In most cases, yes; dependent upon the nature of the injury. Unless carried to a ridiculous extent the jury will give more credence to it than to the ordinary statement of a physician. In some cases it would be unnecessary, but claims on account of nervous troubles and fraudulent subjective ailments can be fought often with success by the expert testimony of a physician as to what really should be the patient's condition judging from a thorough examination.—Georgia Railway & Electric Company, Atlanta, Ga., C. H. Mathews, claim agent.

In many cases, yes. But the best medical expert is the elderly looking doctor, who will put his testimony into simple words, not dwell upon fine spun theories, and tell the real conditions as he finds them. There are some cases, however, where it is necessary to meet alleged conditions with high-class medical expert testimony, so as to show that these conditions are mere theories or the result of conditions prior to accident, and not the result of injuries received in an accident.—Indiana Union Traction Company, Anderson, Ind., E. C. Carpenter, claim agent.

Medical expert testimony is beneficial in litigation when the expert witness is appointed by the Court, for in this case the witness appears as one without bias or prejudice.—Louisville & Southern Indiana Traction Company, New Albany, Ind., Charles B. Scott, claim agent.

Yes. In Arkansas, when there is permanent injury alleged, the Court, on application, will appoint an expert to make physical examination and report at the trial of the case. The Court always appoints one or more doctors whose honesty and integrity are unquestioned, and whose superior knowledge over the professional fake claim doctor makes them very valuable witnesses. It is understood that we have to pay for the examination and for the expert testimony when we use the doctors as witnesses.—Little Rock Railway & Electric Company, Little Rock, Ark., C. J. Kendle, claim agent.

Yes, if the nature of the injuries claimed by the plaintiff is contested. We have had most gratifying results in a few cases from the use of expert medical testimony, but never use this testimony except in cases where we think the plaintiff is a fraud or is magnifying the nature of his injuries. In some cases we have secured a verdict on the strength of our medical testimony and in others we have had the Court make large reductions in the verdict on the strength of the medical testimony. —The Northern Ohio Traction & Light Company, Akron, Ohio, T. W. Wakeman, claim agent.

Our experience is that expert testimony is of little use before a jury, but on appeal of a case it is an advantage before the higher courts. This character of testimony is generally too technical for an ordinary jury to appreciate, but it is well to have it as part of the records of the case, as the trial judge and the higher courts on appeal may be influenced by it.—New Jersey & Hudson River Railway and Ferry Company, Edgewater, N. J., W. N. Barrows, vice-president.

Medical expert testimony is frequently beneficial, and sometimes necessary, to combat the mendacious allegations of unscrupulous doctors, expert and otherwise, who are called by counsel for the plaintiff. If you have on the jury a man who desires to be fair and just you must supply him with your side of the case to enable him to argue the matter intelligently with his colleagues in the jury room.—Philadelphia Rapid Transit Company, Philadelphia, Pa., H. R. Goshorn, general claim agent.

In general it is; for the reason that plaintiffs almost invariably exaggerate the injuries received. In such cases it is very important to have medical expert testimony, and if the medical witness be an expert as a witness, his testimony may be made to go far toward convincing the jury that the suit is an attempt at extortion.—Petaluma & Santa Rosa Railway Company, Petaluma, Cal., E. M. Van Frang, general manager.

I think it good policy to use expert medical testimony in personal injury cases to show extent of injuries. We quite often have the court appoint physicians to examine claimants who allege to have been permanently injured.—The Southwest Missouri Railroad Company, Webb City, Mo., S. W. Gunsalus, claim agent.

If the plaintiff puts on medical testimony which is exaggerated, it is advisable, in fact absolutely necessary, to put on experts to overcome the exaggerated ideas which the plaintiff's physician would probably instill into the minds of the jury.—The United Railways & Electric Company, Baltimore, Md., James R. Pratt, assistant general manager.

Q. 2.—Is it advisable to employ so-called private detectives in the investigation of certain classes of accidents?

We have excellent results from our own detectives.—Connecticut Valley Street Railway Company, Greenfield, Mass., J. A. Taggart, superintendent.

It is my opinion that the use of private detectives in the investigation of accidents is of comparatively small benefit. There are a few special cases in which it might be beneficial but, as a rule, the information desired should be obtained as readily by your own department employes and be far more reliable.—Chicago Union Traction Company, Chicago, Ill., H. C. Bradley, adjuster.

It is absolutely necessary in certain cases if you desire to know the facts.—Cleveland Electric Railway Company, Cleveland, Ohio, W. F. Weh, claim agent.

No. The averge private detective charges more than a regular inspector or helper, and there is very little danger of a regularly employed man in the claim department selling the company out, while there is a chance for the private detective to speculate as to who will pay him the most for the information he may possess.—The Denver City Tramway Company, Denver, Col., Sam C. Dorsey, claim agent.

I hardly think it necessary to employ detectives of any kind in the investigation of any accident. I believe that if the claim agent acts openly and frankly with the parties with whom he is trying to settle that they will be honest enough in return to give him a complete statement of their side of the question. If the accident is of such a character that the conductor or motorman can report the names of witnesses, either passengers or others who have seen the accident, those witnesses, if approached properly, will give an unbiased statement of what they saw, and this kind of statement is what the company wants, no matter whom it favors. If the company is liable, it wants to get rid of its liability as quickly and cheaply as possible; if it is not liable it ought to fight. Private detectives sometimes "encourage" witnesses by promises and "liquid" inducements to make statements which, when called upon to verify at a trial, they fail to do, telling either no story at all, or one directly contrary to the information given to the detective. If the claim agent possesses just a shadow of intelligence, he ought to be able to do his own detective work. If he does not possess

enough intelligence to make investigations of this class, he should work at some other calling.—Easton Transit Company, Easton, Pa.

Only as an extreme measure when all other efforts fail. The average private detective will make out a case whether there is one or not, for the sake of "making good." I had rather take a man from the ranks, and would expect a more truthful report.—Fitchburg & Leominster Street Railway Company, Fitchburg, Mass., H. K. Bennett, claim agent.

The great majority of investigations should be handled by claim agents, but there are a few cases in which private detectives can assist the claim department very materially.—Little Rock Railway & Electric Company, Little Rock, Ark., C. J. Kendle, claim agent.

We have tried it with good results.—Montreal Street Railway Company, Montreal, Can., Patrick Dubee, secretary.

In large cities where many persons derive a living from the practice of fostering litigation, working up "fake" claims, exaggerating injuries and keeping the facts in all cases with which they are connected from the knowledge of defendant corporations, the private detective is necessary. The term "private" is here used in the sense that his connection with the company is unknown to outsiders.—Philadelphia Rapid Transit Company, Philadelphia, Pa., H. R. Goshorn, general claim agent.

In certain classes of accidents it is imperative that the defense procure evidence that can best be obtained by skilled detectives. Detectives should rarely or never be employed unless the employer knows enough about their character and ability to place reliance on their reports, and even then their reports should be checked and corroborated.—Petaluma & Santa Rosa Railway Company, Petaluma, Cal., E. M. Van Frank, general manager.

I have found it beneficial in several fake cases, where parties went to hospitals for operations, to put one or two strangers in the hospital for rest and treatment so that they may be in touch with the nurses and fakers, and keep posted on all that transpires regarding the supposed injured parties. If the so-called detectives are thoroughly experienced they should be able to gather considerable evidence. As for straight accident cases, an efficient claim department should be able to get along much better without private detectives, whom they cannot use as witnesses to testify in case of trial.—Rochester Railway Company, Rochester, N. Y., J. E. Joyce, claim agent.

Yes. When a claim agent is well known, as in a town of our size, much can be learned and much information gathered by some one working under cover to learn the condition of plaintiff prior to and subsequent to the alleged injury, what statements were made and all the facts regarding plaintiff which could not be obtained by the claim agent on account of being known in the locality.—Tri-City Railway Company, Davenport, Ia., R. W. Holland, claim agent.

Q. 3.—What should be the attitude of the company with respect to furnishing the press with particulars concerning accidents?

We find it an advantage to acquaint the press with the particulars in accident cases. I cannot see what advantage is to be derived from a policy of secrecy. Our experience has been that if you do not give them the story they will, in most cases, publish something worse than the facts.—Atlantic Coast Electric Railway Company, Asbury Park, N. J., Geo. B. Cade, claim agent.

Treat representatives of the press fairly, give them all the information possible as to the facts, thereby heading off any sensational stories.—Austin Electric Railway Company, Austin, Tex., W. J. Jones, president and manager.

I do not approve of furnishing information to the press, as, in my judgment, publication of particulars regarding accidents will have a tendency to educate or induce people to present claims, and the least information given to the public, in my opinion, is far better for the company's interests.—Chicago Union Traction Company, Chicago, Ill., H. C. Bradley, adjuster.

In our city I think the less information given the better for, if information is given, the papers do not publish the facts as stated. If they can add something sensational they usually do so.—The Denver City Tramway Company, Denver, Col., Sam C. Dorsey, claim agent.

The press should be made to feel that it is being taken into the confidence of the company and information concerning any accident should be given apparently cheerfully and willingly. No statements, however, should be issued by any one connected with the company unless he is authorized to do so, and even then he should not issue too long a statement until he is fully conversant with all of the facts. It is impossible to prevent witnesses from talking or expressing opinions and it is also impossible to restrain the press from publishing what appears to them to be a good news item, even though the truth in it may be rather elastic. Under some circumstances it might be well to be open and free with information, as it would tend to change public opinion toward the company rather than against it, but on the whole, I feel that a reticence in telling too much to the public is to be commended until all of the details of the case have been properly worked out and the management of the company is satisfied as to the real cause of the trouble.—Easton Transit Company, Easton, Pa.

Statements about accidents of a minor character are all right to give newspapers, but full reports of serious accidents should not be given. Care must be taken at all times in reference to statements given.—Fort Wayne & Wabash Valley Traction Company, Fort Wayne, Ind., Fred R. Fahlsing, claim agent.

Have an understanding with the newspaper men that if they will treat your statement fairly and not attempt to distort or confute it, you will give them all the information in your power. There may be some accidents where a full account might be damaging if presented to the public, but in most cases this plan can be followed.—Georgia Railway & Electric Company, Atlanta, Ga., C. H. Mathews, claim agent.

We have been very liberal with the press in all our accidents and always furnish them with anything in the nature of a report of our investigation.—Houghton County Street Railway Company, Houghton, Mich., Frank O. Mayotte, claim agent.

The less said about accidents in the newspapers the better; whatever reports are given to the reporters should be based upon facts with as favorable a version of the accident as can be given.—Indiana Union Traction Company, Anderson, Ind., E. C. Carpenter, claim agent.

No good to the company can come from giving to your adversary the particulars concerning an accident. The press has no use for them except to inform the public, which includes your adversary, who would use the information to anticipate your defense and defeat you at the trial. I think, therefore, the company should be as non-communicative in its attitude to the public press as is consistent with good behavior.—Indianapolis & Eastern Railway Company, Indianpolis, Ind., William Tichenor, claim agent.

I do not think the company should furnish the press with particulars concerning accidents. In cases where people are seriously or fatally injured, I think we should furnish the newspapers with the information that really concerns the public without going into details. Any facts concerning the question of negligence and liability, which only concerns the person injured and the company, should never be told. By giving the reporters some of the information concerning accidents it enables them to write their story, and they will not make as close an investigation and are not as apt, as they otherwise would be, to get hold of some one who is not friendly to the company for their information.—Little Rock Railway & Electric Company, Little Rock, Ark., C. J. Kendle, claim agent.

I do not run after the press to give them reports or particulars of an accident, but when they hear of one and come to me for information I believe it is best to give the particulars and tell the truth. We have tried the plan of suppressing information, but have always found that the newspaper reporters get a few facts, imagine others and write a story that is detrimental to the company.—The Northern Ohio Traction & Light Company, Akron, Ohio, T. W. Wakeman, claim agent.

The press in our cities usually come directly to this company for an account of accidents of a serious nature, unless some one of their staff happens to be at the scene. I give them the story of the accident as I would like to see it in print, but in the case of collisions of cars and derailments do not give names and addresses.—Tri-City Railway Company, Davenport, Ia., R. W. Holland, claim agent.

In bad accidents it is advisable to give them a general report when asked for by the press, but do not go into details as to the cause of accident, etc. Be perfectly frank with the press; it has been our experience that it is the best policy to treat the press fairly. When you can give them information without injuring your company, do so; when you cannot, tell them frankly that you cannot do so. This frankness is rarely abused.

—The United Railways & Electric Company, Baltimore, Md., James R. Pratt, assistant general manager.

Q. 4.—Is it advisable to offer inducements, whether in the shape of rewards or otherwise, to conductors and motormen, with a view to reducing both the number and severity of accidents? Give reasons.

This method works very satisfactorily with some conductors and motormen, not in all cases, but I think it is well to reward motormen and conductors in some way who have the best records and the least number of accidents.—Benton Harbor-St. Joe Railway & Light Company, Benton Harbor, Mich., H. C. Mason, manager.

No. This is a part of their duties, the same as making out their "trip sheet" or "barn report."—Chicago City Railway Company, Chicago, Ill., R. S. Rowley, claim agent.

No. Make it compulsory for trainmen to make full and complete reports. That is for what the company pays them. If rewards are given trainmen for their reports being full and complete, some what do not possess the education and ability to make thorough reports and fail to secure rewards may become jealous. Our trainmen are allowed six hours within which to make their reports, and if reports are not in within six hours it is charged against their record.—The Denver City Tramway Company, Denver, Col., Sam C. Dorsey, claim agent.

Yes, as it offers a double inducement and incentive toward efficient service; both the fear of punishment and hope of reward. It stimulates a spirit of pride in the men to keep their records clear and makes more noticeable any flagrant recklessness and following punishment.—Georgia Railway & Electric Company, Atlanta, Ga., C. H. Mathews, claim agent.

No. The offer of rewards to motormen and conductors will not tend to reduce the number of accidents. Should rewards be given with this in view the disappointed, who do not receive a reward, are very likely to be so much disappointed that they will not take even the ordinary interest in attempting to prevent accidents, feeling that they have been unjustly discriminated against.—Indiana Union Traction Company, Anderson, Ind., E. C. Carpenter, claim agent.

I have thought it advisable to offer some such inducements with a view to publishing the standing of the men. I believe that publication would be a great incentive to them to use the utmost care. It furnishes them with a means of comparison which they can probably get in no other way. And yet I would not approve of a bulletin such as: June 26, 1907. Woman fell in getting on car No. 80, seriously injured; may die. John Smith, conductor. Or, Car No. 64 ran into a herd of thirty head of cattle at Black Swamp; killed eleven. W. R. Stewart, motorman. Such would only tend to humiliate the men with no encouragement for beter things. While an inducement in the nature of some form of reward, a slightly increased salary for the week or month, a little gift as a token of approval, a prominent place on the roll of honor, or the right to wear a badge indicating the best record would tend to inspire emulation and such emulation would beget watchfulness.—Indianapolis & Eastern Railway Company, Indianapolis, Ind., William Tichenor, claim agent.

I think it a good system to reward careful motormen and conductors. Every man appreciates some act of his employer to show that his services have been acknowledged in some slight way, such as promotion, as occasion arises, or increase in salary for faithful service. The premium system has some drawbacks. This company had the premium system in force here for some two years, that is, each conductor and motorman who had the fewest accidents and best records for keeping their cars on time were allowed a premium of 25 cents per day, payable at the end of each year. It was necessary, however, for a man to put in the entire year in order to get the premium. Should a trainman be discharged before the expiration of the year it was generally his claim that the company discharged him to avoid paying the premium. For this reason the system was discontinued.—International Railway Company, Buffalo, N. Y., A. J. Farrell, claim agent.

We have had for some years a monthly drawing in which all employees who have had no accidents or bad marks against them participate. It has had good results.—Montreal Street Railway Company, Montreal, Can., Patrick Dubee, secretary.

The writer is of the opinion that the effect of such inducements would be to cause many accidents to be concealed. Conductors and motormen are usually as anxious as their employers to avoid accidents, and proper discipline will secure the proper amount of care on the part of platform men. By proper discipline, severe discipline is not necessarily implied. In the vast majority of accidents the platform men are in no wise to blame. —Petaluma & Santa Rosa Railway Company, Petaluma, Cal., E. M. Van Frank, general manager.

The discipline should be such that conductors and motormen would recognize the fact that they must do everything in their power to avoid accidents, and will be dismissed from the service for not reporting accidents which occur in connection with their car. The matter of inducements in shape of rewards does not, in my judgment, make them more careful. Conductors and motormen who get through the year without accidents should be recognized by giving them merit marks, by a complimentary letter from the management, which they will, no doubt, appreciate as much as a reward in some other way, or by a short vacation at full pay, which might possibly be more appreciated.—Rochester Railway Company, Rochester, N. Y., J. E. Joyce, claim adjuster.

Yes. The company which I represent gives credit marks to conductors and motormen. On the Brown system, if there is no demerit mark against your record for three months, this cancels one reprimand, six months' clear record, five days' credit and so on for eighteen months; also on big days as Fourth of July, Circus days and Decoration day, for careful and courteous service you are entitled to credit marks.—Scranton Railway Company, Scranton, Pa., Stephen Dwyer, chief claim agent.

Yes, I think it good policy. Our method is to give merits for clean records. Merit marks are also given for complete accident reports and, as a general rule, our trainmen look forward to a clean record at the end of every six months, when records are posted.—The Southwest Missouri Railroad Company, Webb City, Mo., S. W. Gunsalus, claim agent.

Q. 5.—What has been your experience in selecting assistants for the claim department from among the conductors and motormen on the company's cars?

Think they would make the best as, being more familiar with the causes surrounding accidents, could more readily secure statements bearing directly on them.—Austin Electric Railway Company, Austin, Tex., W. J. Jones, president and manager.

They have not proven satisfactory.—Lehigh Valley Transit Company, Allentown, Pa., R. H. Schoenen, claim agent.

This company has used a number of men in the claim department taken from "Train Service," and has secured some excellent men thereby.—Chicago City Railway Company, Chicago, Ill., R. S. Rowley, claim agent.

No. Would prefer going outside for help and not create jealousy by not giving any conductor or motorman the preference in a situation with the claim department, although there might be some men perfectly capable and trustworthy, but would seek help outside of trainmen.—The Denver City Tramway Company, Denver, Co., Sam C. Dorsey, claim agent.

We have found that the selection of assistants in the claim work should be made from employes of the company, familiar with the business, whether from the train department or other branch. The practical experience of motormen and conductors fits them to a great extent, but in every instance a man's qualifications and special adaptation to such work should be the primary consideration.—Georgia Railway & Electric Company, Atlanta, Ga., C. H. Mathews, claim agent.

I have called on motormen and conductors to render some slight assistance in isolated cases. It has always resulted in good. They feel honored by having been chosen and show their best mettle. They usually do effective work under proper instructions and always emerge from the undertaking with increased friendship for the claim agent and in an effort to cause him less trouble become more useful to the company.—Indianapolis & Eastern Traction Company, Indianapolis, Ind., William Tichenor, claim agent.

I think the best results are obtained by the appointment of men from the train service. They have had experience that is required as an investigator or an adjuster for the claim department; they have learned to deal with the different classes of people, and, to some considerable extent, have become readers of human nature; they know how the majority of accidents occur, and what should be done to avoid them, and they know the locations of the different lines. A trainman who has been in the service from four to six years has given sufficient guarantee of his honesty and reliability and has this much to

start with, which an outsider would naturally have to learn. My experience has been that they are more faithful and efficient as investigators and adjusters in the claim department.—International Railway Company, Buffalo, N. Y., A. J. Farrell, claim agent.

Our experience in selecting assistants from among conductors and motormen has been very satisfactory. They are pretty sure to "know the ropes," and they learn the weak and strong points of the employees as individuals, and appear to have sources of information by having been in touch with their fellow-employees.—New Jersey & Hudson River Railway & Ferry Company, Edgewater, N. J., W. N. Barrows, vice-president.

The Philadelphia Rapid Transit Company has followed for a number of years the plan of recruiting employees of the claim department from among the conductors and motormen. Some of its most useful adjusters and investigators have been selected from the ranks. The men are taken on trial for thirty or sixty days. Their runs are held open and if a man fails to develop he is returned to his car. He makes a better conductor or motorman for this experience even if he fails to qualify for the claim department.—Philadelphia Rapid Transit Company, Philadelphia, Pa., H. R. Goshorn, general claim agent.

In my experience in a metropolitan claim department as adjuster and claim agent where there was a force of twenty or thirty men, the majority of them were from the train service. In fact, they seemed to get a clearer insight into the style of statements wanted and to take more pains with their reports. I was not on the road myself, but learned more when I started in the business from old-time conductors and motormen than I did from those who were not.—Tri-City Railway Company, Davenport, Ia., R. W. Holland, claim agent.

Q. 6.—Does standardization of equipment tend to a reduction in accidents? Give reasons.

Yes; prevents accidents, as men then are familiar with each equipment and do not have to learn over, how to handle the different types. Motormen act mechanically in times of danger and the nearer alike the equipments are the less likely are they to make a wrong move.—Austin Electric Railway Company, Austin, Tex., W. J. Jones, president and manager.

Yes, standardizing equipments reduces the number of accidents on account of the trainmen being familiar with the operation of all equipments. It also makes it more convenient to keep rolling stock in repair by having interchangeable repair parts.—Benton Harbor-St. Joe Railway & Light Company, Benton Harbor, Mich., H. C. Mason, manager.

Yes. When the public becomes acquainted with one style of equipment there are apt to be less cases of people falling in boarding or alighting from cars; also the employes become more capable by operating one style of equipment.—Chicago City Railway Company, Chicago, Ill., R. S. Rowley, claim agent.

I would think so; such as a standard car step, standard lifeguard, etc.—Cleveland Electric Railway Company, Cleveland, Ohio, W. F. Weh, claim agent.

We think so. Both trainmen and the public become more familiar with the equipment, having less to learn about the various means of exit and entrance—and the standard of work by employes and of care by passengers can be greatly helped. —Georgia Railway & Electric Company, Atlanta, Ga., C. H. Mathews, claim agent.

Yes. A standard type equipment would assist employes and the traveling public in familiarizing themselves with it and tend to avoid many accidents. The conductor of a one-type car would be able to do his work more rapidly and promptly, such as collecting fares, assisting passengers on and off and giving signals. The motorman in an emergency would not have to study out the problem whether he had an air or electric brake to handle before he did anything to bring his car to a stop; he would also, in case of anything being wrong with the working of his car, be able in a shorter time to locate and remedy the defect. The traveling public would be better able to protect themselves in alighting and boarding cars and would do so much more rapidly than to find a high step on one car and a low one on another or a wide platform on one car and a narrow one on the other. The standardization of cars would also materially increase rapid transit, lessen cost of maintenance and tend to insure more safety.—International Railway Company, Buffalo, N. Y., A. J. Farrell, claim agent.

No. In five years' experience with this company I cannot recall of an accident due to equipment. All of our accidents for which the company is liable are due to the negligence and carelessness of the employes.—The Northern Ohio Traction & Light Company, Akron, Ohio, T. W. Wakeman, claim agent.

Our system has been standardized in the past five years and we have noticed no increase or reduction in the number of accidents by reason of standardization.—Sioux City Traction Company, Sioux City, Ia., H. Morrison, claim agent.

Q. 7.—Is it advisable to stand upon the test of negligence in judging the claims of company employes?

I would say not. A liberal policy should be pursued toward employes injured while on duty.—Cleveland Electric Railway Company, Cleveland, Ohio, W. F. Weh, claim agent.

Not always, for the reason that the foreman or person in charge of a department may sometimes advise differently and all departments of a street railway company should work in harmony, and if a person in charge of a certain class of men should advise it might be policy to compromise rather than stand on the law of negligence.—The Denver City Tramway Company, Denver, Col., Sam C. Dorsey, claim agent.

It is, in my judgment, much better to make reasonable settlements with employes when injured, wherein company may be held liable for said injury. It creates a better feeling among the men toward the company, and if the men are held well in hand the claim department should be able to secure a very reasonable settlement.—Rochester Railway Company, Rochester, N. Y., J. E. Joyce, claim adjuster.

In cases of accidents to employes it is our policy to allow them their time while off duty and expenses.—Fitchburg & Leominster Street Railway Company, Fitchburg, Mass., H. K. Bennett, claim agent.

It is advisable in cases where the extent of the injury calls for payment of a large amount. In small accidents, while in the performance of their duties, employees should be paid full or half time, according to the circumstances of the accident and work of the man. I do not think this class of accidents should be handled with as strict regard to liability as outside parties.—Georgia Railway & Electric Company, Atlanta, Ga., C. H. Mathews, claim agent.

The policy of this company has always been when a man gets injured in the performance of his duty to pay him for the time he loses and also his doctor's bill. The matter is generally taken care of by the transportation department. The man is seen or called to the office, a statement setting forth the amount of time he would necessarily lose and also the amount of his doctor's bill is furnished and a release is made out; if he signs the release he is paid the entire amount, if he refuses, pay is withheld. This company experiences very little trouble with its employes in this respect.—International Railway Company, Buffalo, N. Y., A. J. Farrell, claim agent.

It is better to make fair settlements with injured employees regardless of your State laws governing the question of liability. By so doing you have more of the confidence and loyalty of the men generally.—Philadelphia Rapid Transit Co., Philadelphia, Pa., H. R. Goshorn, general claim agent.

It is very important that harmonious relations should exist between the claim department and all employees of the company, therefore all claims presented by employees should be dealt with fairly.—The Southwest Missouri Railroad Company, Webb City, Mo., S. W. Gunsalus, claim agent.

The words "the test of negligence" are used as if there was an easily ascertained or defined test of negligence. Think that the question may be intended to refer to cases where employes make claims for injuries, and the defense of the negligence of a fellow-servant could be relied upon by the company. It seems that the law as it has long endured on this question is right. The company should be held for its own negligence and for the negligence of superiors under whose orders the injured party acted, but not for the negligence either of fellow-servants or strangers.—Wheeling Traction Company, Wheeling, W. Va., Louis Lipphardt, claim agent.

Q. 8.—What precaution has your company adopted for the protection of its cars on grade railroad crossings?

Derailing switches; gates and conductor going ahead of car and giving signal before car goes across the tracks.—Atlantic Coast Electric Railway Company, Asbury Park, N. J., Geo. B. Cade, claim agent.

At present this company has not any steep grade crossing. We have one grade crossing, but we use a derail, the conductor is required to go to the further track and throw a lever before the car can go over the crossing. No company should allow a grade crossing on any grade over 2 per cent.—Benton Harbor-St. Joe Railway & Light Company, Benton Harbor, Mich., H. C. Mason, manager.

Where no gates are supplied by the steam railroad company the company in some instances depends upon the conductor going ahead of the car and signalling the motorman. At other locations derailing switches have been put in and the conductor is compelled to operate this derailing switch that the car may continue on the track, the point of operation of the derailing switch being placed at such a location that the conductor has full view of the railroad track in both directions to insure the safety of the car and its passengers.—Easton Transit Company, Easton, Pa.

All cars are required to stop within 100 ft. of a steam railroad crossing. In addition to this there is placed on either side of the crossing on 30-ft. poles, a cluster of twenty incandescent lights, making the crossing bright and aiding greatly in replacing trolley should it come off the wire.—Fitchburg & Leominster Street Railway Company, Fitchburg, Mass., H. K. Bennett, claim agent.

Derailers and interlockers.—Fort Wayne & Wabash Valley Traction Company, Fort Wayne, Ind., Fred R. Fahlsing, claim agent.

That the cars shall not cross until it has stopped and conductor first walked ahead to ascertain if the way is clear and then flagged motorman ahead. We have not so far in our city any guards across streets intersected by steam road tracks. —Georgia Railway & Electric Company, Atlanta, Ga., C. H. Mathews, claim agent.

Requires car to stop and the conductor to go forward and look for cars before crossing at unprotected crossings. Interlockers operated from a tower at some places; derails at some crossings and at sidings, where not much used, a swinging target operated by hand for use of each company.—Indiana Union Traction Company, Anderson, Ind., E. C. Carpenter, claim agent.

Our company, at many of its crossings, at grade, has what is called a derailing switch. Before trolley cars cross the steam railroad tracks it is the duty of the conductor to cross over and throw or hold a lever before signalling the car to proceed. Besides this precaution, the conductor is supposed to look both ways when crossing the tracks to the lever. The point of the derailing switch is supposed to be located at least 50 ft. from the nearest rail of the steam railroad tracks. The motorman, as an extra precaution, before starting, is also required to look both ways to see if the crossing is clear and that no train is approaching, which is close enough to be dangerous.—International Railway Company, Buffalo, N. Y., A. J. Farrell, claim agent.

Derailing switches which must be closed by the conductor at a point near the railroad track.—Lehigh Valley Transit Company, Allentown, Pa., R. H. Schoenen, claim agent.

In the country, interlocking devices; in the city, flagmen.—Louisville & Southern Indiana Traction Company, New Albany, Ind., Charles B. Scott, claim agent.

All of our cars are stopped at railroad crossings and the conductor goes ahead and "runs the crossing." That is, the conductor goes upon or across the railroad tracks and looks both ways for trains and then signals the car to proceed if there are no trains in sight. At some crossings we have derailers.—The Northern Ohio Traction & Light Company, Akron, Ohio, T. W. Wakeman, claim agent.

At all important crossings of main lines this company maintains, at its own expense, a flagman or "whistleman." He is provided with a shrill whistle and motormen are required to wait until he signals by a blast on the whistle before proceeding over the crossing. Safety gates and flagmen are also by city ordinance required to be maintained by the steam roads at all important crossings.—Philadelphia Rapid Transit Company, Philadelphia, Pa., H. R. Goshorn, general claim agent.

Metal charged troughs over trolley wire so that car does not become dead if trolley should jump wire, in addition to this, joint flagman.—Rochester Railway Company, Rochester, N. Y., J. E. Joyce, claim adjuster.

The statutes of Missouri and the rules of our company require that all cars come to a full stop not more than 20 ft. and not less than 10 ft. before crossing a railroad and where a watchman is not kept conductor to go ahead and flag the car across. Strict compliance to this ruling is our method.—The Southwest Missouri Railroad Company, Webb City, Mo., S. W. Gunsalus, claim agent.

In all cases the motorman is required to bring his car to a stop; the conductor must go forward to the center of the steam railroad crossing and look both ways before signalling the motorman to cross. The motorman is also required to see from the front platform that the way is clear before starting. We also have overhead troughs which are supplied with current in case the trolley jumps when crossing the tracks.—The United Railways & Electric Company, Baltimore, Md., James R. Pratt, assistant general manager.

Q. 9.—To secure the best results, should a street railway company place an attorney-at-law at the head of the claim department? Give reasons.

I think it would be well to have claim agent familiar with the law, especially in regard to street railway law and damage suits. This company's claim agent is a good lawyer.—Benton Harbor-St. Joe Railway & Light Company, Benton Harbor, Mich., H. C. Mason, manager.

I think not. With my company, while the claim department is separate from the legal department, both departments work in the utmost harmony and advise together in many cases where claim is made, suits brought and compromises asked for, and with our company think they have acted wisely in their way of conducting all of their different departments.—The Denver City Tramway Company, Denver, Col., Sam C. Dorsey, claim agent.

I believe that the claim department should have a legal authority or head to consult at all times. The functions of this attorney or authority to instruct those not learned in the law as to how far they should go in the investigation or settlement of claims or in the making of agreements with persons demanding damages so as not to incur any extra penalty upon the company. I do not think that an attorney-at-law would make an all-around successful claim agent. He has been brought up in certain channels; he looks at matters from one standpoint only —the legal standpoint; the moral or charitable standpoint in some instances should be taken into consideration as well as the legal and when this part of the question is to be considered, the lawyer's training might be apt to make him adhere too rigidly to certain lines, whereas, one having other than a legal training could have a more elastic mind and be able to cope with questions from a broader view than the attorney. I feel, however, that every claim agent should acquaint himself with the why and wherefore of the legal rights of companies up to that point wherein he knows whether or not the company is liable or whether it might be a question which probably should be determined by a lawyer.—Easton Transit Company, Easton, Pa.

A claim agent should be a man conversant with the business from a practical standpoint, and an able judge of human nature. He should have such knowledge of the law as to be able to dispose of a claim according to its legal value. It does not necessarily take an attorney-at-law; but such an attorney if otherwise qualified for the position might be able to secure better results.—Georgia Railway & Electric Company, Atlanta, Ga., C. H. Mathews, claim agent.

I do not think so, if the claim agent keeps himself posted on court decisions.—Houghton County Street Railway Company, Houghton, Mich., Frank O. Mayotte, claim agent.

While frequent consultations with a good lawyer may be essential to the best results, yet I think good business tact is much more necessary in the claim agent than being a lawyer himself. My reason for saying so is my knowledge of the fourteen years' successful experience of George Bruce as claim agent for the Indianapolis company. He is not a lawyer, but he does the work.—Indianapolis & Eastern Railway Company, Indianapolis, Ind., William Tichenor, claim agent.

What is wanted at the head of a claim department is a man of good sound judgment and a whole lot of common sense. The fact of a man being a lawyer is no bar to the position, though my own opinion is that a lawyer is not the best man, as in the settlement of a case he is apt to put too much stress on the points of law, and does not get as close to the people as a man who is not a legal light; besides a man who is not a lawyer can banter better with a lawyer in the settlement of a case.

The same can be said in the settlement with the people. The ordinary fellow gets the best results. An attorney at the head of a claim department cannot keep posted on the law for want of time, and would necessarily have to consult with other lawyers. So you see an attorney cannot be a claim agent or a claim agent cannot be an attorney as a business proposition, and few companies pay salaries large enough to secure a lawyer who would be competent to fill the position. All claim agents should have a good lawyer to consult when occasion arises, and that is pretty often. However, a lawyer should practice law and a claim agent practice the settlement of claims. Both cannot be successfully done by one person.—International Railway Company, Buffalo, N. Y., A. J. Farrell, claim agent.

We do not consider it advisable. Our system is different to that of most railways, inasmuch as the claims are passed upon by a claims committee, which is composed of the manager, secretary, superintendent, chief medical officer, with the claim agent as secretary. We find that very good results are obtained, in addition to which the executive officials of the company come in touch with one of the most important departments.—Montreal Street Railway Company, Montreal, Can., Patrick Dubee, secretary.

A knowledge of law and also of medicine would be assets in the mental equipment of the head of a claim department, or of an adjuster operating under such department. If a candidate had good common sense and understood human nature; was patient and could adapt himself to conditions and circumstances as found them, it certainly would be no detriment to him if he would learn a little law also; in fact, he cannot learn too much. But we would consider legal knowledge the least of the necessary attainments of a claim agent or adjuster. Patience, tact, good judgment and the knowledge of human nature are far more important factors than legal knowledge. At least in the "claim agent" stages of an accident. The law should be kept in the background and the other attainments of the claim agent should occupy the stage. If it is known that the party negotiating one side is an ttorney the other side will probably want an attorney also.—New Jersey & Hudson River Railway & Ferry Company, Edgewater, N. J., W. N. Barrows, vice-president.

A good attorney would not accept the position and a poor one would be a detriment. A claim agent who is an experienced railroad man with a fair knowledge of law should handle the business to a better advantage than an attorney who has not had railroad experience.—Rochester Railway Company, Rochester, N. Y., J. E. Joyce, claim adjuster.

By no means. In my experience lawyers do not make the best adjusters and have no better idea of liability than a good adjuster or investigator who has put in his years as claim agent. Most every claim agent is well posted on personal injury law and should be and is in a position to handle the problems successfully which confront him and to rely on his own judgment without being a regularly admitted attorney.—Tri-City Railway Company, Davenport, Ia., R. W. Holland, claim agent.

Q. 10.—From the standpoint of safety of operation, should passengers be allowed to occupy the front platform of closed cars?

It makes but little difference.—Chicago City Railway Company, Chicago, Ill., R. S. Rowley, claim agent.

Under no circumstances whatever should passengers be allowed to occupy the front platforms of closed cars. They occupy space which in time of necessity or impending disaster is needed by the motorman for the operation and control of the car and its brake, especially so if the hand brake be employed. They will invariably talk to the motorman, taking his attention away from the operation of the car and the observation of the track. If one is allowed to enter this platform it will only induce others to follow, and the more persons on this platform the greater the interference and the greater the liability for trouble. I make no exceptions whatever in my opinion as to the number of people on the car. If the car is so crowded that people are liable to be forced out upon the front platform to ride, I feel instead of taking on that number of people, admission to the car should be denied; they should be compelled to wait for the next car. The few pennies which the company takes in from the passengers who want to ride on front platforms will not even pay the interest on one-tenth of the money which is liable to be paid for the damages for which the company might be liable owing to the inability of the motorman to properly operate his car.—Easton Transit Company, Easton, Pa.

Passengers should not be allowed to ride on the front platform. They take the motorman's attention off his duty by talking to him. They are in a dangerous position should the controller blow up; they are also in a precarious location in the event of a collision with vehicles or other cars. This company prohibits passengers from riding on the front platform of the motor cars.—International Railway Company, Buffalo, N. Y., A. J. Farrell, claim agent.

No; but the platforms should be made smaller, for they take up too much valuable space.—Scranton Railway Company, Scranton, Pa., Stephen Dwyer, chief claim agent.

No; because in case of a collision they are in a dangerous place and in case of an accident to a vehicle or pedestrian in the street the claimant always says that your motorman was in conversation with people riding with him and was not looking ahead or attending to his duties. On the other hand, those passengers riding on the front platform are often valuable witnesses.—Sioux City Traction Company, Sioux City, Ia., H. Morrison, claim agent.

Passengers should not be allowed to ride on the front platform, neither should they be allowed to board cars by way of the front platform. There is, however, no objection to permitting them to leave by way of the front platform. It is a well known fact that all people at times take chances in boarding and alighting from moving cars. If a passenger falls alighting from the front platform of a moving car, the momentum of his body will carry it from the car. If, however, a person attempts to board a moving car by way of the front platform and falls, his chances of being run over are far greater than if he were leaving the front platform. In my judgment the time will come, and we are now approaching that era in large, congested cities, when it will be necessary for passengers to enter all public conveyances by one door and exit by another, so as to avoid confusion and the delay incident to persons meeting, particularly in cars of the center aisle construction type.—The United Railways & Electric Company, Baltimore, Md. James R. Pratt, assistant general manager.

Q. 11.—What are your views of the advisability of reimbursing car men for a reasonable amount of time devoted to the making out of accident reports? Would such a course assist in the elimination of the unreported accident, as well as result in an improvement in the essential features of the accident report?

a. They should be reimbursed. *b*. I think it would to a certain extent.—Atlantic Coast Electric Railway Company, Asbury Park, N. J., George B. Cade, claim agent.

While I do not think it would have any effect on the elimination of the unreported accidents, it might have a tendency to secure a more complete report.—Chicago City Railway Company, Chicago, Ill., R. S. Rowley, claim agent.

Have never allowed men time for making out accident reports and do not think it should be done, as that is part of their duty. If they fail to report accidents they should be dismissed from the services of the company.—Fort Wayne & Wabash Valley Traction Company, Fort Wayne, Ind., Fred R. Fahlsing, claim agent.

An employee should not be reimbursed for time devoted to making out accident reports, under ordinary circumstances. If the report requires taking a crew off their run for an entire run, consuming several hours, perhaps a day's time, then they should be reimbursed accordingly, the same as if they had been working on their run, but men should not be paid for time in making out ordinary accident reports in the usual way. The payment of employes, for reporting all accidents would not necessarily eliminate the unreported accident, as well as to result in an improvement in the essential features of the accident report, this will depend upon how rigidly the company enforces its rules, requiring the men to make reports and inflicting penalties where employes fail to make reports of all accidents.—Indiana Union Traction Company, Anderson, Ind., E. C. Carpenter, claim agent.

In my opinion it would be money well spent to allow trainmen for the time consumed in making out the regular reports of accidents. This company pays the men nothing for making out the regular report, but if any of the trainmen are called to the office to give information in reference to an accident, they are allowed full platform time. This has been in vogue

here for several years and has given entire satisfaction.—International Railway Company, Buffalo, N. Y., A. J. Farrell, claim agent.

I think it is advisable to reimburse car men for reasonable amount of time lost in making out accident reports, especially when any one is injured. It would result in a vast improvement in the esential features of the report and it would better enable the claim agent to judge the truthfulness of the statemen. Our investigations must show whether or not the company is liable in order for us to make an intelligent settlement, or prepare our defense in case we do not settle. When we have a report covering the essential features of an accident, signed by an employee, he is not so apt to deny it in case he is discharged and we afterwards want to use him as a witness. I think it would also result in the elimination of unreported accidents to some extent, as many of our best men dislike to do clerical work.—Little Rock Railway & Electric Company, Little Rock, Ark., C. J. Kendle, claim agent.

We do not think so, as in the majority of cases, it is not the time that it takes to make the report that prevents employes reporting, but more the fear of being disciplined.—Montreal Street Railway Company, Montreal, Can., Patrick Dubee, secretary.

Employes should be reimbursed for time devoted to the company's service, whether such time is put in on the car platform, or in making out reports at the car-house. This course is nothing more than a "square deal" to the men and is never wasted. It would "assist in the elimination of the unreported accident," but would not necessarily "result in an improvement in the essential features of the accident report." The latter result should be obtained in another manner. The writer believes that much better results would be obtained if the platform man was allowed to dictate his report to a competent person, who would write it out as dictated; this report to be signed by the platform man. The vast majority of men in the car service experience great difficulty in attempting to write an intelligible report and many of them would rather take a day's lay-off than to make out an accident report. This feature, together with the fear of severe discipline, will account for the unreported accident.—Petaluma & Santa Rosa Railway Company, Petaluma, Cal., E. M. Van Frank, general manager.

Any carmen employed by this company failing to make out accident reports when relieved from duty are dismissed from the service, and no excuse is accepted for not making out reports, for the reason that they are educated in a school of instruction one day each week when entering the service. Where an accident is of sufficient importance both motorman and conductor are taken off their car and sent to the claim office and their time made good. The paying of men to remain and make out accident reports after turning in their cars would be expensive and would not prove to be more complete in detail than when it is a matter of compulsion for them to do so.—Rochester Railway Company, Rochester, N. Y., J. E. Joyce, claim adjuster.

A better policy I would think would be to install the merit and demerit system and give so many merit marks for the making out of a complete accident report than to reimburse an employe for time in making it out for any intelligent conductor such as should be employed should be able to make out an accident report in a very few minutes.—The Southwest Missouri Railroad Company, Webb City, Mo., S. W. Gunsalus, claim agent.

Q. 12.—How shall we deal with the problem presented by the superintendent who deliberately conceals reports of mishaps upon his division, in order that he may improve his record as a company official?

Discharge the superintendent immediately for the first offense.—Benton Harbor-St. Joe Railway & Light Company, Benton Harbor, Mich., H. C. Mason, manager.

Secure the evidence and take it up with the general manager or general superintendent.—Chicago City Railway Company, Chicago, Ill., R. S. Rowley, claim agent.

A superintendent who wilfully covered up, or deliberately concealed reports of accidents occurring on his division for his own advancement, in my opinion, is a man who should be released from the service, as he not only works against his employer's interests, but also against his co-employes, and should not be held in an official position. I would call the matter to the attention of the president or general manager, and if they did not remedy his shortcomings, it would be strictly up to them. Our management would not, for an instant, countenance any such action on the part of any superintendent.—International Railway Company, Buffalo, N. Y., A. J. Farrell, claim agent.

Make careful examination as to the facts, and the probability of their having been called to the attention of the superintendent, and make report to the law department.—Little Rock Railway & Electric Company, Little Rock, Ark., C. J. Kendle, claim agent.

In the first place, this part of his record is given undue importance on many railroads. In some cases it is made decidedly to his interest to conceal reports whenever possible, besides making him unduly severe and often unjust in his treatment of the platform man on whose car the accident may occur. This state of affairs should not exist. A superintendent, who is fit to hold his position, will naturally endeavor to keep down the number of accidents on his division, and the number of accidents which he may have should be given much less weight than the character of the accidents. He should be congratulated more on the number and completeness of the accident reports than upon the smallness of their number. The writer has known superintendents who by the severity of discipline which they enforced in accident cases, had so terrorized their men as to materially increase the platform expense per car-mile and greatly injure the service. Motormen feared to approach a team upon the track and the drivers, taking advantage of the state of affairs, would deliberately cut in ahead of the cars. The result, in addition to the undesirable features above stated, was a further increase in the number of wagon accidents.—Petaluma & Santa Rosa Railway Company, Petaluma, Cal., E. M. Van Frank, general manager.

Q. 13.—Is it practicable to employ female assistants as investigators and adjusters in claim and accident work?

It may be, in rare cases, practicable to employ female assistants in the claim department, but generally I do not believe it wise to do so. As a rule, women have more sympathetic natures than men, and they feel that something should be done for the injured, even though the injury may have been the result of negligence of the injured. I believe that if given authority they would be more apt to recommend settlement of cases and at higher rates than male agents would. Generally they do not possess the business training, do not mingle with the world at large as man does, and, therefore, do not have that judgment which man possesses to deal with matters of this kind. I have no fault to find with woman in general, but believe her sphere to be one associated with domestic duties, or work of such a nature where not too much responsibility is put upon her.—Easton Transit Company, Easton, Pa.

With large companies, where claims are numerous, yes; with small companies, no.—Indiana Union Traction Company, Anderson, Ind., E. C. Carpenter, claim agent.

Within proper limitation I think the female an excellent addition to the force; I have known some very effective work to be done in this way.—Indianapolis & Eastern Railway Company, Indianapolis, Ind., William Tichenor, claim agent.

Have used and find them all right; they can often obtain information which a man cannot get.—Lehigh Valley Transit Company, Allentown, Pa., R. H. Schoenen, claim agent.

We have employed them as investigators, but not as adjusters. We don't doubt but some would prove to be good adjusters. There can be no rule laid down, every case presents different features and is a separate problem and must be dealt with in accordance with the conditions. What is good judgment in one case is folly in another. In some cases you want men to investigate, in other cases a woman is necessary. Some of the most perfect and difficult investigation work we ever had has been accomplished by women. Those we have employed are not inferior to men in shrewdness and tact.—New Jersey & Hudson River Railway & Ferry Company, Edgewater, N. J., W. N. Barrows, vice-president.

It is not only practicable to employ female investigators in accident work, but in many cases it is necessary to proper investigation. This is particularly true in the larger cities. We have never tried female adjusters, but if properly trained and equipped they would probably be competent for the work.—Philadelphia Rapid Transit Company, Philadelphia, Pa., H. R. Goshorn, general claim agent.

PAPERS AND REPORTS PRESENTED AT THE ATLANTIC CITY CONVENTION OF THE AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION

CARE OF ELECTRIC RAILWAY TRACKS

BY GEORGE L. WILSON,
Engineer Twin City Rapid Transit Company.

INTERURBAN TRACK

The conditions of the interurban roads located, as all such roads should be, on a private right-of-way, approach closely those of steam roads. Many of the methods used in steam road practice as the result of years of experience are required for electric roads.

Grading, ballasting, construction of bridges, culverts and crossings, care of roadbed and track follow the same lines. The standard works of reference on these subjects apply with slight modifications to the care of electric roads and should be diligently studied by those in charge of permanent way. The maintenance of the earlier and cheaply built electric roads has demonstrated that it is economy to have electric roads built with well ballasted track, ties and rails put in as perfect condition in regard to surface and alignment as possible. Then the object in view is to preserve them in the same condition.

Following the purpose of keeping the track in perfect condition, which includes drainage, care of switches, crossings and side-tracks, we come to the care of the right-of-way, cleaning from snow in winter, maintaining fences, public crossings and the making of the company's property attractive to the passengers. It should be remembered that the principal business of electric roads at present, and probably for a long time, is the transportation of passengers, whose comfort and interest are constantly to be kept in mind. The removal of rubbish, weeds and unsightly objects of all kinds, including advertising signs, from the vicinity of the tracks is a proper part of the care of the roadway.

Company property should be neatly arranged when stored and the land owned by the company along the line and at stopping places ornamented with grassy slopes, vines and shrubbery. At terminal or waiting points there should be flowerbeds and grass plots, instead of ragged grounds and piles of debris. Otherwise waste grounds can be so improved that there is something of interest to attract the passenger's attention at every point. This is looking some distance ahead for new lines, but it is practical to do a little, month by month, and year by year, until the right-of-way becomes a boulevard or parkway.

All passenger transportation lines find it desirable to make their routes as attractive as possible. A sloping hillside cut may, by the proper planting of shrubs, be made beautiful with their flowers in summer and gorgeous with the autumnal foliage. A rocky bank is not of itself attractive, but partly covered with vines it becomes an interesting feature.

Steam suburban roads have done considerable along this line and the lot of the commuter has been cast in pleasant places thereby. The great trunk lines of the country are working to the same end. Through the Eastern States many of the roads pay a great deal of attention to the making of their station grounds attractive. The annual circular of a transcontinental line offering cash prizes to its station agents for the best station flower-gardens lies before the writer. It is attractively illustrated and directed to "Our Fellow Workers Among the Flowers." The aim of every electric road must be to have its patrons attracted and interested along the way that the route may seem both short and pleasant and the trip one to be repeated.

With the care of interurban track, it is proper to consider the men as well as the roadway. It is a fact that track labor has been recruited from the lowest paid classes with the result that ambitious workmen have largely gone into other lines.

Our first railways and public works generally were built by the sturdy Irish immigrants who rose soon to more remunerative employment. In succession we have had Scandinavian, Italian, Austrian and Polish workers. To-day the mass of employes have no apparent interest in, or regard for, the quality or amount of work they perform. In many cases the foremen and officials can communicate with them only through interpreters, and there is an absolute lack of loyalty to the interest of the employers. This must be changed if the best results are to be obtained. It is not necessary that a track crew should be skilled mechanics, but if track, switches, frogs and all appliances are to be in the best working order, men of a fair amount of ability and some mechanical skill are required. To obtain this end the conditions must be such that an intelligent laborer can make a decent living and have a steady income. Work should be planned so as to be distributed through the year as far as possible in order that there may be constant employment for a nucleus of good men.

Let the men from bottom to top have an interest in the results of their work and in the efficiency of the section or division where they are employed. Make them feel that it is their company and that they are a part of the whole machine. The question of keeping skilled laborers who will do good track work is at the bottom of the maintenance of track and the most difficult problem.

All interurban track should be patrolled daily, at least, and this brings us to the track-walker and his duties. This position is above that of laborer and next to that of foreman. A skilled trackman who is sober and industrious and who can be depended upon to see that splices and bolts are in adjustment, drains and culverts open, who will detect any spreading track or broken rails, see that farm gates are kept closed and stock off the track, in fact, be a general inspector and caretaker, is an important person. It is in a great measure to his fidelity that the safety of cars and passengers will be due.

CITY TRACKS

On city tracks the care of the roadway, besides the keeping of rails, switches and curves in good order, includes more or less of cleaning, sprinkling and snow removal. In order to determine the practice of different companies and for a guide for future operation, inquiries on these subjects were sent to fifty leading companies. From their reports, the following notes have been prepared:

Street Cleaning.—In the matter of cleaning the space occupied by tracks on paved streets, the general practice is that the municipality bears the entire expense, as the theory is that the cars do not bring dirt onto the street and the cleaning of the entire paved roadway would have to be done and the expense borne by the city if there were no tracks. The fact of the tracks being in the street does not entail additional expense on the city. This view has been upheld in the courts, and it appears that refuse and things left on the streets by pedestrians, teams and by storekeepers, who often dispose of litter by throwing or sweeping it into the roadway, should be taken care of by the city authorities. Inquiries on this subject were made of fifty companies in all parts of the country, and of forty-six replying and operating 8469 miles of track with a tributary population of 13,241,000, it appears that forty-one operating 6706 miles of track pay no part of the street cleaning expense.

In a few cities the railways bear a part of the street cleaning expense, this being done either voluntarily or by charter requirement. In these cases it should be considered as a contribution or a part of the amounts paid by way of taxation.

The following are among the prominent companies which assist the cities in this matter: Chicago Union Traction Company, Chicago City Railway Company, cost $123.60 per mile for cleaning and sprinkling in 1906; South Chicago City Railway Company.

Columbus: On 79 miles of single track within city limits partly on unpaved streets, the cost for cleaning and sprinkling in 1906 was $13,000. The cost per mile of single track was $164.55.

In Pittsburg the company pays for the proportional part of street occupied by its tracks. In New Orleans the company pays for sweeping one street only. In New York City the company pays for sweeping Broadway only, from Bowling

Green to Fifteenth Street. The Twin City Rapid Transit Company pays for sweeping its track allowance in St. Paul and Minneapolis; 86.12 miles of single track in 1906 cost $23,475.55. The cost per mile was $272.56.

As street sprinkling can be carried on satisfactorily by sprinkling cars, it is believed that the cleaning of the track allowance can be done economically and satisfactorily with sweeping machinery which will take up the debris, place it in a receptacle and take it away to proper dumping grounds. This is an important subject for the companies which pay for cleaning their track allowance.

Street Sprinkling.—In the large majority of towns the street sprinkling is taken care of by the municipal authorities without reference to the street railways, no part of the expense being paid by the companies.

Returns from twenty-four companies, operating 4768 miles and having a tributary population of 10,156,000, show that companies operating 3356 miles sprinkle tracks only with tank cars. Among these the practice is so varied that it is difficult to know how much mileage is sprinkled. In general it appears that the more important streets are the only ones sprinkled. This is done under requirement of state law or city ordinances. The cities are required to furnish water without charge, though in some places the company is obliged to pay for the water; in one case, 6 cents per mile of track.

The business of sprinkling the whole of the roadway from tank cars has been developed to quite an extent. One outside company owning cars makes contracts with cities for sprinkling the roadways and has 250 miles of streets covered. The railway companies operate the cars for a price per car-mile. The authorities of the cities report that the service is very satisfactory. The railway officials report that this plan gives good results, and while the returns are small, the conditions on the whole, are satisfactory.

A number of cities pay the railway companies directly for this same kind of service. Prices received by the company for this work vary from 7 cents to 17 cents per car-mile, 10 cents being about an average. The cost to the property owners per season is about 10 cents per foot of street or 5 cents per front foot.

The tank cars used are of a variety of types, from the plain rectangular box to the cylindrical sheet-iron tanks, operated either directly by gravity or as pneumatic sprinklers, having the tank under air pressure. The capacity is from 2500 gals. to 6000 gals.

Four thousand gallons will sprinkle some 6 miles of tracks or 3 miles of entire roadway. Any statements of this kind are rather indefinite, as they depend upon so many conditions. A better idea of the work done is to say that in actual practice one car making four trips per day will care for 8 miles of street.

While the returns for the service are small, the indirect benefits are of as much or more value. The freedom from dust not only decreases the expense of repairs to car machinery and gives a better contact between rail and wheel, but also, by more comfortable conditions for passengers, increases the pleasure of riding and other traffic so much that managers consider the expense more than met by increased revenue.

OIL SPRINKLING

The use of oil for laying dust on some streets and for the roadbeds of railways has been extensively advocated. It has been tried by a number of roads. Some consider its use satisfactory, but the greater number have not put it into extensive use. The heavy asphalt oils of California appear to give the best results, while in the Central and Eastern States a so-called "Roadbed" oil prepared by the Standard Oil Company has been used more or less experimentally for ten or twelve years.

Among the steam roads that have used oil are: The Boston & Maine, Boston & Albany, Central Railroad of New Jersey, Long Island Railroad, Delaware & Hudson, Santa Fé, Chicago, Burlington & Quincy, Oregon Short Line, Chicago & Alton and the Southern Pacific. The latter company has employed the plan the most extensively, having used it for five or six years on about 900 miles of road.

In practice the roadbed is sprinkled with about 2000 gals. per mile for the first application. After the first dressing, the quantity may be lessened to 600 or 1000 gals. per mile annually, though some parties claim that two applications annually are needed. The sprinkling appliances used and the process are claimed to be controlled by a Chicago firm, which charges a royalty of $10 per mile for its use for the first application, no charge being made for subsequent sprinklings.

Few electric roads have used oil. The Los Angeles Pacific reports its use on unpaved city streets and states that three coats per year are desirable. At 60 cents per barrel, the cost per mile of double track is $100. San Francisco reports its successful use on macadam streets outside the city limits. The Brooklyn Rapid Transit Company is experimenting with 20 miles of track on its suburban lines on private right-of-way where the pleasure riding is very heavy and the roadbed of sandy material.

From the reports of roads using oil it appears that managers of the steam roads, at least, do not consider its use profitable and there is no general movement to adopt it. On electric roads on private right-of-way or on macadam outside of built-up sections of cities, it may prove to be economical where the oil is obtained at a low price, especially on sandy roads leading to pleasure resorts. The accompanying memoranda in regard to the practice and cost may be of interest.

Boston & Maine Railroad: Has used oil in 1899. Covered about 400 single-track miles. Uses 2000 to 3000 gals. per mile. Price of oil, 2.75 cents per gallon. Average cost, $100 per mile.

Boston & Albany Railroad: Made experiments for three years, 1898-1900. Used 2000 gals. per mile first year, 600 gals. second year, 1000 gals. third year. Oil per gallon, 2.75 cents. Cost per mile of track, $80.

Central Railroad of New Jersey: Will use oil on Sea Shore Line for dusty season. Use apparatus constructed at its own shops. Pay a royalty for the process.

Long Island Railroad: Use oil on crossings. Cost, $125 per mile. Use 600-gal. tank cars. Oil costs, 2.4 cents per gallon; 600 gals. used per mile. Results on cinder and gravel ballast satisfactory.

Delaware & Hudson Railroad: From 1896 to 1900 oiled road from Saratoga to Plattsburg, 188 miles. Used roadbed oil prepared by the Standard Oil Company. Price, 2.75 cents to 4.75 cents per gallon. For 2000 gals. per mile cost was $100. Kept dust down, but its use has been given up; 1000 gals. per mile every other year would be sufficient.

Oregon Short Line: Reports using a little oil on a branch line which kept down dust till track was ballasted.

Brooklyn Rapid Transit Company: Reports that some track on private right-of-way has been sprinkled for two years. Will sprinkle 20 miles in 1907. Results satisfactory.

Chicago & Alton Railroad: Uses crude oil at 3 cents per gallon for sprinkling road crossings only. Stone ballast on rest of road and does not need it.

Southern Pacific Railroad: Has used oil for five or six years; 900 miles of track oiled. May use up to 4000 gals. per mile. Pays $10 per mile royalty.

United Railroads of San Francisco: Uses oil on macadam streets, but not inside city limits.

Los Angeles Pacific: In Los Angeles on unpaved streets an occasional coat of oil is applied. Generally, oiled streets are sprinkled three times per year. Cost, $100 per mile of double track.

SNOW REMOVAL

The universal practice with reference to snow is to keep the tracks open for service by the use of plows and sweepers during and immediately after each snow fall. The snow thus deposited on the rest of the roadway is left, so far as it can be done, without impeding travel. At crossings and congested points in business districts all companies assist in removing snow as promptly as possible by the use of cars and teams.

When it is necessary to remove snow from roadway the companies generally pay the cities one-third or one-half the expense incurred on the whole street. In some cases the cities and railway companies divide the streets, the railways taking care of a sufficient number of them to make up the same area as their total track allowance. One company takes one side of the streets and changes sides annually. This is reported as working well in a city of 60,000 people.

Cost.—In many cities no separate account of this expense is kept, and owing to the fact that conditions vary so widely between southern and northern locations, no satisfactory comparison of costs is practicable.

Figures given show these results: Indianapolis, $17.41 per mile of single track in a city of 175,000 with 140 miles of track in the Central States for an average winter. In Chicago, 1906-7, the cost was $41.13 per mile of single track for the Chicago City Railway Company, while in Milwaukee, 85 miles away, but a very small expense was incurred. Another lake city, Detroit, reports $35 per mile for an average winter. Duluth gives $45.45 for an average winter. Toronto reports on 98 miles of single track in 1904-5, a cost of $102.04 per mile for one-third of street area. In Montreal, where the company pays one-half the cost, the average per mile of city streets is given as $2,618.46. Providence, R. I., reports a cost of $148 per mile of single track in 1906 and 1907. Here all snow over 4 ins. in depth is removed.

A YEAR'S EXPERIENCE WITH GAS ENGINES

BY PAUL WINSOR,
Chief Engineer Motive Power and Rolling Stock, Boston Elevated Railway Company

We have now been operating our gas-engine plants over a year and the following statement of the results may be of interest to some of you.

We have two of these plants, both of them generating direct current and feeding into our overhead system in multiple with our steam-driven power at stations. They have been operated most of the time by two 8-hour watches from 7.00 a. m. to 11.00 p. m. and shut down from 11.00 p. m. to 7.00 a. m. The following figures and statements apply to our Somerville power station. I give no figures for our other plant as it has not yet been accepted.

The Somerville power station has the following equipment:

One pair of Loomis-Pettibone gas producers, with the usual auxiliaries; two 600-brake hp Crossley gas-engines, each 2-cylinder, 4-cycle; and two 350-kw, dc Crocker-Wheeler generators.

This plant was started in May, 1906, and since then has given continuous, reliable and satisfactory service. There have beeu no shutdowns, no accidents and no failures. The fuel has been soft coal, the same as used in our steam stations, mostly run-of-mine Pocahontas. The economic results are shown in the following tables:

Somerville Power Station, Boston Elevated Railway Company Power.

Date, January, 1907, to August, 1907.

	Jan.	Feb.	March.	April.	May.	June.	July.	Total.	Average.
Kw-hr. generated	204,080	175,200	192,250	202,870	118,640	35,770	60,170	988,980	.....
Total lb. coal, including coke	391,223	364,817	405,050	401,150	234,705	90,991	124,452	2,012,388	.....
Lb. coal per kw-hr	1.917	2.081	2.120	1.975	1.979	2.542	2.065	.....	2.034
Lb. coal per b. h. p. hour	1.322	1.436	1.426	1.363	1.365	1.755	1.425	.....	1.404
Sta. load factor based on 16 hrs. per day and 7 days per week	58.8%	55.9%	55.3%	60.4%	34.2%	10.6%	17.3%	.....	41.6%
Eng. load factor	84.2%	86.0%	87.4%	82.3%	78.3%	73.3%	82.8%	.....	83.3%
Gen. load factor	99.3%	101.3%	103.0%	97.1%	92.4%	86.5%	97.7%	.....	98.35%

These are the results from actual service and include all the fuel used for power, heating, etc., and the auditor's usual 1 per cent to make his books balance.

A year ago I told you that we were operating on 1.45-lb. per kw-hr. Later, before the Proceedings were published, I had to withdraw that figure. Overzealousness on the part of the producer men working for the contractors led them to use coal that had not been weighed and lack of proper checking on the part of our men failed to catch them at it and it was not until we took account of coal on hand that we discovered what had been going on. The following are some of the points that have particularly interested us:

WATER

We have used a great deal of water for scrubbing the gas and for cooling purposes. The average amount has been 281-lbs. per kilowatt-hour. When we bought this water as we did for a few months—our water cost about twice as much as our coal. Since November 21, 1906, we have been pumping this from a very dirty brook by means of 2-stage centrifugal pumps, electric driven by and filtering it through a pressure sand filter. This outfit has been entirely satisfactory and has given us no trouble. The suction lift is 12-ft. and the pressure at the pumps 30 lbs.

The discharge of water from the gas scrubbers is very dirty, being full of floating lampblack, and is altogether too thick to put back into our dirty brook. A sand filter basin, 246⅔ sq. ft. in area and tile under-drained, removes all the lampblack, so that we are turning back into the brook cleaner water than we take out.

IGNITION

Our ignition current is from 14-volt motor generators and a floating storage battery and we have no trouble with the outfit. The igniters are make-and-break, two on each cylinder. These igniters had originally platinum tips, which cost a great deal and gave considerable trouble. We have been running now four months without any platinum and with less trouble.

BACK FIRES AND PRE-IGNITIONS

During the first months, back fires and pre-ignitions were much too frequent, occurring almost every day. Lowering the compression on one of the cylinders, changes in the igniters, and experience have reduced these troubles, so that we now go two or three weeks without a single one.

RELIABILITY

This plant has proved absolutely reliable. It can be put into service any time in less than five minutes—much quicker than can our steam plants. It can carry good loads and do it continuously. Each unit carried 450-kw (652 brake horse-power) for an hour, with swings to 495 kw. (717 brake horse-power.)

EFFICIENCY

For the first seven months of this year this plant used 2.034-lb. coal per kw-hour, while our steam plants averaged 3.377-lb. per kw-hour—a saving of 41.5 per cent. One of our smaller steam plants, containing three 200-kw compound condensing engines, used 4.414-lb. per kw-hour; this gas station used only 46.1 per cent as much.

CONCLUSION

Personally, I believe that a gas-engine plant, making its own producer gas, will operate at least as reliably as a steam plant and will use from 30 to 60 per cent less fuel, depending somewhat on the size of the gas plant, but principally on the size of the steam plant.

The drawbacks to the gas plant are, in my mind: First. Cost, approximating $200 per kw when rated so as to have a 33⅓ per cent overload capacity; and second, small size of units—the largest gas-engine now built being only of about 3000-kw. capacity.

Below, marked "A" and "B," are copies of reports, which summarize the log sheets of the Somerville Power Station for the weeks ending July 27, 1907, and August 3, 1907, respectively:

(A)—Week ending July 27, 1907.

With the exception of the following incidents, the operation of the plant during the past seven days has been satisfactory.

Eng.	Back fires.	Pre-ignitions.	Interruptions.
No. 1	0	0	0
No. 2	0	0	0

July 22.
Renewed No. 1 engine "A" and "B" upper igniters—general repairs.
July 25.
Renewed No. 1 engine "A" lower igniter—general repairs.
Repaired contacts on No. 1 engine "B" lower igniter.
B. E. Ry. men finished renewing No. 2 armature on July 20 and generator was put in service July 27, 1907.
Cubic feet of city water has been used as follows:

	*Small meter.	Remarks.	Large meter.	Remarks.
July 21	570		670	Low tide.
July 22,	1,180		590	Low tide.
July 23,	1,050		0	
July 24,	880		0	
July 25,	1,110		0	
July 26,	920		0	
July 27,	630		0	

(B)—Week ending August 3, 1907.

With the exception of the following incidents, the operation of the plant during the past 7 days has been satisfactory.

Eng.	Back fires.	Pre-ignitions.	Interruptions.
No. 2	0	0	0
No. 1	6	8	0

Pre-ignitions and back fires were due to carbonized oil in No. 1 A cylinder, July 28 and 29.
Aug. 1.
Repaired contacts on No. 1 engine "A" upper igniter.
Aug. 2.
Cleared ground and repaired contacts on No. 2 engine "B" lower igniter.
Cubic feet of city water has been used as follows:

	*Small meter.	Remarks.	Large meter.	Remarks.
July 28,	940		0	
July 29,	610		0	
July 30,	580		0	
July 31,	810		0	
Aug. 1,	510		0	
Aug. 2,	910		0	
Aug. 3,	680		0	

*Feed water for economizer boiler.

SOME PRACTICAL POINTS IN STEAM TURBINE CONSTRUCTION; WITH PARTICULAR REFERENCE TO THE PARSONS TYPE

BY ST. JOHN CHILTON,
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The greater part of what has been written of the principles governing steam turbine design deals with theoretical considerations that must be left to the experience and judgment of the manufacturer, and are, therefore, of particular interest only to the designer and specialist. The interest of the power plant engineer lies in the results obtained; nevertheless, there are practical considerations of interest indicating results that may be expected from turbines having stated characteristics, and that may be of assistance in fixing operating conditions. In this paper an effort will be made to bring these out.

Steam turbines are divided into two general types, best known as impulse and reaction. In an impulse turbine steam is first expanded in a nozzle or nozzles, in which it acquires a velocity depending, within certain limits, upon the fall in pressure. It is then allowed to impinge upon buckets suitably fastened to the periphery of a disc, and they, in turn, abstract the velocity, thereby imparting rotation to the shaft to which the disc is fixed. No fall in pressure occurs within these rotating buckets; the rotative effort, therefore, is due wholly to the velocity imparted to the steam within the nozzles. When more than one ring of rotating buckets is used to abstract the velocity from a single nozzle, or single group of nozzles, the flow of steam, with little or no further expansion, is reversed by stationary buckets which guide it into a second ring of rotating buckets. Fig. 1 shows relative positions of nozzles, stationary and rotating buckets and the direction of flow of steam through them. The quantity of steam delivered to the buckets is regulated by varying the number of nozzles in action and the quantity of steam supplied to individual nozzles.

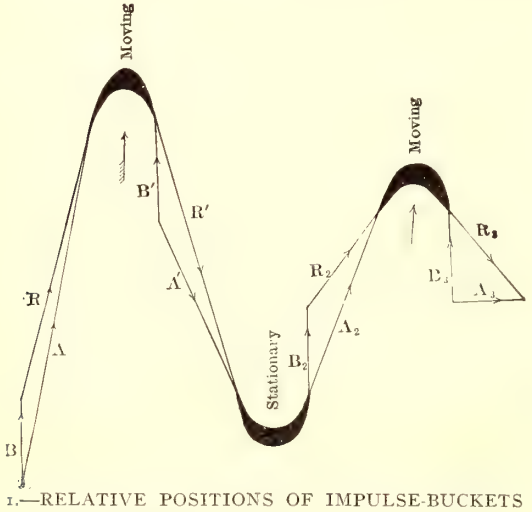


FIG. 1.—RELATIVE POSITIONS OF IMPULSE-BUCKETS AND THE DIRECTION OF FLOW OF STEAM

The velocity of flow through the buckets, in this type of turbine, can be reduced by increasing the number of re-expansions, or stages, a stage being defined as the elements required to develop and to abstract the velocity due to a single-pressure drop; that is, a set of expansion nozzles, with the necessary number of rings of rotating and stationary buckets.

Various applications of the impulse principle are found in turbines of different manufacturers; but in all of this type velocity is first imparted to the steam and then abstracted by the rotating element without having additional velocity imparted to the steam.

Only a part of the periphery of a disc is active at any instant unless multiple-stage construction is used; then the proportion of active buckets increase with the increasing volume of steam, until, in the last stage, all the buckets may be active.

The reaction or Parsons type has no expansion-nozzles, as ordinarily understood, but is provided with alternate rows of stationary and rotating blades. Steam is admitted to the first row of stationary blades, then passes through the length of the turbine, falling in pressure and increasing in volume until the exhaust-opening is reached. Expansion occurs in both the stationary and rotating rings of blades, and the velocity thus required is abstracted by the rotating element; the velocity acquired in the stationary blades being abstracted by impulse action, and that acquired in the rotating blades by reaction. Fig. 2 shows the relative positions of stationary and rotating blades, with the direction of flow of steam through them.

The cross sectional area of the steam passages through the blades is increased from the high to the low pressure end of the turbine, to correspond with the increase in volume of steam. Where this requirement necessitates blades of too great a length the diameter of the rotor, or spindle, is increased. (See Fig. 3.) This admits of a greater number of blades per ring, hence an increased number of openings between blades, thereby permitting of the retention of the blade-lengths within limits mechanically practical. Blades of different lengths are so grouped, with reference to the fall in steam pressure, as to maintain a substantially constant velocity ratio. In the Parsons-type turbine the entire annular space between rotor and cylinder is filled with working steam, and all the blades are active, thus eliminating useless friction, due to idle rotating parts.

The work developed in turbine blades depends upon the quantity of steam supplied and its velocity, and not upon pressures and pressure areas, as in steam engines, therefore the widths of the blades can be so proportioned to the lengths as to insure necessary strength and stiffness, and thus amply meet all mechanical requirements.

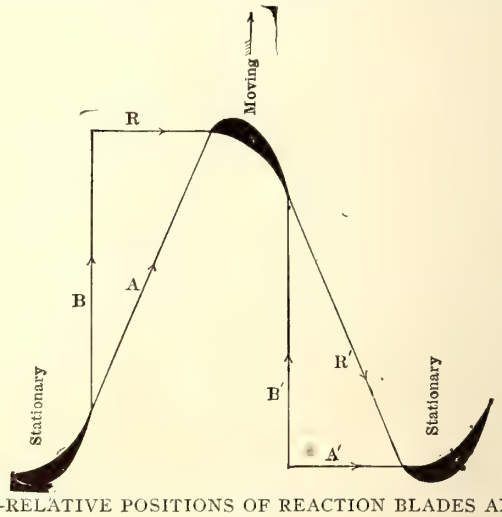


FIG. 2.—RELATIVE POSITIONS OF REACTION BLADES AND THE DIRECTION OF FLOW OF STEAM

As has been already stated, expansion takes place in both stationary and rotating blades of the Parsons-type turbine. Each pair of blade-rings, consisting of one stationary and one rotating ring, may, therefore, be considered as corresponding to a stage in the impulse-type. The reaction turbine has, accordingly, many stages when compared with the impulse-type, and the velocity of steam is thus much lower. Theoretically, the ratio of steam velocity to blade, or bucket velocity, required to obtain the most economical results approximates two to one. Hence the peripheral velocity of the rotating element in a reaction turbine, with its many stages, is generally much lower than in the impulse-type, with its few stages.

Since the peripheral velocity of the rotating element required depends solely upon the velocity of the steam, and is independent of the speed of the turbine, the rotor diameter must be correspondingly increased when the speed is reduced. Lower speed, therefore, does not necessarily mean lower blade vlocity; in fact, the highest peripheral velocity of blades in a reaction turbine is generally below that in impulse turbines, running at

even much lower speed. Another disadvantage of high steam velocity is that the erosive effect of steam increases directly with the square of its velocity.

In reciprocating engine practice it has been customary to compare the weights of engines as an indication of relative strength and rigidity. Even with this prime mover, such comparisons are often unreliable unless distribution of weight is also considered. In steam turbines there are no reciprocating motion strains to be considered, and the most important factors are of a nature distinct from those governing reciprocating engine design. For instance, the rotor diameter, and, therefore, the cylinder diameter, is changed for different speeds. The weight depends chiefly upon the diameter of these parts, and, furthermore, to remove all weight that does not contribute to its strength, considerable additional expense is incurred in the construction of the rotor. Indeed, so many things have to be taken into consideration if weights of steam turbines be compared, that any such comparison is misleading, even in turbines of the same type. Owing to difference in construction, no comparison is possible between turbines of different types.

Both types of steam turbines are essentially high speed, and the tendency is toward increasing the speeds that were accepted standards a few years ago. Higher speed means increased economy of operation, and experience has shown this speed advance to be practical mechanically up to the limits set by the generators to which the turbines are connected. Appreciating this, some manufacturers are voluntarily incurring the expense of developing new standards.

Each type of turbine had its inherent difficulties to be overcome before the requirements of commercial operation could be met satisfactorily. In the reaction, or Parsons type, an important source of loss in efficiency is the steam leaking past the ends of the blades without doing work. It is desirable, therefore, to reduce this loss to a minimum. The quantity of steam thus lost past a ring of blades, depends upon the peripheral length of the ring, the percentage that the clearance is of the length of blades in the ring, and the clearance at the ends of the blades. Obviously, then, leakage will be greatest over the shortest blades. The effect of speed upon economy here is self-evident. Increase of speed and consequent decrease in rotor and cylinder diameters reduces the peripheral length of the rings, and, by increasing the blade lengths, reduces the percentage that the clearance is of the lengths of the blades; this clearance remains practically constant. It is also evident that economy demands the smallest possible radial clearance consistent with safety. In reaction turbines small clearances between stationary and rotating blades, in line with the flow of steam, are unnecessary, and in practice the clearance is never less than ⅛ inch between the smallest blades, and often as much as 0.75 inch between the largest blades, thereby allowing ample room for difference in expansion of rotor and cylinder.

Necessity for small radial clearance soon demonstrated the advisability of protecting the tips of the blades to prevent them from being knocked out through accidental contact with cylinder or rotor. Many interesting patents, in fact, endeavoring to accomplish this, have been taken out by manufacturers of this type of turbine. The one that experience has proved both practical and effective is seen in the blading construction in Fig. 3 and more in detail in Figs. 4 and 5. In this construction the blades are cut from drawn stock and each blade is formed by special machine tools so that at its root it is of angular dovetail shape, while at its tip there is a projection. To hold the roots of the blades firmly a foundation ring is provided. (A in Fig. 4.) This foundation ring is first formed to a circle of the proper diameter and then slots are cut in it by a special milling machine, and these, accurately spaced and inclined to give the required pitch and angle to the blades (see Fig. 5), are of dovetail shape to receive the roots of the blades. The tips of the blades are substantially bound together and protected by means of a channel-shaped shroud ring (B, Fig. 4), in which are holes punched to receive the projections on the tips of the blades.

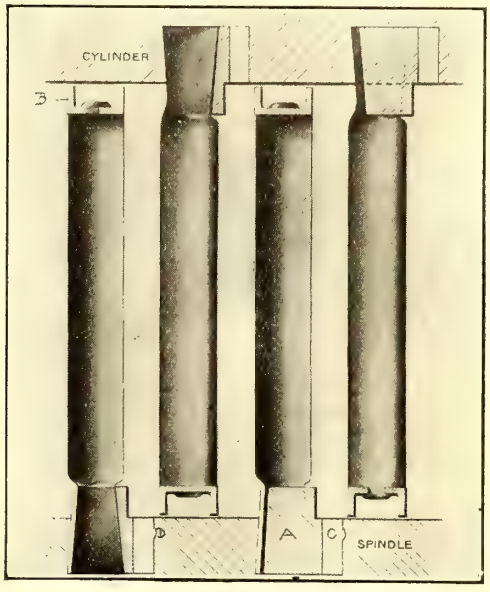


FIG. 4.—STEAM TURBINE BLADING

Accurately spaced by a special machine, these holes match the slots in the foundation ring.

The foundation rings themselves are of dovetail shape in cross section, and, after receiving the roots of the blades, are inserted in dovetailed grooves in the cylinder and rotor, where they are firmly held in place by key pieces. (C, Fig. 4.) Each key piece, when driven in place, is upset into an undercut groove (D, Fig. 4), thereby locking the whole structure together.

After being inserted in the turbine, as above described, each blade is so firmly held between the bottom of the slot in the foundation ring and the side of the groove, owing to the dove-tailed shape of its root, that it is impossible for a blade to get out of place.

The flanges of the channel-shaped shroud rings are purposely made thin, so that, in case of accidental contact between revolving and stationary parts, they will wear away enough to prevent the blades from being ripped out. This protection is such that to rip them out a whole ring of blades must be sheared off at the roots. The strength of the blading, therefore, depends not upon the strength of an individual blade, but upon the combined shearing strength of an entire ring of blades.

The blading is made up in half rings. These rings are a thorough machine-shop job, easily inspected, with the uncertainty of hand-work eliminated.

No matter what precautions are taken to prevent trouble, it

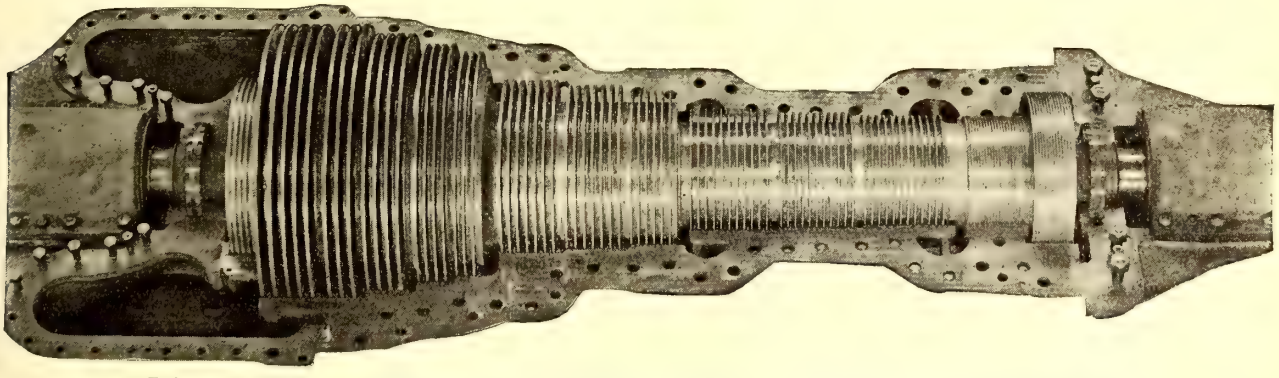


FIG. 3.—TURBINE. ROTOR AND HALF-CYLINDER, SHOWING BLADING AND BALANCE-PISTONS

is generally appreciated that the possibility of defective material creeping in makes easy facilities for repairs advisable. With the construction described any blading trouble would be localized, and damaged rings could be removed and the turbine continued in operation until such rings could be replaced conveniently. These half rings can be inserted quickly and without disturbing the thrust balance of the rotor.

The improvements effected by this construction may be summed up as folows:

1. Firm attachment of blades.
2. Ample stiffening of blades of all lengths against effects of vibration.
3. Accurate spacing and accurate angles of blades.
4. Protection of blade-tips, so that accidental contact will not rip out blades.

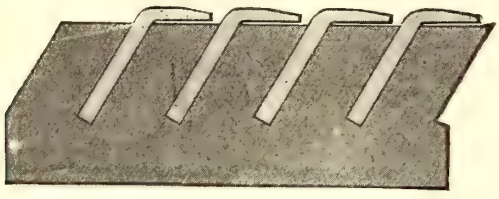


FIG. 5.—SECTION OF FOUNDATION—RING SHOWING ROOTS OF BLADES INSERTED

5. Smaller clearance, resulting in diminished steam-leakage and, hence, increased economy.
6. Improved baffling against steam-leakage by reason of the shape of the shroud-ring.
7. Protection against a possibly defective blade coming out and destroying other blades.
8. Accurate machine-work, as against uncertain hand-work.
9. The facility for thorough inspection of workmanship.
10. The localizing of any possible trouble and the convenience of making quick repairs.

Another difficulty that, in the past, caused some trouble, was due to the method used to balance the thrust along the rotor, resulting from the drop in pressure in the rotating blades of the reaction turbine. Balance pistons, connected with several points in the turbine cylinder, by means of equalizing passages, are used for this purpose. These balance-pistons (marked L.M.N.) are shown in Fig. 6. The earlier construction was to place the three balance-pistons upon the high-pressure end of the turbine rotor, as shown in Fig. 6. No trouble was experienced from this arrangement except with the largest, or low pressure, piston. In the larger turbines, this became of considerable diameter, and, owing to the necessity of constructing it with a web, showed a tendency to warp, thereby bringing in contact the dummy-rings in the periphery of the piston with those in the cylinder. These dummy-rings serve as buffles to prevent steam-leakage past the pistons, and their contact at high velocity meant not only their own destruction, but also injury or destruction to the surrounding parts. A simple but effective means of eliminating this trouble is shown in Fig. 3. The two smaller balance-pistons, easily made sufficiently stiff to prevent warping under any conditions of operation, are allowed to remain upon the high-pressure end, but the largest piston is placed upon the low-pressure end, of the rotor immediately behind the last ring of blades. In this location its effective area starts from a smaller inner diameter, hence the required area can be obtained with a smaller outer diameter. It can be also constructed as part of the rotor, and, therefore, has ample stiffness to prevent warping. It receives its steam pressure from the same point in the turbine as the largest piston shown in Fig. 6, which it replaces; but the steam-passage is through holes in the webs of the blade carrying-rings, which are pressed on the rotor to obtain the largest diameter shown in Fig. 3. Entrance to these holes is through the small annular opening in the rotor, visible in Fig. 3, between the second and third barrels.

As the area of these balance-pistons cannot be changed without replacement, and as it is not advisable to change the blade-angles after the blades have been correctly set in place, doubt may arise as to the possibility of calculating the thrust with sufficient accuracy to obtain perfect thrust-balance. From the construction of the blading, the accuracy of the blade-spacing and blade-angles can be depended upon. It remains, then, only to determine, by calculation, the pressures at the various points in the turbine. It is, therefore, interesting to note that repeated tests have shown the pressures at different points in turbines having correct blade-spacing and angles, to be within one per cent of the calculated pressures.

For new installations, inquiry is often made as to the steam pressure best suited to turbines. Taking everything into consideration, it seems probable that the most economical operating pressure will be found at about 150 lbs. above atmospheric pressure at the throttle valve, and that a greater saving can be affected by the use of a small amount of superheat than by increasing the initial pressure beyond this point. Reliable data shows the gain in steam economy, by increasing the pressure from 150 to 175 lbs., to be approximately 2 per cent; an increase of pressure from 150 to 200 lbs. improves the steam economy by approximately 3 per cent. Against this should be placed the increased cost of piping, valves and boilers, and the loss due to increased leakage. The selection of the most economical steam pressure, therefore, resolves itself into a comparison of the cost of fuel and initial investment, that ought to be made for definite conditions. Increasing the steam pressure also has a tendency to add to, rather than reduce, the cost of the turbine.

Since steam turbines have become better known, the impression is not so common, that higher vacuum is required to obtain economical results with this prime mover than with reciprocating engines. Higher vacuum is not required to obtain good results; but as turbines are not subjected to the changes in temperature, present in the cylinders of reciprocating engines, they can utilize high vacuum to better advantage. The difference in steam economy, within the range between 6 ins. and 3 ins. absolute, is, approximately, 5 per cent per inch. The saving effected between 3 and 2 ins. is approximately 6 per cent, and between 2 ins. and 1 in. approximately 7 per cent. An idea of the relative quantity of condensing water required for different vacuums may be gained by comparing that required for the usual operating vacuums. For example, with injection water of 70 degs. F., the usual temperature upon which condenser guarantees are based, it is customary to figure upon using about 36 lbs. water per pound of steam condensed, to obtain a vacuum of 3 inches absolute, and about 1.4 times this quantity is required for a vacuum of 2 ins. absolute. With injection water of 60 degs. F., which may be considered the winter temperature, the quantities required for the foregoing vacuums are approximately 28 and 34 lbs. respectively. Having the quantity of condensing water required, the cost of fuel, and cost of water delivered to the condenser, the vacuum best suited to the conditions under consideration may be determined. Theoretically, the effect upon the turbine of reducing the vacuum below that for which it is designed, is to reduce the capacity and to lower the rating at which maximum economy is obtained.

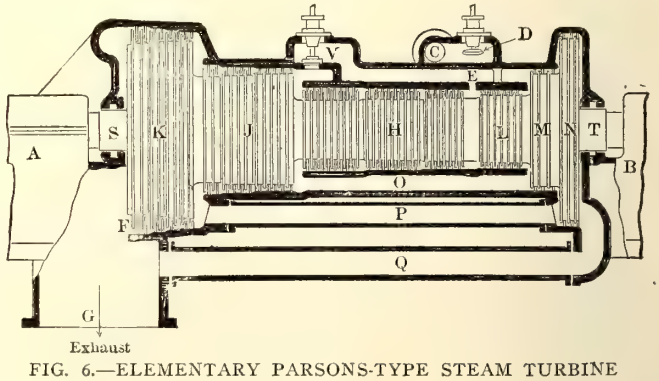


FIG. 6.—ELEMENTARY PARSONS-TYPE STEAM TURBINE

Turbines, however, are designed with sufficient flexibility to allow of varying operating conditions within wide limits, hence the theoretical reduction in capacity is not one that need be considered unless an unusual reduction in vacuum is contemplated. In the reaction-turbine, for a given initial pressure, lower operating vacuum permits of fewer rings of blades; likewise a smaller area of exhaust-opening. Therefore, the effect upon the cost of the turbine is to reduce rather than increase it; the difference, however, is not sufficient to be of importance in determining the operating vacuum desirable.

Although much remains to be determined concerning superheated steam, experience has shown that, in turbine plants, a substantial saving in fuel can be effected by its use. Steam consumption tests show that the increment of saving becomes smaller as the superheat is increased. For 50 degs. F. superheat

at the turbine throttle, a reduction in steam consumption is effected, approximating 7 per cent. The reduction for 100 degs. F. approximates 10 per cent, and for 150 degs. F., 12.5 per cent. This saving is due, in part, to the maintenance of drier steam, and to a reduction of skin-friction upon the blades. The effect of superheat upon a turbine designed for dry saturated steam is to increase its capacity by reducing the quantity of steam required, thereby raising the rating at which maximum economy is obtained.

The Parsons-type turbine is too well known to require detailed description. However, the important position occupied by steam turbines in power-plant work insures interest in marked improvements in details of their construction. The turbine shown in Fig. 3 has several besides those already described, and among them may be mentioned the governor mechanism. This is of the hydraulic type, and the governor is required to operate the small, balanced oil relay-valve only, while the two steam valves, main and by-pass, are controlled by a strong force due to oil pressure of about 20 lbs. per sq. in., acting upon a piston of suitable size. As a turbine by-pass valve opens only when the turbine is required to develop overload or the vacuum fails, a good feature of this governor mechanism is that this valve can be kept constantly in motion, thereby preventing sticking even if called into action only at long intervals. Another feature of importance is that the oil supply to the bearings, and that to the governor, can be inter-connected so that the governor will shut off the steam if the oil supply fails.

The speed at which turbo-generators must operate necessitates mechanical construction different to that found satisfactory in other classes of electric generators, and also more expensive. Owing to the compactness of these generators, however, and to the small number of poles, better electrical efficiencies can be obtained.

The higher peripheral velocity necessitates the use of stronger material in the rotating parts, and special provisions must be made for holding the field windings firmly in place and for protecting the insulation. One of the interesting features of the rotor of these generators is that the winding is placed in radial slots to prevent rubbing between adjacent conductors, that might cause injury to the insulation. The generator is totally enclosed to insure noiseless operation, and forced ventilation is provided by having a small fan on each end of the rotor. If desired, the air inlets can be piped through the basement to the outside of the building and a lower operating temperature thus obtained.

REPORT ON RAIL CORRUGATION BY THE MAINTENANCE OF WAY COMMITTEE

Among the subjects investigated by your Maintenance of Way committee this year is that of rail corrugation. The following report on this subject embodies the questions contained in the data sheet and circular letter which were sent to the various member companies and the answers which were received to these questions. Out of forty-eight replies only thirteen contained any definite information on the subject of rail corrugation and even these answers seem to be considerably at variance with each other.

Answers to Question No. 1 indicate that various types of rails are subject to corrugation.

Answers to No. 2 indicate that about one-third of the companies have had different types of rails affected where conditions are similar, while the remaining two-thirds of those who answered the question have had but one type of rail affected in this way.

Answers to No. 3 indicate that the length of rail affected varies from three feet to several hundred feet.

Answers to No. 4 show that the length of time the rail is in service before corrugation appears, varies from four months to thirteen years.

Answers to No. 5 seem to bring out the fact that the length of corrugation is from 1 to 15 ins.

Answers to No. 6 indicate that the depth of corrugation varies from an inappreciable amount up to 3/16 in.

Answers to No. 7 show that deep girder rails are most liable to rail corrugation.

Question No. 8 is answered in a way that would indicate that the corrugations occur mostly upon track which is not laid upon a thoroughly rigid base.

Question No. 9 is answered by seven of the thirteen companies stating that the corrugations occur on the outer rail of slight curves. One company states distinctly that the corrugations are found on the inner rail of curves of large radius. Three companies state that the corrugations occur on straight track. Braking seems to have little effect, although three companies distinctly state that corrugations occur where brakes are most frequently applied.

Question No. 10 is answered by some companies stating that double-truck cars cause corrugations and by others that corrugations occur where single trucks are used. All answers to this question indicate heavy traffic on track affected.

Question No. 11 is answered in some detail by one company describing a machine which it has for grinding out the corrugations. This company has also remedied the defects in certain cases by stiffening the web of the rail either with fish plates, rail braces or other devices. It has been able to take out corrugations which were formed on the rail by the use of these stiffeners of the web. Two other companies have used a girder for taking out the apexes of the corrugations, which grinder they did not consider satisfactory.

The companies which answer Question No. 12 seem to agree that the cause of the trouble is produced by rails being insufficiently supported by the web of the rail being weak, that the track construction is faulty and that the slipping of the wheel on the outer rail of curves produces the corrugation.

The Philadelphia Rapid Transit Company, which company appears to have had the greatest experience with this phenomenon, has given a very interesting account of its dealings with the subject, and this information is unusually instructive. The remedies applied and the expenditures made show that this company is treating the matter thoroughly and its progress will be watched with much interest during the next few years.

QUESTIONS AND ANSWERS.

Q. 1.—Type of rail affected?

Mostly 95-lb. girder, about 9 ins. in height.—Boston Elevated Railway Company, Boston, Mass.

Nine-inch girder.—Old Colony Street Railway Company; Boston & Northern Street Railway Company, Boston, Mass.

Grooved rail.—Springfield Street Railway Company, Boston, Mass.

Nine-inch semi-grooved.—Worcester Consolidated Street Railway Company, Worcester, Mass.

Nine-inch girder; Lorain Steel Company, Sec. 94-313, and Johnson Company, 94-204.—International Railway Company, Buffalo, N. Y.

Sec. 200, Pennsylvania Steel Company.—United Railways & Electric Company, Baltimore, Md.

All types; mostly 90-lb. girder.—Philadelphia Rapid Transit Company, Philadelphia, Pa.

Lorain Steel Company, Sec. 95-319; Sec. 95-297; Pennsylvania Steel Company, Sec. 95-222.—Cleveland Electric Railway Company, Cleveland, Ohio.

Seventy-pound A. S. C. E.—Indiana Union Traction Company, Anderson, Ind.

Six-inch, 72-lb. Shanghai "Tee" rail.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

Lorain Steel Company, Sec. 94-313.—San Juan Light & Transit Company, San Juan, P. R.

Q. 2.—Are different types of rail affected where conditions are similar?

Yes.—Boston Elevated Railway Company, Boston, Mass.

Girder rails only seem to be affected.—Old Colony Street Railway Company; Boston & Northern Street Railway Company, Boston, Mass.

Not in our experience.—Springfield Street Railway Company, Boston, Mass.

No, apparently not.—Worcester Consolidated Street Railway Company, Worcester, Mass.

Yes.—International Railway Company, Buffalo, N. Y.

Have only noticed this condition on the above-mentioned section.—United Railways & Electric Company, Baltimore, Md.

Yes.—Philadelphia Rapid Transit Company, Philadelphia, Pa.

No.—Cleveland Electric Railway Company, Cleveland, Ohio.

Only one type affected.—Indiana Union Traction Company, Anderson, Ind.

No.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

No, 70-lb. A. S. C. E. "Tee" rail not affected.—San Juan Light & Transit Company, San Juan, P. R.

Q. 3.—Length of section affected?

Varies with the length of the curve.—Boston Elevated Railway Company, Boston, Mass.

From 50 to 300 ft. approximately.—Springfield Street Railway Company, Boston, Mass.

About 150 ft. in each case.—Worcester Consolidated Street Railway Company, Worcester, Mass.

Three to 15 ft.—International Railway Company, Buffalo, N. Y.

Usually entire length of rail. In a few instances several consecutive rails.—United Railways & Electric Company, Baltimore, Md.

Short spots except on curves.—Cleveland Electric Railway Company, Cleveland, Ohio.

At various places over 25 miles of tracks.—Indiana Union Traction Company, Anderson, Ind.

Three hundred to 400 ft. in three locations.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

Twenty to 40 ft.—San Juan Light & Transit Company, San Juan, P. R.

Q. 4.—Length of time rail was in service before corrugation appeared?

Varies from four months to five years according to the number of cars operated over it.—Boston Elevated Railway Company, Boston, Mass.

From one and one-half to four years.—Springfield Street Railway Company, Boston, Mass.

Cannot say; probably about three years.—Worcester Consolidated Street Railway Company, Worcester, Mass.

Thirteen years and seven years.—International Railway Company, Buffalo, N. Y.

Variable.—United Railways & Electric Company, Baltimore, Md.

From three months to ten years.—Philadelphia Rapid Transit Company, Philadelphia, Pa.

From three to four years.—Cleveland Electric Railway Company, Cleveland, Ohio.

From three to four years.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

Six years.—San Juan Light & Transit Company, San Juan, P. R.

Q. 5.—Length from center to center of corrugation?

Two to 6 ins., more or less.—Boston Elevated Railway Company, Boston, Mass.

Two to 12 ins.—Old Colony Street Railway Company; Boston & Northern Street Railway Company, Boston, Mass.

Four to 6 ins.—Springfield Street Railway Company, Boston, Mass.

Two to 3 ins.—Worcester Consolidated Street Railway Company, Worcester, Mass.

Three to 10 ins.—International Railway Company, Buffalo, N. Y.

Three to 8 ins.—United Railways & Electric Company, Baltimore, Md.

Ten to 15 ins.—Cleveland Electric Railway Company, Cleveland, Ohio.

One to about 2 ins.—Indiana Union Traction Company, Anderson, Ind.

One-half to 5 or 6 ins.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

Three to 8 ins.—San Juan Light & Transit Company, San Juan, P. R.

Q. 6.—Depth of corrugation?

Nothing to possibly 3/16-in.—Boston Elevated Railway Company, Boston, Mass.

From slight to about ⅛-in.—Old Colony Street Railway Co., Boston & Northern Street Railway Company, Boston, Mass.

One-sixty-fourth to 1/32-in.; very few 1/16-in.—Springfield Street Railway Company, Boston, Mass.

One-eighth to 3/16-in.—Worcester Consolidated Street Railway Company, Worcester, Mass.

One-sixty-fourth to 1/32-in.—International Railway Company, Buffalo, N. Y.

One-thirty-second to ⅛-in.—United Railways & Electric Company, Baltimore, Md.

One-sixteenth to 3/16-in.—Cleveland Electric Railway Company, Cleveland, Ohio.

About 0.01-in. or less.—Indiana Union Traction Company, Anderson, Ind.

Not appreciable yet.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

Nothing to ⅛-in.—San Juan Light & Transit Company, San Juan, P. R.

Q. 7.—Please describe rails most affected, giving the type, weight, manufacturer, date rolled, date laid, and composition of rail, if possible.

Ninety-five and 96-lb. half grooved and tram-top girder rails, rolled by Pennsylvania Steel Company and Lorain Steel Company, 1896 to date, because there were more of these than other types in the tracks.—Boston Elevated Railway Company, Boston, Mass.

Pennsylvania Steel Company, secs. No. 200 and 201 seem to be the ones most affected. The weight of rails 90-lb. and 85-lb. respectively, and laid about ten years ago.—Old Colony Street Railway Company, Boston & Northern Street Railway Company, Boston, Mass.

Nine-inch Trilby, Metropolitan Section; 107-lb. Trilby and 95-lb. half-groove, Pennsylvania Steel Company and Lorain Steel Company.—Springfield Street Railway Company, Boston, Mass.

Pennsylvania Steel Company semi-grooved girder rail, sec. 222; composition, ordinary rolling; date rolled, 1901; weight, 95-lb. to yard.—Worcester Consolidated Street Railway Company, Worcester, Mass.

Lorain Steel Company's sec. 94-313, semi-grooved, 1900 rolled, laid 1900; also Johnson Company., sec. 94-204, rolled 1894, carbon .45% to .55%; phosphorus not over .10%; silicon not over .20%; manganese .80% to 1.10%.—International Railway Company, Buffalo, N. Y.

Pennsylvania Steel Company, sec. 200.—United Railways & Electric Company, Baltimore, Md.

Do not have this information.—Cleveland Electric Railway Company, Cleveland, Ohio.

Seventy pound, A. S. C. E.; laid 1903; Lorain Steel Company, rolled 1902.—Indiana Union Traction Company, Anderson, Ind.

Six-inch, 72-lb. T-rail rolled in 1900 by the Cambria Company, carbon, .50% to .55%.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

Sec. 94—313 rolled 1899.—San Juan Light & Transit Company, San Juan, P. R.

Q. 8.—Please describe the track construction, giving the rigidity, drainage, condition of paving and general method of construction, and specify as between track in paved streets and truck laid on earth and loose stone or gravel ballast.

As a rule, on 6 by 8-in. ties with cast iron tie plates, 2-ft. 6-in. c.c. paved with granite blocks between rails and 18-in. outside, on gravel ballast. Also on tracks laid on concrete base, with all movement eliminated.—Boston Elevated Railway Company, Boston, Mass.

Rail is laid on ties in gravel ballast. Track is paved between rails and outside with cobble and granite blocks.—Old Colony Street Railway Company, Boston & Northern Street Railway Company, Boston, Mass.

Seven-foot, 6 x 6-in. chestnut ties, 2-ft. centers and tie rods 7 feet apart and some of track laid with concrete base with granite, block, brick, wood paving.—Springfield Street Railway Company, Boston, Mass.

Track tie-rodded every 5 ft. with standard 1-in. flat rods. Ties resting on gravel ballast; paving, granite block laid on cement foundation to bottom of ties with 2-in. sand, then the whole grouted with thin grout.—Worcester Consolidated Street Railway Company, Worcester, Mass.

Solid concrete 6-in. under rail full width of track and 2 feet outside; drainage natural; No. 1 Medina block stone on 3-in. gravel cushion; stone grouted one part Portland cement and three parts sand; laid 1900. On the Johnson Company, sec. 94-204, track laid 1904, sand tamped, common stone paving, Medina sand stone.—International Railway Company, Buffalo, N. Y.

Nine-inch girder rail laid in paved streets and spiked directly to tie, with gravel ballast.—United Railways & Electric Company, Baltimore, Md.

We have had very little trouble except on curves. All track has concrete or broken stone bed.—Cleveland Electric Railway Company, Cleveland, Ohio.

Subgrade loam or clay, gravel ballast; interurban track; tire 2-ft. c.c., drainage fair.—Indiana Union Traction Company, Anderson, Ind.

Concrete for 6 inches under ties. Asphalt pavement with granite toothing both sides of rails. City sewer underlaying in all three cases.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

Lorain sec. 94-313; rail laid on 6 by 8-in.; 8-ft. ties; 2-ft. centers on gravel ballast, track paved with brick on 6-in. gravel base.—San Juan Light & Transit Company, San Juan, P. R.

Q. 9.—Please describe location of corrugations, both on straight tracks and as to inner or outer rails on curves, with degrees of curvature; as to grades and their percentage; as to points where brakes are applied and all other locations tending to indicate a cause. Are opposite rails always corrugated?

Corrugations occur usually on curves and adjacent tangents from 20 to 100 ft., and occur first on outer rails both on the surface and side of treads, being later transferred to the inner rails to a greater or less degree.—Boston Elevated Railway Company, Boston, Mass.

Corrugations appear generally on the long rail of curves which have no guard rails. They seldom appear on straight, and never on the short rail of curves, or on curves which have guard rails on either side.—Old Colony Street Railway Company, Boston & Northern Street Railway Company, Boston, Mass.

Almost invariably the outer on slight curves 1,200 to 2,000-ft. radius. Our observation is at points where brakes are most used we find the most corrugation.—Springfield Street Railway Company, Boston, Mass.

Corrugations (four or five in number) found only on inner rails on curves of 800 to 1,000-ft. radius. On nearly level track just where brakes are frequently applied.—Worcester Consolidated Street Railway Company, Worcester, Mass.

Corrugations occur on tangent in spots all along the line, both where cars apply brakes and between blocks. On curves the worst corrugations come on outside rail; sometimes on inside curve of rail. Opposite rails are not always corrugated, although slightly affected.—International Railway Company, Buffalo, N. Y.

On both straight and slightly curved tracks. In the latter case, however, only noticeable on outer rail. Grade does not seem to have much bearing on this matter. Opposite rails are not always corrugated.—United Railways & Electric Company, Baltimore, Md.

The corrugations have appeared on the outside rails on long, easy curves, where cars go fast and are not started. Radius about 300 feet.—Cleveland Electric Railway Company, Cleveland, Ohio.

Corrugations not peculiar to either curves or tangents; noticed on 1-degree curve but on none of greater curvature; grades easy; not confined to either side of track on either curve or tangent.—Indiana Union Traction Company, Anderson, Ind.

Straight track only; both rails; no reference to braking; believe it is in formation of rail, as rail affected is all from one rolling.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

Corrugations occur on outer rail on 500 to 1,000-ft. radius curves on grades and on level track. Opposite rails not affected. —San Juan Light & Transit Company, San Juan, P. R.

Q. 10. Please describe the traffic conditions at points of corrugation, giving frequency of car service, weight, types and speed of cars, type of brake used, type of truck employed, etc.

Too complicated on this system.—Boston Elevated Railway Company, Boston, Mass.

Corrugations are more pronounced and are longer on track when only single-truck cars are used.—Old Colony Street Railway Company, Boston & Northern Street Railway Company, Boston, Mass.

Double-truck car; three-minute car service; 20 to 22 tons. Straight side car; speed, eight miles per hour. Christensen air brake. Majority, Wason No. 16 truck.—Springfield Street Railway Company, Boston, Mass.

About two-minute headway on average during daytime; weight of maximum car, 25 tons. Both double and single-truck. Trucks: Taylor, Bemis, Laconia & Brill (single) and Curtis. Brakes, mostly air.—Worcester Consolidated Street Railway Company, Worcester, Mass.

One-minute service; 18 to 30-ton cars; J. G. Brill type of car.—International Railway Company, Buffalo, N. Y.

On one line in the morning the headway was three and four minutes. Five minutes throughout the day and three minutes during the evening, rush trips. The past year double-truck four-motor cars, weighing 45,000 pounds, light, with Brill, 27 G.E.1 trucks were used. Previous to that time, single-truck cars, averaging 20,000 pounds were used. Type of brake on both of these equipments was a sliding brake rigging. On another line the service was three minutes in the morning, four minutes throughout the day and two minutes during the evening, rush trips. For the past five years the cars used upon this line have been double-truck cars, in the winter weighing 29,000 pounds light, and in the summer, 12-bench and double-truck open cars, weighing 30,000 pounds, light. The trucks on both of these types of cars are Brill maximum traction, having a sliding brake rigging. The schedule speed upon both of these lines averages between eight and nine miles per hour and with a maximum for the four-motor equipment of 22 miles per hour. For the maximum traction two-motor equipment from 18 to 20 miles per hour.—United Railways & Electric Company, Baltimore, Md.

Double-truck cars; city and suburban, 37,000 pounds; 50,000 pounds; one to five-minute service; 10 to 18 m.p.h.; air brakes, Baldwin & Brill.—Cleveland Electric Railway Company, Cleveland, Ohio.

An average of twenty cars each way per day.—Indiana Union Traction Company, Anderson, Ind.

Heavy double-truck cars; about two-minute headway. Hand-wheel brake.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

Cars of 13 tons capacity of 7.5-minute headway, passing at speed of eight miles per hour; maximum traction trucks. Hand brakes.—San Juan Light & Transit Company, San Juan, P. R.

Q. 11.—Please state what remedies have been applied, if any, and what result has been obtained therefrom; also the cost of applying such remedies, if possible.

We have temporarily helped matters by grinding off the top surface of corrugated rails, using a specially constructed motor-truck geared to advance slowly, the grinding wheel being guided so as to leave a plane surface on the top of the rail. As, however, this process does not take out the corrugations on the side of the head at the gage line, the hollows, after a while, occur again on the top surface of the rail, sooner than they would on a new rail.—Boston Elevated Railway Company, Boston, Mass.

We have used a rail grinder in a few instances. Not very satisfactory because it is almost impossible to get a level surface the same as on a new rail.—Springfield Street Railway Company, Boston, Mass.

No remedies tried to date as corrugations are not deep enough to cause trouble.—International Railway Company Buffalo, N. Y.

No satisfactory remedy has been applied.—United Railways & Electric Company, Baltimore, Md.

None; took rails out.—Cleveland Electric Railway Company, Cleveland, Ohio.

No remedies applied.—Indiana Union Traction Co., Anderson, Ind.

Not developed sufficiently yet.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

Q. 12.—Please give your general conclusions in the matter and such other information as you may think pertinent.

Many different theories have been advanced as to the cause of this trouble, and several remedies suggested, but the rails continue to become corrugated, even where the greatest care has been taken with the track construction to make it perfectly solid and free from vibration, and to properly widen the gage on the curve, etc. The conclusion seems to be that it is the direct result of the way that the trucks are designed at the present time and that there will be no effectual remedy until the wheels on each axle are made to always set radially. Of course, to bring about such radical changes in design involves many and, perhaps, insurmountable mechanical difficulties, so that rails will undoubtedly continue to corrugate for some time to come.—Boston Elevated Railway Company, Boston, Mass.

We have the grooved rail in paved streets with concrete base, in the streets where we have gravel, and also in streets finished with macadam. We find that most of our corrugation is in the paved streets. It may be on account of having heavier traffic in the paved streets. We have not any T-rail that is corrugated, and we have not any corrugated rail on tracks where we run only single-truck cars.—Springfield Street Railway Co., Boston, Mass.

Thick, poorly adjusted brakes and their improper use, soft spots in rails, possible loosing of ties or too much rigidity of track, all might be responsible for corrugations.—Worcester Consolidated Street Railway Company, Worcester, Mass.

We feel that a number of conditions produce corrugations: 1. Design of rail; web weak for weight of cars. 2. Side-bearing rail causing bad turning movement and causing side movement. 3. Material rolled too hot, causing soft and hard spots in rail.

4. Poor workmanship on concrete under rail, allowing rail to work.—International Railway Company, Buffalo, N. Y.

We have quite a lot of rail, Lorain Steel Company, sec. 86-329, bought and laid in 1898, which shows corrugation. None of this is so bad that it affects the riding of the car. We have not gone into the theory of the corrugation to any extent and are unable to throw any light on the subject. We have practically the same section which was put down in 1890 and 1891, and which is in some sections, corrugated, but it is no worse than that put down in 1898, is as bad.—Capital Traction Company, Washington, D. C.

We believe that the webs of rails are too light and that there has been a movement in the foundation. We know that when we had the most trouble the concrete was the poorest. On curves we believe that the currugations are caused by the slipping of the wheels.—The Cleveland Electric Railway Company, Cleveland, Ohio.

Rail second quality from the best information I can obtain.—Indiana Union Traction Company, Anderson, Ind.

The primary cause of corrugations in street car rails, it is assumed here, is vibration, either in the rails or in the entire track structure; that is, the wheels of motor or other power-driven cars have a tendency to skid or slip because of the rapid vibration of the rails, which, by reason of the inertia of the car, the wheels are unable to follow instantaneously, thereby causing friction between the wheels and rail to vary in accordance with the wave length of vibration.

The corrugations may arise from any one of four different causes, namely: the vibration or lateral bending of the web of the rail itself; the rails being loose on their supports; the ties being loose on their foundations; the vibration or movement of the foundation immediately under the track structure. Which one of these defects or conditions caused the corrugations can be ascertained by inspection of the head of the rail. Each condition produces corrugations of a different character, not only in length and form, but also with certain other peculiarities difficult of explanation without referring to a case in point.

The writer has several times been asked why these corrugations do not appear more frequently on steam roads, if they are, as he believes, due to vibration. The answer is, in his opinion, that the comparatively loose rail is forced ahead by the great weight of the locomotive in the well-known long wave, and that there is very little slipping in the wheels of the trailer cars. The writer has had several letters from engineers of foreign roads, describing their troubles with corrugated rails, and has noted that in the most serious cases the rails were supported by chairs or were provided with some form of a cushion. He thinks a careful inspection would show that there is a slight movement between the rail and its supports.

It has also been called to his attention that on some street car tracks where the rails were extremely loose there were apparently no corrugations. He has found, however, that in many cases the corrugations actually existed, but in such elongated form as not to be apparent from casual inspection. However, a rail flexible enough to produce only these long corrugations would bring other troubles quite as serious, and it would be practically impossible to maintain such a track in any heavily traveled paved street.

The writer has made quite a number of experiments and trials to verify his theory, and would call attention to one case. About five years ago it was proposed to reconstruct a section of double track about 2,000 feet in length, using a 90-lb. 9-in. girder rail laid on ties on a gravel base. When the excavation was made, however, the earth was found to be very spongy, consisting of clay and water-bearing gravel. For this reason the excavation was carried about 7 inches below the ties, and the space filled with concrete to a point one inch below the grade of the bottom of the ties. The ties were then carefully tamped with a mixture of fine concrete and the space between them filled to the base of the rail, which was also tamped. An additional two inches of concrete was then placed as a foundation for the paving.

After a year's service the rails of both tracks were found to be badly corrugated over practically their entire length, the corrugations being one inch to 1.5-in. apart and extending from the gage line over about two-thirds the width of the head. In order to ascertain the cause of this trouble, the paving and the concrete were removed above the ties, both in and outside the rails, and a careful inspection was made and measurements taken to ascertain if there were any vertical movement in the road-bed or rails, but none could be detected. It was thus evident that if the writer's theory was correct, there must be a lateral bending or vibration of the rail itself, and in order to ascertain if this were a fact an instrument was constructed. The frame may be rigidly clamped to the base of the rail, and a vertical arm is provided with a piston carrying a nut. The piston may be forced against the head of the rail by a spring behind the nut. The upper end of a hand or pointer engages the nut, the other end resting on a graduated arc. The lengths of the upper and lower arms of the hand or pointer are in the ratio of 10 to 1, each gradation representing 1/64 of an inch.

In using this machine it is only necessary to clamp it to the base of the rail and set the lower end of the hand at zero, which can be done by turning the piston in the nut. The amount of the lateral motion in the head of the rail, due to bending or bucking of the web, will then be indicated by a marker which is placed against the hand before a car is allowed to run over the rail. In many cases a movement of 3/32 of an inch has been noted.

In order to further verify the results of this experiment, fish plates 30 feet in length were secured and bolted to the outside of the rail, thus giving a support to the head and greatly stiffening the entire rail. After a few months it was found that on rails equipped with these fish plates corrugations were rapidly disappearing. As strengthening the rail in this matter would be too expensive to be practical, it was decided to stiffen the web of the rails by using a special brace on each alternate tie along the outside of the rails. This work was completed a little over a year ago, and a recent inspection shows that nearly all of the corrugations have disappeared.

It has been noted by some roads that corrugations were appearing on rails laid on a concrete base, but in every case that has come to the notice of the writer the rails had been temporarily supported by wooden ties, concrete being tamped under the base of the rail between the ties with no provision made for taking up the shrinkage, which always takes place during the settling and drying of the concrete.

In many cases where track is constructed in this manner the rails seldom have a continuous or uniform support, by reason of their not having anchorages or holding-down devices other than spikes in the ties, spaced at long intervals. This results in a slight movement of the rail on its foundation, and soon causes corrugations to appear, although quite frequently where light rail is used the trouble comes from the bending or buckling of the web of the rail, as noted above.

The writer believes that in concrete road-bed construction, it is absolutely necessary to provide some means of drawing the rail down on its bed, thereby taking up the shrinkage and preventing any liability of the rail moving on its foundation. In this class of construction, vibration can be prevented only by providing a rail of the proper design and an absolutely uniform and continuous support.

When the trouble in tie construction is found to have been caused by loose rails or ties, the only remedy is to grind or file the head of the rails, and to immediately follow this work by firmly securing the rails to the ties and by tamping, using a coarse gravel wherever the foundation is found to consist of soft or spongy material.

Corrugations in light rails, due to the bending of the thin web, are difficult to remedy without considerable expense, but after the heads have been filed to a comparatively smooth surface, it has been found that setting the track to a slightly wide gage will sometimes prevent a recurrence of the defect.

It is very difficult to grind off the summits of corrugations without a specially constructed machine mounted on a truck and practically impossible with the usually portable grinding equipment, consisting of an emery wheel connected to a motor by a flexible shaft, because when the eye approaches the rail closely enough to permit the operator to manipulate the wheel the corrugations apparently disappear. In nearly all cases filing is probably the best method. The file should be mounted in a heavy cast-iron holder having guiding lugs bearing along the gage line of the rail and equipped with long handles at each end, so as to permit of operation by two men from a standing position. To prevent the possibility of trouble from bending of the webs of the rails, the writer, about two years ago had the web of the heavy rail which his company is using increased to a thickness of 9/16-in. In support of the theory which he has advanced, he would add that on a system of about 600 miles he has been able to reduce the amount of corrugated rail to a very small percentage. The price of immunity from this

trouble, however, is eternal vigilance, and it might also be added, the expenditure of considerable money in maintenance when any form of wooden support is used.—Philadelphia Rapid Transit Company, Philadelphia, Pa.

Respectfully submitted,

Fred G. Simmons, Chairman.
Thos. K. Bell.
C. A. Alderman.

REPORT OF THE COMMITTEE ON OPEN VERSUS CLOSED TERMINALS FOR CAR HOUSES

On investigation of the points at issue in the proposed discussion, it appears that there has been some misinterpretation of our subject. It can be established beyond all reasonable doubt that there is no question about open or closed storage for cars that are not in operation or out of season equipment. It is certain that a car standing idle will depreciate faster in the open than it would if placed under cover, let this cover be a building, canvas or any other protection. Besides, a greater expenditure for maintenance would be required than what is represented in the saving of the first cost of the cover, plus the maintenance of a protected car. So we are presuming that our subject evolves itself into a discussion as to whether or not it is economical and desirable to operate cars out of an entirely closed depot or out of a terminal that only has a shelter for offices, men's quarters, inspection shed, etc., and with the trackage in general or part unprotected.

Then the subject before us deals with live cars and rolling equipment in service. As soon as a car is not fit for the road for any length of time, it is to be taken off the premises and put into permanent protected storage or shop. Again open terminal operation would not be a fair question in climates subject to severe weather conditions, say, where there were long, rainy seasons, or much snowfall. Then an open terminal would have an advantage where a considerable percentage of the rolling equipment was changed each season. Take the case of summer and winter cars, where summer cars are used four or five months and closed cars the remainder of the time. Here the equipment is out of service and placed in a regular storage barn; so in this case a car is protected a considerable portion of its existence, let it be or not be operated from an open yard.

If a railroad company is not able to obtain a large amount of money at one time, an open terminal would seem to have a considerable advantage and be worthy of important consideration. Then the existing conditions are liable to vary on account of consolidation of lines or other causes; and in this modern day of different ideas of different organizations, there is often a question about permanent location, so here we have another point commendable for the small investment.

To make the discussion clear and intelligible, several layouts are submitted that represent actual practical examples of car-barn operation that are now being carried out on some of the large properties.

Referring to Fig. 1, we have a closed operating depot. The general construction is pretty well illustrated in the figure. There are twelve tracks under cover and one track outside. The offices, men's quarters, lockers, toilet rooms, etc., are on the second floor at the front of the structure, while at the west side are provisions for starter, another toilet and bins for sand, coal, salt, coke, a compartment for oil and lamps and a storeroom. The special work is arranged, so that cars may enter the building in the front and leave by the rear. There is a pit 150 ft. long under each track, so that a car entering the barn must necessarily pass over it before being permanently placed. All the floors are 5-in. concrete, cement finish on a sub-base of 12 ins. of ashes.

The walls of the building are of brick, 12 ins. thick, with 24-in. x 20-in. pilasters on 16-ft. centers, and there are four bays, each containing three tracks, so that the fire risk will not be excessive in any one compartment. There is a clear space of 16 ft. under trusses and the roof is of heavy mill construction with wire glass sky-lights and galvanized-iron ventilators. Trolley wire is protected by troughing and light wire is enclosed in metal conduit approved by the underwriters. There are ample provisions for other fire protective apparatus; outside fire hydrants, inside fire hydrants, chemical fire extinguishers, fire pails, auxiliary fire alarm and a sprinkling system.

It is understood that the committee does not submit the details of the depots as a criterion or standard type, but is presenting the layouts as representing permanent modern construction, with all necessary requirements; but at the same time of economical design. It is evident that the cost per square foot will be low as compared with some of our present structures that represent operating depots. Many are long spans, high roofed and elaborate in detail, that would often mean an increase of fifty per cent over the figures that we are about to use. It is noted that the cost of a sprinkling system is included in the terminals, but in using figures for open terminals against closed terminals, no advantage is taken of the cost of the sprinkling equipment. It appears, however, that in using an open yard for operating, it would not be very practicable to install a sprinkling system, but fire hydrants, chemical fire extinguishers, water pails and an auxiliary fire alarm system would be necessary.

Now the same barn illustrated by Fig. 1 may be considered an open operating terminal by simply cutting a portion of the building as designed by line A B on drawing. Then we would have offices, men's quarters, etc., still intact and protection for 100 ft. of pits so that repairs and inspections could be comfortably carried on. Similarly any portion of the operating barn outside of line A B may be taken away.

Fig. 2 is intended to show another lay-out but on a somewhat different plan. In this example the offices, men's quarters, inspecting shed, etc., are separate from the barn proper and do not represent a minimum space design, but have the advantage of convenience. Here it is taken that the barn is located at the end of the division and also is the turning point for cars when in service. We also have pits 150 ft. long as previously figured but in addition there is an inspection shed with a pit that is protected. So that each trip a car makes in going around the loop, it must pass through the inspection shed and over the pit, where it is examined and inspected by the regular housemen. Again, the major portion of the repair work is done in the day time, and night repairing, when cars are supposed to be in storage and out of service, is reduced to a minimum. Considering the lay-out as a closed terminal, we have four tracks in each bay, and the walls are of brick and the roof made up of steel trusses arranged with louvres of sky-lights the entire length. Here we also have 16 ft. under trusses and a concrete floor. Separate buildings are of a substantial brick design and of one-story construction. The fire protection for the entire design would follow on similar lines to those described in the first figure.

Fig. 2 may be considered an open terminal by retaining the office building, inspection shed and pits. The cars in the yard under such an arrangement would have no protection. Again any portion of the barn proper may be retained.

Fig. 3 shows still another form of an open car-barn terminal, where the scheme of Figs. 1 and 2 are consolidated. Like Fig. 2 the office building is a separate structure, but similar to Fig. 1, part of the trackage is protected for inspections and repairs. However, in this lay-out we have a terminal that would take care of fifty cars where in the others suggested eighty-four cars would be operated. Besides, the design only allows cars to enter from one end of the property, and if single equipment was operated the cars would be required to back into and out of the property; so double-end operation would be more favorable. In this lay-out it is noted that provision is made for proposed closed barn sometime in the future. It seems it would be good practice in building an open operating terminal, under any conditions, to allow for converting it into a closed terminal, if ever, in the future, it is considered advisable.

Below is an estimate of the cost of the different depots that have been referred to above. In the estimate submitted only the price of the building has been considered, for it is understood that the track lay-out, when we are comparing open and closed operating depots at the same location, is practically equal, so that the question of trackage does not enter into the discussion:

Fig. 1, closed terminal (plus $14,000 sprinkling system)	$105,000
Open terminal cut off at line A B	45,000
Difference	$60,000
Fig. 2, closed terminal (plus $14,000 sprinkling system)	$108,000

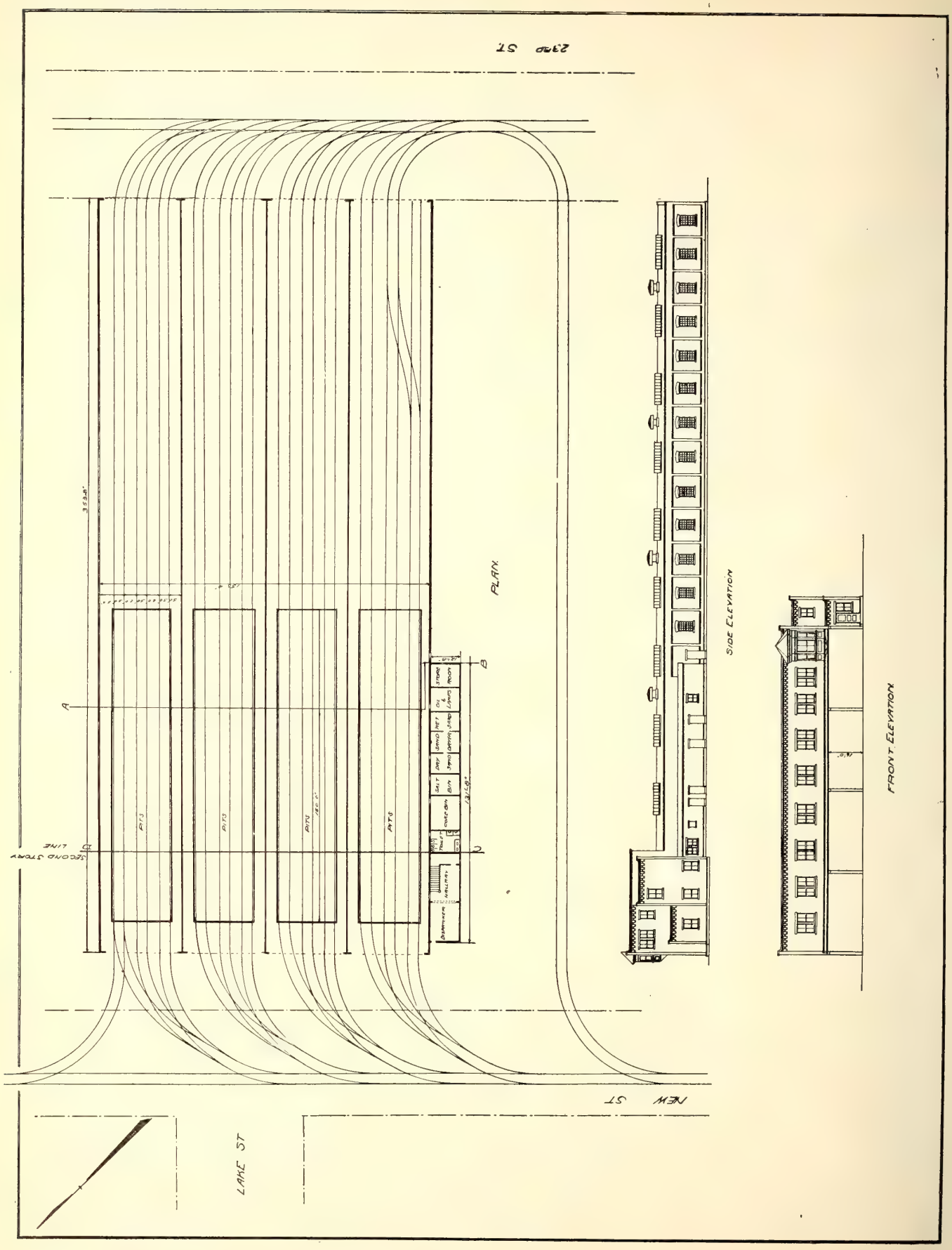


FIG. 1.—OPERATING TERMINAL, CAR HOUSES AND OFFICES UNITED

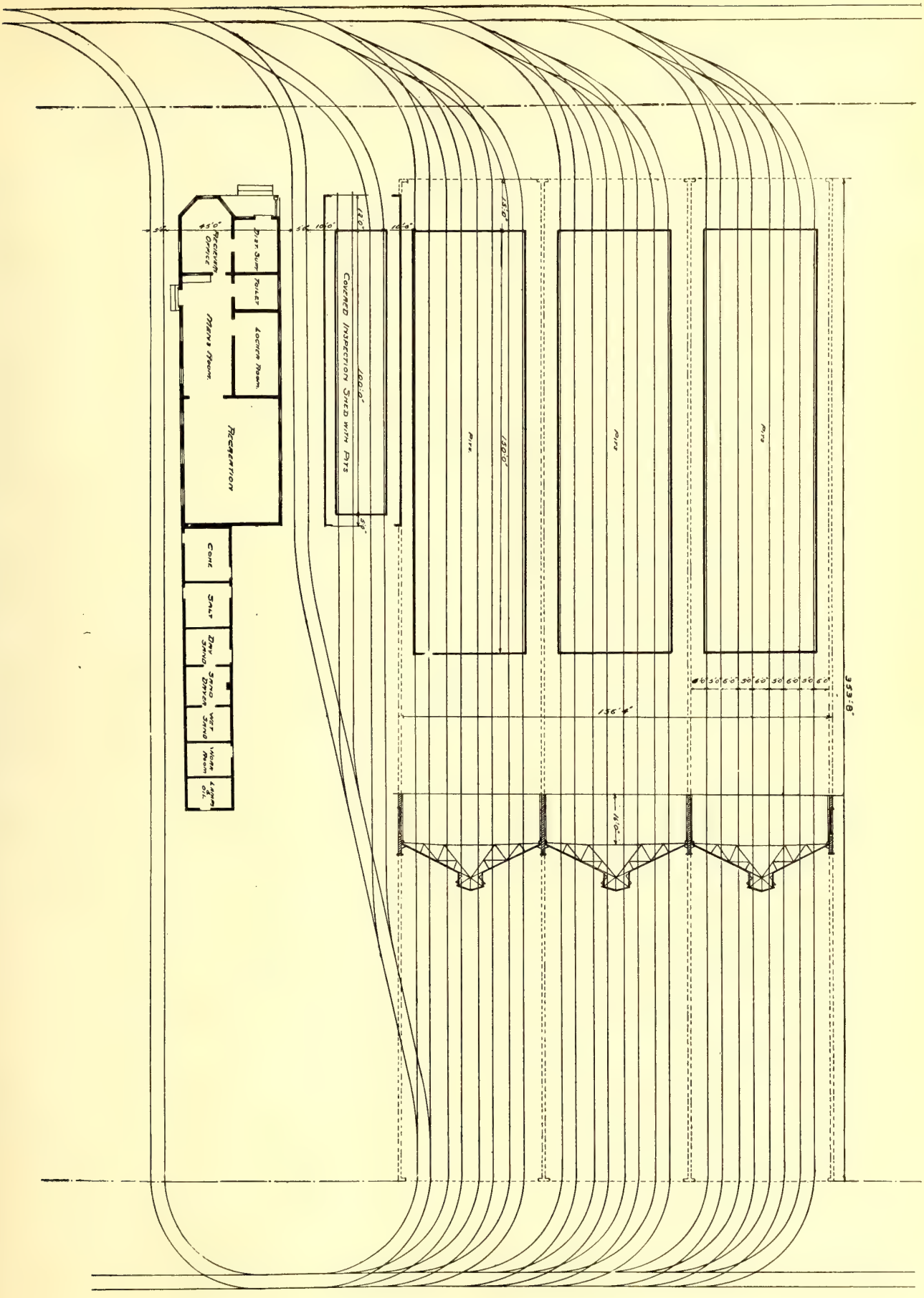


FIG. 2.—OPERATING TERMINAL, CAR HOUSES AND OFFICES SEPARATE

Open terminal trackage unprotected	25,000
Difference	$83,000
Fig. 3, closed terminal	$108,000
(plus $14,000 sprinkling system)	
Open terminal, offices remain and 100 ft. of barn	49,000
Difference	$59,000

Referring to Fig. 1, open car-barn lay-out, shows a saving in the first cost of $60,000 over the closed barn; and figuring five per cent on investment and seven per cent on insurance, taxes, maintenance and depreciation, we have a total of twelve per cent, which represents an annual saving of $7,200. Of course, there may be further variations in the saving by simply changing the area of the protected section of car barn; in other words, is subjected to, in order to come to any decision for or against an open or closed operating barn. In the lay-out in Fig. 1, figuring the length of a car to be 50 ft., including clearance, the barn would accommodate 84 cars; assuming that two-thirds of the cars are regulars running from six o'clock in the morning to twelve at night, and one-third are trippers that are on the road six hours out of the twenty-four, and all the cars are in the house from twelve at night until six in the morning, then we have the following figures:

Total hours possible with the equipment	84 by 24 = 2016
Regulars	56 by 18 = 1008
Trippers	28 by 6 = 168
Total	1176

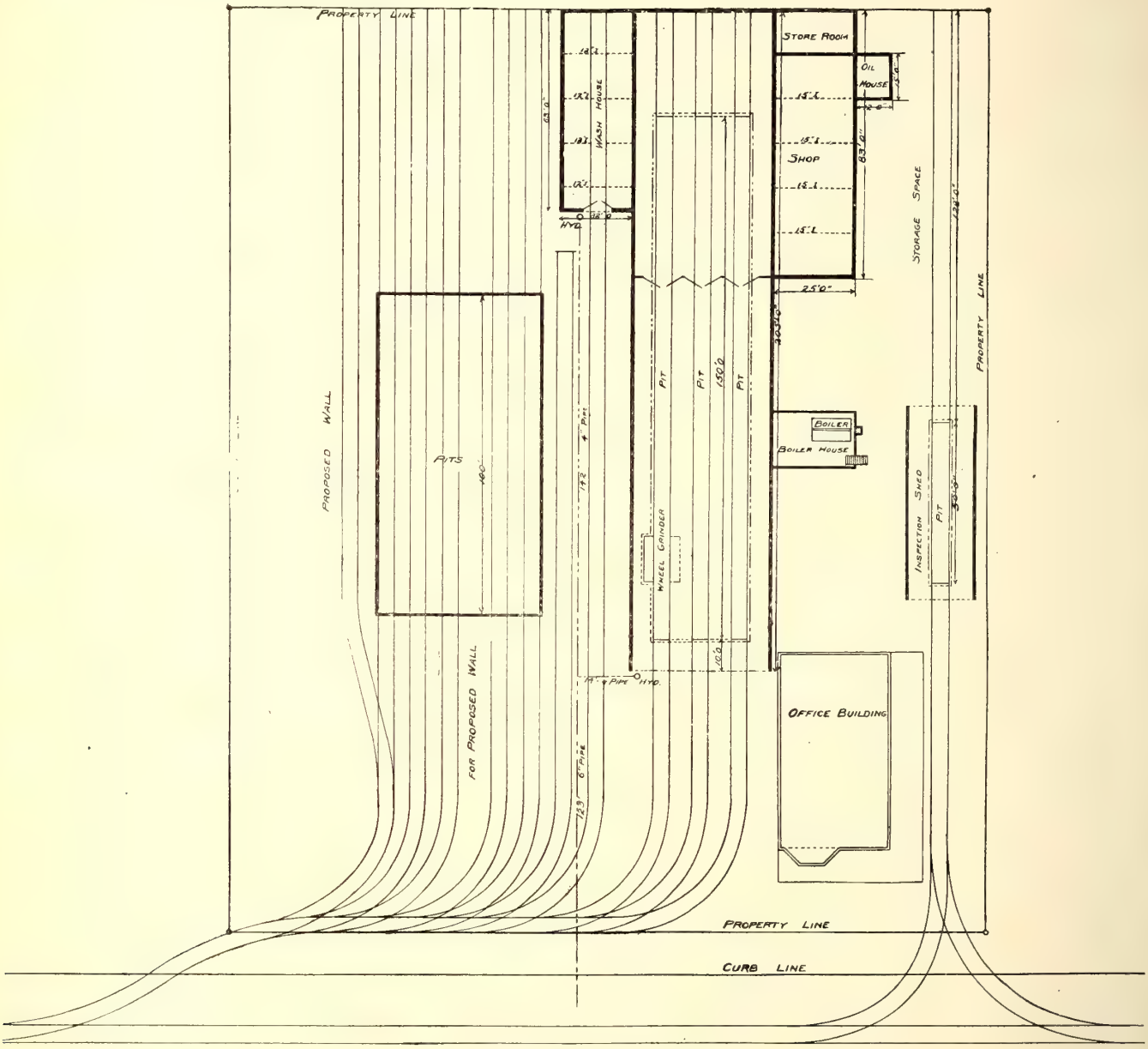


FIG. 3.—SEMI-CLOSED TERMINAL

when we increase the building covering a portion of the tracks, the annual saving decreases and when it becomes nothing we have a closed barn.

Fig. 2, open car-barn lay-out, shows a saving in the first cost of $83,000 and $59,000 respectively, and an annual saving of $9,960 and $7,080.

From the above it is plain that there is good reason for considering an open operating terminal. To take a concrete example, and as afterward will be explained, it is not held that the particular property or condition designated generally applies, but it is necessary to know what are the conditions the property against a possible 2016, so we have about 50 per cent of the equipment out of the barn all the time. The terminal designated when considered as an open barn, cut off on line A B, is designed to protect about one-third of the equipment. In other words, all cars standing in the barn from six o'clock in the morning until 12 o'clock at night, are protected, and the different cars could be housed on different days. Certainly those that were disabled would naturlly be the ones retained in the barn, so it appears the principal advantage of a closed terminal in this particular instance is the fact that from twelve o'clock at night until six o'clock in the morning, two-thirds

more cars are under cover, which is not the case with the open arrangement. This means besides the first cost of investment of $60,000, it is worth $85 per car per year for every car that is being operated in order to accomplish the result. Figuring that it costs $400 to maintain a car for a year and the entire maintenance for body, painting and varnishing is twenty-five per cent we would have $100 for these items, which makes it appear favorable for the open yard. In Fig. 2, we do not have the advantage of protecting one-third of the equipment between rush hours but on the other hand the difference for an open terminal would be $83,000 and $59,000, first cost of investment and $118 and $84 per car per annum. A master mechanic of a very large road made the statement that the life of the paint is 50 per cent less for open-yard operation than for closed operation, and the maintenance for modern electric equipment is the same, while the deterioration of bodies and woodwork is not over 25 per cent in favor of a housed car.

On the other hand, there are considerations backed by important advantages for tracks that are entirely protected and those advantages go a considerable way in neutralizing the saving we have designated. The bad feature about a car being outside all the time is that the joints in the woodwork do not have an opportunity to dry out, causing a rapid deterioration. Panels become wet and spongy all the way through and their life is shortened, as well as that of the roof. When the rolling equipment is entirely protected by a cover there is ease of inspection, and this has more significance than its literal meaning, because in severe weather it is unfavorable for workmen, who will not do as well when they are forced to work in discomfort and exposure. Experience has proven that attention and proper repairs to cars in the open are neglected and encourages carelessness on the part of the housemen. Naturally the little necessities will be let go for another time, which is sure to have a serious effect on the economical maintenance of the equipment and increasing depreciation. In fact, it is very difficult for any one to anticipate how much open inspection or storage of cars does affect the entire cost of maintenance, on account of the reasons referred to. It is not only the direct results of the paint, varnish, woodwork and wiring that is affected, but how much does the rest of the equipment suffer? Of course, this argument is very materially reduced when cars are taken care of in an open barn, as in Fig. 2, and where they are inspected every trip. There is no doubt that considerable inconvenience as well as cost is caused in open-terminal operation during severe weather. Brakes are set when a car is run in and the motors are more or less heated and then snow drifts in so that as soon as the equipment cools off sufficiently to freeze, the brake shoes hold fast to the wheel. It is also necessary to send out the cars in severe weather on the road unclean which is more or less unsatisfactory.

Another consideration for the closed terminal is the increase in the number of extras that are run on most systems, especially in large cities. With many companies practically the same number of extras are handled as regulars. This increases the number of cars to keep in storage between rush hours. Then, when the terminal is large there is the advantage of dividing it into separate compartments for better fire protection.

Summing up the situation it is positive that a marked saving could be made if the conditions on the particular property were favorable, by using an open lay-out. But the committee is not prepared to make a general statement recommending either open or closed terminals, without first knowing the conditions that exist on the particular property. However, below are seven questions and answers, which would seem to make it a comparatively simple matter to decide for or against an open or closed terminal:

(1) Climate?
(2) Finance?
(3) Do you anticipate any change in desired location?
(4) Are the same cars operated the entire year? Or do you have an open and closed car-barn equipment with permanent storage for out-of-service cars
(5) What proportion of the 24 hours are all of your cars housed? What proportion of cars are in barn between rush hours?
(6) Do you intend storing out-of-season or out-of-service cars at operating terminals? Or do you have other locations for permanent storage?
(7) Is most of the repairing and inspection of rolling equipment done in the day time or at night? And will barn be located so that an arrangement would be desirable as shown in Fig. 2?

CONCLUSIONS:

(1) Mild and comfortable climates would be favorable to unprotected yards. Extreme weather would make closed terminals desirable.
(8) Inability of management to get large sums of money for investment would favor an open terminal.
(3) Anticipated change in location would want an open terminal.
(4) A large proportion of cars when out of season stored in separate storage barns leans toward unprotected terminals.
(5) The more cars housed and the less on the road the entire 24 hours favors protected trackage.
(6) If the terminal is used for storing out-of-service cars as well as actual operating rolling equipment it makes protected depots a necessity.
(7) If terminal is located at lay-over point or end of trips for all cars, so that they may be inspected at turning points and no repairs are made at night, this would be a point in favor of an open-operating barn.

Respectfully submitted,

Edwin W. Olds, *Chairman.*
John Hanf,
Martin Schreiber.

REPORT OF THE COMMITTEE ON STANDARDIZATION

Your committee appointed to investigate the subject of standardization as applied to electric traction equipment reports that it has proceeded upon the lines laid down for this committee in the year 1906, and has investigated the same topics, namely:

(a) Standard axles, journals, journal bearings and journal boxes.
(b) Standard brake shoes, brake shoe heads and keys.
(c) Standard section of tread and flange of wheel.
(d) Standard rails.

Considerable work on all of the above subjects was done by the committee during the year 1906, both previous and subsequent to the convention at Columbus, and all the information given in the data sheets was compiled in tabular form for consideration by the committee.

It was subsequently decided desirable to have the subject of rails considered by the Way Committee. All the information received on this subject was turned over to that committee by direction of the president, and that committee will submit a separate report. This committee has considered the subject of rails and special work only as affecting the recommendation of a standard wheel tread and flange.

In order thoroughly to study the conditions affecting the above subjects, the committee held meetings in New York on May 20 and 21, in Cleveland on July 26 and 27, and again in New York on September 12 and 13, 1907. At each of these meetings representatives of the various manufacturers of all the equipment under consideration were present, and materially assisted the committee in arriving at the recommendations which are embodied in this report. Abstracts of the discussions at these meetings have been printed and widely circulated and this has resulted in a favorable sentiment toward the subject of standardization. The committee appends the stenographic reports of its meetings, blue prints, and other information obtained bearing on the subjects under discussion.

(a) STANDARD AXLES, JOURNALS, JOURNAL BEARINGS AND JOURNAL BOXES

A consideration of this subject disclosed that it would be very difficult to adopt standards which would accommodate, to any general extent, the equipments already in service. After a thorough discussion by the representatives of all the interests involved, this committee decided to recommend arbitrary dimensions which conform to what is believed to be the very best recommended practice, at the same time meeting as nearly as possible the requirements of the existing conditions. The dimensions proposed very nearly approach the standards adopted by many of the large electric railway properties of the country.

In this connection the committee has profited very materially by the experience of similar organizations which have developed the axle problem since the beginning of operation of railroads in this country, and this was found to be not only valuable in

taking advantage of what experience had taught, but also desirable from a commercial standpoint. We, therefore, recommend the axles shown in Fig. 1 and designated as EA, EB, EB-1, EC, EC-1, and ED. A general summary of the axle and gear data is given in Table I.

Table I. Summary of Axle and Gear Data.

Type.	Journals, inches.	Motor fit, inches.	Gear fit, inches.	Wheel fit, inches.	Distance between hubs.	Centers of journals.	Maximum capacity.	Horsepower.	Length of gear seat.	Gear pitch.	Gear face, inches.	Diameter of gear hub and motor bearing flange.	Finished width gear hubs. Wheel side.	Finished width gear hubs. Motor side.
EA	3¾ by 7	4½	5½	5 7-16	48	75	15,000	45	6⅛	3	5	8	1	⅛
EB	4¼ by 8	5	6	5 15-16	48	75	19,000	45- 65	6¼	3	5	8	1	⅛
EB1	4¼ by 8	5½	6	5 15-16	48	75	22,000	65-100	6⅛	3	5	8	1	⅛
EC	5 by 9	6	7	6 15-16	50	76	27,000	100-150	6⅛	2½	5¼	9½	⅛	¾
EC1	5 by 9	6½	7	6 15-16	50	76	31,000	150-200	6⅛	2½	5¼	9½	⅛	¾
ED	5½ by 10	7	8	7 15-16	50	77	38,000	200-250	6⅛	2½	5¼	10½	⅛	¾

Axle EA has a journal of 3.75 ins. x 7 ins. It is designed to carry a load of 15,000-lbs. per axle and for the accommodation of motors not to exceed 45-hp capacity.

Axle EB has a journal 4.25 in. x 8 ins. and is designed to carry a load of 19,000 lbs. per axle and for motors not to exceed 65-hp capacity.

Axle EB-1 has the same general dimensions as axle EB, except that it is 5.5 in. in diameter at the motor-fit. It is designed to carry 22,000 lbs. per axle, and for motors not exceeding 100 hp capacity.

Axle EC has a journal 5 by 9 in. It is designed to carry a load of 27,000-lb. per axle, and is intended to accommodate motors not to exceed 150-hp capacity.

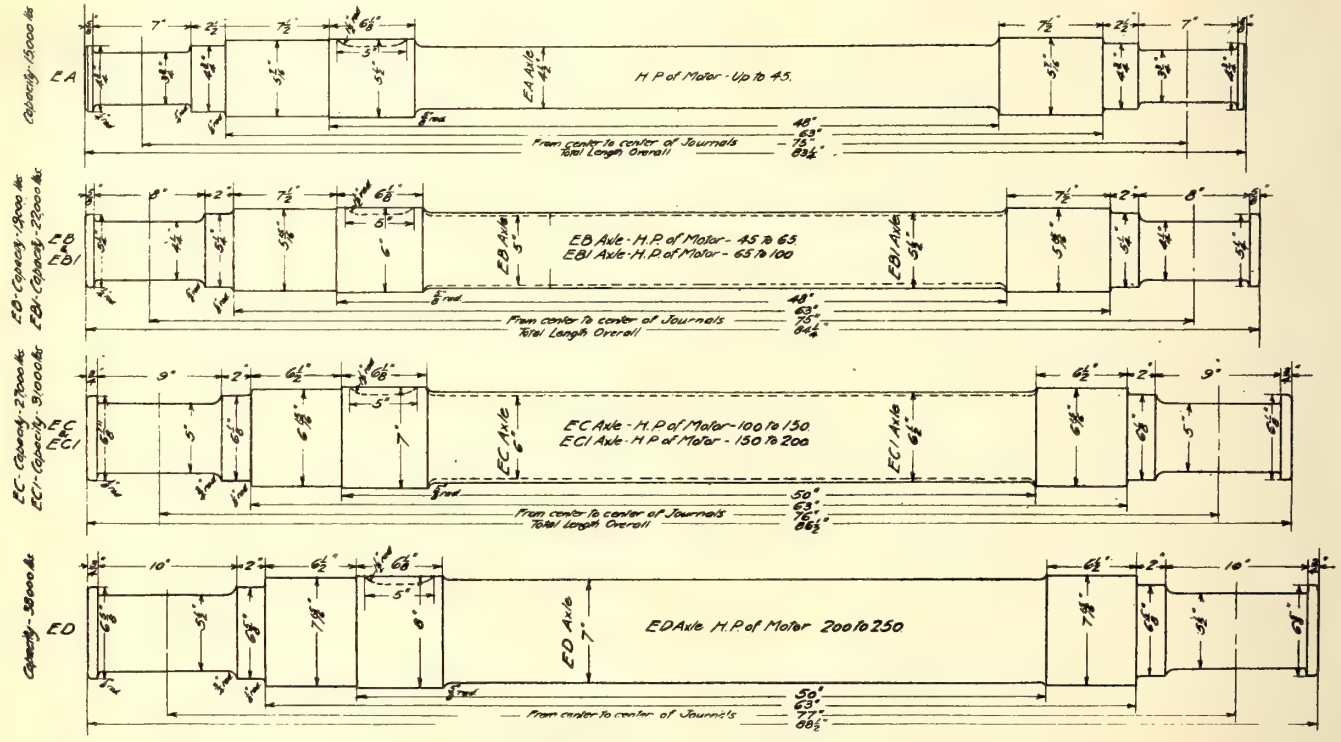
Axle EC-1 is of the same general dimensions as axle EC, excepting that the diameter at the motor-fit is 6.5 in. It is designed to carry 31,000 lbs. per axle and to accommodate motors not exceeding 200-hp capacity.

Axle ED has a journal of 5.5 x 10 ins. and a carrying capacity of 38,000 lbs. per axle. It is designed to accommodate motors not to exceed 250-hp capacity.

Axles EA, EB and EB-1 are to accommodate motors that do not require more than 48 ins. between the wheel hubs, and axles EC and EC-1 and ED are to accommodate motors that do not require more than 50 ins. between hubs.

Particular attention is directed to the dimensions given on these axles, all of which were worked out with a great deal of care by the committee and were adopted only after a very careful consideration of each and the relation of each to all the others. This applies with particular emphasis to the diameter and length of wheel fit, diameter and length of gear fit, the gear keys and the diameter of the motor fits. The discussion in connection with these subjects developed that the dimensions recommended by the committee are the most desirable and very acceptable to the manufacturers of the different parts of the equipment. Their original adoption will result in eliminating a great variety of dimensions of these parts. This lack of uniformity in the past has worked a particular hardship, not only on the manufacturers, but also upon the companies operating the equipment.

Special attention is directed to the length of gear seat and the key way, as well as to the diameter of the gear hub and the width of gear face, as it was found that by adopting these dimensions, the motor builders would be able to arrive at a uniform gear practice.



PROPOSED STANDARD MOTOR AXLES

It is further recommended that for motors not to exceed 100 hp, a three-pitch gear with 5-in. face be adopted as standard; and that motors exceeding 100 hp should have a 2-5-in. pitch gear with a 5.25-in. face.

JOURNALS AND JOURNAL BEARINGS

For journals and journal-bearing keys we recommend the use of the four sizes known as the Master Car Builders' standards. These are the result of years of experience in equipments of similar character and generally familiar, and are specified in reports of the proceedings of that association.

JOURNAL BOX

In connection with the axles already recommended, we submit herewith Figs. 2, 3, 4 and 5, showing journal boxes for each of the different journals recommended, showing two styles of design for the tops of the boxes to accommodate the two styles of trucks generally used in electric traction equipment. The interiors of these boxes are arranged to accommodate the journal bearing keys referred to above and will be subject to the test gages in common use for journal boxes of this character.

(b) BRAKE SHOES, BRAKE SHOE HEADS AND KEYS

Your committee believes that this feature of the equipment most readily permits of standardization and that the results obtained therefrom, both mechanically and commercially, will be most desirable.

The data sheets compiled by your committee show that at the present time there are innumerable styles and patterns of brake shoes and brake heads in use throughout the country, many of which vary but slightly from the recommendations which your committee herewith submits.

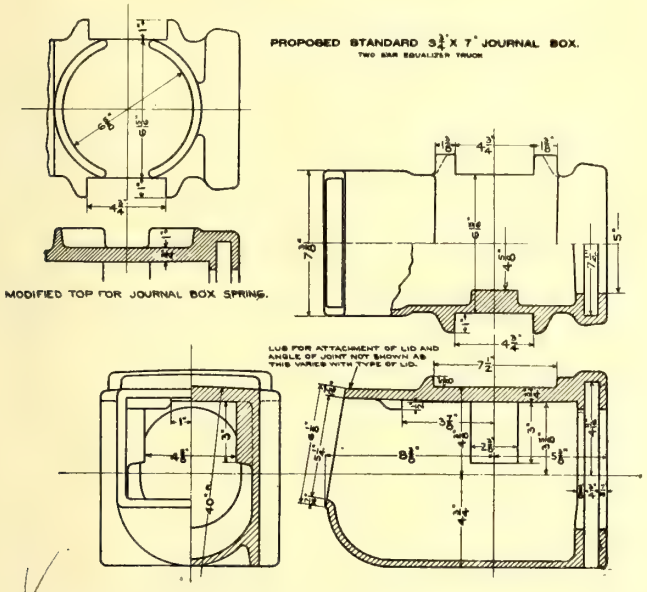


FIG. 2.—PROPOSED STANDARD 3¾ IN. BY 7 IN. JOURNAL BOX

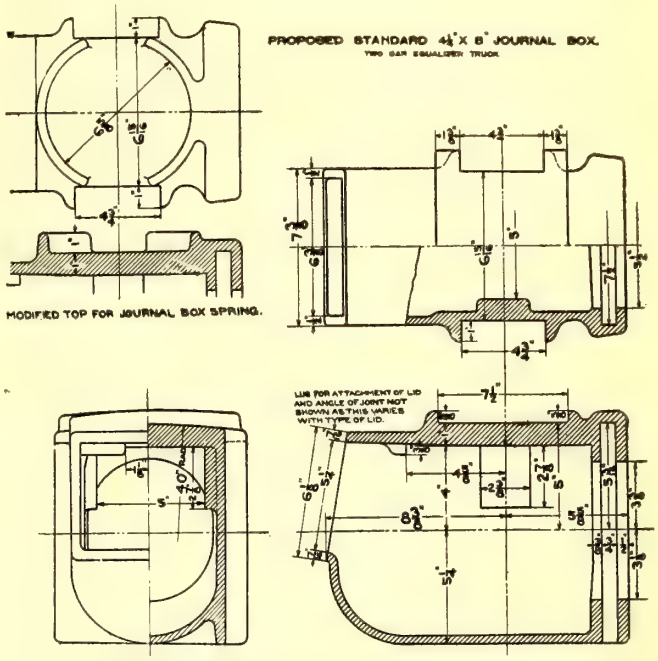


FIG. 3.—PROPOSED STANDARD 4¼ IN. BY 8 IN. JOURNAL BOX

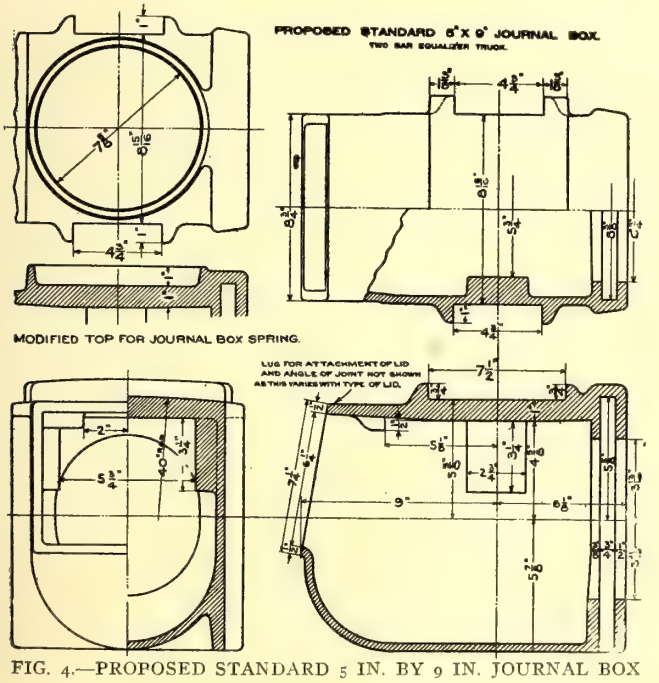


FIG. 4.—PROPOSED STANDARD 5 IN. BY 9 IN. JOURNAL BOX

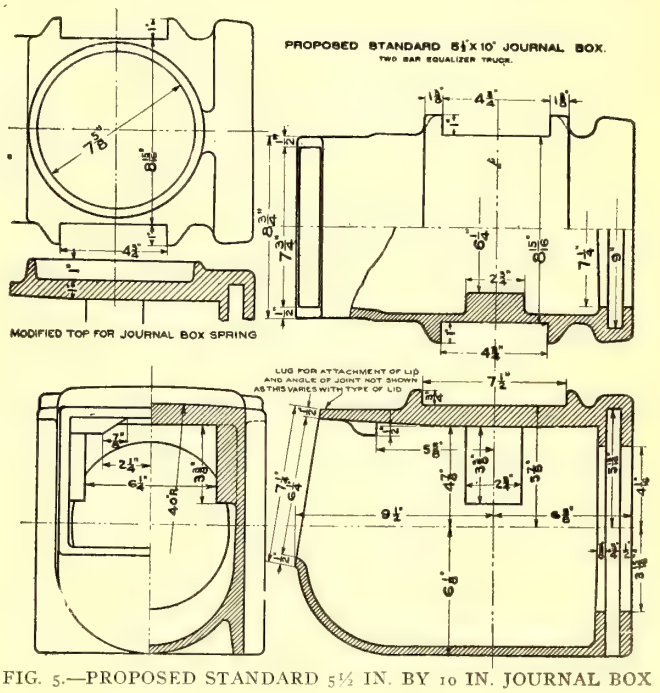


FIG. 5.—PROPOSED STANDARD 5½ IN. BY 10 IN. JOURNAL BOX

For wheels having a tread of 3 ins. wide and over, your committee recommends a design of brake head and shoe (see Figs. 6 and 7), both of which are interchangeable with those in general use in steam railroad practice. The brake head recommended is adapted to both the flanged and unflanged shoes. The unflanged shoes to go with this head are reversible on their own wheels, and the flanged shoes may be reversed by changing the shoe from end to end on the brake beam.

To accommodate wheels in service, with treads narrower than 3 ins., the committee deems it advisable to recommend the second brake head and shoe illustrated in Fig. 8. This head is adapted for use on any of the narrower tread of wheels, viz., those less than 3 ins. wide. The brake shoe can be used either flanged or unflanged, the unflanged shoe being reversible upon the same wheel, and the flange shoe will be reversible by changing it to the other end of the brake beam, thus requiring but one pattern of brake shoe for all equipment which will be standardized with this brake head.

No attempt has been made at this time to suggest a standard for the brake-head-hanger arrangement, as the patterns submitted are simply for the brake-shoe attachment. For the brake head shown in Figs. 6 and 7, it is intended to use the brake shoe key now in general use.

(c) STANDARD SECTION OF TREAD AND FLANGE OF WHEEL

The investigation by this committee of the various types of wheels in service on electric traction properties throughout the country shows that there is a very wide variation of wheel sections in use, especially as regards flanges and treads. An inspection of the data sheets demonstrated that it was almost impossible to select one wheel which would meet all the varying conditions. These sheets also showed conclusively that wheels of a considerably narrower tread than the increased weight of

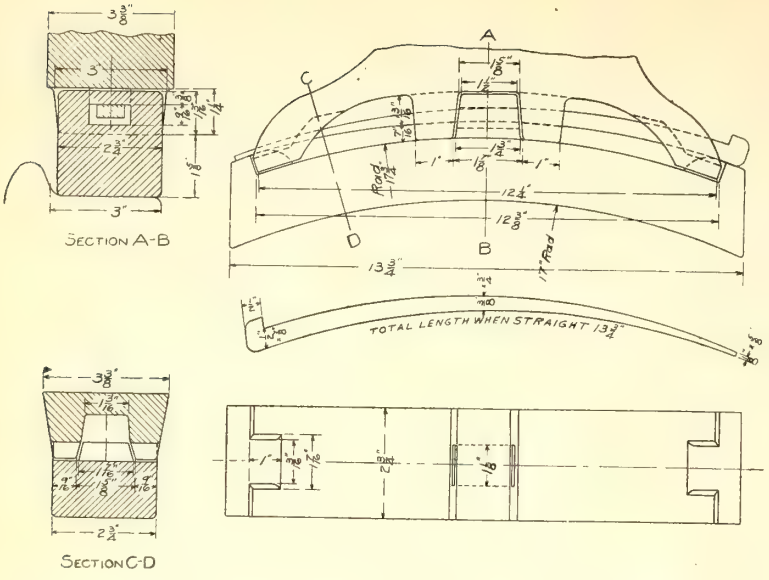


FIG. 6.—PROPOSED STANDARD BRAKE HEAD, UNFLANGED SHOE AND KEY FOR WHEELS, WITH 3-INCH TREAD AND OVER

the equipment requires are being operated. Your committee, therefore, recommends as standard for street and interurban railways as far as it can be applied, a wheel tread and flange contour which conforms to that shown in Fig. 9 and indicated as Wheel A, this wheel to have a tread 3 ins. wide and a flange ⅞ in. high and 1 3-16 ins. thick at the throat. It is the opinion of the committee that this wheel tread and flange can be applied with comparatively little difficulty to a great majority of the roads forming our association.

A number of roads are using wheels with a tread 3.5 in. wide for combined city and interurban work, and there is a decided tendency in this direction. This wide tread assists in carrying the load across special work without running on the flange, and avoids the necessity for flange bearing on the special work. We, therefore, also recommend Wheel A with the tread increased to 3.5 in. for interurban work, and also for city work where it can be used. In the judgment of your committee, it is especially desirable to work toward the general adoption of wheels having this tread.

Your committee recognizes the fact that local conditions on many of the systems forming our association are such that it will be difficult for a number of years to operate a wheel of the dimensions represented by Wheel A. To meet these conditions your committee recommends Wheel B (Fig. 9), with a tread of 2.5 in. wide and a flange 0.75 in. high, this flange to have the same general dimensions as Wheel A with the exception of the height above the tread line.

In mounting and gaging wheels it is understood that the gage line is at a point on the flange 0.25 in. above the wheel tread, and your committee recommends that the wheels be gaged 0.25 in. narrower than the gage of the track, the track gage being measured between points 0.25 in. below the tops of the rails.

RECOMMENDATIONS FOR FUTURE WORK

The investigation conducted by this committee during the past two years indicates the need on the part of the association in the future for a standing committee or standing committees to take charge of the changes and progress in electric traction equipment. The extent of the field suggests the desirability of dividing the subject among various committees, as has been found necessary in the case of similar work carried on by other associations.

CONCLUSION

In making these recommendations, your committee has been greatly assisted by representatives of the manufacturers of the various parts of the equipment concerned, and it is pleasing for us to report that these recommendations appear to meet with their general approval. In fact, they will gladly co-operate in the adoption of these standards, as many of the various manufacturers represented in our conferences have long felt the necessity for the adoption of standards for electric traction equipment. It is possibly well to state that these recommendations are the result of a very thorough and general discussion on the part of all the interests involved, both the manufacturing and various departments of the electric railways. Your committee takes this occasion to acknowledge the very valuable assistance and enthusiastic support of all those who co-operated in the work leading up to these recommendations.

The recommendations of this committee are the result of the labor of two years, and we urge that definite action be taken at your convention.

W. H. Evans, *Chairman.*
H. Wallerstedt,
J. M. Larned,
H. B. Fleming,
R. C. Taylor,
H. A. Benedict,
H. W. Blake,
C. B. Fairchild, Jr.

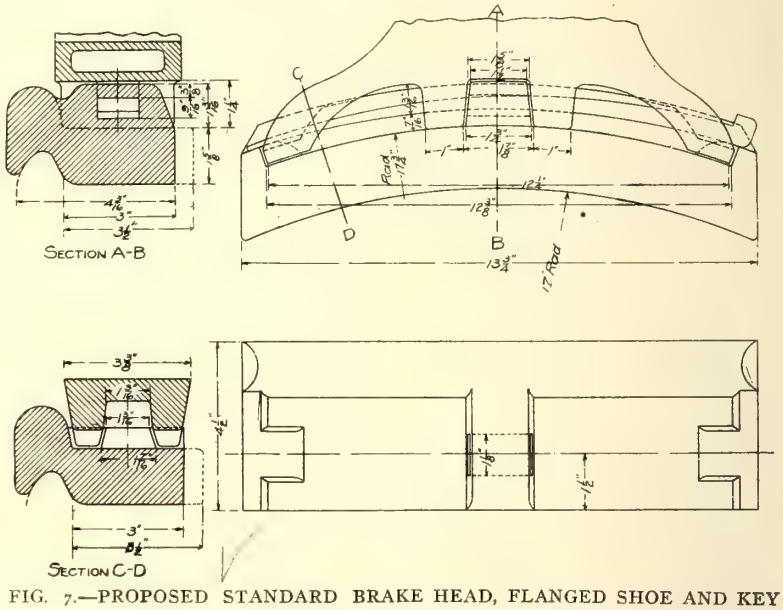


FIG. 7.—PROPOSED STANDARD BRAKE HEAD, FLANGED SHOE AND KEY FOR NARROW TREAD WHEELS

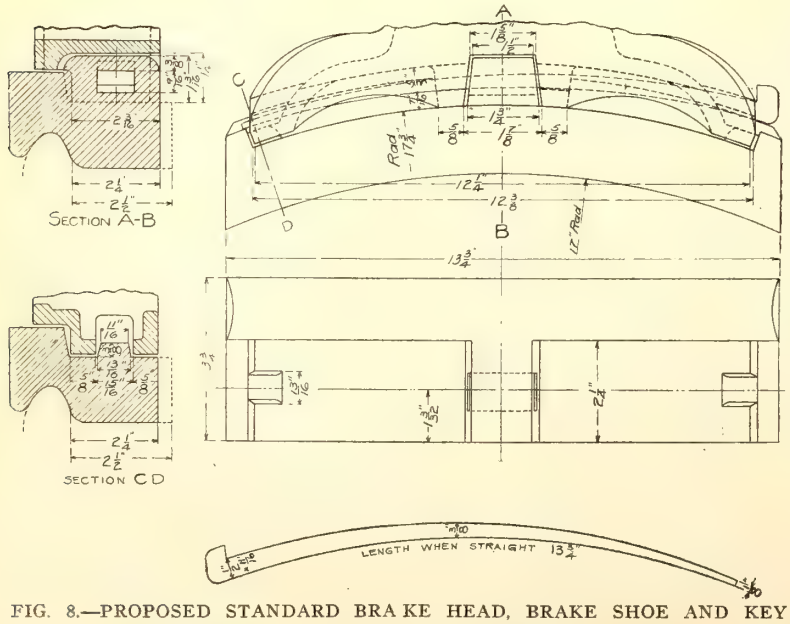


FIG. 8.—PROPOSED STANDARD BRAKE HEAD, BRAKE SHOE AND KEY FOR WHEELS, WITH 3-INCH TREAD AND OVER

RECENT IMPROVEMENTS IN CONTROL APPARATUS FOR RAILWAY EQUIPMENTS

BY F. E. CASE,
General Electric Company, Schenectady, N. Y.

I have been asked to present some new features of multiple unit and hand control at this meeting and therefore will describe some of the apparatus the company which I represent has brought out since your last meeting.

For some little time we have felt that the standard form of K-type series parallel controllers was not entirely satisfactory for service operating conditions. While these controllers successfully handle the ordinary arcing and currents, if a motor or other part of the equipment becomes damaged so as to take an excessive amount of current through the controller, the capacity for disrupting arcs is exceeded and short-circuits sometimes occur. The use of higher operating voltages also has imposed a greater duty upon the platform type of controller. We have, therefore, designed a new line of cylinder controllers with improved magnetic blow-outs, which can be safely used where the voltage peaks may reach 750. The present controllers comprise three sizes, as follows:

The K-34 controller, suitable for either two 150-hp or four 75-hp motors rated at 550 volts; the K-35 controller, for either

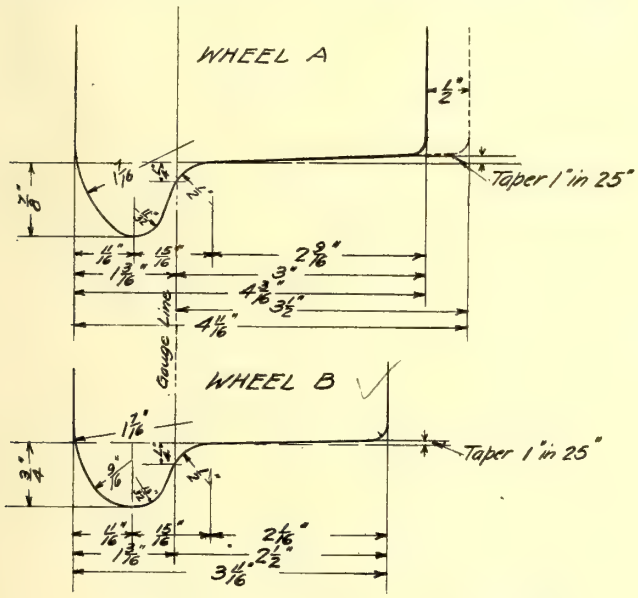


FIG. 9.—PROPOSED STANDARD SECTIONS OF WHEELS

two 100-hp or four 60-hp motors and less; and the K-36 controllers, for two motors only of a capacity of 60 horse-power or less. As some of the newer railway motors are based on a horse-power rating at 600 volts, the capacity of these controllers at this voltage will be correspondingly increased.

The K-34 and K-35 controllers produce the bridge connections by which full current is maintained through all the motors during the transition from series to parallel. The acceleration of the car, therefore, will be smoother than with the connections where the circuit was opened or one motor was shunted, and the strain on motors and gearing will be reduced. The bridge connections are not produced by the K-36 controller, as they were not considered so essential on small equipments. This connection also requires a somewhat greater space, making the controller correspondingly larger.

The main operating handle in all of these controllers is directly connected to the operating cylinder without gearing. The reverse switch and handle are located at the left of the controller to permit a better arrangement of the new style of magnetic blow-out, differing from the previous K types of controller in this respect.

To secure an efficient magnetic field for extinguishing the arc when opening the circuit, each controller finger—or set of fingers where several are mounted on a common base—is provided with an individual blow-out coil and arc chute. These blow-out coils are mounted on the contact finger blocks and are provided with thin steel pole pieces placed above and below the finger. Additional steel plates are embedded in the arc deflector partitions which distribute the magnetic flux across the arc chutes in a line parallel to the shaft and at right angles to the arc, thereby projecting the latter away from the cylinder and not against the division plates of the arc deflector, as in previous cylinder controllers of the K type. This form of magnetic blow-out insures the extinction of the arc under very abnormal conditions and should reduce the burning and wear of fingers and segments to a minimum.

The K-34 and K-35 controllers provide six breaks in series when opening the circuit under ordinary conditions. In case No. 1 motor becomes grounded and short-circuits the breaks between No. 1 and No. 2 motor, there will still be four breaks in series to open the circuit. In previous controllers four breaks were provided in series under normal conditions, but a short-circuited motor might reduce this number to two, and I believe that many cases of controller trouble have resulted from this cause.

To simplify the construction of the controllers and to eliminate as far as possible parts which might be a source of trouble, it was decided to abandon the connection board as used in the K-10, K-6, K-28 and similar controllers, and bring the car wiring cables directly to the contact finger bases. The terminals are of the clamp form, which does not require the use of solder, and there are no set-screws to injure the wire. The clamps are very accessible, and the leads can be quickly connected and disconnected when desired. Cut-out switches are located near the top of the controllers where they are more accessible, and are not so exposed to the collection of dust. Consequently, less trouble from short-circuiting is to be expected.

The omission of the connection board leaves additional space in the controller, which has been utilized for lengthening the reversing cylinder and placing all of the contact fingers with their clamp terminals on the outer side, where they are very accessible for inspection and repair.

An improved method of securing the cylinder castings to the shaft has also been used. The shaft is of hexagonal section and is wrapped with several thicknesses of thin sheet insulation cemented together and put under a heavy pressure to bring to the exact dimensions required. The cylinder castings fit over this insulation and are securely held by steel keys, the width of one of the hexagonal faces. Heavy set-screws passing through bosses on the casting bear against these keys and hold them firmly. This construction provides an excellent insulation between the castings and the shaft, and at the same time absolutely prevents the former from shifting. If necessary, the castings can readily be removed from the shaft and replaced by others without the use of special tools or fixtures.

Several improvements have also been made in type M control. To economize space, a new form of contactor, in several sizes, has been designed which is narrower than the present contactors, and simpler in construction. This produces a heavier contact pressure than previous contactors of the same capacity without requiring any more operative current. New contactor boxes have been designed for these contactors, in which the control circuit fuses are placed at one end, thereby simplifying the control circuit wiring. The length of the contactor box suitable for use with four 60-hp motors is about 54 ins. over all and for four 25-hp motors is about 72 ins.

There have been many discussions regarding the comparative merits of automatic and non-automatic control for street car and similar service, where great variations in load of car and conditions of track are encountered. With a current limit relay set for one rate of input to the motors it is obvious that the amount of current which will start a light car satisfactorily on a level track may not be sufficient to start the same car loaded on a grade or curve. In several instances, to overcome this objection we have provided switches to cut out the current limit and permit a greater amount of current to flow through the motors in an emergency. This arrangement, however, makes it more difficult for the motorman to notch up without slipping the wheels, and we have, therefore, proposed the use of two relays of different current settings; one to be used for normal operation and the other to be cut in by a small switch when it is necessary to obtain a greater motor torque.

A radically new design of contactor for alternating-current operation has been developed. This contactor has a very efficient magnet for operating it, and a pressure as great as that in our direct-current contactors is obtained. This contactor is just as simple in construction as the latter and operates with perfect freedom from the disagreeable humming incident to most alternating-current magnets. The same type of magnet

is used for operating the reverser, oil switch and other devices requiring to be operated by magnets.

We have developed a new electrically-controlled circuit breaker of smaller capacity than the previous one, known as the DB-105, for locating under the car. This circuit breaker may be used with either type M or cylinder platform control. It is enclosed in an iron box to protect it from wheel wash and dirt. A small double-throw switch, located conveniently near the motorman, is used for setting and tripping the circuit breaker from the platform.

The MA-11 copper ribbon fuse box used with equipments of 30 degs. to 500 horse-power has been criticised on account of the difficulty in replacing a fuse. To overcome this we have designed a fuse box, known as the MA-14, having a hinged lid similar to the smaller size, the MA-13. This fuse box is made of fireproof molded insulation instead of sheet fibre.

Many opinions have been expressed regarding the proper design for a trolley base. We have attempted to incorporate in a new base, known as the US-13, the desirable features recommended by our railway friends and to eliminate those points which other types in service have proved to be objectionable. The following is a brief specification:

Vertical roller bearing comprising thirty-one steel rollers ¼ in. in diameter by 5⅜ ins. long; four tension springs adjusted with one screw; capacious oil well; resilient spring stop; height 5 ins.; weight, approximately, 100 lbs.; maximum pressure at 45 degs. with 14-ft. pole and high-speed fork and wheel, 35 lbs., the pressure increasing slightly at a lesser height and decreasing at a greater; minimum pressure at 45 degs. with 12-ft. pole and small wheel, 18 lbs. It is believed that this trolley base is one which can be universally used for both high-speed and city service with excellent results. The master mechanics of several different railways have examined the base and given favorable opinions on it.

REPORT OF THE COMMITTEE ON MAINTENANCE AND INSPECTION OF ELECTRICAL EQUIPMENT

BY J. LINDALL (Chairman), W. D. WRIGHT, E. T. MUNGER, L. L. SMITH.

In considering the nature of the report to be submitted your committee felt that it could best serve the interests of the association by finding out, so far as possible, the present practices in the maintenance and inspection of electrical equipment of the member companies and to point out to some extent the good and bad practices with such suggestions and recommendations for further improvement as would seem advisable.

To this end, early in the summer, there were prepared and sent out question blanks asking for considerable data and, while some of the information asked for may seem lacking in importance, it has been said to your committee that the mere endeavor to supply the information has brought to the attention of operating men conditions which otherwise would probably have gone unnoticed for some time. Your committee realizes that it is impossible to make recommendations that will fit all conditions, but, if we are to learn to shoot we must have a mark to shoot at.

The maintenance and inspection of car equipment is such an important item in the reliability of operation of a street railway system that the period of overhauling and inspection should be very carefully fixed. Too many overhaulings and inspections are not conducive to economy, while, on the other hand, too few mean many failures. There is always some one part of the equipment which requires attention more frequently than any other. A study should be made of this part and endeavor made to improve it until it is no longer the first to need attention; then the periods of overhauling and inspection can be lengthened to meet the new conditions, etc.

CONTROL EQUIPMENT

In reply to the question as to the "Frequency of Inspection of Control," the answers were:

"K-Type."

Daily—13	5th day 1	300 miles 1
2d day 1	7th day 8	500 miles 1
3d day 7	14th day 2	

"Multiple Unit Type."

Daily—1	500 miles 1
3d day 1	1000 miles 1
7th day 1	1200 miles 1

It is evident from the above that, notwithstanding the varying conditions, some are inspecting unnecessarily often while others are not giving sufficient attention.

Your committee recommends that the control equipment of the "K-type" be given a thorough overhauling for every 60,000 miles of service as follows:

Controller should be taken apart, thoroughly cleaned, defective parts replaced, wood scraped and shellaced and other parts of the controller painted with insulating paint. The controller should then be given a break-down test of not less than 1500 volts a. c. for five seconds. With controllers in good condition your committee believes that periodical inspections on a basis of from 300 to 500 miles service—depending upon the conditions of operation—would be sufficient and the most economical, and desires to call attention to the importance of giving careful attention to the fit of controller and reverse handles on spindles, as a loose fitting control handle will sometimes make it impossible to secure the proper contact on the last point. It also renders the pointer useless as an indicator to the motorman and has a tendency to make him careless in the operation of the controller as the notches cannot be readily distinguished. A loose fitting reverse handle will sometimes prevent the reverse being thrown quickly, thus being the means of causing an accident when an endeavor is being made to stop the car with the reverse.

MULTIPLE UNIT CONTROL M-TYPE

Your committee recommends an overhauling on a 60,000-mile basis as follows:

All coils removed from the contactor, reverser and circuit-breaker boxes, thoroughly cleaned and painted with an insulating paint. Interior of boxes cleaned and painted; contact strips between coil frames inspected for loose contacts; all working parts thoroughly inspected and worn parts replaced where necessary; wires inside of contact box thoroughly painted and when reassembled given an insulation test of 1500 volts a. c. It would then seem to your committee that periodical inspections on a basis of from 600 to 900 miles of service would be satisfactory.

As the experience of some of the operating companies with this type of equipment is rather limited the following points are suggested as requiring attention at such times:

Examine for broken shunt straps and broken hinge pins.

See that interlocks are properly adjusted and that small arcs do not form between the fingers and discs, thereby burning finger and disc, which would eventually cause a defective contact at this point and a dead car.

Clean the disc and finger with fine emery cloth.

Keep the arc chutes and plates clear of all copper caused by contactors breaking current.

See that all connections are tight.

See that springs are not broken and are in good order, insuring good contact when closed.

See that plungers do not bind and that contactors break free when the current is thrown off.

Contact plates should not be worn so low that screws holding them are burned.

Blow out contactor box with compressed air.

Note condition of wiring in the box.

Clean the master control cylinder and use a small amount of vaseline on the fingers.

See that the handle is of proper fit and works perfectly free.

The adjustment of controller should be looked after very carefully, as there are no adjustment screws on the contact fingers.

Note condition of throttle.

Clean throttle discs and fingers and see that adjustment nuts are not loose.

Do not clean throttle plunger unless it shows signs of sluggishness.

Great care must be taken when cleaning plunger.

Clean reverser and note adjustment and condition of plates and fingers and that the reverse throws in properly.

Use no oil or grease on contactor or reverser finger or plates.

A great deal depends on the close adjustment of interlocks.

All bearings on contactors and interlocks must be made loose.

When a contactor box becomes coated inside with a yellow coating, caused by the burning of copper, short circuits are very likely to occur if this is not cleaned off.

MULTIPLE UNIT ELECTRO-PNEUMATIC TYPE

Overhauling on a 60,000-mile basis is recommended as follows:

Clean the drum and adjust fingers of master switch; inspect cab switch terminals and see that they are held rigidly and no strands of wire are broken. Repair, clean and carefully adjust line relay, limit switch and battery relay. Limit switch should be adjusted with ammeter. Take apart, clean, scrape and shellac drums of motor cut-out switch and reverse; replace any parts that will not make the mileage and adjust the finger tension. Strip switch groups of all magnets, switch arms and moving parts, replace worn parts when necessary. Replace worn or burned arc shields; adjust all magnet valves to operate at proper voltage; replace defective shunts; adjust and clean all interlocks and interlock fingers; examine all insulation and make as good as new; examine piston leathers and see that they are flexible and replace those badly worn. Storage batteries should be cleaned of sediment and acid strength adjusted. Grid diverters should be cleaned, the insulation renewed where necessary, and all connections tightened. Control jumpers should be tested by passing seven amperes of current through them for three minutes, at the same time giving jumper the same motion that it has when in service. Clean and adjust circuit-breaker; thoroughly blow out all piping and air chambers connected with the control.

On short period inspection the following is the practice on a road having inspection periods based on a 600-mile service:

Master Switch.—Clean and lubricate every tenth inspection.

Cab Switches.—Inspect terminals each inspection day.

Close jaws of cab switch to fit tight each inspection day.

Line Relay and Limit Switches.—Clean with crocus cloth each tenth inspection.

Inspect connections each inspection day.

Motor Cut-off Switch and Reverser.—Inspect finger tension and oil drum contactor each second inspection and feel the terminals to see if the wires are O. K.

Inspect interlocks each twelfth inspection.

Oil reverser switch toggle each tenth inspection.

Circuit-breaker and Switch Group.—Clean armature and valves each tenth inspection.

Inspect contacts each inspection day.

Clean arc chutes each inspection day.

Blow out with compressed air all switches and grid diverters each third inspection.

Inspect all grid diverter connections and oil all pistons each inspection day, see that all terminals are tight and inspect wires.

Wipe off insulators.

Inspect shunts and battery connections each inspection day.

Add distilled water to take care of evaporation when necessary.

Test specific gravity each thirtieth inspection day.

Test battery relay and inspect terminals of battery switches each inspection day.

INSPECTION

In reply to question as to "Whether inspection is made by day or night?" twenty answered by day, seven by night and nine both day and night.

We believe that it is well understood that inspection made by night is less reliable and more expensive than that made by day.

Your committee would urge that very careful consideration be given this question by those doing inspection work by night. It has been found on a number of roads where at first thought it seemed impossible to have inspection done during the day that by careful study it was found possible to arrange for the work being done in the day time, and that this has resulted in an improvement to the service as well as being more economical.

The replies to the question as to "What determines the frequency of inspection: Whether brakes, control, commutator work or oiling?" would indicate that on 75 per cent of the equipment "adjustment of brakes" was the first part of the equipment requiring attention, although several companies report motor brushes and oiling as requiring first attention.

It would seem, therefore, that a satisfactory slack adjuster for brakes is very much needed in order to obtain length of service from this part of the equipment equal to that provided by the later types of electrical equipment.

CAR WIRING

In reply to the questions as to "What is done to maintain car wiring in a safe condition?" "How do you test car wiring, including light, heat, motor wiring?" and "How is light, heat, motor wiring installed—in canvas hose, conduit, cleats, molding or in transite?"

The answers indicate a general tendency toward iron pipe conduit installation with a periodical test for insulation breakdown. Your committee believes this to be the best practice, but that in the rewiring of old equipment it is frequently necessary to modify this and use iron pipe conduit under the cars where exposed to wheel wash, and cabling or boxing wires in the interior of the car.

Your committee recommends that in all cases where wires are run through metal conduit before reaching the main fuse or circuit-breaker, a wire or ribbon fuse be placed on the roof of the car near the trolley of such capacity as would blow only in case of short circuit of wires before reaching the main fuse or circuit-breaker.

One company reports the use of a large number of cars of a factory-made cable, which consists of a number of flexible insulated wires made up in cable form, the outside covering, or jacket, being made of fireproof material woven around the wires, taps being led out through the covering.

TROLLEYS

Replies to question "How often do you inspect trolley apparatus?" show that 90 per cent inspect them daily, four every seven days, one every ten days, two from 300 to 500 miles, and two roads report inspecting trolley wheels every trip.

This would certainly indicate that improvement tending to increase life and reduce the necessary attention is much needed. One company reports that with the use of an automatic trolley lubricator they find it only necessary to inspect trolleys every sixty days. Another road reports that with a similar device the labor required to take care of the trolley wheels is reduced 75 per cent and the life of the bushing is increased nearly 100 per cent. It, therefore, appears to your committee as being well worth investigating by railroads having trouble in maintaining trolley bushings.

Replies to the question "How often do you replace trolley bushings?" show that for light cars in city service the bushing usually lasts as long as the wheel, but with heavy equipments and high speed the trolley bushing is the weakest part of the equipment, the wheel lasting from two to three times as long as the bushing.

Your committee would call attention to the importance of having trolley contact springs of sufficient capacity and in good order so that they will carry the current from the wheel to the harp, and thus prevent burning between bushing and spindle. Two companies report using trolley wheels without bushings.

SAFETY DEVICES

In the matter of safety devices for the protection of wiring and apparatus, your committee recommends the use of a fuse in addition to a circuit-breaker on all equipments requiring current-carrying capacity of over 200 amperes, the fuse to be of slightly greater carrying capacity than the circuit-breaker, and would also call attention to the importance of overhead trolley cars being properly equipped with lightning arresters and that the same be periodically inspected and tested to insure their being in proper working order.

ARMATURE REPAIRS

The growing tendency of operating motors at high temperatures due to increased service requirements has brought to the operating men the question of making repairs with insulating material suitable for withstanding the higher temperatures.

Your committee feels that sufficient attention has not been given by operating men to the question of "Motor temperatures." If a motor does not melt the solder or actually get on fire, the average car barn foreman gives the matter no further consideration, whereas motor temperatures should be followed closely and where this is found to be higher than the motors were designed for, effort should be made to find the cause and remedy it.

For insulation of armature coils wound with round wire and where the ultimate temperature rise is less than 65 degs. C., cotton-covered and varnished cambric insulation is sufficient.

Where ultimate temperature rise is 65 degs. to 100 degs. C., asbestos covering for the wiring is necessary.

In the use of asbestos material your committee would call

attention to the vital importance of impregnation with moisture-repelling varnish.

The asbestos should be considered as a fireproof material and a good spacer rather than a good insulator.

Armature coils, and especially those wound with asbestos-covered wire, must be held rigidly in place in the armature core to exclude all movement or vibration in the slot or at the ends.

By some roads it is considered good practice to impregnate an armature after it is wound by heating the armature and revolving it in an impregnating bath. The advantage of this method is improved insulation and rigidity of windings in the core. The disadvantage is the difficulty of raising a coil should it ever be necessary to patch up an individual coil.

Experiment is suggested with the use of all fireproof insulation of armature coils; that is, asbestos-covered wire; spacing and wrapping with mica and wrapping with asbestos tape. It is suggested that this process may give longer life even under moderate temperatures than the cotton-covered, oiled-cambric wrapped coils.

REPAIRS OF BAR WOUND ARMATURES

Where the original equipment was bar wound it is recommended that insulation be mica, partially, if not wholly; where bars are to be replaced it is preferable to replace with bars similar to the original, that is, with insulation of mica. However, should it be necessary to repair at short notice and no mica-insulated bars are at hand, a varnished-cambric insulated bar is recommended, appreciating that the life is not as great as mica and shorter as the working temperature is higher.

Referring to the question "What test do you give coils for short circuits?" the reports show about equal use of a. c. and d. c. for this test. The committee would recommend the a. c. transformer test as a very satisfactory one. For testing armature windings the usual yoke transformer test and bar to bar test are recommended. For bar-wound armatures it is further recommended that a test be made by applying full load current through the brushes in their normal position on the commutator at such a frequency as to give approximately full voltage across the brushes, armatures in all cases to be outside of their frames.

Referring to the question "What insulation test do you give armature coils?" reports show the use of 3300 volts a. c. as maximum and 500 volts d. c. as minimum. Majority between 1000 and 2000 volts a. c.

Your committee recommends an insulation test between windings and ground as follows:

For roads using trolley:

New armatures—2500 volts a. c. 5 seconds.
Old armatures—1000 volts a. c. 5 seconds.

For roads using third-rail where voltage fluctuations have to be taken into consideration:

New armatures—3000 volts a. c. 5 seconds.

Old or partly repaired armatures—1500 volts a. c. 5 seconds.

Commutator bar to bar test and between armature coils before windings are connected we recommend:

New armatures—220 volts d. c. 5 seconds.
Old armatures—110 volts d. c. 5 seconds.

As to the question "Have you any preference for rolled or drawn copper over drop-forged segments?" in twenty-two reports where preference was stated, twelve favored rolled or drawn copper and ten drop-forged.

Your committee recommends for commutators hard drawn copper as possessing greater uniformity in size and hardness over the forged bars and corresponding superiority in life and service.

Your committee wishes to call attention to the importance of material and workmanship in the construction of commutators being such as to insure a solid structure which will not shrink, become loose or get out of true.

Built-up mica is preferable for commutator segments, but it is very important that the building-up should be even and compact. Assembled commutators should be baked at 230 degs. C. and compressed while hot to insure solidity, clamps being tightened before pressure is released.

The best method of maintaining sizes of armature shafts and bearings has been much discussed. To the question "How many sizes of shaft journals on one type of armature in use?" the replies have been:

7 report 1 size.
6 report 2 sizes.
6 report 3 sizes.
2 report 4 sizes.
2 report 5 sizes.
1 reports 12 sizes.

In regard to allowable difference in diameter between sizes:

8 report 1/16-in.
5 report 1/32-in.
4 report 1/64-in.

After considerable discussion your committee has come to the conclusion that owing to the wide variety of conditions it is impossible to suggest any one set of standards to fit them all, and recommends that each road select such standards as best fitted for its own conditions.

Referring to questions "Do you sleeve worn shaft journals with steel tubing?" and "Do you apply same hot or cold?"

We find that the practice of sleeving worn armature shaft journals with steel tubing is becoming quite general and is in the opinion of your committee without doubt good practice.

With but one exception these sleeves are applied hot. Your committee recommends applying sleeves hot with an allowance of .004 in. for each inch in diameter.

Referring to the question "Do you bore your babbited armature bearing shells or babbit to size?"

While it is the general practice to bore rather than to babbit to size, your committee suggests that possible economy and good results may be obtained by babbiting near to size and complete finish by forcing a broach or finishing plug through the shell giving a hard smooth surface.

In reply to the question "What grade of steel wire do you use in banding armatures?" Four use bronze wire Nos. 16 and 17, others use tinned steel wire, usually No. 17, two report No. 18 and one No. 19 B. & S. gage.

There appears to be lack of sufficient attention as to the quality of the wire.

Your committee would call attention to the necessity of using a high grade of wire on high speed motors and would suggest that for motors not exceeding 75 hp, band wire should have an ultimate tensile strength of 125,000 lbs. per square inch, while for large motors operating at a maximum armature speed of 1200 revolutions per minute or upward, the band wire should have an ultimate strength of 175,000 lbs. or a sufficient additional number of turns of wire of lower ultimate strength to be equivalent thereto.

Your committee would suggest on account of higher motor temperatures the importance of using solder suitable to these temperatures and would recommend on all motor work the use of commercially pure tin solder, owing to its high fusing point and greater reliability.

As a flux, resin dissolved in alcohol is recommended and the use of any flux containing acid or salts is condemned.

In reply to question "Do you have evidence of old cores materially increasing armature temperature?" the answers have been nine in the affirmative and eighteen in the negative.

It is the opinion of your committee that this is not a serious matter and, owing to the difficulty of properly reassembling the laminations, the advantage given by dismantling the core and reinsulating the laminations is doubtful.

Where necessary to reassemble laminations they should be drifted and filed to make the core slots smooth and true.

In reply to question "Do you manufacture your own field coils?" replies from eighteen roads owning 100 cars and upward showed that seventeen, to a greater or lesser extent, manufactured their own field coils; one did not.

In reply to question "Do you use asbestos-covered wire for fields? If so, are you satisfied that the results obtained justify the use of absestos-covered wire at extra cost?" and "What experience have you had with field coils wound with cotton-covered wire impregnated by vacuum process with solid compounds?"

Some replies indicate the use of wire having a layer of asbestos paper and single covering of cotton, which at one time was quite extensively used. Some reports show the use of all asbestos-covered wire and the companies satisfied with it at increased cost. One road reports ownership and use of vacuum impregnating plant, using there what is known as solid compound. Although others report that they have in use

fields, vacuum impregnated with solid compound, there are but two adverse reports.

It is evident that considerable is yet to be learned from actual experience as to the comparative value of field coils wound with all asbestos-covered wire and vacuum impregnated with solid compound.

Your committee recommends for fields where temperature rise will not exceed 65 degs. that the wire be cotton-covered and coil impregnated with solid compound and wrapped with varnished cambric, further wrapped with heavy webbing and dipped in varnish.

For fields where temperature rise is 65 degs. to 100 degs. that the wire be asbestos-covered, and coil impregnated with solid compound and wrapped with asbestos tape, the asbestos tape also thoroughly impregnated. The above recommendation for temperatures between 65 degs. and 100 degs. applies to strap-wound fields, as well as those of round wire.

Replying to questions "What test do you give field coils in shop?" and "What test do you give field coils in use in motor?" reports show that a majority of the larger roads are using coil-testing instruments such as are on the market for following up the conditions of field coils. One elevated road reports the use of full load alternating current, detecting short-circuited fields by difference in temperature or by drop in voltage. One interurban road reports bridge measurements of resistance for testing fields for short circuits or number of turns.

In the absence of better facilities the use of the ordinary field-testing instruments with induction coil and telephone earpiece is valuable, but your committee recommends that where alternating current can be obtained it is desirable that some form of transformer test be used.

For an insulation test of fields in motor your committee recommends the same voltage of alternating current as was recommend for the test of armature, as follows:

For roads using trolley:

New fields—2500 volts a. c. 5 seconds.
Old or partially repaired—1000 volts a. c. 5 seconds.

For roads using third-rail where voltage fluctuations have to be taken into consideration.

New fields—3000 volts a. c. 5 seconds.
Old or partially repaired—1500 volts a. c. 5 seconds.

AIR COMPRESSORS

Your committee recommends that air compressors be given a thorough overhauling and test, electrically and mechanically, at intervals not exceeding 50,000 miles and periodical inspection at 1000-mile intervals.

MISCELLANEOUS MOTOR MAINTENANCE

In considering the subject before it, your committee has felt that repairs of troubles to electrical equipment after they have occurred form only a part of its work; another part hardly less important is to consider the prevention of troubles before they occur.

In seeking preventive measures it is well to look into what our troubles really are, analyzing them, tracing the cause and if possible devising a remedy. The old adage: "No chain is stronger than its weakest link," finds application on many electric railways in the car motor proving to be the weak link in the chain.

Neglect of inspection, continuous overloading or gross abuse of equipment on the road will naturally cause motor troubles, but assuming that these conditions are obvious enough on most roads to be kept within reasonable limits, there still remain troubles which warrant study and analysis.

Inasmuch as a large portion of motor troubles occur at the commutator, the estimated causes of commutator troubles, as shown by data sheets in answer to the following questions, should be of interest.

To question "What proportion of your commutator and brush holder troubles do you attribute to—

(a) Fast feeding of controller?
(b) Quality of brushes?
(c) Quality of commutator bars?
(d) Quality of commutator mica?
(e) Design or characteristics of brush holders?
(f) Other causes?"

In a number of replies these figures were omitted, but from figures submitted representing all parts of the country and nearly 10,000 cars the following averages were taken, each road's figures contributing to the average in proportion to the number of cars owned.

The percentage and relative magnitude of the several causes of trouble at the commutator are shown in Table 1.

TABLE I.

Fast feeding of controllers	42.6 per cent.
Quality of brushes	18.2 " "
Miscellaneous causes	11.4 " "
Brushholder design	11.0 " "
Quality of commutator mica	9.8 " "
Quality of commutator copper	7.0 " "

Referring to diagram, Table 1, let us, following the principle laid down by Abraham Lincoln, "One thing at a time and the big things first," consider:

Fast Feeding of Controllers.—This is an evil which in the opinion of your committee will always exist so long as the rate of acceleration is dependent upon the judgment and thoughtfulness of the motorman. We recommend wherever practicable the use of such automatic devices, operated electrically or otherwise, as will limit to a fixed maximum the amount of current the motor may receive. Much of the fast feeding is done by motormen through thoughtlessness and not realizing its harmful effect upon the equipment. To such cases an educational effort, thorough and persistent, with the assistance and cooperation of the operating department, should be made, and your committee is confident that the resulting benefit will amply repay for the time and trouble expended. For interurban lines particularly there should be determined, experimentally, the distance a car will travel while building up from rest to full parallel to receive the most rapid acceleration the motors can safely stand. This distance should be fixed as the minimum allowable and its observance insisted upon.

Quality of Brushes.—From data received of trouble experienced with quality of brushes, one road reports no brush trouble whatever, but aside from this one exception prevalence of brush holder trouble in some degree appears to have been well nigh universal.

The widest variety of opinion is expressed describing the qualities of brushes most satisfactory. Regarding hardness preferences run between soft, medium soft, medium hard and hard. Several replies in regard to hardness favor a brush hard enough to dress down the mica, but at the same time soft enough or containing graphitic or other lubricant to maintain a smooth commutator surface. Regarding price, one road uses the cheapest brush, while another holds the best is none too good. Regarding the conductivity of brushes, two roads prefer brushes of high resistance, one calls for a brush of low resistance and one advocates plating of brushes with copper to increase conductivity.

Regarding specifications, few roads have any and those submitted are of a general character calling for uniformity of size, evenness of quality, freedom from breaking and crumbling, and in general that the brush must give satisfactory service.

In a few instances beveled edges are advocated.

Regarding size of brushes, many replies urge the uniformity of size so that brushes shall be a good fit in the holders, not loose so as to rattle around nor so tight as to stick.

Regarding treatment of brushes by boiling, a large proportion favor no treatment at all; twenty-one roads are opposed to boiling brushes in paraffin against seven roads which favor it and two additional which favor boiling if brushes are very hard. Five roads favor boiling in oil, two in vaseline and one in soap.

Test for Brushes.—Most roads have no test other than the test afforded by everyday service, while several suggest breaking the brushes and the fracture will show the grain of the brush and whether it is homogeneous and free from lamination and hard specks to irritate the commutator.

Brushes in General.—Replies indicate the quality of brushes has caused a troublesome and in some cases a serious problem of maintenance, and that the problem is of sufficient magnitude to warrant careful investigation and study. Your committee feels very strongly that sufficient attention has not been given by operating men or brush manufacturers to obtaining brushes suitable to the various types of motors and conditions of operation, and it recommends that the further consideration of the association be given the subject either at the hands of a special committee or that specialists of the manufacturing plants or research laboratories be invited to contribute papers throwing

light on the only partially understood details of brush practice, pointing the way to the best and most intelligent methods.

Miscellaneous Causes.—Under this head troubles reported form, in the aggregate, quite a feature of the total of bad results at the commutator, but no one item is pre-eminent. The troubles largely arise from local conditions of equipment and service.

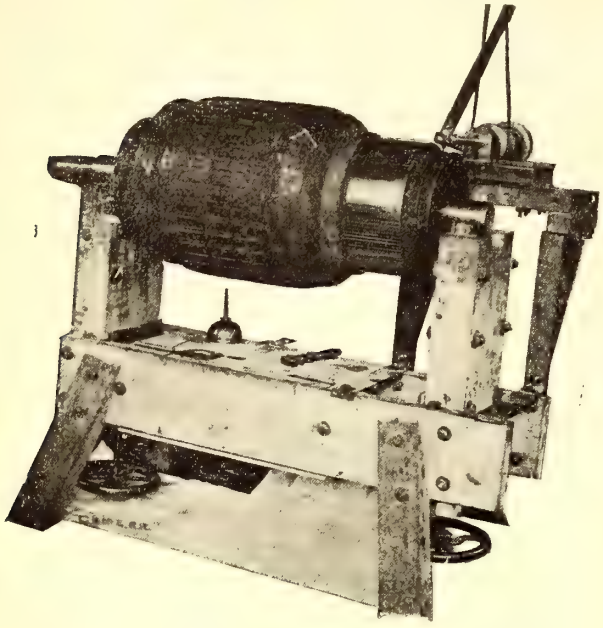


FIG. 1.—COMMUTATOR GROOVING DEVICE

The various items have been enumerated as follows:

Broken springs.
Loose holders or yokes.
Weak fields.
Reversing.
Wrong setting of brushes.
Insulation of commutator core.
Electric brakes.
Carbonized string bands.

Brush holder design is a subject which your committee suggests receive the careful attention of each individual member, and errors of design or workmanship which may have escaped the attention of the manufacturer through their not having been brought to his notice by the user may be brought out and corrected. Improvements in electric machinery have been frequently made at the suggestion of the user, who has constant opportunity to observe its behavior in everyday service, and the progressive manufacturer is always glad to receive intelligent criticism from "the man behind the gun."

Quality of commutator mica is one of the causes which are very generally assigned for unsatisfactory results at the commutator. Interesting evidence of this is found in answer to question "Do you consider grooving mica below the surface of the commutator effective in improving commutation?" Expressions from thirty-three roads, representing 13,810 cars, are as follows:

In favor of grooving mica...23 roads, or 76.3% of cars.
Not in favor of grooving.... 7 roads, or 9.5% "
Non-committal ..... 3 roads, or 14.2% "

These answers are represented in Table II.

TABLE II.

In favor of grooving	76.3 per cent.
Non-committal	14.2 " "
Not in favor of grooving	9.5 " "

One reply to Question No. 8 is as follows: "Yes, if using soft brushes or hard mica. Would do this more if it were easier to do." Those who approve of grooving and are prevented by lack of convenient facilities might look with favor upon a home-made device built at small expense along such lines as shown in the photographs, Figs. 1 and 2.

The apparatus consists of a substantial oak armature stand with V-blocks to take the end of the armature shaft, the V-block at the commutator end is adjustable vertically by a screw attached to hand-wheel shown beneath. The V-block at the pinion end can be adjusted laterally as well as vertically.

At the commutator end is a shelf on which are two slides carrying the boxes of a buzz saw shaft. The saw is 1.25 ins. in diameter, .02 in. thick and is driven at about 1000 r. p. m. The saw is fed the length of the commutator by means of a hand lever, shown. On the opposite end of the shaft from the saw is a flywheel. It takes about five minutes to set the work and twenty-five minutes to groove a 75-hp railway armature of 117 segments, making a uniformly creditable job of the grooving. The principle of grooving mica appears to your committee to be correct and in some cases more urgent than others, and recommends that in cases of high mica or troublesome commutation a trial of grooving mica be made.

Motor Lubrication.—Reports from thirty-four roads show twenty-nine lubricating on a time basis, three on a mileage basis and two on a combination of the two methods. Of the twenty-nine roads lubricating on the same basis, the figures are not in all cases complete or definite; but as nearly as may be determined the periods between lubrication are shown in Fig. 3.

Lubrication of Armature and Motor Axle Bearings.—One of the most important movements of recent years in railway motor design has been the change from the old grease cup to the waste-packed chamber for lubricating motor and axle bearings. The replies received seem to indicate that all roads have not taken full advantage of this improvement from the fact that a number of roads oil armature and axle bearings every night regardless of the fact that waste lubrication enables the period of lubrication to be extended from three to seven days with perfect safety and with a saving of both labor and lubricant. That in most cases the old designs of motors required armature bearings to be oiled every night admits of but little argument, but your committee would urge that a sharp distinction be drawn between the types of lubrication, that the old type motor be oiled every night or on a corresponding mileage basis, but that the modern motor be not oiled every night merely from force of habit, but that the period be lengthened to as great an extent as true economy and the proper lubrication of the bearings will permit. For this period 1000 miles is recommended for a fair average.

Truck Journal Lubrication.—For the interval between truck journal lubrications, most replies concentrate at the weekly and thirty-day periods, both of which appeal to your committee



FIG. 2.—COMMUTATOR GROOVING DEVICE

as good practice, the weekly period for interurban and the thirty-day period for city cars, or corresponding periods on the mileage basis.

Motor Gearing.—Your committee would recommend inspection of gears and pinions each 1000 miles supplying lubricant if needed, believing that a small quantity of gear grease applied

frequently will insure a better economy of lubricant than heavy doses administered at long intervals.

Your committee would call attention to the higher duty required of pinion material on the larger sizes of motors, as, for instance, a 40-hp motor pinion has a 5-in. face, while a 200-hp motor pinion has but 5.25-in. face. It is, therefore, of vital importance that consideration be given to pinion material being of quality suitable for the higher duty.

Mileage versus Time Basis Governing Inspection.—Of thirty-three roads submitting data, three are governed strictly by a mileage basis, two used a combined time and mileage, while the rest are governed by time only. There seems to be a growing tendency, however, to give importance to the mileage element and most roads keep a strict mileage record so that the mileage of any car can be readily arrived at between any two dates.

Your committee regards the miles run as a more rational measure of wear and tear on equipment requiring inspection than hours or days and that the mileage sheet in the files is a more reliable guide than the calendar on the wall. Your committee recommends that the tendency to give weight to mileage rather than to elapsed time be maintained and where consistent carried to its logical conclusion, viz., the mileage basis to the exclusion of the time basis.

The method of obtaining mileage is substantially uniform on the various roads. The individual mileage for each car is furnished daily from the transportation department, usually through the auditor's office, and is then transferred in the mechanical department to books, tables or charts and the total miles run from the first of the month, or first of the year,

TABLE SHOWING PERIOD BETWEEN TIMES OF LUBRICATION OF 29 ROADS

		Daily	2 Days	3 Days	4 Days	5 Days	Weekly	10 Days	2 Weeks	3 Weeks	Monthly	6 Weeks	2 Mo.	3 Mo.
A Armature Bearings	Old Type Motors	●●●● ●●●												
	Modern Type Motors		●	●●●●		●	●●●							
	Old & New without Distinction	●●●●● ●●●● ●●●●	●●	●●										
B Motor Axle Bearings	Old Type Motors	●●●●												
	Modern Type Motors		●	●●		●	●●				●			
	Old & New without Distinction	●●●●● ●●●●●	●	●	●		●●							
C Truck Journal Bearings		●●●●		●			●●●●● ●●●●●		●●●●		●●●●● ●●●●● ●		●	
D Air Compressors		●		●			●●●●● ●●	●●	●●●	●	●●●●			
E Motor Gears							●●●●● ● ✖	●	●●●●		●●●●● ●	●●	●	●●

NOTE: EACH "DOT" REPRESENTS THE PRACTICE OF ONE ROAD. ✖ INSPECT EVERY WEEK, LUBRICATE WHEN NECESSARY

FIG. 3.—TABLE SHOWING PERIODS BETWEEN LUBRICATION

posted daily, so that to obtain the mileage between any two dates becomes merely a matter of subtraction.

The intervals between motor overhauling vary as widely as do the equipments and condition of service. Seven roads have no stated time, while from the rest the general average for interurban cars is six months, for city cars one year.

Rules for inspection on a number of roads have been outlined on the data sheets. There is a general tendency in inspection to adopt the wise practice of specialization. The work is divided up and each man is assigned and made responsible for a certain part of the work on all cars coming under his care; for example, one man is responsible for the oiling, one man for brushes and brush holders, and one man and helper for brake shoes and rigging, etc. Your committee would recommend this practice and would have inspection report forms printed where the inspectors sign for each car inspected and thus place themselves on record. In all cases records should be such as to enable the responsibility to be definitely placed and indicate when inspection and repairs were made.

In conclusion.—It has been our aim in the foregoing report to avoid exploiting the individual views of members of the committee, and instead, if possible, to make the report as based on the data sheets a composite of the judgment of the railways of the association taken as a whole. We regret that many of the roads belonging to the association have failed to send in data sheets. However, a large number has been received, forming a representative and valuable showing, and your committee wishes to thank those members for their cooperation in furnishing the data and for the careful and painstaking manner in which it has been prepared.

Your committee desires to acknowledge and express its appreciation of the valuable assistance rendered by E. H. Anderson, of the General Electric Company, and J. L. Davis, of the Westinghouse Electric & Manufacturing Company, in giving the benefit of their judgment and experience in the preparation of this report.

QUESTION BOX OF THE ENGINEERING ASSOCIATION*

POWER HOUSES

Q. 1.—Is the use of jet condensers on turbine installation advisable?

No. Better vacuum with surface and use condensed wat in boilers.—Auburn & Syracuse Electric Railway Compan Auburn, N. Y., R. A. Dyer, Jr., assistant general manager.

Have found the use of jet condensers on turbines advisable from several standpoints. First; decreased cost over surface condensers. No tubes to become leaky and split. Ability to carry as high a vacuum as with a surface condenser and decreased maintenance. If injection water is not salt this can be used for boiler feed and its temperature being as high as the hot well water of the surface condenser.—Lynchburg Traction & Light Company, Lynchburg, Va., A. J. Kohler, chief engineer.

The use of jet condensers on turbine installation is not advisable. Surface condensers work successfully and give best satisfaction.—Little Rock Railway & Electric Company, Little Rock, Ark., D. A. Hegarty, treasurer and general manager.

The use of surface condensers in connection with the steam turbine is an ideal condition if the condenser can be kept tight. The absence of all oils in the water of condensation makes it an excellent boiler feed water. Surface condensers around the city of New York have not, as a rule, been a very great success. In only a very few places have they been able to us their water of condensation. The cost of labor and materi necessary to keep the condenser tight more than offsets the saving that would be made by the use of the water of condensation. The economy of the steam turbine is more susceptible to vacuum than a reciprocating engine. The fraction of an inch reduction in the vacuum means a considerable increase in the pounds of water per hp-hour. The principal cause of leaky condensers is pitting. A number of means for preventing thi has been tried, but no one has been wholly successful. In some of the large power stations boosters are used, and in nearly all power stations different kinds and mixtures of metals have been tried, but without success. Where water is not very expensive I would advocate the installation of a jet condenser, but where water is as expensive as $1.00 per 1000 cu. ft. I would recommend the installation of surface condensers and entertain the hope that a remedy for the trouble experienced with them will be found before very long.—Alfred Green, 111 Columbia Heights, Brooklyn, N. Y.

The use of jet condensers on a turbine installation depends on the volume of water available for the condenser. If the question of the boiler feed water and particularly the water for the condensers is important, the surface condenser is by far the best; otherwise the jet condenser would be just as satisfactory and much cheaper.—Knoxville Railway & Light Company, Knoxville, Tenn., P. E. Mitchell, general superintendent.

Q. 2.—Have you had any trouble with stripping of blades in a turbine of either the Parsons or Curtis type? If so, to what did you lay the cause? What do you suggest as a remedy?

No trouble. Operating fifteen months.—Auburn & Syracuse Electric Railway Company, Auburn, N. Y., R. A. Dyer, Jr., assistant general manager.

Have had no trouble from stripping blades. Our turbines are of the Curtis type.—Little Rock Railway & Electric Company, Little Rock, Ark., D. A. Hegarty, treasurer and general manager.

We have partly stripped the blades from two 2250-hp Parsons turbines. Cause, exceptionally long spindle, flexibility, distortion and an imperfect balance. Remedied with a shorter spindle.—Ft. Wayne & Wabash Valley Traction Company, F Wayne, Ind.

Have run two 500-kw Curtis turbines thirty months an have had no trouble with the blades.—Rockland, Thomaston & Camden Street Railway Company, Rockland, Me., Thos. Hawkens, general manager.

*Abstract.

Never stripped a blade.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

Never. Curtis used.—The Columbus Railway & Light Company, Columbus, Ohio, C. C. Collins, assistant general manager.

We have had blades stripped from the Curtis turbine caused by failure of the step bearing.—Knoxville Railway & Light Company, Knoxville, Tenn., P. E. Mitchell, general superintendent.

Q. 3.—Have you had any trouble caused by deposits of foreign matter forming on the blades of the turbine? How do you remedy this?

No. Use condensed water for scaling glands.—Auburn & Syracuse Electric Railway Company, Auburn, N. Y., R. A. Dyer, Jr., assistant general manager.

We have had no trouble by deposit of foreign matter on the blades of the turbine. Have had considerable deposit due to gland water in the gland and on the ends of the spindle. Remedy: A cistern with treated or soft water in connection with a cooling tower.—Ft. Wayne & Wabash Valley Traction Company, Ft. Wayne, Ind.

Steam as dry as possible should be used and care should be taken to see that the proper kind and amount of boiler compound is used. With the superheated steam there should be practically no deposit on the blades or vanes of the turbine. Leaky condensers causing the percentage of salt in the boiler feed water to be high may be responsible for some of the deposit that has been found in turbines.—Alfred Green, 111 Columbia Heights, Brooklyn, N. Y.

Q. 4.—What success have you had with motor generators wound for 6600 to 16,000 volts on the alternating current side? Is any difficulty experienced due to direct exposure of windings to lightning?

We have operated 13,200-volt generators for four years and have had no breakdown or disturbance from lightning.—Ft. Wayne & Wabash Valley Traction Company, Ft. Wayne, Ind.

With a proper lightning arrester I think no great difficulty need be experienced with motor generators wound for 6000 to 16,000 volts on the alternating current side.—Alfred Green, 111 Columbia Heights, Brooklyn, N. Y.

Q. 5.—What is the smallest size of boiler plant or minimum coal consumption which warrants the use of automatic stokers?

Depends on cost and kind of coal used.—Auburn & Syracuse Electric Railway Company, Auburn, N. Y., R. A. Dyer, Jr., assistant general manager.

A plant consuming 30 tons of coal in eighteen hours, developing its rated boiler hp, should be equipped with stokers.—Ft. Wayne & Wabash Valley Traction Company, Ft. Wayne, Ind.

About 2000 hp with one boiler in reserve for hand firing for peaks.—The Calumet Electric Street Railway Company, Chicago, Ill., H. M. Sloan, general manager.

Twelve hundred hp.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

My choice is 1000 hp, but a Caldwell shovel is economy on a single boiler.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

Would say that the smallest boiler plant on which automatic stokers would pay would be in the neighborhood of 4000 hp.—Knoxville Railway & Light Company, Knoxville, Tenn., P. E. Mitchell, general superintendent.

Q. 6.—Is it advisable to use gaskets for superheated steam headers?

It is better to use ground joints for superheated steam headers.—Little Rock Railway & Electric Company, Little Rock, Ark., D. A. Hegarty, treasurer and general manager.

The ground joint I think is preferable to a gasket on a superheated steam header.—Alfred Green, 111 Columbia Heights, Brooklyn, N. Y.

No.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

Would advise corrugated copper gaskets on superheated steam headers.—Knoxville Railway & Light Company, Knoxville, Tenn., P. E. Mitchell, general superintendent.

Q. 7.—In a small or medium size plant, what is the best method of increasing boiler capacity during heavy peak loads? Give details and results obtained.

We think induced draft. Just about installing an outfit.—DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

Have been using the Parsons' system of furnaces in two plants to increase boiler capacity with very good results, obtaining 25 per cent to 40 per cent more steam from boilers than with hand fire. This system was installed to carry us over the peak load, otherwise we would have had to purchase more boiler capacity and have bought more land for boiler room. We have got as much as double rating from boiler with clean boiler and clean fires, the only requirement being that boiler be kept clean so as not to lose tubes.—Lynchburg Traction & Light Company, Lynchburg, Va., A. J. Kohler, chief engineer.

Increase the grate area. The output of the boiler depends very largely upon the amount of coal that can be burned, which in turn, the draft being good, depends on the grate area. In power station work it is, therefore, of great importance to have a large grate area. While forcing a boiler in this way will necessarily give a high flue temperature, the losses thus caused are not great and only last for a comparatively short time.

In a medium-sized plant where No. 3 buckwheat coal, or a mixture of No. 3 buckwheat and soft coal are burned, the capacity of the boilers can be considerably increased by increasing the percentage of soft coal in the mixture and still make very little smoke. With a mixture half and half of No. 3 buckwheat and soft coal at least 175 per cent rating can be obtained with less than 2 ins. of air under the grates.—Alfred Green, 111 Columbia Heights, Brooklyn, N. Y.

By blowing superheated steam and air at bridge.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

Q. 8.—What schemes are there for inducing firemen to take greater interest in their work? Please give details and results obtained.

CO_2 recorder.—Auburn & Syracuse Electric Railway Company, Auburn, N. Y., R. A. Dyer, Jr., assistant general manager.

Have a chief engineer with a full cargo of sand. If he lacks that element go into the boiler room yourself and demand that a 6-in. to 8-in. clean level fire be run; see that the water is kept nearly constant in the boiler; see that these points are carried out to the letter. After one week of this work in the fire-room, the firemen and engineers will see that they have been in the ruts and will be so astounded by the results that they will afterwards try hard to make a good showing. Get the firemen interested to produce a good pressure card.—Rockland, Thomaston & Camden Street Railway Company, Rockland, Maine, Thos. Hawkens, general manager.

Several electric railway companies have put in force a premium system for power house employees. The Sheboygan Light, Power & Railway Company, of Sheboygan, Wis., has reduced the cost of generating power through the means of a premium system. Taking the cost of power at 1.1 cents per kw-hour, which was the average cost before the premium system was started, the company each month divides among the station employees 10 per cent of the saving whenever the cost per kw-hour for any one month drops below that amount. The division is made according to rank, the engineers receiving the largest amount and the oilers the lowest. The company is paying out in premiubs $40 to $80 per month, indicating a saving in power station expenses of $400 to $800 per month. The company states the adoption of the bonus system has brought about a marked improvement, not only in the cost at which power is produced, but in the service in general as well. Every man not only tries to do his best, but also helps the others to do their best. Engineers watch the firemen to see that the coal is economically burned and the firemen protest if the engineers run the larger units at low power factor instead of putting in smaller units. Every employee is on the watch for hot bearings, which would mean costly repairs, and carelessness in one employee will not be tolerated by the other.

Simply watching and checking them.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

By having frequent evaporated tests considerable rivalry can be developed among the firemen, also by posting in the boiler room the name of the fireman who can evaporate the most water with the least amount of coal and have the smallest amount of combustible matter in the refuse. It could be understood that the man making the best showing will receive the next position as water-tender. The CO_2 recording apparatus can be made good use of by posting the record made by different firemen in the boiler room.—Alfred Green, 111 Columbia Heights, Brooklyn, N. Y.

Q. 9.—How can coal fires be prevented?

Have the cold storage bins built with concrete walls between them so that only a smal portion of the coal pile can burn at

a time.—Little Rock Railway & Light Company, Little Rock, Ark., D. A. Hegarty, treasurer and general manager.

By sufficient ventilation to keep the temperature below the combustion point.—Fort Wayne & Wabash Valley Traction Company, Fort Wayne, Ind.

Prevent pockets from forming around wood, especially around trestle uprights. Have tried 3.5-in. boiler tubes in a pile of 2300 tons, but did not prevent fire. The tubes make it convenient to take the temperature and to flood the coal piles with water.—Rockland, Thomaston & Camden Steert Railway Company, Rockland, Me., Thos. Hawkens, general manager.

Coal containing sulphur is apt to ignite spontaneously. Such coal should not be piled deep and should be closely watched. Vertical tubes, say, old boiler tubes, placed in the pile give an opportunity to test the temperature of the pile by means of thermometers. Keep down size of pile and take coal from center or deepest part.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

If soft coal is to be stored, it should be done when the coal is dry, and it should be stored on a dry foundation. The coal should not be dropped from any great height as the friction generates heat and it is a fact that coal dropped from great heights is much more liable to spontaneous combustion than where it is thrown up on the pile or dropped from a low elevation. It is not advisable to store coal to a height of over 20 ft. When coal is stored to any great height the pressure at the bottom of the pile is so great that the fire is easily started. In storing soft coal care should be taken not to mix coal from different mines, and not to mix anthracite and soft coal. It is advisable to provide as much ventilation as possible.—Alfred Green, 111 Columbia Heights, Brooklyn, N. Y.

Keep coal dry.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

Q. 10.—Allowing for additional cost, is it not advisable to have creosote blocks, or a wood floor, on concrete foundation in the machine, blacksmith and wheel section of a shop, in preference to ordinary concrete floor, which becomes uneven quickly and is hard on workmen walking about?

Prefer wood floors, as concrete floors are hard on the workmen's feet, and are continually chipping, getting very rough and uneven.—Lynchburg Traction & Light Company, Lynchburg, Va., A. J. Kohler, chief engineer.

Creosoted block makes an exceedingly durable floor for blacksmith shop and general overhauling shop. It is particularly easy on the workmen.—United Railways & Electric Company, Baltimore, Md., H. H. Adams, superintendent of shops.

I have had experience with concrete floors in shops and barns and have found this class of construction not at all serviceable. My notion of an ideal floor, however, is about a 5-in. hardwood creosoted block on about 4-in. of concrete.—The Calumet Electric Street Railway Company, Chicago, Ill., H. M. Sloan, general manager.

I believe it advisable to use wood floor on concrete foundation in the wheel section of the shop, but prefer concrete foundation covered with cinders and iron borings for blacksmith shop, with finished concrete floor in the machine shop. Prefer concrete floor on solid foundation, either grout or solid packed earth.—Austin Electric Railway Company, Austin, Tex., W. J. Jones, president and manager.

See no good reason for this. Will increase insurance rate with wood floor.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

Advisable, yes, in the particular rooms mentioned. Concrete floors even if constructed without the faults mentioned, and though perfect in surface, yet are subject to the chipping of wheel flanges; drooping of tools, moving of machinery by crowbar, etc., and soon with wearing surface broken, the concrete fragments loosened, the floor is a ruin and the second cost of repair or removal is added to the first cost. Ease and warmth to the feet of men in winter time in shops, seldom comfortable at best, would add energy to mind and body and become a money factor on the right side of the shop earnings. To the suggestion of creosote blocks, or wood floors, instead of cement, might be added also, asphaltum flooring, as sanitary, smooth, serviceable and easy to the tread. Not advisable. Construct your floor areas with the same care as to foundations, grades and finish coats (with skilled labor) as is done in all cement sidewalks of our cities and towns, over which the multitudes pass daily with pleasure and comfort and you will not have your "quickly uneven places" or "be hard on the workmen walking about." Shop floors are too quickly constructed by "levelling off the rubbish" in a rush to "clean up," subdrainage neglected, foundations not dry and settled—the work done in a "mass," floors not laid out in blocks, so as to give expansion at joints, not enough instrument work for levels, put into service before drying out, etc. Good cement flooring, constructed with the care given to street sidewalks, is the most sanitary, useful and permanent form of shop flooring.—Milwaukee Electric Railway & Light Company, Milwaukee, Wis., Fred G. Simmons, superintendent of construction.

A wood floor is much more satisfactory for the men to work on than a concrete one, and, when properly constructed, will last for a number of years. For a blacksmith shop a clay floor properly constructed gives excellent satisfaction.

Would strongly advise wood floors as far as surface of the floor is concerned for any machine or wheel section of the shop; for the blacksmith shop, a cinder floor would be the most advisable.—Knoxville Railway & Light Company, Knoxville, Tenn., P. E. Mitchell, general superintendent.

Q. 11.—Owing to the breaking of concrete around pit traks, the inability to secure a safe jacking base and the possibility of shocks to workmen, is not a plank floor preferable to concrete?

A desirable construction is to bolt a stringer next to the rail and between the concrete floor and the rail, thus affording a base support for the jack.—United Railways & Electric Company, Baltimore, Md., H. H. Adams, superintendent of shops.

I prefer a plank floor between the pits, with finished concrete on the outside. Floors with a top wooden surface are much to be preferred, as they are more agreeable for the men standing upon them. This floor, however, must be protected from rot by a proper substructure. A recent specification called for the ground to be well tamped to a level 14 ins. below the finished floor line and then covered to a depth of 6 ins. with broken stone, the voids being filled with small stone, and the whole being well rolled or rammed into place. This surface was to be liberally covered with hot coal tar, and after setting it was to be brought to a level by 1 in. of sand and tar, the sand being heated and thoroughly incorporated with a mixture of two parts of coal and one part of coal tar pitch. On this were to be placed 3-in. x 4-in. yellow pine zinc-treated sills, the spaces between the sills being filed with tarred sand and packed while hot to a level with the top of the sills. Over this was to be laid a course of 2.75-in. treated yellow pine, this being covered with a layer of roofing felt, and finally a course of 1.25-in. hardwood boards. While such floors are expensive, they are very permanent, and we have heard of cases where they have been in use for twenty to thirty years.

Yes, but fire hazard is increased.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

Q. 12.—What is the most desirable construction for an operating car barn, considering cost, maintenance, operating and insurance? (1) Brick walls, mill construction roof; (2) brick walls, roof iron trusses—2-in. boards, tar and gravel; (3) brick walls, reinforced concrete roof; (4) reinforced concrete walls and roof.

Brick walls, reinforced concrete roof by all means.—DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

The most desirable construction for an operating car house is either brick walls or reinforced concrete walls, combined with reinforced concrete columns supporting reinforced concrete beams, girders and roof slabs.—United Railways & Electric Company, Baltimore, Md., H. H. Adams, superintendent of shops.

Brick walls and mill construction roof with tar and gravel.—Austin Electric Railway Company, Austin, Tex., W. J. Jones, president and manager.

Brick walls, reinforced concrete roof.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

"Brick walls, roof iron trusses, 2-in. boards, tar and gravel roofing," is most desirable construction. It is second lowest in first cost, second lowest in maintenance, second lowest in insurance, and of time-tried and tested service, of almost universal use throughout the transportation and manufacturing world. Milwaukee Electric Railway & Light Company, Milwaukee, Wis., Fred. G. Simmons, superintendent of construction.

Brick walls, roof iron trusses, 2-in. boards, tar and gravel.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

For economy and insurance, brick walls and heavy mill con-

struction, or concrete walls and heavy mill construction is preferable. For insurance without regard to the cost, brick walls and reinforced concrete roof would be preferanble. Any construction with steel, unless fireproofed thoroughly, is very unsatisfactory for car barns.

TRACK.

Q. 13.—What is the life of ties or timber imbedded in concrete?

The Cleveland Electric Railway Company recently had occasion to remove several miles of track that had been laid with different kinds of wooden ties imbedded in 10 ins. of broken-stone concrete (4 ins. under the ties). The track had been down four years. Under exactly the same conditions the white oak ties were found in excellent state of preservation; the chestnut ties were so far gone that they split badly when removed from the concrete with crow bars; the red and black oak ties were absolutely decayed beyond further use.

Cedar ties in Wisconsin imbedded in concrete for twelve years are nearly all being used in new work.—Milwaukee Electric Railway & Light Company, Milwaukee, Wis., Fred G. Simmons, superintendent of construction.

If water proof—15 years.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, General Manager.

The first time that tracks were laid on concrete base on this system was in 1892. The concrete was six inches deep, just the thickness of the ties, and at the same grade, so that there was no concrete under or on top of them. In 1898 new rails were laid on the same ties, which were found in perfect condition. In 1906 these tracks had to be taken up on account of the building of a tunnel and the ties were found in good condition, and if they had not been disturbed, would have lasted several years more. So really the experience of this company has not been sufficiently long to show what the life of ties would be even when only partially imbedded in concrete.

Have had white oak in six years and it is in good condition. —The Columbus Railway & Light Company, Columbus, Ohio, C. C. Collins, assistant general manager.

Q. 14.—Is there a standardized specification for track and roadbed?

We have our own standard.—Ft. Wayne & Wabash Valley Traction Company, Ft. Wayne, Ind.

The American Railway Engineering and Maintenance of Way Association has standard specifications for track and roadbed.—Milwaukee Electric Railway & Light Company, Milwaukee, Wis., Fred G. Simmons, superintendent of construction.

Q. 15.—Which is the best material for ballast on interurban lines, gravel, crushed rock or stone?

Rock.—Auburn & Syracuse Electric Railway Company, Auburn, N. Y., R. A. Dyer, Jr., assistant general manager.

Crushed rock.—DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

Crushed rock first and if too expensive then gravel.—Austin Electric Railway Company, Austin, Tex., W. J. Jones, president and manager.

Crushed rock, because the sharp points on the stones hold the ties rigid, preventing sun kinks in the line.—Rockland, Thomaston & Camden Street Railway Company, Rockland, Maine, Thos. Hawkens, general manager.

From a practical point of view, the question of ballast for interurban lines is solely a question of what materials are most available. Most of the interurban roads in the Middle West have used gravel, because there is plenty of it. Likewise many of the roads along the Atlantic Seaboard and the Gulf have used clam and oyster shells. In the mining districts of the South, furnace slag as ballast is giving good results. The average interurban road will probably continue to use the most available material. If ballast has to be purchased and hauled a long distance buy broken stone if you can get it.

Gravel.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

Good gravel (75 per cent pebble, 25 per cent coarse sand), being more generally obtainable than rock or stone, not requiring breaking or crushing, costing less, more adapted to tamping, giving quicker results on new line construction and easy of maintenance on old work, is the best material for ballast on interurban lines.—Milwaukee Electric Railway & Light Company, Milwaukee, Wis., Fred G. Simmons, superintendent construction.

Crushed rock.—Auburn & Turner Railway Company, Turner, Maine, H. B. Potter, manager.

Q. 16.—What is the best method of handling weeds on interurban roadbeds?

We cut them down.—DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

By mowing and hoeing.—Ft. Wayne & Wabash Valley Traction Company, Ft. Wayne, Ind.

Burn them.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

Cut short, then acid bath.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

We use "herbicide" (a poison liquid) for killing weeds on our suburban lines.—Knoxville Railway & Light Company, Knoxville, Tenn., P. E. Mitchell, general superintendent.

Q. 17.—Has the sprinkling of crude oil on the roadbed been tried to lay the dust and kill weeds, and have the results been satisfactory?

The use of weed-killing preparations has been found satisfactory in some cases, but have heard of instances where roads were obliged to pay for cattle poisoned by eating the weeds that had been treated with oil.—Electric Traction Weekly, Geo. S. Davis, assistant editor.

Q. 18.—Some companies have laid their tracks with joints directly opposite one another, and as they continue the practice, it must have some advantages, what are they?

Do not know of any advantages for T-rail. If girder rail the tie rod holes may come better.—Auburn & Syracuse Electric Railway Company, Auburn, N. Y., R. A. Dyer, Jr., assistant general manager.

The advantage of having the thump at the low joints at the same time, the saving of one tie in each rail length, and having your curve out of line.—Ft. Wayne & Wabash Valley Traction Company, Ft. Wayne, Ind.

Track laid with square joints preferred, as it prevents oscillation and tendency to spread rails.—Austin Electric Railway Company, Austin, Tex., W. J. Jones, president and manager.

This subject can be considered from four points of view, viz.: maintenance of track, maintenance of rolling stock and equipment, ease in riding and cost of construction. If the track is kept in good condition there should be no difference so far as the operating qualities of the road are concerned. With low joints, however, the opposite joint construction gives a vertical blow to each end of the tie, in case of supported joints, and to each end of the two ties where suspended joints are employed; while with broken joints only one end of the tie is struck a blow by the wheels of the car. This should make the latter form of construction easier to maintain. The blow to each rail should be the same in either case, as it is difficult to imagine that a four-wheel truck would be rigid enough to hold up one wheel the small distance it would drop at a low joint. The effect on the car in one case is a shock on each side at the same time which should be detrimental to axles and motors, and in the other a twist which should be bad for the truck and gears. It is hard to say which is the worse. As regards riding, opposite joints give harder blows to the car and with a single-truck car produce teetering; broken joints give a rocking motion. In construction, opposite joints allow a somewhat more economical arrangement of ties and of cross bonding than broken joints. Staggered joints, *i. e.*, breaking joints by 10-ft. to 15-ft., offer some of the advantages of opposite joints, such as reducing cross bonding, and diminish the rocking motion caused by evenly broken joints.—Street Railway Journal, H. W. Blake, editor.

Broken joints, I find, make it hard to keep the track in alignment; also make the wear and tear much greater on the rolling stock.—Rockland, Thomaston & Camden Street Railway Company, Rockland, Maine, Thos. Hawkens, general manager.

Secure therefrom best operating conditions. Saves racking the cars, which occurs with staggered joints.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

One of the disadvantages of "staggered" joints is the galloping motion they are liable to give a car, which motion is very liable to derail the short interurban cars even where not affecting long steam railroad coaches. The principal advantage of "even joints" in track construction, over "broken joints" is that the jar in passing over the joints placed opposite so as to occur at the same time or as one, descreases the total number of

"jars" 50 per cent. There is a second reason, that in "even joints" there is in a given amount of track, less "rail cutting" in putting in the various classes of special work. But the preponderance of advantage in the "broken joint" method in reducing the force of the "jar" by distributing it, the strengthening of the track, by not having two weaknesses unite at the same place, the better maintenance of line and grade, etc., has led to the adoption of the "broken joint" method by a vast majority of the railroads in the United States.—Milwaukee Electric Railway & Light Company, Milwaukee, Wis., Fred G. Simmons, superintendent construction.

In regard to laying tracks with joints in the rails directly opposite one another which is the practice on this road, it can be stated that the advantages are: That when the joints begin to fail and there is a slight pounding of the cars as they pass the joints, such defective places in the track are twice as far apart as they would be if the joints in the rail on one side were located opposite the centers of the rails on the other side. Also that when it is necessary to make repairs to the joints in expensive pavement, with perhaps renewal of ties at the joints, only half the number of excavations are required, which greatly reduces the expense. The old trouble of tracks spreading at the joints, which made breaking joints perhaps desirable, does not occur with heavy girder rails properly held to gage by large tie rods and laid in pavement.

OVERHEAD WORK

Q. 19.—Is there a standard and reliable specification form for overhead trolley construction?

Yes.—Ft. Wayne & Wabash Valley Traction Company, Ft. Wayne, Ind.

Varies, as to the different classes of construction.—The Columbus Railway & Light Company, Columbus, Ohio, C. C. Collins, assistant general manager.

Q. 20.—What should be the dimensions of a substantial lightning arrester ground plate for the purpose of grounding station arresters?

At least 12 ft. to 16 ft. of metal (preferably copper) buried in 400 or 500 lbs. of gas coke.—DeKalb Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

4 ft. by 6 ft., 0.75-in. thick.—Ft. Wayne & Wabash Valley Traction Company, Ft. Wayne, Ind.

Not less than 24-in. square and imbedded in coke or charcoal not less than 6 ft. in the ground or where permanent moisture can be assured.—Austin Electric Railway Company, Austin, Tex., W. J. Jones, president and manager.

Galvanized rods will do out on the line. For station use plates which must not be less than 36 by 36 copper plates.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

I figure 1000 amp. per sq. in. conductor in good bed of iron in powdered coke.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

We use a very satisfactory lightning arrester ground for line work made of a piece of ¾-in. galvanized iron pipe driven its full length into the ground, and the ground wire soldered to the top of same. For more important installations we use a grounded plate made of a piece of flat copper 14-in. square by 0.75-in. thick with projecting painted copper pieces running through same and soldered to it, this plate being buried six or seven feet in the ground and surrounded by broken coke. We always choose the dampest location possible for placing it. This gives the most satisfactory results.—Knoxville Railway & Light Company, Knoxville, Tenn., P. E. Mitchell, general superintendent.

Q. 21.—What experience have you had with a fuse arrester, viz.: an arrester of the type composed of one or more pieces of 18 to 20 d. c. c. m. w., 16 ins. or 18 ins. long, bared at one end and suspended over the positive bus to ground?

Have had very good results with the fuse arresters, but during a very heavy storm the current has to be cut off to renew wires which have burnt out, as it is dangerous to apply new wires while the storm continues. We prefer grounding positive bus through a water box allowing 15 amperes to flow through during storm.—Lynchburg Traction & Light Company, Lynchburg, Va., A. J. Kohler, chief engineer.

Good arrester, but some trouble to keep them "loaded."—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

Q. 22.—What is the most efficient method of preventing short-circuits by reason of low-tension feeders coming in contact with trees?

Encase wires in wood.—Auburn & Syracuse Electric Railway Company, Auburn, N. Y., R. A. Dyer, Jr., assistant general manager.

Cut the trees.—DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

Insulation.—Fort Wayne & Wabash Valley Traction Company, Fort Wayne, Ind.

Tree insulators and creosote wood sleeves.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

Wooden insulator clamped on feeder. Should be creosoted.—The Columbus Railway & Light Company, Columbus, Ohio, C. C. Collins, assistant general manager.

Q. 23.—Can sleet be prevented from forming on the trolley by greasing the wires? Has such an idea ever been tried?

Yes—with success—using petroleum jelly sold as trolley wire grease.—DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

The greasing of the trolley wire to prevent sleet, I found to be ineffectual after repeated trials.—The Calumet Electric Street Railway Company, Chicago, Ill., H. M. Sloan, general manager.

Yes; the writer tried this with good results. The trouble is that greasing the wire is rather expensive, but is every effective.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

In the fall of 1892, on the Mountain route of the Suburban Traction Company, Orange, N. J., we had a lot of trouble with sleet. I heard a remark passed "Why don't they grease the trolley wire?" I tried it and found it to be all right. We have not used a sleet cutter or wheel for this route in four winters.—John Stephenson Company, Elizabeth, N. J., John K. Pischke, chief electrician.

CAR BODIES

Q. 24.—What is a good form of monitor deck ventilator for suburban cars, one that will change the air in the car sufficiently and yet not allow annoying drafts in winter?

High arched roof—no monitors—and metal ventilators.—DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

Use ventilators hinged at one end and arranged to open at the other. Two ventilator sash being coupled together with an opening device so that one ventilator of the pair may be opened toward the rear of the car. This creates a suction which gives ventilation without draught.—United Railways & Electric Company, Baltimore, Md., H. H. Adams, superintendent of shops.

I prefer louver ventilators, such as the Perry, without any means of adjustment. We are putting out some cars with twelve louver ventilators, arranged with outside covers for six of them, which covers will be left in place all winter and removed in the summer.

Closed box system, induced draft same as P. R. R. standard.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

Q. 25.—What is done to prevent brush and brush-holder troubles by operators of fast and heavy equipments?

Brush-holders and brushes should be inspected daily. Brush-holder springs should be kept at the right tension and the holders should be properly adjusted and well cleaned. Brushes must not be too soft or too hard, but of sufficient hardness to cut the mica, and commutators should be inspected frequently for flat or rough surfaces.

Grind brushes for a neat fit and use heavy springs.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

Use good carbon brushes and see that the brush-holders and yokes are in first-class condition and properly adjusted.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis., E. W. Olds, superintendent of rolling stock.

Q. 26.—Will controller blow-outs be reduced if the fields are connected ahead of the armatures, and why?

No—but armatures are protected from lightning.—Auburn & Syracuse Electric Railway Company, Auburn, N. Y., R. A. Dyer, Jr., assistant general manager.

Q. 27.—Which are preferable, solid or split gears, and why?

Solid—no bolts to get loose.—DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

Solid gears pressed on axles preferred, because if same are put on properly they cannot become loose.—United Railways & Electric Company, Baltimore, Md., H. H. Adams, superintendent of shops.

Solid; no bolt heads to go into teeth and ruin motors and gears.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

Solid on high speed with proper shop equipment.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

I always prefer a split gear for the reason that most houses are not prepared for pressing them on and off. If a solid gear gets clogged up or breaks, the road is tied until you throw the car off the rail so as to change wheels, whereas if it was a split gear you could remedy this inside of thirty minutes or less.—John Stephenson Company, Elizabeth, N. J., John K. Pischke, chief electrician.

Solid gears have proven more satisfactory to us, inasmuch as they bring up truer on the shaft and thereby wear more evenly, besides they never work loose as in the split gear.—Knoxville Railway & Light Company, Knoxville, Tenn., P. E. Mitchell, general superintendent.

Q. 28.—What are the best methods of wiring on open city cars?

All light wires to be of good quality, having good insulation and thoroughly concealed; all motor cables to be placed underneath the car in asbestos-lined boxes of good construction.

Wire conduit with screwed opening and asbestos lined.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

Have wiring made up into cables with braided cotton covering treated with a good waterproof paint; run in iron conduits under the car where they are accessible and at the same time not exposed to water from the wheels or injury by the wheels when cars are off the track.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis., E. W. Olds, superintendent of rolling stock.

In 3-in. cotton hose painted with insulating waterproof paint.—The Columbus Railway & Light Company, Columbus, Ohio, C. C. Collins, assistant general manager.

Q. 29.—Which is the more economical, all things considered, hot water or electric heating for cars?

Hot water.—DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

Hot water, because it is very much more economical and radiates more evenly.—The Calumet Electric Street Railway Company, Chicago, Ill., H. M. Sloan, general manager.

I believe, all things considered, that electric heating is the more economical and the safer.

Q. 30.—What in your opinion should be the requisites and general design for a car coupler for interurban car service?

Modified M. C. B.—DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

Automatic with spring buffer.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

One that can be automatically coupled with cars standing on a curve or track with uneven surface, and will not uncouple when passing around short radius curves.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis., E. W. Olds, superintendent of rolling stock.

Standard M. C. B. same as used on steam railroads.—Auburn & Turner Railway Company, Turner, Maine, H. B. Potter, manager.

Q. 31.—Are the results obtained from the use of a high-grade brass motor bearing so much more satisfactory than a babbitted bearing to warrant the additional cost?

No.—Auburn & Syracuse Electric Railway Company, Auburn, N. Y., R. A. Dyer, Jr., assistant general manager.

Yes, on large axles or where an excessive amount of bronze is not required.—The Columbus Railway & Light Company, Columbus, Ohio, C. C. Collins, assistant general manager.

Q. 32.—Is there any method by which carbon brushes for railway motors can be tested without a running test to determine whether they are of the same grade as before used?

Think not.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

No.—The Columbus Railway & Light Company, Columbus, Ohio, C. C. Collins, assistant general manager.

Q. 33.—Has anyone experienced trouble with loose field coils in the newer types of motors, and what can be done to prevent it?

Look after the bolts holding fields in place.—Auburn & Syracuse Electric Railway Company, Auburn, N. Y., R. A. Dyer, Jr., assistant general manager.

We have experienced some trouble with loose fields in newer types of motors, which have been remedied by putting additional liners between pole-piece and field.—United Railways & Electric Company, Baltimore, Md., H. H. Adams, superintendent of shops.

Yes. Give them close inspection, and when showing any indication of becoming loose, see that they are properly tightened, using shims.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis., E. W. Olds, superintendent of rolling stock.

Yes. Insert heavy canvas gasket.—The Columbus Railway & Light Company, Columbus Ohio, C. C. Collins, assistant general manager.

Q. 34.—What is the best way to straighten armature shafts that are sprung between pinions and bearings without removing the winding or shaft from the core?

We have straightened them by mounting in a lathe.—DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

Have straightened armature shafts which have been bent between pinion and bearing, by heating them with a large Bunsen burner, using city gas, and have been enabled to true them.—Lynchburg Traction & Light Co., Lynchburg, Va., A. J. Kohler, chief engineer.

One armature shaft straightener consists of a pair of heavy yokes with cross pieces near the top and a section of 60-lb. T-rail. The armature and shaft are placed on centers in the lathe, the ends of the shaft being first slipped through the yokes. The section of T-rail is then slipped under the cross pieces by an overhead carrier. The upper portion of the screw was made from a piece of an axle and has a pair of small lugs at the top to accommodate the width of the head of the T-rail, preventing this portion of the screw from turning. The lower portion is shaped to fit the shaft and has a projection which fits up into the center section of the screw. By turning this center section with a long lever the shaft at the point of bend is forced downward while a lifting strain is imparted by the yoke nearest the bend. By this method no strain is brought upon the center pins and it is very easy to straighten out the bend.

Tight fitting extension piece and press.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

Heat with blow torch and straighten with sledge.—The Columbus Railway & Light Company, Columbus, Ohio, C. C. Collins, assistant general manager.

Q. 35.—Should armatures rewound or repaired be balanced before being put in service?

Most assuredly.—DeKalb-Sycamore & Interurban Traction Co., DeKalb, Ill., D. Thomson, general manager.

Only roughly.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

No. If the cores are properly balanced before being rewound.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis., E. W. Olds, superintendent of rolling stock.

Q. 36.—Which is the more economical for finishing armatures, the higher-priced, smooth, hard oil-proof varnish at about $1.50 per gallon, or a grade costing about 75 cents per gallon, and which has not all the qualities mentioned above?

The higher priced.—DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

Best way of making determination in relation to insulating varnish is to have it tested by some of the testing laboratories which will give reports on material of this character.—United Railways & Electric Company, Baltimore, Md., H. H. Adams, superintendent of shops.

Best grade, $1.50.—Green Bay Traction Co., Green Bay, Wis., Geo. W. Knox, general manager.

Varnish at $1 per gallon.—The Columbus Railway & Light Company, Columbus, Ohio, C. C. Collins, assistant general manager.

Q. 37.—What is the average cost of equipping double-truck cars with four motors and air brakes, including the wiring, mounting motors, piping, etc.?

In equipping a lot of 100 cars the installation of air brakes, including piping and fittings averaged $31.78 per car; mounting of motors and wiring averaged $31.24 per car; unloading of the electrical equipment, air brake equipment, the cleaning up of the car before placing in service averaged $3.71 per car, making a total of $66.73. This figure includes an allowance for shop expense—four motor equipments with K-28 B controllers and straight air brakes.—United Railways & Electric Company, Baltimore, Md., H. H. Adams, superintendent of shops.

Q. 38.—Give formula of babbitt used for your own journals.

For armature journals, add to 90-lb. of tin, 10-lb. of copper and 10-lb. antimony.—The Calumet Electric Street Railway Company, Chicago, Ill., H. M. Sloan, general manager.

Q. 39.—Is it practical to use the same kind of a fender on city and interurban cars?

No.—Auburn & Syracuse Electric Railway Co., Auburn, N. Y., R. A. Dyer, Jr., assistant general manager.

No.—The Columbus Railway & Light Company, Columbus, Ohio, C. C. Collins, assistant general manager.

Q. 40.—What are the arguments in favor of a pilot for purely interurban service?

Pilots are the only practical thing for high speed, and just as good probably in case of striking a person, as a fender.—Auburn & Syracuse Electric Railway Company, Auburn, N. Y., R. A. Dyer, Jr., assistant general manager.

Won't drop down and is strong enough to push off large obstructions.—DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

Strength to knock and not pick up.—Greenville Traction Co., Greenville, S. C., H. R. Fothergill, general manager.

WHEELS AND AXLES

Q. 41.—Why are chilled iron wheels preferable in interurban service to steel tired wheels?

Don't think they are, although we use them on account of low cost.—DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

Steel wheels are best for interurban service.—United Railways & Electric Company, Baltimore, Md., H. H. Adams, superintendent of shops.

Do not believe chilled wheels are preferable in interurban service to steel tired wheels. The chilled wheel chips more readily than the steel wheel, especially in cold weather. Narrow special work and frogs and switches chip the chilled wheels, making them dangerous on high speed service.—Electric Traction Weekly, Geo. S. Davis, assistant editor.

Steel tired wheels are much to be preferred owing to their being less liable to break. Also, they are probably cheaper than chilled wheels, owing to their less liability to skid flat and, if skidded flat, will usually, if left in service, roll the skid out.

Q. 42.—What causes car axles to crack and break?

Crystallization, changes in diameter and cutting key slots in body of axle.—Auburn & Syracuse Electric Railway Co., Auburn, N. Y., R. A. Dyer, Jr., assistant general manager.

My experience has been that the flange way on railroad crossings is much too narrow for the wheel flanges, thus making a wedging effect on the inside of the wheels and causing the axles to become crystallized.—Rockland, Thomaston & Camden Street Railway Company, Rockland, Me., Thos. Hawkens, general manager.

Too small in size.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

Over heat and rough special work.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

Generally softening of steel in hot boxes.—Auburn & Turner Railway Company, Turner, Me., H. B. Potter, manager.

Q. 43.—What is the average life of 4, 4.5 and 5-inch cold rolled steel axles under cars having four motor equipments, ranging from 15 to 27 tons?

Three to four years. Not that in some cases.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

Have some that have run 150,000 miles.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

From three to five years, according to conditions of track and surface.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis., E. W. Olds, superintendent of rolling stock.

One and one-half years.—Auburn & Turner Railway Company, Turner, Me., H. B. Potter, manager.

Eight to ten years.—The Columbus Railway & Light Company, Columbus, Ohio, C. C. Collins, assistant general manager.

Q. 44.—What is the chief factor in determining when a steel wheel should be turned down in the lathe, i. e., is it flange wear, tread wear, diameter or what? About how often is it found necessary to turn them?

Flange wear always, and this depends largely on characteristics of road, viz.: curves speed and use of brake. Average run between turnings 40,000 to 60,000 miles.—Auburn & Syracuse Electric Railway Company, Auburn, N. Y., R. A. Dyer, Jr., assistant general manager.

Both flange wear and tread wear, as well as diameter should be considered, although generally the flange is the most important. It all depends on mileage, condition of track, speed and curves as to how often they should be turned.

Flange wear. Every 20,000 mile service.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

INSPECTION

Q. 45.—How often should clearance of motors be taken?

The clearance of motors should be determined whenever the equipment is in for regular weekly or periodical inspection.—United Railways & Electric Company, Baltimore, Md., H. H. Adams, superintendent of shops.

Every ten days.—Austin Electric Railway Company, Austin, Texas, W. J. Jones, president and manager.

Three times a week.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

First sixty days once a week, after that every two days if on regular run.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

Q. 46.—In maintaining rolling stock, what is a fair average in cars per man for the maintenance of trucks and electrical equipments at car houses?

On a road, having equipments consisting of four motor and two motor equipments (on both double and single trucks), an average of 7.7 cars per man.—United Railways & Electric Company, Baltimore, Md., H. H. Adams, superintendent of shops.

Four cars per man.—Austin Electric Railway Company, Austin, Texas, W. J. Jones, president and manager.

Six per man; double-truck.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

Eight regulars and eight extras per man.—The Columbus Railway & Light Company, Columbus, Ohio, C. C. Collins, assistant general manager.

Q. 47.—What is a fair average in motors per man?

On a road having equipments consisting of four motor and two motor equipments (on both double and single trucks) there is an average of 19.2 motors per man.—United Railways & Electric Company, Baltimore, Md, H. H. Adams, superintendent of shops.

Six motors per man.—Austin Electric Railway Company, Austin, Texas, W. J. Jones, president and manager.

Ten to twelve motors per man.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

Twelve, exclusive of winding.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

Sixteen regulars and sixteen extras per man.—The Columbus Railway & Light Company, Columbus, Ohio, C. C. Collins, assistant general manager.

LUBRICATION

Q. 48.—What is the most economical depth of oil to use in the oil wells of the armature bearings of the G. E. 80 or 101-B motors? State length of time between oilings for the various depths to be mentioned.

Our practice is to place in each G. E. 80-motor bearing a gill of oil every five days. On 101-B motors with oil wells carrying a depth of 4 inches of oil, they will run one month without additional oil, but 2 inches of oil is recommended as a good depth with an inspection every five days.—United Railways & Electric Company, Baltimore, Md., H. H. Adams, superintendent of shops.

Saturate waste every other day.—The Columbus Railway &

Light Company, Columbus, Ohio, C. C. Collins, assistant general manager.

Q. 49.—Which gives the better results for lubrication of gears, grease or a heavy oil?

Combination of both where cars are high speed.—Auburn & Syracuse Electric Railway Company, Auburn, N. Y., R. A. Dyer, Jr., assistant general manager.

Grease with wood filler.—DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

A heavy oil gives good lubrication for gears.—United Railways & Electric Company, Baltimore, Md., H. H. Adams, superintendent of shops.

Grease, by all means.—Austin Electric Railway Company, Austin, Texas, W. J. Jones, president and manager.

Heavy oil.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

Q. 50.—What is the best simple shop test of lubricating oils and greases, including gear grease?

Not any good (under average conditions).—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

Heat test, and ultimate destruction by heat.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

Q. 51.—As the operating department deals with and receives complaints from the public as to the cleanly condition of the cars, why is it not best to have our cleaning come under the operating end, provided the advice of the master mechanic is adhered to regarding the use of proper cleaning compounds which will not prove injurious to the paint?

The master mechanic is the one responsible for the life, appearance and condition of the paint and varnish on the car. The proper or improper cleaning of a car has a vital effect on the paint and varnish. Therefore by all means let the master mechanic have full charge of the cleaning of cars. Responsibility without authority is bad practice.

It is.—Auburn & Turner Railway Company, Turner, Maine, H. B. Potter, manager.

Q. 52.—Is a long or short pull register preferable, and why?

Rod and lever every time.—DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

Short; does not fool public or inspector.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

Q. 53.—What is the best method of checking motormen on the operation of controller with reference to care of equipment and saving of power?

Automatic accelerating controller.—Auburn & Syracuse Electric Railway Company, Auburn, N. Y., R. A. Dyer, Jr., assistant general manager.

Put on meters.—DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

By a mechanical check on the controller.—The Calumet Electric Street Railway Company, Chicago, Ill., H. M. Sloan, general manager.

Use automotoneers.—Austin Electric Railway Company, Austin, Tex., W. J. Jones, president and manager.

Watch the meters at sub-stations.—Auburn & Turner Railway Company, Turner, Maine, H. B. Potter, manager.

Q. 54.—In how great detail should the mileage of parts of equipment be kept?

Wheels, trolley wheels, motor gears and pinions.—DeKalb-Sycamore & Interurban Traction Company, DeKalb, Ill., D. Thomson, general manager.

We keep the absolute daily mileage of each car. In this way the mileage of any particular part can be easily kept. We always keep the mileage of certain parts, such as armatures. Entry is made on the car card when the armature goes into service; another entry when it comes out of service; the mileage run by the car between these two dates is thus easily drawn off.

Q. 55.—What should be the angle between trolley pole and wire?

45 degs., as at this angle the trolley wheel will follow the wire better and a more nearly even pressure is maintained.—Austin Electric Railway Company, Austin, Tex., W. J. Jones, president and manager.

30 degs.—Green Bay Traction Company, Green Bay, Wis., Geo. W. Knox, general manager.

40 degs., with 35-lb. pull at end of pole.—Greenville Traction Company, Greenville, S. C., H. R. Fothergill, general manager.

CURTIS TURBINES IN RAILWAY SERVICE

BY AUGUST H. KRUESI,

Engineer, General Electric Company, Schenectady, N. Y.

Less than fifteen years ago the severity of street railway loads called forth much discussion as to the design of steam engines for this work, the loads being compared to those arising in rolling mill service. To-day we have to deal with a repetition of loads of the same nature as regards variability in connection with interurban and heavy traction systems operating small numbers of heavy cars on infrequent headway, but engines have been all but superseded, in new plants, by steam turbines which are so peculiarly adapted to these requirements that their behavior has called forth little or no discussion with reference to variation in load. Nowadays discussion of power house operation generally deals with the behavior of the newer types of apparatus which the turbine has called into existence, such as superheaters and piping for superheated steam, condensers, etc. Hence some reference to these features may not be out of place.

TABLE I.—RESULTS OF TESTS ON 5000-KW CURTIS TURBINE

Installed November, 1906, oil step, hydraulic valve gear, condenser base, generator 10-pole, 720 r.p.m., 60 cycles, 3-phase, 6900 volts. Boston Edison Company

Date, 1907	Feb. 12	Jan. 29	July 1	Feb. 12	Feb. 12	Feb. 13
Duration, hours	1.00	1.17	1.00	.33	.33	1.00
Kw-load	2,558	5,195	7,526	2,523	2,382	5,104
Total water per hour	38,997	70,492	103,353	41,445	41,820	78,483
Steam pressure, gage	173.0	173.7	167.7	171.0	173.5	172.2
Steam temperature throttle	526.1	519.0	509.0	535.0	536.0	539.4
Superheat deg. Fahr	149	142	134	159.5	159.3	163.3
Barometer	30.11	30.48	29.95	30.12	30.12	30.43
Vacuum inches Hg	28.98	29.30	28.60	28.25	27.63	27.51
Water lb. per kw-hour	15.24	13.57	13.73	16.45	17.58	15.38

CURTIS TURBINE GENERATORS

The peculiar adaptability of the Curtis turbine to railway loads, which entail frequent variations in pressure and temperature, is in a large measure due to its having no revolving parts subject to high pressure or temperature. The part subject to the full pressure and superheat, where superheat is used, strainer, throttle valve, valve chest and valves are made of cast or rolled steel. The process of expansion to the pressure in the wheel casing, which seldom exceeds 50 lbs., reduces the temperature of the steam to approximately that of saturation at the latter pressure, and it is the general experience that when difficulties in operation do arise from high temperature the turbine causes less concern on this account than any other steam apparatus in the plant.

STEAM CONSUMPTION

Fig. 1 represents tests made by the Edison Illuminating Company, of Boston, on a five-stage, 5000-kw turbine of recent design. Table 1 gives results on individual tests.

Table II* gives the results of tests made by the Commonwealth Electric Company, of Chicago, on a five-stage, 9000-kw, 750 r. p. m. turbo-generator. The very high vacuum obtained in these tests is noteworthy and is probably due in a large measure to the surface condenser being placed in the base of the turbine. It is probable that the figures given in this table represent the highest attainment thus far reached in the generation of power from steam.

*Presented by Mr. W. L. R. Emmet before National Electric Light Association, Washington, D. C., June, 1907.

TABLE II.—TESTS OF 9000-KW CURTIS TURBO-GENERATOR AT CHICAGO

Turbine five-stage, condenser base, 750 r. p. m., generator four-pole, 9000 volts, three-phase, 25-cycle.

Load in Kilowatts	Gage Pressure Lbs.	Vacuum Inches	Superheat Deg. F.	Water Rate Lb. per Kw-hr
5,374	182	29.43	133	13.15
8,070	179	29.35	116	13.0
10,186	176	29.47	147	12.9
12,108	182	29.34	148	13.05
13,900	198	29.31	140	13.6

Fig. 2 shows the results of acceptance trials on a 2000-kw, four-stage, 810 r. p. m. turbine, with a 6600-volt, 27-cycle generator, for the Westville power house of the West Jersey & Sea Shore Railroad Company. The tests were made at Schenectady for representatives of the purchaser. The overload test required some correction for vacuum on account of the condenser being defective. The other tests were made under contract conditions.

These tests indicate that the hourly steam consumption from no load to a point considerably beyond rated load follows a straight line when plotted to load and that the total consumption of steam includes a fixed amount (this being the amount required to maintain the machine at speed without load) plus an additional quantity proportional to the load. A high economy at light loads requires that the fixed amount required for no load shall be as small as possible. In the tests on the three machines referred to above, it is found that this constant is about 12.5 per cent, 7.1 per cent and 14.2 per cent of the steam consumption at full load respectively and the economy curves are correspondingly flat over a wide range of load. A first-class steam engine and generator under similar conditions would probably have no-load steam consumption of not less than 15 per cent of that required at rated load. The additional quantity of steam per kilowatt over and above this fixed amount at no load is 12.1 lbs. per hour in the case of the Boston Edison tests. Steam at the pressure and superheat employed in these tests expanding to 1.5 ins. absolute back pressure would generate one kilowatt for 9.27 lbs. per hour in a theoretically perfect steam engine or turbine driving a generator of unity efficiency. It will be seen that, barring the unavoidable no-load losses, the efficiency of the turbine amounts to about 76.4 per cent of that theoretically obtainable. This represents a very decided step forward and indicates that we are approaching the practical limit of perfection in the production of power from steam.

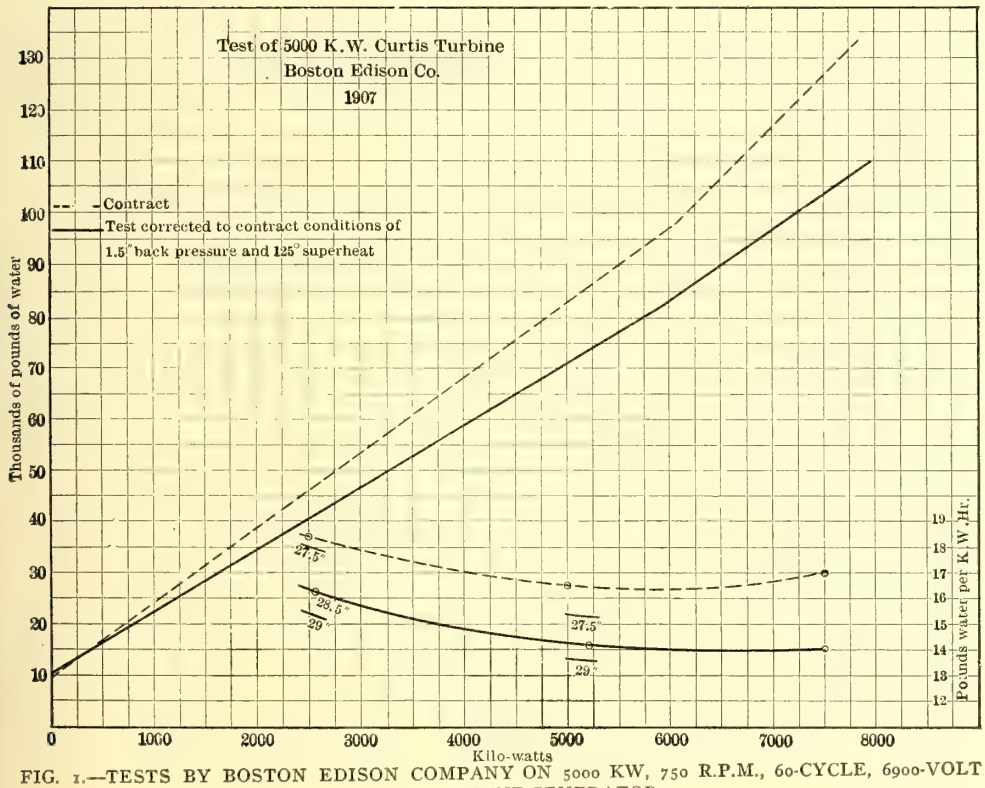


FIG. 1.—TESTS BY BOSTON EDISON COMPANY ON 5000 KW, 750 R.P.M., 60-CYCLE, 6900-VOLT CURTIS TURBINE-GENERATOR

RATING OF TURBINE GENERATORS

The high sped of turbine generators necessarily involves a close and compact arangement of large masses of iron and copper which dissipate relatively large amounts of energy on small surfaces and in a small space. To ventilate adequately such machines, and avold repeated circulation of the hot air in the immediate locality of the machine requires that cool air (generally from outside the station) be supplied to the generators in considerable quantities. When such provision for ventilation is made it is possible to generate continuously larger amounts

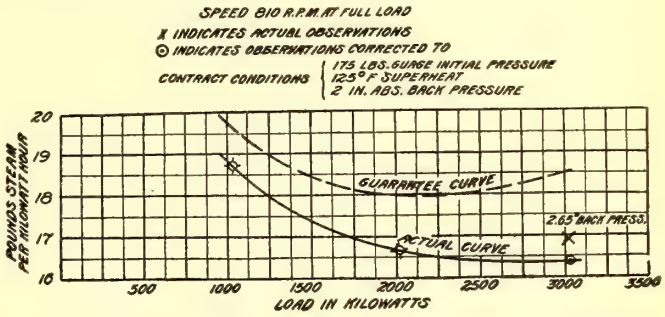


FIG. 2.—ACCEPTANCE TEST ON A 2000 KW, 810 R.P.M., 27-CYCLE CURTIS TURBINE

of power in individual machines and thereby very materially reduce not only the initial cost of the station but the operating cost as well. The turbines were formerly designed to carry approximately full load non-condensing and in consequence had a very large margin of output condensing. Experience demonstrates that the non-condensing capacity is of little value. They operate at all loads without by-passing steam and the tests show their economy to be almost constant through a wide range in load. It therefore is desirable, in order to reduce the capital and operating costs, to operate them at their highest economical output with such a margin for momentary excess loads as actual service requires and with a due reserve for governing with a reasonable drop in vacuum and steam pressure under such conditions. Engines when designed for the most economical performance at rated load necessarily have a large overload capacity, but operate when overloaded at relatively very poor economy and can only be used advantageously at overloads for comparatively short peak periods. Generators for engines have accordingly been designed with an overload capacity of 50 per cent for two hours only. The fundamental difference in this respect between engines and the turbines under discussion calls for an entirely different ratio of capacities between generator and prime mover. Generators to be used with the turbines should permit the set to be operated continuously at a larger proportion of the maximum output of the turbine. Generators of the larger rating will show an appreciably better efficiency than those of the older rating. The economy of operating the turbine at the larger capacity has already been pointed out. Such a ratio of capacities naturally must change the basis of rating. If the generator's continuous capacity is to be made nearly that of the turbine a smaller margin in temperature rise need be made for protracted overloads.

The advantages of this increase in generator capacity are obvious for power and lighting service as well as for large units in city railway service. Consideration of the load curves for

stations carrying the more variable loads of interurban systems shows that it is also desirable in such service. For example, the load curve of the Westville power station of the West Jersey & Seashore Railroad for Sunday, Aug. 25, 1907, is shown in Fig. 3.

It represents a particularly heavy day's operation with extreme momentary loads. This station is equipped with 4-2000-kw Curtis turbo-generators, but the generators are virtually machines of 3000 kw on account of being ventilated by forced blast taken from the air chamber for the air-blast step-up and rotary converter transformers.

The curve is drawn from the hourly readings of integrating watt-hour meters and therefore does not represent momentary variations. The actual maximum out-put in each successive

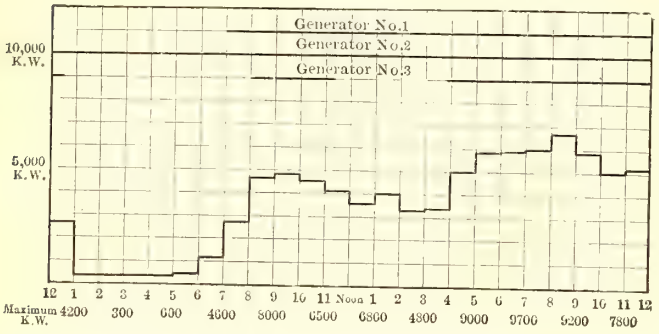


FIG. 3.—LOAD CURVES OF WESTVILLE POWER STATION, WEST JERSEY & SEASHORE RAILROAD COMPANY

two-hour period is indicated in the figures immediately below the curve and the number of machines in service by straight lines above the curve. The maximum momentary loads determine the number of machines in service at any time and these momentary loads are of such extreme variation that the same number of turbines would be required for service regardless of the rating of the generators within reasonable limits, but the peak load lasts for five hours and is equivalent in heating to a steady load of not less than 6300 kw, so that even in this case of an electrified steam road, with extraordinary load fluctuations, machines limited to a two-hour overload basis would have little or no margin as regards heating if limited to a ratio of 2000 kw generator rating to 3500 kw turbine output. Some margin is essential on account of the impossibility of maintaining unity power factor and the advantage of the larger generator capacity for a given turbine would become greater as the station load became larger and steadier.

GOVERNING

All of the large 25-cycle turbines are now equipped with hydraulically operated valves controlled by balanced pilot valves connected to the governor and taking oil from the step bearing pumping system. These governors and valves have proved reliable, permanent in adjustment, sensitive and responsive to abrupt changes in load and require very little attention in operation. They represent probably the greatest single improvement which has been effected in this type of turbine. They are ordinarily set for 2 per cent change in speed and this degree of regulation is found sufficiently large to afford stable operation in parallel. It is the usual experience that after being adjusted for the correct speed at the factory, they seldom require alteration of speed or regulation when new machines are set up and parallel with machines of the same type already in operation.

The very considerable kinetic energy of these turbines and generators (far exceeding that of the fly-wheel and generator of engine-driven sets of the same capacity) contributes very largely to their responsiveness to extraordinary fluctuations of load and to their close speed regulation. As an example, the 3500-kw, 750-r. p. m., 13,200-volt set has a total fly-wheel effect, WR^2, of approximately 320,000 and this represents at rated speed a storage energy of 30,600,000 ft.-lbs. by virtue of which the machine when working at any load can carry an additional load equal to the full rating for about 0.75 of a second with a drop in speed of 3 per cent and without additional steam, or a momentary increase in load of half the rating for 1.5 seconds, thus affording the governor plenty of time in which to act even if it were for any reason sluggish.

LUBRICATION

The step bearings of these machines are now lubricated with oil instead of water, which was formerly employed. The change to oil involves the use of an additional shaft packing where the turbine shaft passes through the base, but as this packing has only to seal against the atmosphere its duty is relatively light and its operation simple. The upper bearings of these machines are now being lubricated under pressure from the step oiling system dispensing with tanks and sight-feed glasses. The pressure lubrication enables the bearings to be supplied with any quantity of oil desired. It is found that a flooded condition of lubrication in the guide bearings materially improves the operation of the machines as regards freedom from vibration. The oil is filtered continuously and an ordinary grade of mineral engine oil is satisfactory. Its specific gravity at 20 degs. C. should be about 0.89 and its viscosity between 0.6 and 0.95 measured by the pipette viscosimeter.

PRESSURE VACUUM AND SUPERHEAT

It will be seen from the tests presented that very noteworthy advances have been made in the economy of these machines. Further advantage in station economy can be made by extending the temperature range through which the machine operates by increasing the pressure and superheat of the live steam and by reducing the temperature of the exhaust steam through little vacuum. The Curtis turbine has no inherent limitations to the economical conversion of such added energy at either end of the temperature scale.

Steam working from 200 lb. gage to 28 in. vacuum makes available about 5 per cent more energy than steam at 150 lbs. pressure while it requires only about 0.6 of 1 per cent more heat making a theoretical gain of about 4.4 per cent due to this increase in pressure. The actual improvement in the economy of the turbine due to this increase would be about the same. Practically all of this is realizable inasmuch as the efficiency of the boilers under these two pressures would be substantially the same.

The addition of 100 deg. of superheat adds about 4.5 per cent to the total heat of the steam and would require an extra fuel expenditure of approximately 6 per cent and makes a reduction of about 8 per cent in the steam consumption of the turbine, resulting in a net gain on this account of approximately 2 per cent.

This, however, does not represent the whole gain due to the use of superheat as compared with ordinary saturated steam operation, because such steam is never dry and a small amount of moisture causes an altogether disproportionate increase in steam consumption. The idea may be expressed by saying that the first 50 deg. of superheat is of appreciably greater value than the second 50 deg. The large gain from superheat as compared with more or less wet steam was discussed at length by the late Dr. R. H. Thurston* as far back as 1900 in connection with steam turbine tests. While higher superheat will undoubtedly result in proportionately increased net economy its employment must in a large degree be dependent not only upon the load factor and the size of unit to be employed but also upon the nature of the service as regards severe and frequent variations in load, in view of the difficulties which have been encountered in the practical operation of superheaters, steam piping, valves, pumps and engine-driven auxiliary machinery.

It seems probable that much of the trouble which has undoubtedly attended the use of superheated steam is due not to any want of strength but to want of elasticity in the parts affected and that they are not the result of high temperature so much as the unceasing variation in temperature incidental to the ordinary railway load. It is now generally believed that water may exist under certain conditions in the presence of superheated steam and if variations in load cause occasional priming of the boilers and water in the steam piping the resulting variation in temperature due to the spraying of heated surfaces is enormously increased. The substitution of annealed steel castings in place of cast-iron fittings and valve bodies, the omission of copper gaskets and copper alloy internal parts in valves, better design of boilers and superheaters so that the boilers will deliver only steam and no water to the superheaters and so that water can readily drain out of the superheaters and

*"The Steam Turbine," R. H. Thurston, Trans A. S. M. E. Vol. XXII, Dec. 1900.

piping, are all factors which will permit the satisfactory employment of higher degrees of superheat.

The low velocities in steam piping which have become customary by reason of the pulsating flow of steam engines are not suitable for superheated steam. It is essential that the piping be made flexible to the greatest practicable degree and this requires small sizes of pipe. The steam pipes for Curtis turbines will require velocities of about 8500 ft. per minute at their maximum ratings, based on saturated steam. One hundred degrees superheat will increase the volume of the steam about 15 per cent, but the velocity will be substantially the same on account of the reduction in the steam consumption of the turbine. The use of higher pressure and superheat will be facilitated by the introduction of steam-turbine driven pumps and auxiliary machinery, and a satisfactory beginning has already been made in this direction in the shape of a high-speed centrifugal circulating pump driven by a 75-kw horizontal Curtis turbine for the condenser of the fourth 2000-kw unit in the Westville power station of the West Jersey & Seashore Railroad referred to above.

Improvement in economy arising from better vacuum is probably the most easily attained. Raising the vacuum from 28 ins. to 28.5 ins. makes 5 per cent more energy available and of this the turbine realizes an improvement of from 0.5 to 0.6 lb. per kw-hour at rated load, that is from 2.5 per cent to 3.5 per cent, depending on the economy of the unit. Another way of regarding this is to consider that it adds just so much to the capacity of the station. To improve the condensing equipment is often the easiest way to lighten the duty on the boilers.

REPORT OF SUB-COMMITTEE ON RAILS AND JOINTS

Mr. Fred G. Simmons, Chairman of Way Committee:

Your sub-committee on Rails and Joints as a result of its study recommends, as best practice and as a standard for city construction in paved streets, the use of the 7-in. T-rail, known as the Lorain section No. 95-400 and the Pennsylvania Steel Company's section No. 272.

In cities where the use of the T-rail is not approved, your sub-committee recommends the proposed four half-Trilby 9-in. and 7-in. sections. Their weights and principal dimensions are as follows:

(1.) One hundred thirty-seven lbs. per yard; 9 ins. high; 6½-in. base; 9/16-in. web; 3-in. head, 1 13/64 ins. deep, with a top slope of 1½ degs., beveled outside edge ¾ in. horizontal by 5/16 in., vertical, having a groove of 1¼ ins. deep by 1¾ ins. wide, with lip ¾ in. wide, ½ in. below head and ⅞-in. maximum thickness; total top width of head and lip 5½ ins.

(2.) One hundred twenty-two lbs. per yard; 9 ins. high; 6-in. base; ½-in. web; 2¾-in. head, 1 3/32 ins. deep, with top slope of 1½ degs., and beveled outside edge ½ in. wide, maximum thickness of lip about ¾ in.; with the other dimensions the same as first above noted.

(3.) One hundred twenty-two lbs. per yard; 7-in. rail; 6-in. base; ½in. web; with the other dimensions the same as first above noted.

(4.) Ninety-eight lbs. per yard; 7-in. rail; 5½-in. base; 7/16-in. web; with the other dimensions as given in second above.

Sections of proposed tram-rails of 9 ins. and 7 ins. height, with beveled heads to correspond with the half-Trilby sections above noted, have been designed and are shown on blue prints attached, viz.: A 9-in. tram-rail to weigh 137 lbs. per yard; a 9-in. tram-rail to weigh 120.3 lbs. per yard; a 7-in. tram-rail to weigh 122 lbs. per yard; a 7-in. tram-rail to weigh 96.4 lbs. per yard.

Sections of grooved guard rails for special work have also been designed 9 ins. and 7 ins. high, with beveled heads for grooves 1⅜ ins. and 1½ ins. wide, of heavy and light weights as follows: A 9-in. rail groove 1½ ins. wide to weigh 156.2 lbs. per yard; a 9-in. rail groove 1½ ins. wide to weigh 139.7 lbs. per yard; a 7-in. rail groove 1½ ins. wide to weigh 141.2 lbs. per yard; a 7-in. rail groove 1½ ins. wide to weigh 115.8 lbs. per yard; a 9-in. rail groove 1⅜ ins. wide to weight 155 lbs. per yard; a 9-in. rail groove 1⅜ ins. wide to weigh 138.6 lbs. per yard; a 7-in. rail groove 1⅜ ins. wide to weigh 140 lbs. per yard; a 7-in. rail groove 1⅜ ins. wide to weigh 114.7 lbs. per yard. The lip in each pattern of guard rail is shown ⅜ in. above the head.

Four patterns of splice bars would be required for the sixteen rail sections proposed, which might be 6 or 12-hole to meet the views of the user, although best practice would doubtless altogether avoid the use of bolted splices in paved streets. No recommendation concerning splices is now made by your sub-committee.

A blue print attached shows the relation to the proposed rail heads of wheels with flanges of 1-in., ⅞-in. and ¾-in. depth, and heads of 3½-in., 3-in. and 2½-in. widths.

Another drawing shows the planing of special work suggested on outside and inside guard rails on curves for the minimum waste of metal combined with the maximum guard-rail effect.

The rail sections as above proposed were designed in co-operation with J. M. Larned of the standardization committee, who, also by request, kindly prepared the drawings for the illustration.

JULIAN GRIGGS,
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CHARLES H. CLARK,
Engineer M. W. International Traction Company,
Buffalo, N. Y.
E. O. ACKERMAN,
Engineer M. W. Columbus Railway Light Company,
Columbus, Ohio.

In an appendix to the report the sub-committee analyzed the replies received to circular No. 12 of Sept., 1906, sent out by B. V. Swenson, secretary of the American Association. Of 1500 street and interurban railways in the country, 81 made replies which were classified as follows:

Urban, 36 companies, 13,184 cars, 3775 miles of track.

Urban and interurban, 42 companies, 8958 cars in service, 5628 miles of track.

Interurban, 3 companies, 68 cars in service, 134 miles of track.

While the replies seldom covered all the questions asked they showed great variety of rail sections, including all that have ever appeared in any rail-makers catalogue, with a sprinkling of European sections. Statistics of the Pennsylvania and Lorain Steel Companies for the years 1903, '04, '05 and '06, show the proportion of different sections:

Rail	Pennsylvania Steel Co.	Lorain Steel Co.
High T	22.4	23.2
Full groove	.9	.8
Half groove	8.5	22.9
Trilby	21.2	25.2
Plain tram	31.6	17.4
Guard	9.1	10.5
Girder for steam roads	6.3	...
	100.0	100.0

Twenty-nine companies reported T-rails prohibited in municipalities; 36 reported T-rails permitted in municipalities, and 16 did not answer the question. The T-rail is generally prohibited in large cities of the East, in Texas and in the Middle West, except in Indianapolis. The T-rail is permitted in cities of the South and West and the smaller cities of New England, where macadam streets are commonly used. T-rails are suggested for standard by 32 companies, while nine companies suggest grooved or tram-rails.

On Aug. 13, 1907, the sub-committee sent a circular letter, with 13 blue prints illustrating proposed rail standards, to 81 companies having 100 miles or more of track in cities of 100,000 population and upward and to 40 city engineers of such cities, requesting criticism and suggestions.

Of the 15 companies which replied, four use only T-rails; three say standards are satisfactory; one objects to a base less than 6½ ins. for lighter sections; one is using narrow tread wheels which leave a ridge on the outside of wide rail heads; one prefers 9/16 in. as a minimum thickness of web for rails 7 ins. high and over to prevent corrugation; one uses rails similar to the 9-in. tram section recommended by the committee; two merely acknowledge the circular. Of 12 city engineers who replied, two object to bevel heads; one (Philadelphia), where the bevel head is most extensively used, reports it as satisfactory and a great improvement over old-fashioned trams; three prefer the Trilby sections; five make no comment and one is satisfied with the standards proposed.

In a continuation of the appendix the sub-committee cites data regarding the practice of 22 companies which made replies to inquiries concerning chemical specifications for rails. The sub-committee, however, states that it has given but little attention to the question of rail manufacture and makes no recommendations at this time. The sub-committee also incorporates in its

report the standard specifications of the New York, New Haven & Hartford Railroad Company for 1905.

(The New York, New Haven & Hartford specifications are not included in this abstract of the report because this subject is now under consideration by a committee of the American Railway Association which is expected to submit its final report on Oct. 30, and this report will doubtless represent the consensus of opinion.)

RECENT DEVELOPMENTS IN STEAM TURBINE POWER STATION WORK, WITH SPECIAL REFERENCE TO THE FORT WAYNE & WABASH VALLEY TRACTION COMPANY SPY RUN STATION

BY J. R. BIBBINS,
Engineer, Westinghouse Machine Company, East Pittsburg, Pa.

If any one feature may be said to characterize recent engineering practice in turbine power plant construction, it is that simplification of operating equipment which lowers investment, cost, labor and up-keep and the possibility of service interruptions, the while preserving a degree of working economy commensurate to the service in view. The underlying object is, of course, the maximum commercial, rather than physical efficiency. And this applies as much to auxiliary as to principal generating practice. A very important factor, contributing to this desired simplicity of plant, is compactness of arrangement such as permits the subdivision or grouping of related apparatus more or less on the unit principle. Thus, in many modern stations, each unit is served by a certain group of boilers and an independent set of auxiliaries, so that in the event of trouble, the damage may be entirely isolated. In one plant (Carville), all auxiliaries are motor-driven, and at starting, all motors of a particular section, "pick up" load with the main generators to which they are connected. With this system, the absence of exhaust steam for feed heating is made up by the use of economizers. In the case of the condenser, the old centralized plant has developed not only into individual units, but particularly condensers located directly beneath the turbine. And, owing to the relative bulk of the surface type, this has again led to skeleton turbine foundations, and finally, to constructions of steel or reinforced concrete.

To what an extraordinary degree of compactness turbo-machinery has attained, is evidenced by Fig. 1. Less than one-fourth of the horizontal Corliss, and less than one-third of the vertical, the turbine in larger sizes require but 1/20-sq. ft. per generator hp. This has further brought about radical changes

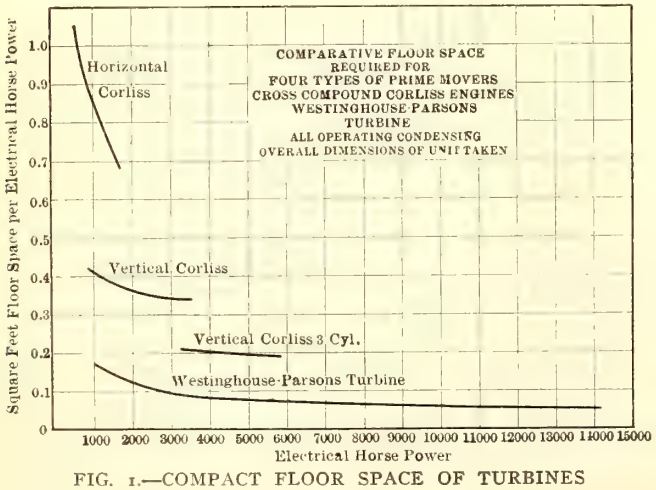


FIG. 1.—COMPACT FLOOR SPACE OF TURBINES

in boiler plant arrangement. In place of the familiar square power house, divided equally between parallel boilers and generating rooms, the latter now occupies barely one-third of the total, and boiler batteries are arranged at right angles to the turbine room to provide for the otherwise cramped boiler capacity without unduly lengthening either building or steam piping; for example, Carville station, Newcastle (Eng.); Gould Street station, Baltimore; Commonwealth station, Chicago; Waterside station No. 2, New York City, etc. In many cases, the value and limitations of the site have even necessitated multiple-decked boiler rooms, such as Waterside No. 1 and No. 2; Lots Road station, Chelsea (London); Long Island station, Pennsylvania R.R., New York City; Kent Avenue station, Brooklyn, etc.

Another important development has taken place along lines calculated to foster heavy peak and emergency overloads; in the generator, forced ventilation; in the turbine, auxiliary or secondary admission of steam to assist on overloads without detriment to the economy on normal loads; in the boiler plant,

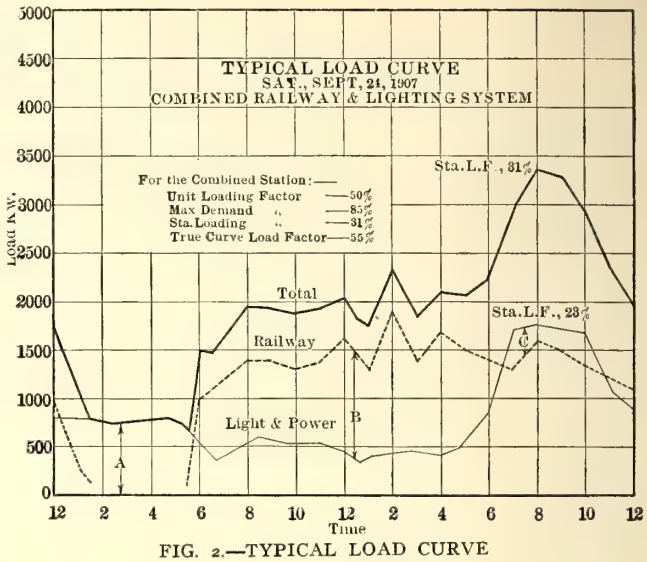


FIG. 2.—TYPICAL LOAD CURVE

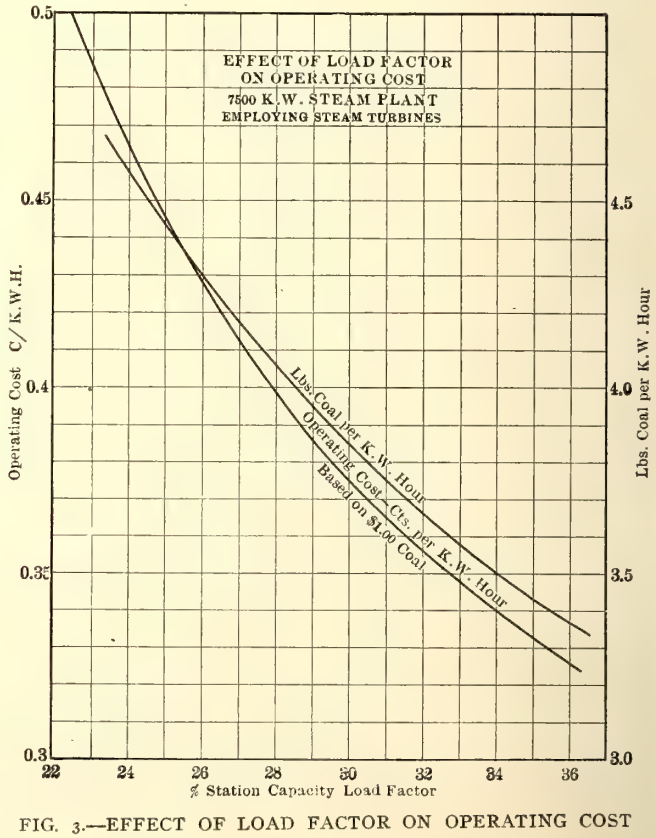


FIG. 3.—EFFECT OF LOAD FACTOR ON OPERATING COST

mechanical stokers and mechanical draft auxiliaries to normal chimney draft; *e. g.*, Waterside station, New York; Kent Avenue station, Brooklyn; Neasden station, London; Carville station, Newcastle; Delray station, Detroit, etc. The equipment of these stations thus provides exceedingly valuable forcing capacity. At Kent Avenue, overloads of 75 per cent during peak, are not infrequently sustained on the turbines, and a similar machine of 7500-kw capacity at Waterside No. 2 sustained nearly 100 per cent overload during emergency. Thus, an essential requisite of the modern turbine, is usually rugged

construction, even at the expense, to a certain degree, of fine economies, obtainable at best only under extremely favorable conditions, which are seldom obtained and never maintained.

The vital necessity of security against total interruption has, in the most modern station, taken form in the provision of an auxiliary storage battery floating in the exciter bus. This battery comes into actual use perhaps only once or twice a year, being entirely idle during the rest of the time. But, on these few occasions, the importance of uninterrupted service usually far outweighs considerations of cost and maintenance. In the Gould Street station, Baltimore, a recording chart of exciter bus voltage covering the period of exciter breakdowns, showed not the slightest fall of voltage, due to the instantaneous substitution of battery current.

COMBINED SERVICE

A development of considerable importance, especially in the field of moderate sized power properties, is the combination of services of different characters in a single central generating station—such, for instance, as interurban railway and central station lighting. This, of course, has been common practice where same kind of current is distributed, but by no means general when the services have been kept distinct. A number of systems have been put into operation, or projected within recent years which embody this feature of combined service. Of these, the Fort Wayne system, later described, is typical.

This system possesses at least one important advantage—the more effective working of boiler capacity—perhaps the most fruitful field for effort toward the improvement of plant efficiency. In the generating room, the two systems are presumably independent electrically, unless interconnected through a frequency changer which, although complicating the equipment somewhat, might prove invaluable in emergencies. Steam, on the other hand, is generated to meet the average load of both systems, irrespective of frequency. This will be clear from a study of load curves, Fig. 2, and the accompanying analyses, Table I—data taken from an actual system, such as the Fort Wayne, and of about the same size. The curves represent a Saturday load only, but are typical of other days. Note first the relative loading of generating units. For the lighting load, yielding a true loading factor (avg. max.) of 39 per cent, which is high, the average unit loading is but 34.6 per cent of the rated capacity. But, the railway load gives a unit loading of 67.8 per cent rating; and combined, the plant operates at an average unit loading of 50 per cent, which is also high, considering the relative size of the units, 1000 kilowatts. This problem, of course, reduces to the question—whether two small plants can be operated at respective unit loadings of 34 per cent and 68 per cent more efficiently than a combined plant of 50 per cent unit loading—undoubtedly so. Fig. 2 shows in a general way, how well the systems superpose. Thus, lighting load at (A) makes up for the early morning deficiency in railway load. During the day, the situation is reverse as at (B). In the evening, railway load usually falls off as lighting load increases (C).

TABLE I.

Analysis of Load Curves—Combined Railway and Lighting Systems.

	Average 24-hour load.	Average load when running.	(1) Loading factor per cent rating.	(2) Max. demand factor.	(3) True loading factor.	(4) Station loading factor.
			Unit.			
Saturday, Railway.....	1,058	1.355	67.8	95	56	35.3
Sept. 24, Lighting.....	692	.....	34.6	89	39	23.0
(Curves), Station.....	1,850	.....	49.9	85	55	31.0
Sunday, Railway.....	921	1,034	50.2	75	61	30.6
Sept. 25, Lighting.....	471	.....	47.1	123	38	15.7
Station	1,392	.....	53	88	53	23.2
Wednesday, Railway...	1,050	1,230	61.5	75	70	35.0
Sept. 28, Lighting.....	634	.....	31.7	79	40	21.0
Station	1,685	.....	45.4	72	58	28

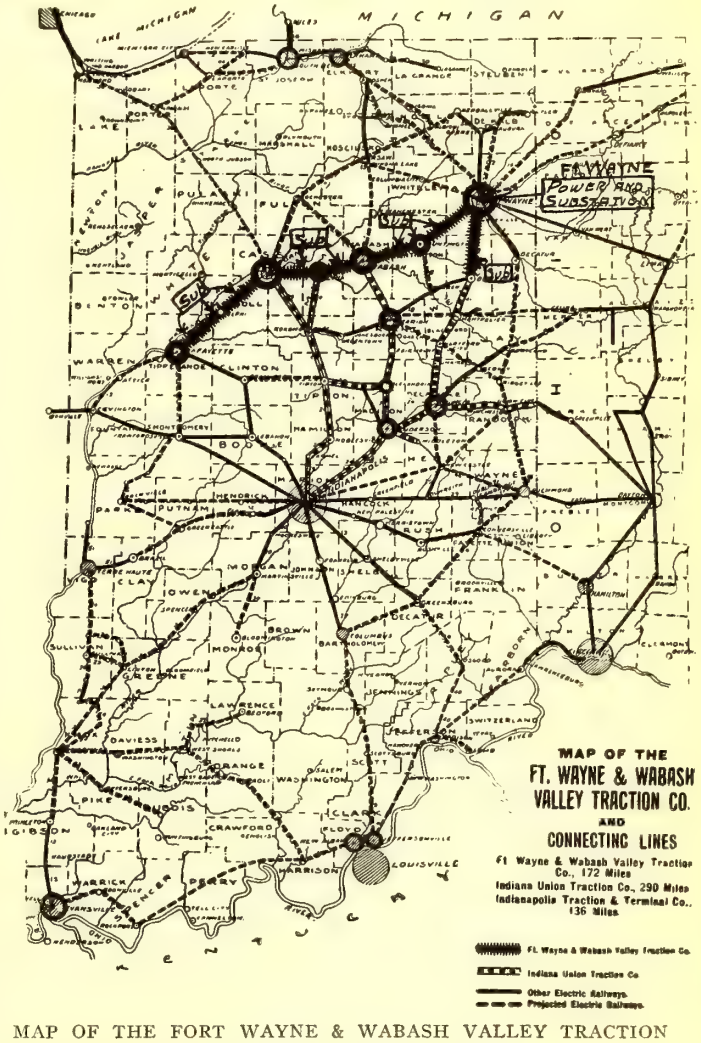
(1) Average load when running—capacity of unit.
(2) Maximum demand from load curve—capacity running.
(3) Average 24-hour load—maximum from load curve.
(4) Average 24-hour load—station capacity, including one spare unit each 25 and 60-cycle.

This question is, however, best answered by Fig. 3, representing the variation of cost and efficiency with station loading factor avg. load sta. cap. for this same system. It is notable that an increase in the lower loading factor brings the greatest increase in efficiency. From 25 to 30 per cent, the decrease in operating cost was 15.7 per cent; from 30 to 35 per cent, 9 per cent. This shows that considerably more is gained by increasing the lighting factor than is lost by decreasing the railway, which, together with the decreased boiler standby losses and the good effect of centralization, represents the net results of the combination of operating systems. In the one case, 3.1 times the average day boiler capacity is necessary to carry the lighting peak; for the entire plant, but 1.8 per cent. This not only lowers standby losses, but also materially reduces the boiler capacity necessary for a given turbine output. Thus, at Fort Wayne, there is installed but slightly over 0.5 boiler hp per kw, whereas, the usual allotment is 0.75 boiler hp and over.

THE FORT WAYNE STATION

The above notes serve to introduce the principle subject of the paper—a consideration of the characteristic features of the new electric service stations of the Fort Wayne & Wabash Valley Traction Company at Fort Wayne, Ind. Executed along decidedly novel lines, it presents an ususually interesting study of the engineering possibilities of turbine plant construction.

Service. Like many other similarly situated railway concerns, The Fort Wayne & Wabash Valley Traction Company has adopted the policy of developing light and power business in connection with its traction system—serving both traction and



MAP OF THE FORT WAYNE & WABASH VALLEY TRACTION SYSTEM AND CONNECTING LINES

lighting systems from a central power station, as previously outlined. In the city of Fort Wayne, this business has assumed such proportions that nearly one-half of the new power station is devoted to 60-cycle lighting equipment—the remainder to 25-cycle equipment for traction purposes. The extent of the system is apparent from the accompanying map, Fig. 4. High-tension transmission lines parallel the railway from Fort Wayne to Lafayette—a total transmission distance of 112 miles from the source of supply. En route, the lines touch Wabash, Logansport, Huntingdon, Peru, and numerous smaller towns, in most of which considerable lighting business is available. Along this route are eleven rotary converter sub-stations ranging in capacity from 200 to 500-kw, totalling 3600-kw, or somewhat in excess of the present station generating capacity. But as the maximum demands from these sub-stations do not superpose, owing to the distribution of cars, there results at the station an unusually uniform load for traction work.

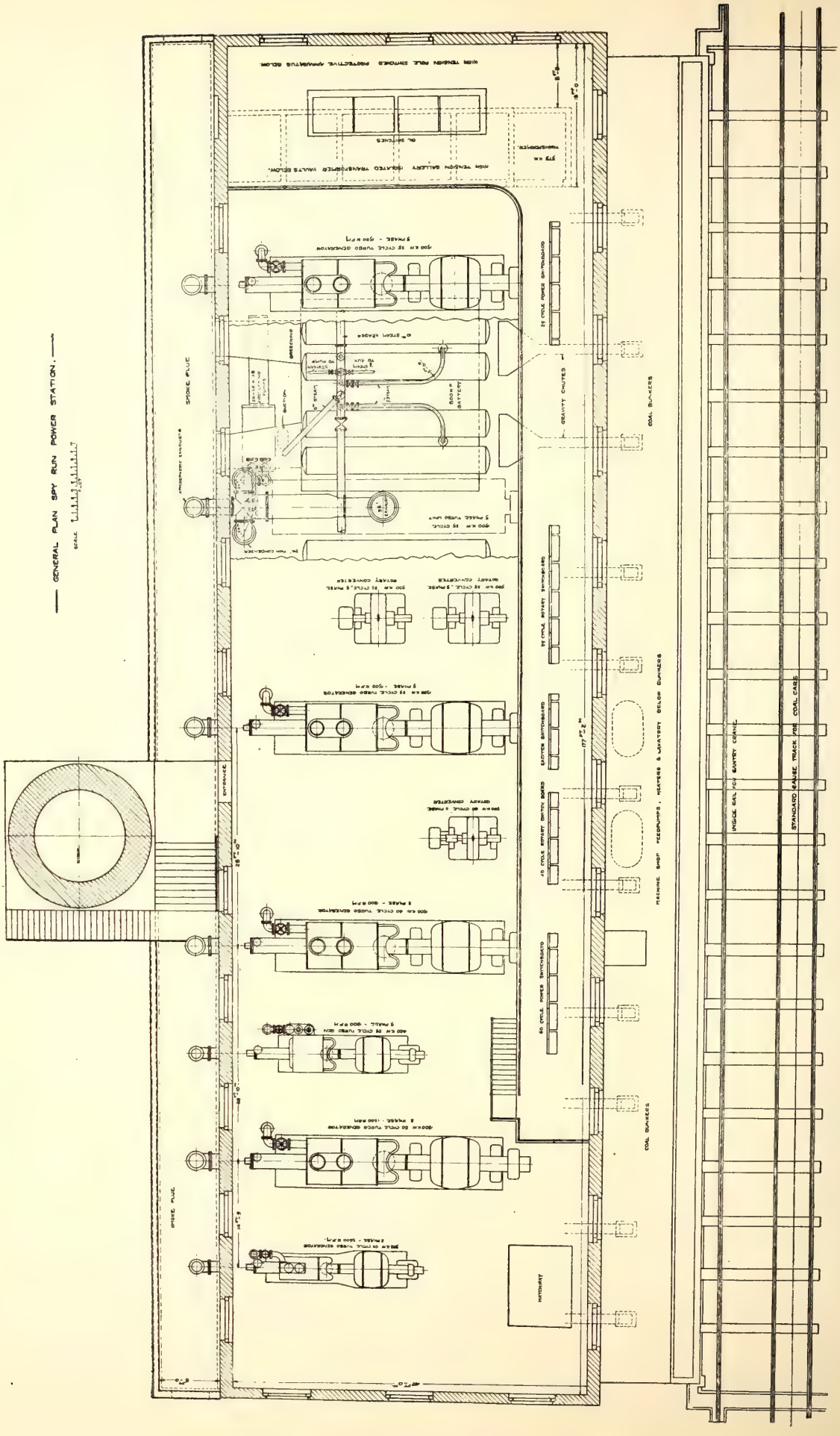


FIG. 5.—PLAN OF FORT WAYNE & WABASH VALLEY TRACTION COMPANY'S PLANT

The site chosen parallels a small stream—St. Joseph's River—from which the water supply is drawn for both feed and condenser purposes. Owing to the contour of the country, the 25 feet difference in level, between river bed and station floor, was unavoidable. A lower location would not only have introduced difficulties in coal trackage, but also would have endangered the station at periods of excessive flood, to which the stream is liable.

Appendix A of this paper contains a detailed list of the principal apparatus in the station. The chief features of the station may be summarized as follows:

(1) A two-story, rectangular brick structure with side wings for the accommodation of auxiliary apparatus, coal bunkers, machine shops and stores.
(2) Generating machinery on second floor over boilers.
(3) Structural foundations with concrete arch floor construction.
(4) Independent barometric jet condenser—moderate vacuum.
(5) Gravity conduit system for cooling water.
(6) Independent, direct-driven exciters—common bus for each system.
(7) Steam piping—simple, short and direct, with continuous upward slope from boiler nozzle to turbine throttle.
(8) Sufficient superheater surface to maintain dryness, or moderate superheat at beginning of expansion in the turbines—100 degrees to 125 degrees at the boiler.
(9) Mechanical stoking with gravity fuel feed.
(11) 6000-ton (two months') coal storage, served by gantry crane.
(12) Steam driven auxiliaries for feed heating.
(13) System of forced ventilation for turbo-generators.
(14) Fireproof transformer compartments, with transformers mounted on rolling trucks to facilitate removal.
(15) Remote control oil circuit-breakers with time limit overload relays.

Essentially the station represents an attempt to produce a power property that will show to best advantage in the balance sheet with a medium price coal—one in which the absence of engineering "frills" for securing the highest efficiency, is compensated for by lower capital cost. This should be borne in mind in the discussion of the operating results later noted.

TABLE II.

Data on Power House.

Dimensions of building, ground floor plan (47 ft. by 177 ft. 2 ins.)	8,340 sq. ft.
Dimensions of building, condenser room (9 ft. 6 ins. by 177 ft. 2 ins.)	.....
Dimensions of building, pump room (8 ft. by 177 ft. 2 ins.)	1,419 sq. ft.
Dimensions of building, heater and pump room (12 ft. 6 ins. by 173 ft.)	2,160 sq. ft.
Total area of power house	11,919 sq. ft.
Total area of power house, single deck basis	20,273 sq. ft.
Height boiler room, 28 ft. 6 ins.; turbine room to crane rail, 21 ft. 7 ins.	
Present capacity, 60-cycle, 3,500 kw.; 25-cycle, 3,500 kw.	7,000 kw.
Ultimate capacity	8,500 kw.
Ultimate capacity, entire plant max. rated overload	12,750 kw.
Present sub-station capacity, 1,300 kw. ultimate	2,600 kw.
Present boiler capacity, 10 400-h.p.	4,000 br. h.p.
Ultimate boiler capacity, 12 400-h.p.	4,800 br. h.p.
Relative area.	
Station, ground floor plan	1.39 sq. ft. per kw. ult.
Station, single floor plan	2.39 sq. ft. per kw. ult.
Operating room (floor plan)	0.98 sq. ft. per kw. ult.
Operating room (exc. high-tension and sub-station equipment)	0.722 sq. ft. per kw. ult.
Boiler room (net floor plan)	1.74 sq. ft. per br. h.p.
Total boiler room and bunker	2.19 sq. ft. per br. h.p.
Boiler settings (24 ft. 8 ins. by 23 ft. 5 ins.)	0.725 sq. ft. per br. h.p.
Relative boiler capacity, ultimate	0.56 br. h.p. per kw.

Building. As previously pointed out, the building construction in turbine power plants is largely influenced by arrangement of boiler equipment. In this case, it was apparent that a somewhat lower boiler capacity than usual would be required for the combined service. For moderate sized units, a well equipped boiler room requires from 2 to 2.5 sq. ft. per boiler hp. In some extremely compact arrangements requiring as low as 1.5 sq. ft. per boiler hp. The Fort Wayne arrangement works out 1.75 sq. ft. per boiler hp. Assuming a capacity ratio of 0.6 boiler hp per kw, the floor area then works out slightly over one sq. ft. per kw for boiler room alone.

Now, for a fairly compact generating room in a station of this size, from 0.75 to 1.15 sq. ft. per kw are required. For the Ft. Wayne plant, some provision had to be made for d.c. sub-station apparatus. Assuming one sq. ft. per kw as a reasonable area, we find that this practically coincides with the above boiler room area. The designer thus had two alternatives: First, a double-decked power station, or second, a building of twice the area with two equal sized operating rooms in parallel and under one roof, which arrangement would be preferable. From an investment standpoint, it is hardly open to question. As it stands, the building cost about $12.50 per kw, including additions, which is by no means excessive.

Inseparable from this building arrangement, is the question of structural foundations which are entirely justifiable in the cases of steam turbines, owing to the absence of cyclical movement arising from unbalanced parts, requiring in the case of low speed reciprocating engine the most rigid foundations. Moreover, there was ample precedent for this type of foundation structure, notably the two turbine stations of the Philadelphia Rapid Transit Company. Fig. 6 shows a cross section of the turbine and condenser arrangement relative to foundation. Here reinforced concrete columns 20 ft. in height and 10 to 15 inches in section, support the entire turbine floor, as shown in the drawing. These machines are 1,500 kw capacity, spaced 14-foot centers.

The floor structure of the Ft. Wayne station is shown in detail in Fig. 8. It consists of individual pairs of transverse plate girders extending across the building under each turbine

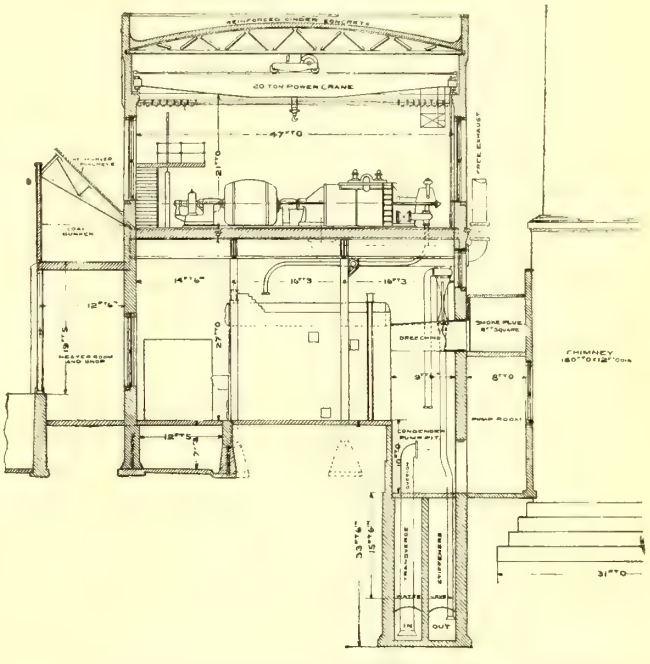


FIG. 6.—CROSS-SECTION OF TURBINE AND CONDENSER ARRANGEMENT RELATIVE TO FOUNDATION

bed plate. Short cross girders serve to tie the longitudinal girders together at column intersections, the whole forming "bents" or cradles between the several generating units. Box columns divide the building width into practically three equal spans, these columns rising between the several boiler batteries. Thus the weight of the generating machinery is distributed between two building walls and two rows of columns. Only in the case of the smaller machines and rotaries does any of the weight fall upon the areas intervening between columns. In order to insure even settling, the precaution was taken of carrying footings for both columns down to practically the same level so as to encounter homogeneous strata.

Boiler Plant. It is apparent from Fig. 8 that the location of the large turbines was chosen so as to accommodate under each floor "bent" a single battery of boilers. With the small boiler units chosen, this of course, provides a larger turbine room above than is necessary; but, by utilizing the excess floor space for sub-station apparatus, this disarvantage is largely overcome. The floor plan drawing, Fig. 5, shows to what advantage the space has been utilized.

It is noteworthy here that with larger boiler units, a far more compact arrangement would be possible with little increase in floor span between batteries. Fig. 9 shows clearly the relative reduction in boiler area for units ranging from 500 to 2,000 hp. The majority of these are the standard B. & W. type setting, with single tiers of tubes. In case of a special demand for stations of the Ft. Wayne type, it is quite possible that a boiler

could be obtained giving a much narrower battery than with the standard setting, but with ample grate surface.

This relative disposition of boilers and turbines evidently permits of the simplest form of piping. Strictly on the unit principle, this would involve but two bends, as shown in the cross section drawing, Fig. 7. The addition of an equalizing header running the length of the building then, complicates the piping only to the extent of extra valves, fittings and hangers, resulting in:

(1) Most direct path of steam from boiler to turbine.
(2) Equalizing connection to compensate for variations in the rate of steaming of boilers in service.
(3) Provision for most convenient distribution of boiler capacity to carry any load.
(4) A cost of $2.50 per kw for steam piping, complete.

In the normal operation of the plant, effort is made to keep those boilers in service nearest to the turbines in operation, thus giving the minimum distance of steam flow. When occasion arises, the plant may be operated on the unit system, valves in the header between the various risers being supplied for this purpose.

Superheaters were installed principally for the purpose of insuring thoroughly dry steam at the beginning of expansion in the turbine. Although the presence of moisture in the steam system is not encountered in normal operation, the precaution was taken of delivering steam from the boilers underneath and discharging it above the header, so that a continuous draining is provided from turbine throttle back to boiler. This is likely to be an advantage in starting a section of the plant that has stood idle for a time.

In the arrangement of the breeching, the main smoke flue might have been run inside the boiler-room walls, thus avoiding the breech connection shown in Fig. 7. This, however, would have necessitated locating the condensers outside of the building. With the present arrangement, a 10-ft. space back of the boilers is ample for all condensing apparatus, and the space under the external smoke flue is utilized as additional boiler-room area for small auxiliaries, oil filters, etc.

Superheated steam is provided direct from the main to all principal auxiliaries in the plant. This avoids an auxiliary steam main. According to customary practice, the auxiliary main draws its supply from opposite extremities of the steam system so as to avoid to the greatest degree possible a shutdown of auxiliaries. At Fort Wayne nearly the same security is provided by connecting auxiliaries directly into the steam main at different points. Thus boiler feed pumps are connected in duplicate to opposite sections of the steam main, each of which is supplied by at least four boilers. Similarly, condenser pumps are connected to the same section of the main as the turbines which they serve. If a turbine unit is disabled, the pumps will not, of course, be needed.

The absence of economizers will be noted. These were not considered necessary with coal at $2 to $2.50 per ton. For feed heating, auxiliary exhaust steam is entirely relied upon—all boiler, service and condenser pumps, also fan and stoker engines contributing heat through the medium of open heaters. Exciters are direct-driven, as later noted. Nevertheless, a feed temperature of 160 degrees to 180 degrees is obtainable during the day, and 200 degrees at night. This feed is drawn from hot condenser discharge tunnel and delivered to elevated tanks, which provide a static head on the heaters and is of sufficient capacity to supply the plant for 3 hours at full load. Similarly the heaters are elevated a few feet to insure a positive lift of feed pump valves. With this feed system, boiler cleaning is not necessary oftener than at monthly intervals.

Mechanical stoking was adopted not only to minimize labor cost, but also to provide ample forcing capacity for peak loads or emergencies. With Hocking Valley screenings, three men can handle without difficulty, ten boilers, or 1,330 boiler hp each. Hand firing for the same capacity, would require ten firemen and two water-tenders, or 400 boiler hp per fireman, a reduction of 60 per cent. Present boiler-room labor, averaging $11.75 per 12-hour shift, would be increased to about $28 per shift, providing 12-hour shifts could be maintained.

Condenser Plant. The character of river water had, of course, an important bearing on the design of the condenser system. Although carrying considerable sediment at times, the water is extremely soft and develops no hard scale even after many weeks of continuous running. This annulled the principal advantage of the surface condenser; viz., return of pure exhaust steam for feed water. The 25-foot difference in level between ground floor and low water, made one of two condenser systems imperative:

(a) Surface condenser with continuous pipe loop (balanced water column), with power-driven circulating pumps to overcome fluid friction.
(b) Barometric jet condensers mounted near the level of turbine exhausts with tail pipes extending downward to the normal river level, with power-driven circulating pump to overcome excess barometric head.

With the former, dry vacuum pumps would be imperative in order to prevent the condensers from becoming air-bound, or losing their vacuum altogether through air leaks in the water system, thus adding another auxiliary. Moreover, the surface type of plant is extremely bulky and would have seriously interfered with the "double-decked" layout.

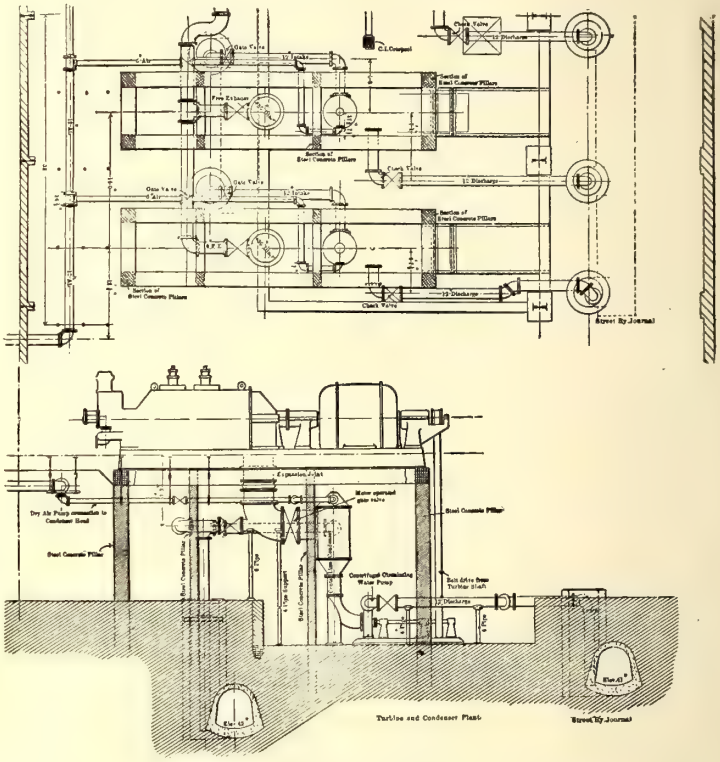


FIG. 7.—SECTIONAL VIEW OF STATION

On the other hand, the barometric type fits particularly well into the scheme. The condenser head may be suspended beneath the turbine where its most bulky part is out of the way. The tail pipes may then be carried down at any angle or turn sufficient to clear necessary obstructions. Thus, the 9.5-ft. area way which would ordinarily be provided in the rear of the boilers is conveniently utilized as operating space.

With the arrangement employed, as shown in Figs 5 and 6, a difference of about 47 ft. exists between the condenser head and low water level. This, however, does not interfere with the operation of the condensers, as a partial void simply results in the upper part of the barometric column.

The use of twin condenser units permits the use of less bulky apparatus, and also makes it possible, in the event of the disablement of one side, to continue operation on the other with reduced vacuum. Long stroke reciprocating pumps were chosen for this purpose instead of high speed centrifugal pumps, as being best suited to the high lift—sixteen feet. With this type of pump, a small air chamber will suffice to carry over the moment of reversal without any "dip" in vacuum, which would otherwise accompany the non-uniform flow of injection water. This equipment without dry vacuum pumps, yields a vacuum during warm weather of about 26.5 to 27 ins. at full load (referred to 30-in. barometer). Its simplicity and ease of up-keep, is apparent, especially in view of the low cost—about $2.50 per kw, including pumps and piping, but no tunnel work.

Water is conducted to and from a screen house on the river bank entirely by gravity through a double-duct concrete conduit. At the river a double screen prevents debris from entering the intake, which is at right angles to the current, while the discharge is down-stream. This conduit system, of course, necessitated considerable excavation in the rear of the boilers. The two retaining walls were then reinforced at intervals by transverse stiffener arches sprung across the pit.

Coal Storage and Handling. The Ft. Wayne plant uses normally about 100 tons of coal per day. In the provision for coal storage, an elevated bunker of relatively small capacity (400 tons) fulfils all requirements for gravity feed. Even this would tide the plant over a period of at least three days in case of failure of coal handling apparatus. The main storage yard will contain about 6000 tons—sufficient for two months' supply, but only about 4000 tons is ordinarily held in stock, except in case of impending fuel shortage. The Gantry crane which serves this storage yard combines the function of unloader, crusher, elevator and distributor. Its efficiency is attested by the fact that while its normal capacity is considered to be one 50-ton car per hour, the operators have unloaded a 40-ton car in sixteen minutes, and a maximum of eleven cars (500 tons) in a short working day. The crane is electrically operated from a single controller tower by one man.

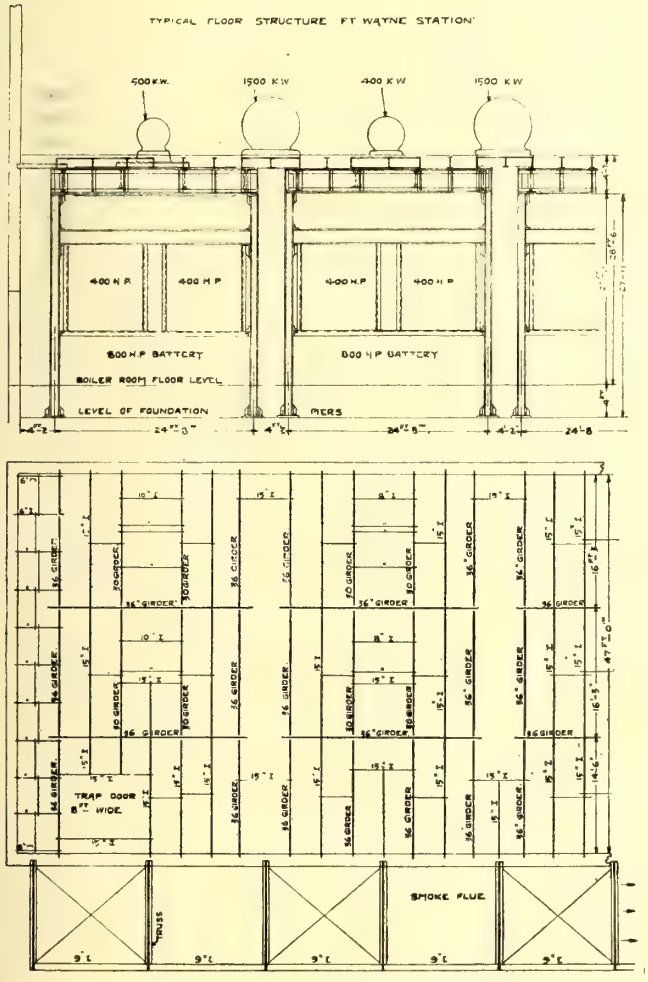


FIG. 8.—DETAIL OF FLOOR STRUCTURE

Generating Plant. The two sections of the generating plant, 25-cycle and 60-cycle, are, of course, separated electrically, and each therefore controlled by a separate switchboard. Two additional boards control the rotary converter output for both 25-cycle and 60-cycle systems, the latter consisting of a d.c. power circuit for elevators and other intermittent power. A fifth board controls the exciters. With perhaps the exception of the exciters, the generating plant is quite standard throughout. In place of the usual steam-driven exciter unit, with motor-driven duplicate, each generating unit is provided with its own direct-connected exciter, all generating at the same voltage—125 volts. Each exciter has sufficient capacity to carry two generators. All may be connected to a common bus, as an emergency condition. Normally the 25- and 60-cycle exciters are separated to permit the use of independent voltage regulators.

Assuming the case of instantaneous fluctuating loads, the voltage regulation of a direct connected engine-generator-exciter unit, is not, of course, comparable with that of steam-driven exciters, due to cumulative drop in speed and voltage. Of the three systems (a) independent steam-driven exciter, (b) independent motor-driven exciter, (c) exciter-driven by prime mover, the first undoubtedly gives the best results. But with the use of the automatic voltage regulator, the three are brought practically to an equality.

This subdivision of exciter assures uninterrupted service to a degree quite impossible with the usual arrangement of independent exciters, and almost to the same degree as the standby storage battery quite frequently employed as an insurance against current interruptions. With half the exciters in the station inoperative, there would still be ample capacity remaining .

These direct-connected exciters add 2.6 per cent to the expense of the main generating unit. A detailed comparison of the total cost of the exciting plant, as compared to the cost of an inequivalent independent exciting plant, including reserve unit, shows some 20 per cent in favor of direct drive.

All the generators draw their supply of ventilating air from a sheet steel duct running the length of the plant above and in front of the boilers. This has served its purpose, but a positive pressure fan has been installed as an auxiliary to accelerate the air flow during certain prevailing winds when the required draft is more difficult to maintain through the long supply duct. This system of positive generator ventilation has the advantage of maintaining low generator temperatures the year around, while by means of the fan auxiliary a large excess of air can be supplied to any of the units that may be for any reason abnormally overloaded. In other words, the fan blast may be regarded as a generator auxiliary. It makes possible greater generator overloads.

Turbines. In some large turbine plants of recent design where considerable distance must necessarily intervene between switchboard operator and turbine throttle, it has been found desirable to control the running speed entirely from the switchboard by a small motor-driven mechanism connected to the governor. This system has undoubtedly advantages from an electrical standpoint in synchronizing and distributing load. Yet in compact stations such as Ft. Wayne, it seems a better plan to commission the engineer in charge with entire authority over the mechanical equipment, as is the case. All speed adjustments are taken care of at the individual governors by the engineer or from the switchboard.

Designers of large plants also tend to concentrate in a continuous return cooling and filtering system, the usual independent system has been used, largely with the intention of isolating trouble in so important a function as the lubrication. Each turbine has its own oil pump, cooler and strainer reservoir, all of which apparatus is readily accessible from the engine-room floor. When desired, however, the oil may be entirely drained out of any of the machines into the filter below where it is screened, washed and returned by a small steam pump.

Operation. Owing to the brief period in which the Spy Run station has been in operation, it is not possible to analyze very accurately either the operating efficiency or the operating costs. Moreover, considerable extensions are under way, which will materially increase the loading factor of the station. During the month of June, the Ft. Wayne station turned out 24 per cent of its rated output. Fig. 10 shows a typical daily load for Saturday, the loading factor from which is about 33 per cent of 24-hour capacity. The dotted line represents the railway load alone, and for uniformity, could hardly be improved. Combined with the lighting, the station is still loaded very efficiently, with the result that while there is but little advantage from the traction standpoint, by combined operation the lighting system is greatly improved. Here arises the greatest gain from the combined system. Following these load characteristics through the month, we find little change in the relative load from day to day. The regular drop in Sunday lighting load is usually made up by the increased Sunday railway load, which will generally be the case on all holidays.

Now, taking this month as a basis, we may predict with some degree of certainty, the change in operating efficiency and cost with the improved loading factor, by applying data from the

similarly equipped and operated system previously noted in Figs. 2 and 3. This data was obtained at a time when the system had developed to just about the same extent as the present Ft. Wayne system. Assuming the average loading factor of a normal lighting system to be in the neighborhood of 23 per cent, this data shows a reduction in operating cost of nearly 30 per cent (to 0.35 cents per kw-hour) by increasing the loading factor to 33 per cent of the output capacity of the station. Owing to extensions in city and suburban traction, a loading factor of 40 per cent at least, may be expected at Ft. Wayne. It is, therefore, evident that an extremely low power cost may be anticipated. How much the various mechanical contrivances around the station have contributed to the low cost is shown by the fact that the labor cost for the entire station,

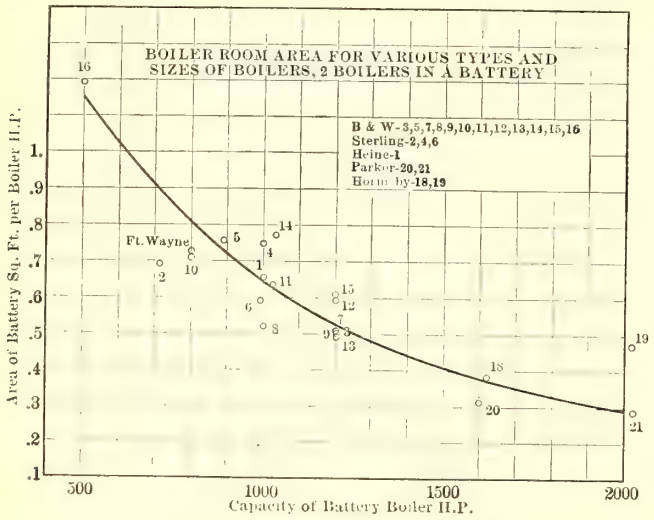


FIG. 9.—BOILER ROOM AREAS

including coal handling, averages but $34.60 per twelve-hour shift, equivalent to 0.12 cents per kw-hour at 33.5 per cent loading factor, which is considerably lower than the usual figure in steam plants. Even this could be reduced about 10 per cent at the present, as several men in training for outside service are now maintained upon the regular station payroll.

Costs. In the final analyses of ultimate cost of power, fixed, or capital costs, of course, have an important bearing, and it is in this regard that the type of station exemplified in that previously described exerts the strongest influence. In the preceding discussion it has been the object to show wherein the double-decked station has made the greatest advance along engineering lines. Owing to the absence of many refinements it is evident that the maximum possible efficiency could hardly be obtained. In compensation we should look for a considerable reduction in the capital charges in order to bring the total cost of the power generated to as low a point as would result from the use of a more efficient plant. This proves to be the case with the Ft. Wayne station.

Analyses of the total power costs from modern steam plants of 5000 to 10,000, kw capacity, shows that the capital costs, including interest and depreciation, amount to about 50 per cent of the total. For such high-grade stations, with thoroughly modern requirement, we should expect an investment cost of from $150 per kw in the smaller, down to $100 per kw in the larger sizes. In a few very large stations the investment cost has been less than $100 per kw, but for stations under 10,000 kw it very rarely occurs that the cost is below the above figure. The Ft. Wayne station is thus unique in having set a new standard for power station cost which may well be emulated in cases where turbine machinery is applicable. The following table shows the cost of the complete station, exclusive of substation apparatus, but including main line transformers—a total of $66.25 per kw generating capacity.

TABLE III. COST OF COMPLETED POWER STATION. 8,500 KW. NO SUBSTATION APPARATUS

Building: Including general concrete and steel work, galleries, coal bunker, smoke flue, condenser pit, coal storage pit, etc.	$93,217	$10.97
Generating Plant: Including turbines, generators, exciters, cables, switchboards, transformers and ventilating ducts	259,711	30.55
Boiler Plant: Including boilers, superheaters, stokers, piping, pumps, heaters, settings, breechings and tank...	118,313	13.92
Condenser Plant: Including condensers, pumps, piping, free exhausts, water tunnels and intake screen.....	33,790	3.98
Coal Handling Plant: Including Gantry crane, crusher, motors and track.....	7,990	0.94
Erection Superintendence, Engineering and Miscellaneous	50,500	5.94
Total, excluding property and siding.....	$563,520	$66.25

In this summary the building cost is naturally high owing to the large amount of structural material necessary. On the other hand, boiler and condenser costs are extremely low for reasons previously set forth.

Using as a basis the above costs and the rate of variation with loading factor already shown in curve form, Fig. 3, the ultimate total cost of power at different loading factors may now be predicted; in other words, the total financial result of station operation. Fig. 11 has been prepared along these lines. Fixed charges are dealt with entirely above the horizontal line and operating costs below. The total power cost at a given loading factor is then represented by the total vertical distance between the two outer curves. These fixed costs are based upon the following assumptions:

(a) Bond interest and taxes..... 7 per cent
(b) Sinking fund, equivalent to 6.43 per cent depreciation* ..... 4.2 per cent
(c) Total fixed charges on capital cost..... 11.2 per cent

From these curves, Fig. 11, the total cost of power at the present station loading factor, 24 per cent, is 79c. per kw-hour. At 33 per cent loading factor the total cost would be 0.57c. per kw-hour, and at a possible loading factor of 50 per cent, 0.41c. per kw-hour. This, the author ventures, is a result which it will be difficult to duplicate in any station of expensive construction burning the medium grade of bituminous coal at a cost in the neighborhood of $2.25 per ton. It is the ultimate result that proves the correctness of the engineering principles involved in the design of the station.

Comparative Data. As extreme compactness is one of the striking features of the Ft. Wayne station, it is instructive to note its relative position in this regard to other turbine stations, of both smaller and larger capacity, now in operation. To this end, Table No. IV (see Appendix B) and Fig. 12 have been prepared, the former comprising the principal data on the various stations. In the latter the curves show principally the element of space occupied. The lower curve represents net generating room area, exclusive of switchboard room; i. e., the actual space devoted to generating machinery and the neces-

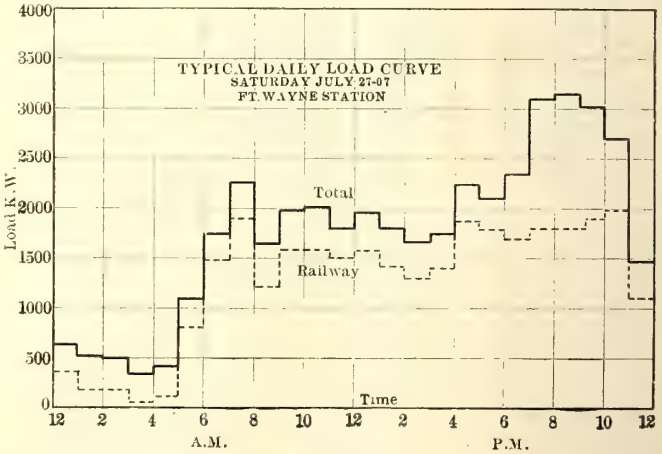


FIG. 10.—TYPICAL DAILY LOAD

sary auxiliaries. It is instructive to observe that there is little to choose between the horizontal and vertical types of turbines, the facts pointing to the former if anything, as tending to secure the most compact construction. This is principally due to the fact that there is usually room for surface condensing apparatus directly beneath the turbine within the skeleton or structural foundations, while the vertical type turbine requires extra floor space for condensing apparatus and auxiliaries, except when sub-base condensers are used. Even then the advantage is not materially greater. For instance, the Benning Station, Washington, which seems to be relatively the

*Depreciation determined by summing the depreciation on the several parts of the plant, as follows: Building, 3 per cent; boiler plant and coal-handling apparatus, 10 per cent; condensing plant, 6 per cent; generating plant, 7.5 per cent; general average, 6.43 per cent.

most compact of its kind using base condensers, appears on the plot as not materially lower than the average station; while, on the other hand, Boston Edison, containing the same type of condenser, appears to considerable disadvantage, largely owing to the arrangement of the boiler and auxiliary plants. In this comparison the Ft. Wayne station easily approximates the average.

The second curve shows the relative ground floor area of the total plant as installed, whether single, double or triple deck. Here a great discrepancy appears, owing to the wide difference in arrangement of boiler rooms. In this respect the comparative data serves hardly more than a record. Here the Ft. Wayne station appears to the greatest advantage—showing the same relative compactness as stations some four or five times its capacity.

In many of these stations economizers are provided for on the boiler floor; in others on a separate floor or gallery above. Hence, comparison can best be made on a single-deck boiler or generating plant throughout. In the diagram all of the multiple-deck plants are also designated on the single-deck basis, and the results are at wide variance. But here again the Ft. Wayne station compares favorably with stations many times its capacity, so that from all standpoints the constructive scheme employed seems well taken.

For purposes of comparison a number of large engine-driven plants have been added to the diagram—Waterside station No. 2 appearing to be the most compact.

In the matter of boiler capacity allotted to a given generating equipment the comparative table shows general practice to average about 0.75 boiler hp per kw, in some cases running as high as 1 boiler hp per kw and as low as 0.6. In but one plant, however (Carville), is the ratio considerably below that at the Ft. Wayne station, where the combined lighting and traction service occurs. To this, of course, may be attributed a large share of the cost reduction. From most standpoints, therefore, the station under description may be regarded as a distinct step forward in the field of electric power properties. It is, of course, possible that inherent defects will later develop, tending to offset the advantages otherwise secured, but experience alone will determine this definitely. Up to the present time no defects have appeared serious enough to occasion any fundamental change in plans and the station may be regarded as an eminently successful experiment.

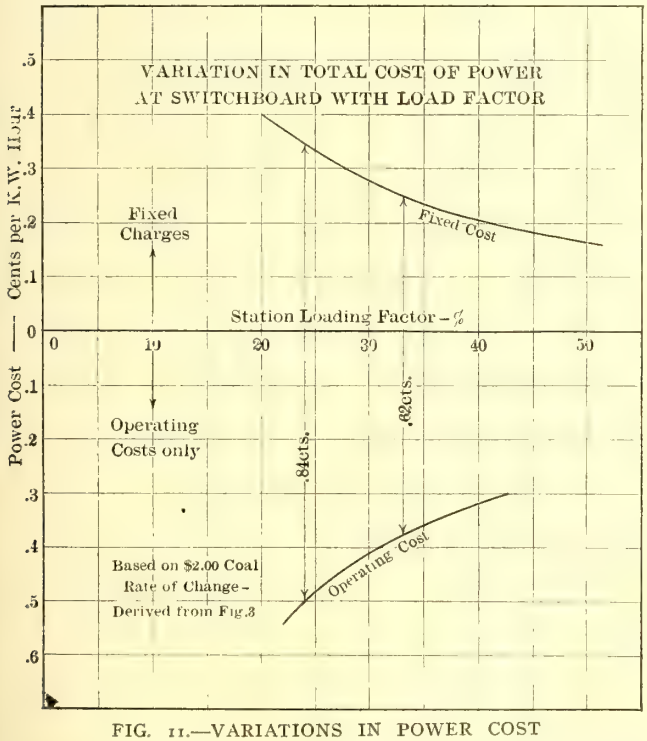


FIG. 11.—VARIATIONS IN POWER COST

In closing, the author desires to acknowledge the courtesy and assistance of C. D. Emmons, general manager of the Ft. Wayne & Wabash Valley Traction Company, and M. J. Kehoe, superintendent of power, in the preparation of this paper, and for the opportunity to place before you the details of design and data on the cost and operation of the Spy Run Power Station.

APPENDIX A.—EQUIPMENT SCHEDULE

Railway System.—Three-phase, 25-cycle, 33,000 volts transmission, 550 volts, direct connected from power station and substations.

Lighting System.—Two-phase, 60-cycle, 2300 volts.

Heavy Power Service.—550 volts, direct connected from 60-cycle rotaries.

Generating Units (Westinghouse).—Two 1500-kw, 3-phase, 25-cycle, 390-volt railway units; 37.5-kw, 125-volt exciter; two 1500-kw, 2-phase, 60-cycle, 2300-volt lighting units; 37.5-kw, 125-volt exciter; one 400-kw railway unit, 10-kw exciter; one 500-kw lighting unit, 10-kw exciter.

Boilers (Babcock & Wilcox).—Ten 400-hp water tube, inclined header type drums 42-in. x 23-in. 4-in. tubes, 16 sections, 12 high, 200-lb. pressure; internal type U-tube superheaters in first pass; 75 degs. superheat.

Condensers (Buckley).—Four pairs barometric jet for large units, 24-in. heads, 10-in. tail pipes; one 7-in. and one 8-in. single condenser for small units; no dry vacuum pumps.

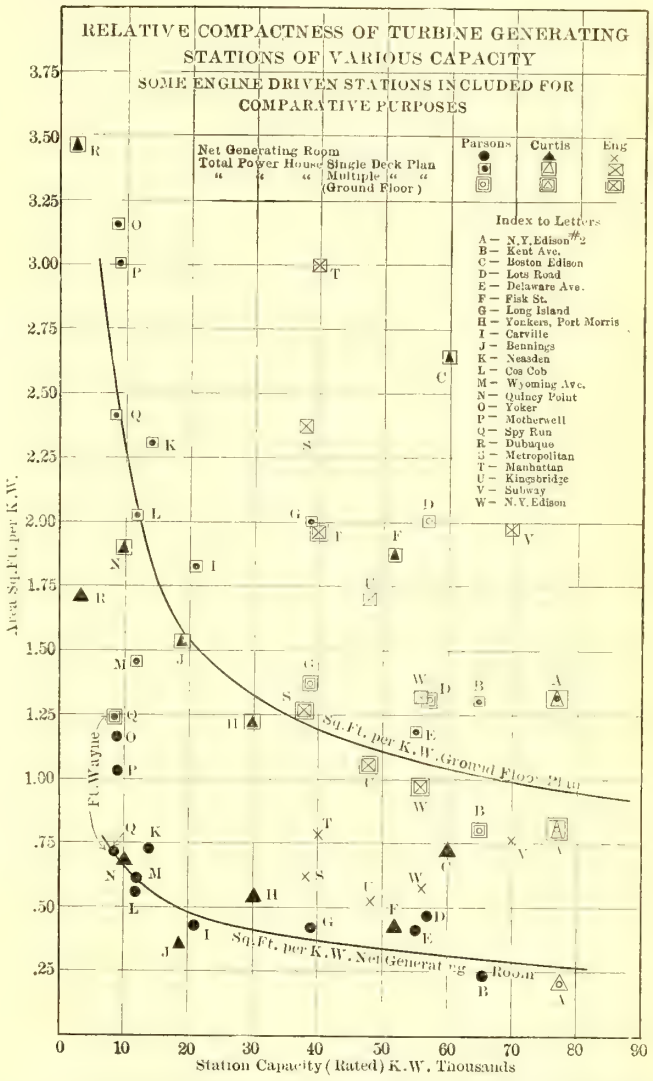


FIG. 12.—CURVES SHOWING ELEMENT OF SPACE OCCUPIED

Pumps (Boyts-Porter).—Boiler feed, two 20 x 12 x 30 "Yough" outside packed plunger type; condensers, four 20 x 36 x 48 inside packed plunger type for large units; two 12 x 20 x 48 for small units. General service pumps, one 10 x 12 x 18 "Yough," one 8 x 12 x 17 x 10, Laidlaw-Dun-Gordon duplex-compound.

Heaters (Platt Iron Works).—Two units, in duplicate, open heater type, with automatic float valves.

Steam Piping (Pittsburg Valve & Foundry Company).—Designed for 200-lb., long radius bends, extra heavy fittings flanged and peened, corrugated copper gasket, 2-in., 85 per cent magnesia covering, 10-in. headers, 8-in. risers to turbines (5-in. for small machines), 6-in. feed-water header.

Chimney (Alphons-Custodis).—12 ft. diameter, 180 ft. high, radial brick construction, rotary damper operated in connection with automatic damper regulator.

Rotary Converters (Westinghouse).—Two 500-kw, 3-phase, 25-cycle, for railway; one 300-kw, 2-phase, 60-cycle for city power service, induction type starting motors.

Transformers (Westinghouse).—Railway, seven 375-kw, 390 33,000 volts (one for reserve). Power, two 150-kw, 2300-390 volts.

Switching Apparatus (Westinghouse).—390-volt, 3-phase, 25-cycle railway board, 33,000-volt, high-tension board with distant-control circuit breakers, fuses and protection apparatus; 2300-volt, 2-phase, 60-cycle lighting board; 60-cycle rotary power board; 125-volt exciter load for both systems, automatic voltage regulator, independent feeder voltage regulators, main and auxiliary buses to permit exchange service between 25-cycle and 60-cycle system. Automatic circuit breakers on generators, and time limit overload relay control of railway output.

Coal Handling (Fairbanks-Morse Company).—Gantry traveling crane, clamshell bucket, with crusher delivering into elevated bunker, motor-driven, capacity 50 tons per hour.

Appendix B of J. R. Bibbin's Paper.—*Table IV, Comparative Data.*

Col.		A	B	C	D	E	F	G	H
	Name of Station.	Waterside No. 2.	Kent Avenue.		Lots Road.	Delaware Ave.	Fisk Street Station.	Long Island.	Yonkers & Port Morris.
	Operating Company.	N. Y. Edison.	Brooklyn Rpd. Trans.	Boston Edison	Metropolitan District, London.	Philadelphia Rapid Transit.	Chicago Edison	P. R. R.	~~N. Y., N. H. & H. R. R.~~ N.Y.C.
1..	Capacity, ult. kw. *a*	77,500	65,500	60,000	57,700	45,000	52,000	38,900	30.000
2..	Boiler capacity, ult. h.p. *b*	62,400	46,800	49,172	41,600	51,200	32,000	25,056	15 000
3..	Boiler h.p. per rated kw	.805	.702	.82	.72	.948	.80	.66	.50
4..	Sq. ft. per kw. (ground floor plan) *c*	.818	.817	2.64	1.31	1.206	1.88	1.37	.228
5..	Sq. ft. per kw. (total single deck plan) *d*	1.31	1.306	2.64	2.063	1.206	1.88	2.005	1.228
6..	Sq. ft. per kw. (total generating room)	.30	.326	1.04	.563	.47	.77	.595	.546
7..	Sq. ft. per kw. (net gen. room exc. switchboard) *e*	.208	.248	.737	.464	.39	.44	.422	.533
8..	Sq. ft. per kw. (boiler room, actual floor plan)	.506	.49	1.6	.75	.73	1.11	.765	.679
9..	Sq. ft. per kw. (boiler room total, single deck plan)	1.01	.98	1.6	1.5	.73	1.11	1.41	.679
10..	Sq. ft. per boiler h.p., boiler room (single deck plan)	1.25	1.374	1.95	2.08	.778	1.8	2.14	1.357
11..	Prime mover, type and size	Parsons; Curtis	Parsons	Curtis	Parsons	Parsons	Curtis	Parsons	Curtis
12..	Boilers h. p.	B. & W. 650 superheat	B. & W. 650 superheat	B. & W. 512 superheat	B. & W. 512 Superheat	Parker 800 superheat	B. & W. 500 superheat	B. & W. 520 superheat	B. & W. 625 superheat
13..	Number boiler decks	2	2	1	2	1	1	2	1
14..	Draft	Auxiliary fan	Auxiliary fan	Natural	Natural	Natural	Natural	Natural	Natural
15..	Boiler firing	Roney stoker	Flat grate; Roney stoker	Roney stoker	Chain grate	Roney stoker	Chain grate	Roney stoker	Roney stoker
16..	Condensers	Horizontal surface high vacuum	Horizontal surface high vacuum	Base surface high vacuum	Vertical surface high vacuum	Surface high vacuum	Horizontal surface high vacuum	Horizontal surface high vacuum	Surface high vacuum
17..	Economizer	No	No	No	Yes	No	No	Yes	No

Appendix B.—*Table IV, Comparative Data.—Continued.*

Col.		I	J	K	L	M	N	O	P
	Name of Station.	Carville.	Bennings.	Neasden.	Cos Cob.	Wyoming Ave.	Quincy.	Yoker.	Motherwell.
	Operating Company.	Newcastle Electric Co.	Potomac, Electric Wash.	Metropolitan Railway, London.	N. Y., N. H., & H. R. R.	Philadelphia Rapid Transit	Old Colony Railways.	Clyde Valley Electric Co.	Clyde Valley Electric Co.
1..	Capacity, ult. kw. *a*	21,000	19,000	14,000	12,000	11,990	10,000	9,500	9,500
2..	Boiler capacity, ult. h.p. *b*	9,100	14,400	8,020	8,400	11,600	7,500	6,160	6,160
3..	Boiler h.p. per rated kw	.435	.758	.578	.7	.97	.75	.648	.648
4..	Sq. ft. per kw. (ground floor plan) *c*	1.81	1.554	2.195	2.03	1.46	1.9	3.15	3.0
5..	Sq. ft. per kw. (total single deck plan) *d*	1.81	1.554	2.195	2.03	1.46	1.9	3.15	3.0
6..	Sq. ft. per kw. (total generating room)	.65	.413	.995	.79	.83	.966	1.374	1.158
7..	Sq. ft. per kw. (net gen. room exc. switchboard) *e*	.433	.533	.727	*i* .558	.62	.676	1.154	.97
8..	Sq. ft. per kw. (boiler room, actual floor plan)	1.16* .678 *f*	1.165	1.73	1.467	1.18	.966	1.72	1.72
9..	Sq. ft. per kw. (boiler room total, single deck plan)	1.16	1.165	1.73	1.467	1.18	.966	1.72	1.72
10..	Sq. ft. per boiler h.p., boiler room (single deck plan)	2.68* 1.563 *f*	1.538	3.1	2.097	1.25	1.286	2.65	2.65
11..	Prime mover, type and size	Parsons	Curtis	Parsons	Parsons	Parsons	Curtis	Parsons	Parsons
12..	Boilers — h.p.	Sterling 638; B & W. 400 superheat	B. & W. 600 superheat	B. & W. 573 superheat	B. & W. 525	Parker 1000 superheat	A—T. B. & W. 750 superheat	B. & W. 400 superheat	B. & W. 400 superheat
13..	Number boiler decks	1	1	1	1	1	1	I	1
14..	Draft	Auxiliary fan	Natural	Auxiliary fan	Auxiliary fan	Natural draft	Natural draft	Auxiliary fans	Auxiliary fans
15..	Boiler firing	Chain grate	Roney stoker	Chain grate	Roney stokers	Box mech. stokers	Jones underfed	Roney stokers	Roney stokers
16..	Condensers	Surface high vacuum	Base surface high vacuum	Barometric jet high vacuum cool tower.	Surface high vacuum	Surface high vacuum	Surface high vacuum	Vertical surface high vacuum	Barometric jet high vacuum
17..	Economizer	Yes	No	Yes	Yes	No	No	Yes	Yes

a Capacity possible in present building. *b* Based on standard rating, 10 sq. ft. per boiler h.p. *c* Ground floor plan—dimensions of actual station building, inside walls. *d* Single deck, equivalent to area all boiler room space on one level. *e* Area switchboard room based on floor plan only, not aggregate of all floors. *f* With economizer and fans. *g* Including sub-station. *h* Turbines over boilers. *i* Switchboard very small, no dimensions. *j* One condenser for four engines. *k* Including upper boiler room floor for economizers and heaters.

APPENDIX B.—*Table IV, Comparative Data.—Continued.*

		Q	R	S	T	U	V	W
	NAME OF STATION.	Spy Run.	Dubuque.	Metropolitan 96th Street	Manhattan 74th Street.	Kingsbridge.	Rapid Transit 58th Street.	Waterside, No. 1.
Col.	OPERATING COMPANY.	Fort Wayne & Wabash Valley	Union Electric Co.	Interboro Rapid Transit.	Interboro Rapid Transit.	Interboro Rapid Transit.	Interboro.	New York Edison.
1..	Capacity, ult. kw. *a*	8,500	3,000	38,500	40,000	48,000	70,000	56,000
2..	Boiler capacity, ult. h.p. *b*	4,800	2,400	23,050	33,300	31,200	43,000	36,400
3..	Boiler h.p. per rated kw	.565	.8	.599	.833	.65	.614	.65
4..	Sq. ft. per kw. (ground floor plan) *c*	1.42	3.46	1.266	1.955	1.05	1.985	.958
5..	Sq. ft. per kw. (total single deck plan) *d*	2.4	3.46	2.36	3.01	1.70	2.8 *k*	1.336
6..	Sq. ft. per kw. (total generating room)	.98*g*	1.71	.634	.884	.762	1.16	.658
7..	Sq. ft. per kw. (net gen. room exc. switchboard) *e*	.722	.71	.614	.784	.524	.76	.575
8..	Sq. ft. per kw. (boiler room, actual floor plan)	1.235	1.746	.55	1.063	.468	.823	.384
9..	Sq. ft. per kw. (boiler room total, single deck plan)	1.235	1.746	1.65	2.12	.936	1.64 *k*	.768
10..	Sq. ft. per boiler h.p., boiler room (single deck plan)	2.19	1.825	2.75	2.55	1.44	2.68 *k*	1.08
11..	Prime mover, type and size	Parsons	Curtis	Corliss vertical	Corliss 2 horizontal 2 vertical	Corliss vertical	Corliss vertical and horizontal	Corliss vertical
12..	Boilers — h.p.	B. & W. 400 superheat	B. &. W. 400 superheat	B. & W. 265	B. & W. 520	B. & W. 520	B. & W.600 h.p. superheat	B. & W. 650 arranged for superheat
13..	Number boiler decks	1	1	3	2	2	1	2
14..	Draft	Natural Draft	Natural draft	Auxiliary fans	Auxiliary fans	Auxiliary fans	Auxiliary fans	Auxiliary fans
15..	Boiler firing	Roney stokers	Chain grate	Roney	Roney	Roney	Roney	Roney
16..	Condensers	Barometric jet medium vacuum	Surface high vacuum	Surface condenser	Jet condenser	Barometric jet central plant	Barometric jet	Surface
17..	Economizer	No	No	No	Yes	Yes	Yes	Yes

a Capacity possible in present building. *b* Based on standard rating, 10 sq. ft. per boiler h.p. *c* Ground floor plan—dimensions of actual station building, inside walls. *d* Single deck, equivalent to area all boiler room space on one level. *e* Area switchboard room based on floor plan only, not aggregate of all floors. *f* With economizer and fans. *g* Including sub-station. *h* Turbines over boilers. *i* Switchboard very small, no dimensions. *j* One condenser for four engines. *k* Including upper boiler room floor for economizers and heaters.

THE ENTERTAINMENTS

The excellent program of entertainments arranged by the entertainment committee was carried out with one execption, that of the roller chair parade, as scheduled up to Wednesday night, the date of going to press with the STREET RAILWAY JOURNAL. Two events were transposed, it is true, but that was merely as a matter of convenience and did not affect the program as a whole. These were the third annual Supply Men's amateur vaudeville and theatrical performance, originally arranged for Wednesday, and given on Thursday, and the theater party at Young's Pier Theater and Savoy Theater, arranged for Thursday, and given on Wednesday.

Those who arrived in Atlantic City on Sunday were fortunate in being able to hear the farewell concert of the Royal Berlin Orchestra, given on the steel pier. While this had nothing to do with arrangements made by the association for entertainment, many delegates and their ladies were in attendance and enjoyed what certainly was an excellent program.

The arrangements made for the use by the delegates of the roller chairs was greatly appreciated, the ladies especially taking advantage of the opportunity thus afforded to enjoy the open while the business sessions of the different associations were in progress. The baths were also patronized by the hardy ones to a considerable extent, considering that the season is so well advanced.

On Monday evening Miss Kitty Cheatham entertained for an hour at the solarium in the Marlborough-Blenheim Hotel. Informal dancing followed.

On Tuesday evening the annual reception was held in the solarium of the Marlborough-Blenheim in honor of the presidents and other officers, with their ladies, of the Street and Interurban Association, Engineering Association, Accountants' Association and the Claim Agents' Association.

On Wednesday afternoon tea was served for the ladies at the Country Club of Atlantic City, where golf and tennis were played. While no attempt was made to have any official automobile trip for the ladies, many individual excursions were made, a popular objective point being the golf grounds.

On Wednesday, as before stated, the theater party was held at Young's Pier Theater and the Savoy Theater, and was followed by informal dancing at the Marlborough-Blenheim Hotel.

THE TRACK EXHIBITS AT ATLANTIC CITY

A feature in connection with the exhibits that was greatly appreciated was the temporary siding laid from the main track of the Atlantic City & Shore Railroad on Virginia Avenue to the board walk. Here were shown the Russell snow plow made by the Russell Car & Snow Plow Company, of Ridgway, Pa., the plows of which are operated pneumatically; a car for the Washington, Baltimore & Annapolis Railroad, built by the Niles Car & Manufacturing Company and described in the STREET RAILWAY JOURNAL of Oct. 12, and a Westinghouse single-phase, 15-cycle locomotive, No. 10,003, built for the Pennsylvania Railroad Company. This locomotive was briefly described in the STREET RAILWAY JOURNAL several months ago, and will be made the subject of a comprehensive article in an early issue.

Columbia University will offer at night during the year 1907-1908 twenty evening courses specially adapted to the needs of technical and professional workers. This includes work in Applied Mechanics, Architecture, Electricity, Fine Arts, Industrial Chemistry, Mathematics, and Surveying and Structures. The work begins on Oct. 28 and continues for twenty-five weeks. A full description of the courses is contained in the Announcement of Extension Teaching, which may be obtained on application to the Director of Extension Teaching, Columbia University, New York City.

PAPERS AND REPORTS PRESENTED AT THE ATLANTIC CITY CONVENTION OF THE AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION, WEDNESDAY, OCTOBER 16, 1907

THE TECHNICALLY-TRAINED MAN AND THE ELECTRIC RAILWAY PROFESSION

BY PROF. HENRY H. NORRIS,
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It has only been a few years since many practical business men considered that a technical education had a tendency to render young men unduly theoretical and hence unpractical. There was good reason for this belief in many cases, as the young men as well as their employers had incorrect ideas of the purpose of a technical education. As pointed out by the writer in a recent paper before the American Institute of Electric Engineers, the purpose of a technical education is not to teach trades, nor directly to produce business or professional men. The technical school is intended to educate young men in the best sense of the word, and the education which does not make young men better business or professional men is not a satisfactory education. A few years ago there were three classes of employers; one placing too high, the second too low, and a third, a correct estimate upon the value of a technical education. The first class of employers placed too much responsibility upon the young men at first, supposing that they were already engineers. As a consequence many failed to meet the expectations, and gave apparent reason for criticism of their technical training. The second class of employers, not realizing the purpose of technical education, failed to take advantage of it, and did not give the young men suitable opportunity to rise. The third class of employers fortunately realized both the shortcomings and the merits of technically trained young men. Opportunity was given for overcoming the former, and the latter were utilized by placing such responsibilities upon the shoulders of young men as they were able comfortably to carry.

The manufacturers were the first, and have been foremost in utilizing the product of the technical schools. They have carried this to such an extent that apprentice courses are offered by all of the large companies, and the young men are given every possible opportunity to develop normally and quickly. They are taken through all departments of the works, learning in each enough of the detail to enable them to appreciate the reasons for the development of existing forms of apparatus, and for the employment of present methods of construction. They test the finished product and so learn what to expect of the various classes of machines.

The operating companies are now taking this matter actively in hand, and a few lighting companies have developed courses similar in purposes, but necessarily different in plan from those of the manufacturers. The Denver Gas & Electric Company was a pioneer in this direction, and their example is being followed by other companies.

The purpose of the present paper is to inquire of the members of this association whether or not it is practicable for them to institute something corresponding to the apprentice courses of the manufacturing and lighting companies. Some years ago, at the request of the New York State Street Railway Association, the writer conducted an investigation to determine the attitude of the members of that association toward the technical school.* The result of this inquiry was to find that technical graduates are favorably regarded by the officers of the railway companies. At that time technical graduates were found mostly in the engineering departments, although some had risen to managerships and superintendencies. In response to an inquiry as to how young men should go about entering the electric railway field, the replies were not entirely satisfactory. The general advice was to begin at the bottom and work up, it being a matter of small consequence what the first position is. There was, however, no systematic way by which a young man fresh from college could learn the electric railway business nor, as far as the writer is aware, is there any at the present time. While it is natural that the graduates should find their way first into the engineering departments, it is the firm conviction of the writer that if their training is a success, the young men should be equally well adapted to the other departments, provided, of course, that they have the necessary personal qualities for superintending and managing.

The men who are now controlling the electric railway companies have largely grown up with the industry. The experience of many dates back before the early nineties, when the horse was supplanted by the electric motor. These officials are now training young men to take their places when they retire, and they naturally desire to find for this purpose individuals with the necessary characteristics and training. For many reasons they have the right to expect the technical schools to supply the class of men required. The first of these is, that the technical schools should, and probably do, attract a large proportion of industrious, active and capable students. A young man who has the nerve and ability to conquer the difficulties of a technical training, especially if he is financially handicapped, ought to be one who is needed in business. In the second place, the mental and physical discipline tends to bring out his good qualities and make him self-reliant and original. It increases his initiative power, the most important business qualification which he can possess.

It is surprising that such a comparatively small number of the technical graduates find their way into the electric railway business. Of the more than two thousand graduates of Sibley College, probably not more than fifty are directly or indirectly engaged in this line. Of these, quite a proportion are in the supply business, and only a small number are actually in the field. This is probably not because railway work is not attractive, but other lines have been so much easier to enter that they have attracted the bulk of the graduates. Some kind of an apprentice course would be welcomed by technical students. They enjoy any work in this direction that is given in the schools, and they show great aptitude for it.

To make the matter entirely practical the following arrangement is suggested for such a one and one-half year's course:

1. Three months in Master Mechanic's Department. This time should be largely spent in the car houses and repair shops. The apprentice can serve as helper on car inspections and repairs, construction of special parts, tests, etc.

2. One month in Purchasing Agent's Department, partly as assistant to the store-keeper, and partly as general assistant to the purchasing agent.

3. Three months in Motive Power Department. This time should be spent as general helper, oiler or in any other capacity in which the apprentice could be made useful. He could also assist on tests, designs for repairs and inspections. He could also act as emergency supply for sub-station attendance. A short time in the superintendent's office would familiarize him with the details of administration.

4. Two months in Transportation Department. The apprentice could be given miscellaneous work in connection with the preparation of time tables, familiarizing himself with the train dispatching system, and, in general, making himself useful to the superintendent. In many ways he could assist in this department as emergency supply in ticket offices, on express cars, etc.

5. Two months on outside line work. The apprentice could be employed as assistant with the repair gang, and he could also make himself useful in construction of new work, testing, repairs to instruments, etc.

6. Three months in Way Department. This time should be spent in office work, laying out details of new construction of track, bridges, etc. The apprentice should also assist in surveying and other field work.

7. Two months in Comptroller's Department. This time should be spent as general office assistant, and in conducting special investigations for the financial officers of the company. A technically trained man would be well equipped by this time to be of great assistance in compiling statistics. These cover not only the operation of the company itself, but of other companies. The apprentice would thus become familiar with the

*Proceedings N. Y. S. R. A., 1904, p. 187.

methods of accounting used, and of the relation of this department to the others.

8. Two months in General Manager's Office. The apprentice should now be in a position to be of practical use to the manager, and could be detailed to special duties which happened to demand attention.

One and a half years have thus been scheduled and subdivided among various departments with a view to preparing the apprentice for any line of work in the railway field which may happen to be open to him. He has had the opportunity to demonstrate his peculiar abilities and disabilities, and if he has "stood by" for the full period, he has shown his appreciation of the opportunity. It is obvious that a very large company could handle a number of such apprentices without serious difficulty, if the officers in charge of them were in hearty sympathy with the idea. The plan requires the co-operation of the heads of all departments, and there are numerous objections which appear as soon as the scheme is suggested. The young men are in the various departments such a short time that they are not able to work at maximum efficiency. Further, it requires a little effort on the part of the superintendents of the various departments to lay out work for the apprentices. The young men are apt to leave, and thus the company loses the benefit of the effort expended. On the other hand, opportunities are constantly arising in every company, demanding loyal, well-trained employees. These are difficult to obtain and could be picked out instantly from the apprentice corps. Smaller companies by slight modifications could use the same general plan, and with the same results.

The matter of pay for the apprentices is one of practical importance. It is not to be expected that they will be able to earn as much as men regularly employed in the departments. On the other hand, they should be expected to earn for the company as much as possible. Their wages should be based more upon a reasonable living expense, than upon their earning capacity. This will depend upon the cost of living in various communities. Probably from ten to twelve dollars per week at the start, with a reasonable increase at the end of each six months' period, would be reasonable and satisfactory to all concerned.

This paper is not intended to recommend that companies go into the apprentice business on a wholesale scale. If each year one or two men could be employed by the smaller companies, and half a dozen or so by the large companies, there would be a sufficient supply of new material always in processes of development. Of the men hired, probably one-half would drop out before the end of the period, and those who remain would naturally be the ones best fitted for the work. From the writer's personal experience he is aware in a general way of what the companies need in this line, because he has the frequent privilege of recommending young men for various positions in electric railway work. In every such case if the apprentice corps were in existence the needs of the company could have been met better within their own organization.

REPORT OF THE COMMITTEE ON CAR WIRING

Following their appointment in February, the members of your committee received from the secretary of the association a request for views concerning the changes suggested in the rules of the Underwriters' National Electrical Association relating to wiring and equipment of a street railway property including rolling stock. The material was desired for use at the annual meeting of the Underwriters held in New York the latter part of March. Through a misunderstanding as to the date of this meeting your committee was not represented.

The chairman was then instructed by the secretary of the association to obtain a copy of the approved changes in the rules to see what suggestions concerning them and the other rules might be made with advantage to street railway companies.

Your committee's views were brought to the attention of the Underwriter's representative by the chairman with the result that the approved changes were modified before being published in the 1907 edition of the "National Electrical Code," as follows:

As approved by Underwriters Ass'n at meeting in March, 1907.	As modified and appearing in edition of code, published in July, 1907.
Rule 28, sec. b (flexible cord).	Rule 28, sec b (flexible cord).
"Must not be used when the difference of potential between the two wires under normal conditions is over 300 volts."	"Must not be used when the difference of potential between the two wires is over 300 volts." Supplemented by the following fine print note: "The above rule does not apply to the grounded circuits in street railway property."
Rule 33, sec. c (car houses).	Rule 33, sec. c (car houses).
c. "Must have a cut-out switch located at a proper place outside of the building so that the trolley wire in the building can be cut out at one point, and section insulators must be installed so that when this cut-out switch is open the trolley wire will be dead at all points within 100 feet of the building. The current must be cut out of the building whenever the latter is not in use or the road is not in operation."	"Must have an emergency cut-out switch located at a proper place outside of the building, so that all the trolley wires in the building may be cut out at one point, and line insulators must be installed, so that when this emergency switch is open, the trolley wire will be dead at all points within 100 feet of the building. The current must be cut out of the building when not needed for use in the building." Fine print note added as follows: "This may be done by the emergency switch or if preferred a second switch may be used that will cut out all current from one building, but which need not cut out the trolley wire outside as would be the case with the emergency switch."
Rule 33, sec. e (car houses).	Rule 33, sec. e (car houses).
4. "Must have all rails bonded at each joint with a conductor having a carrying capacity at least equivalent to No. 00 B. & S. gage annealed copper wire. All rails and all lightning and stationary motor circuits must be connected to the outside ground return circuit by a No. 00 B. & S. gage copper wire, or by equivalent bonding through the track.	"Must have all rails bonded at each joint with a conductor having a carrying capacity at least equivalent to No. 00 B. & S. gage annealed copper wire, and all rails must be connected to the outside ground return circuit by a not less than No. 00 B. & S. gage copper wire or by equivalent bonding through the track. All lighting and stationary motor circuits must be thoroughly and permanently connected to the rails or to the wire leading to the outside ground return circuit."

Examination of these modifications will show that they permit of more liberal application of the rules to street railway property than was the case in their originally approved form, and it was possible to have the changes brought about because they did not materially affect the principles involved.

Your committee would further suggest a change in Rule 32, sec. f (Lighting and Lighting Circuits), as follows: Clause reading, "No lamp of over thirty-two candle-power to be used," to be changed to read, "No lamp consuming more than 128 watts of energy to be used." This change is suggested as it was evidently the purpose of the old rule to limit the energy consumption through a single outlet, rather than the quantity of illumination; and the advance made in incandescent lamp manufacture in the past three years has greatly increased the possible illumination for the same consumption of energy.

There are two suggestions which, from their nature, call for more radical changes in the rules than could be approved by the electrical committee without the sanction of the underwriters' association in annual meeting.

The first relates to Rule 32, sec. g, paragraph 2 (Heaters and Heater Circuits), and calls for its modification in such a manner as to allow the use of a truss plank heater by providing a thickness of 3-16 in. of approved fire-resisting insulating material between the back of heater and truss plank.

The second refers to Rule 33, sec. e, paragraph 3 (Car Houses), which requires bonding for all rail joints to have a capacity at least equivalent to No. 00 B. & S. gage copper wire, and it is suggested that No. 0 B. & S. gage wire should be large enough and might reasonably be specified.

For the reasons above stated it would seem best to refer

these suggestions to the succeeding committee, to be taken up by it with the underwriters and have them act upon it at their meeting next year, and this course your committee respectfully recommends. Respectfully submitted,

John W. Corning, Chairman,
C. B. King,
L. P. Crecelius,
Hugh Hazleton,
I. D. Shipper.

THE NATIONAL FIRE PROTECTION ASSOCIATION

BY RALPH SWEETLAND,
Engineer, New England Insurance Exchange, Boston, Mass.

The National Fire Protection Association, as its name implies, is an association whose object is to promote the science and improve the methods of fire protection. It was organized in 1896 by men connected with stock fire insurance companies in an attempt to unify requirements for construction in new and old buildings, installation of automatic sprinklers and other fire appliances. It was soon seen, however, that if the association was to accomplish its mission, not only the underwriters, but all national bodies having primary jurisdiction, must be included in its membership. To that end, in 1904, its constitution was changed so that it now has as active members the American Institute of Architects, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, American Street & Interurban Railway Association, American Water Works Association, National Board of Fire Underwriters and practically every insurance organization of importance throughout this country and Canada.

Its work might be described as the preparation of standards for so-called fireproof or fire-resistive construction, slow-burning construction and correction of buildings of inferior construction, especially as regards resisting the action of fire; standards for fire doors and fire shutters and wired glass windows; standards for construction and installation of all fire-fighting appliances and apparatus, such as the automatic sprinkler; steam, rotary, centrifugal or electric fire pump; hydrants, hydrant houses, hose, play pipes; chemical fire extinguishers; standards for signalling systems used for the transmission of signals affecting the fire hazard, such as thermostats, journal alarms, watchman's time recording apparatus and automatic sprinkler alarms; standards for the construction of ash cans, waste cans, safety cans for benzine, gasoline, etc.

As an example of the association's method of treating a subject, I might cite the course pursued before the standard for construction and equipment of "Car Houses" was completed. A committee to consider this subject was appointed early in 1905 and a preliminary report was submitted to the association in May of that year which, after being discussed, was referred back for further consideration. The committee worked on the matter during that year and again submitted a report in May, 1906.

This report, while fairly satisfactory, was not finally adopted and was again referred to the committee. During the next year, after our committee was practically agreed, a conference with members from your association was requested that the indorsement of your association might be obtained. This conference, as you are well aware, was held, a joint report has been agreed upon, the report adopted by the National Fire Protective Association and will, I trust, receive the approval of this convention.

During the time that the matter was under consideration by the committee the data obtained from numerous fires in carhouse property was gone over, engineers engaged in designing car storage buildings were consulted and numerous tests to determine the efficiency of the protection afforded by the so-called aisle line sprinklers were made.

Among other important subjects now receiving consideration I would call attention to the work of the committee on cement for building construction, as this committee's work includes an investigation of concrete, a material coming into such general use not only for foundations, retaining walls and bridges, but also for building construction. Members of this committee together with representatives of the United States Government, various engineering associations, the National Board of Fire Underwriters, arranged for extensive tests, which are being made by the Structural Materials Testing Laboratory at St. Louis. Owing to the non-completion of these tests and the importance of harmonizing differences with committees from the various national societies, such as the American Institute of Architects, Society of Civil Engineers, the Mechanical Engineers and others, the report of this committee has not yet been completed. It well illustrates, however, the care which is taken by our association, not only to have our standards conform to what we believe to be the best practice from a fire point of view, but be in accord with the standards as recommended from other engineering societies.

In the preparation of a standard for the construction and installation of a particular device, such, for example, as the fire door and shutter, wired glass window, automatic sprinkler, etc., an immense amount of experimental work is necessary to determine the efficiency of the device under as near actual conditions as is possible to obtain. That the tests and investigations may be uniform and that a direct comparison of the efficiency of particular devices may be made, it is necessary that these tests and investigations shall be done by experienced engineers, trained in the particular line of investigation in which the device would class.

For this purpose the Underwriters' Laboratories at Chicago, which are said to be the best of their kind in the world, have been incorporated and tests on these devices, especially as to whether they may create a fire hazard or serve as a fire retardant, are here made. After a particular device has been tested, the report goes to a committee of the association for final review and for vote as to whether it is worthy of approval or not. Take, for example, the tests which were necessary before the standard for a fire door or shutter could be decided upon. Numerous doors agreeing with the proposed standard were constructed, hung with regular hardware, subjected to a fire upon one side, the temperature running as high as 2000 deg. F., and then, while the doors were hot, fire streams were played upon them, thus duplicating actual conditions which occur when a fire door in an opening to a building is subjected to a fire on one side with hose streams playing into the building and striking it.

In the standards for the construction and installation of automatic sprinklers, field conditions as near as possible are duplicated, such as subjecting the sprinklers to as extreme a water pressure as would occur by severe water hammer; the effects of corrosion, as from the fumes of sulphuric or muriatic acid; the effect of loading, as when a sprinkler head is whitewashed or calcimined at the time the ceiling of the room is so treated; the distribution of water from the sprinkler under smooth or joisted ceilings and under varying pressures.

Again the hand chemical fire extinguisher, a device which is coming into quite general use for car storage houses, might be mentioned to show the detail which must be gone into before a standard for such a device can be issued. Not only the quality of the material, thickness of the shell, coating of the interior to resist corrosion, strength of the hose, nozzle, etc., but practically every detail of construction must be carefully gone into.

As soon as a standard for a particular device is issued numerous manufacturers, who profess ability to make devices agreeing with this standard, request approval of their product. Here, again, the laboratory is called upon to test the particular make of apparatus as to whether or not it conforms in all essential features with the pre-determined standard.

Originally, after devices as made by a number of manufacturers had been checked up and found to agree with the standard a list of such manufacturers was issued by the National Board of Fire Underwriters and circulated by the various underwriting boards and associations so that the public could ascertain in advance whether or not a certain manufacturer's device was or was not approved. It was found, however, that owing to competition, while a manufacturer could make a device which would meet the requirements of the standard when submitted to the laboratories for test, the devices sold in the open market in many cases fell far short of the standard, even when it was known that samples would be obtained from the field, sent to the laboratories and tested. This led to the introduction of what we know as the Factory Inspection Service.

This inspection system has been applied to hand chemical fire extinguishers, fire doors, metal framed and wire glass windows, and is about to be applied to fire hose and numerous other devices. As this inspection service is carried on at the present time an engineer connected with the laboratories visits the factory of the manufacturer, checks over the material, the process and the completed article and a tag is then fastened to

the article, this tag bearing a serial number and a statement that it is made under laboratory inspection.

Consider again the hand chemical fire extinguisher, as this is a device which must be carefully and accurately made, since possibly months after installation it may be needed and must be free from corrosion, capable of withstanding a high pressure and must freely discharge its contents. A factory where any considerable number of these are being turned out is visited by the engineer two or three times a week. He notes the thickness of the shell, the coating of the interior surface, the attachment of the hose, the condition of the nozzle and the general character of the extinguisher after it is assembled. Tests are also made on a certain number of extinguishers which have been completed since the engineer was last in the factory and if any of these fail the whole product is rejected.

This inspection service, as you will note, follows quite closely the inspection as carried on by the Government for armor plate, guns, ammunition, etc. The cost of this inspection service to the consumer is nominal and is never applied where its cost is more than 1 per cent of the selling price. With devices bearing these labels there is a reasonable guarantee that the customer is obtaining that for which he is bargaining.

Such, briefly, is the work which our association is trying to accomplish. In most, if not all, of this work you are necessarily interested for, with the large amount of property directly under your control, you are anxious to have it in such a condition that there will not only be the least liability of fire, but in case one occurs that the flames will be extinguished with as little trouble and inconvenience as possible, since, regardless of the money which you may collect from insurance companies, the loss in revenue due to destruction of the property is of very serious importance.

In closing I want to express what I believe to be the desire of our association and this is that you take an active interest in our work, not only by being represented at our annual meeting, but by serving on committees and assisting in promoting the best methods of construction and protection, that the enormous fire waste, amounting in the United States for this year to nearly $185,000,000, may be diminished.

THE INFLUENCE OF THE DESIGN OF RAILWAY STRUCTURES ON ECONOMY OF OPERATION

BY H. T. CAMPION AND WILLIAM McCLELLAN,

There is no doubt whatever that some of the finest engineering in the world has been done in connection with the larger power plants of the country, and the writers have no intention of criticising or discussing these more important examples of railway work. In traveling over the country, however, on various kinds of engineering business, one naturally sees a large number of smaller plants. In many cases it is interesting to note the great ingenuity by which money is saved and extraordinary results accomplished. The struggle for net earnings is so great and the intelligence of the average engineer together with the widespread diffusion of information is such that one need not be surprised at the great effort that is made to reduce the expense to a minimum. But in spite of all this, it is almost pathetic at times to see the amount of effort spent in wrong directions and the neglect of very important factors of operation in the attempt to reduce minor ones which are perhaps more obvious and outstanding.

Perhaps this neglect is found more frequently in connection with structures and their accessories than anywhere else. When a power house consists of an engine or two with only a few boilers, it seems as though any one can design it. The car house apparently may be placed here, there, anywhere, so long as it is along the line of the road. The cars may be gotten out and into it in any fashion which occurs first to the person who makes the design. Presumably, the car inspectors will get the trucks from under the cars in some way, so no great effort need be made to do this quickly and conveniently. Reinforced concrete is somewhat new and desirable in many cases so that it is often used to the exclusion of steel, brick, and other materials whether it is most suitable and least expensive or not. These are only a few points indicating how the law of economy is violated.

The effect which the design of structures has on cost of operation is two-fold: first, through maintenance charges; second, through convenience and adaptability in reducing the labor item. The writers know of several roads to-day for example, which are operating an unnecessarily large total number of cars because too great a percentage of them are in the shop constantly. Cost of operation suffers here because of the increased fixed charges and, again, because of the large repair costs.

But the real cause is the lack of shop facilities. In many cases, this lack is due, not to actual want of space, but rather because the space is inappropriately utilized, or proper accessories are not provided.

In connection with the power house, coal and ash-handling furnish other examples full of infinite and frequently expensive variety.

The greater demand for liability, both for the public and the employes, has introduced a cost which can be reduced through proper attention to design of buildings and highway bridges. This is particularly so for the new high-tension alternating roads. Finally, the matter of maintenance, really a large item in the cost of operation, is greatly influenced by the choice of materials.

As proof that these are facts and not fancies, it is only necessary to point to the great number of roads which are yearly taken under the control of large operating firms or companies. About the time these roads are taken over, they are tottering and about to fall. As soon as they are acquired, the strong engineering talent of the new company starts an extensive system of improvement. Many times it is carried out gradually and in such a way that the original owner with perhaps little money could have done it had there been sufficient insight and foresight.

The reasons for this apparent blindness are not hard to find. First, we have the almost total absence of any systematic recording or analysis of costs; and second, an utter lack of any proper idea of a provision for maintenance. There is no understanding of what a serious cost proper maintenance really is. If there were, greater efforts in design would always be made to reduce it to a minimum.

There is not space in such a paper as this to cover the whole ground of our subject. We shall merely give some more or less detached notes on these points which come up for discussion most frequently, particularly in connection with smaller systems, and where the answer is often not obvious or easily obtained and yet is of the utmost importance.

MATERIALS

Before discussing certain details of particular structures, it may be well to say a few words about materials in general, especially as there seem to be many erroneous ideas prevalent.

This may be called the day of reinforced concrete, not because other materials are not being used in large amounts but because its introduction has been recent and the increase of its use very rapid. There seems to be a disposition on the part of all owners to try to find some excuse to explain why they have not found it advisable in certain cases to use reinforced concrete. We have frequently found men of late who apparently believe they are using some inferior substitute when building with steel or wood for structural work. Yet it does not seem to be as well known as it ought to be that reinforced concrete has certain limitations and, although it is one of the most useful building materials ever devised, it is still not applicable to all kinds of work.

In the first place, reinforced concrete is not beautiful in itself and, unless much money is spent in very elaborate centering and in finishing, it cannot be made attractive from the standpoint of aesthetics. The beauty of reinforced concrete lies in its solidity and its very apparent durability.

It is also very apparent that changes cannot be made in reinforced concrete buildings. Therefore, unless plans are fairly well determined for a building, it would not be advisable to build of reinforced concrete. It should be remembered that in destroying a reinforced concrete building there is little or no salvage. And frequently added expense to dispose of the material after it is taken down is necessitated.

The most attractive features about reinforced concrete are, of course, its fireproof qualities and the total absence of any maintenance charges. It must be conceded that these two arguments are very powerful and will warrant even some extra amount in the investment. The difference in cost, however, should be very carefully calculated and capitalized in order to see whether such extra expense as may be required is warranted. Maintenance charge on interior steel work is very small and for long spans such structural work costs less than concrete and steel under ordinary circumstances. There may

be certain conditions which may warrant using concrete for very long spans. The writers are now engaged in placing concrete roof girders over a span of seventy feet. These girders require no greater head than would a steel or wooden truss and, though eighteen inches thick, they will not look cumbrous owing to their great length. Concrete girders on such a span are only possible because all the material except cement is found right on the site.

Fig. 1 gives a view of a paint shop in which girders of forty-eight feet span were found much cheaper and entirely advisable under the circumstances. This span is not what would be considered a long span, however.

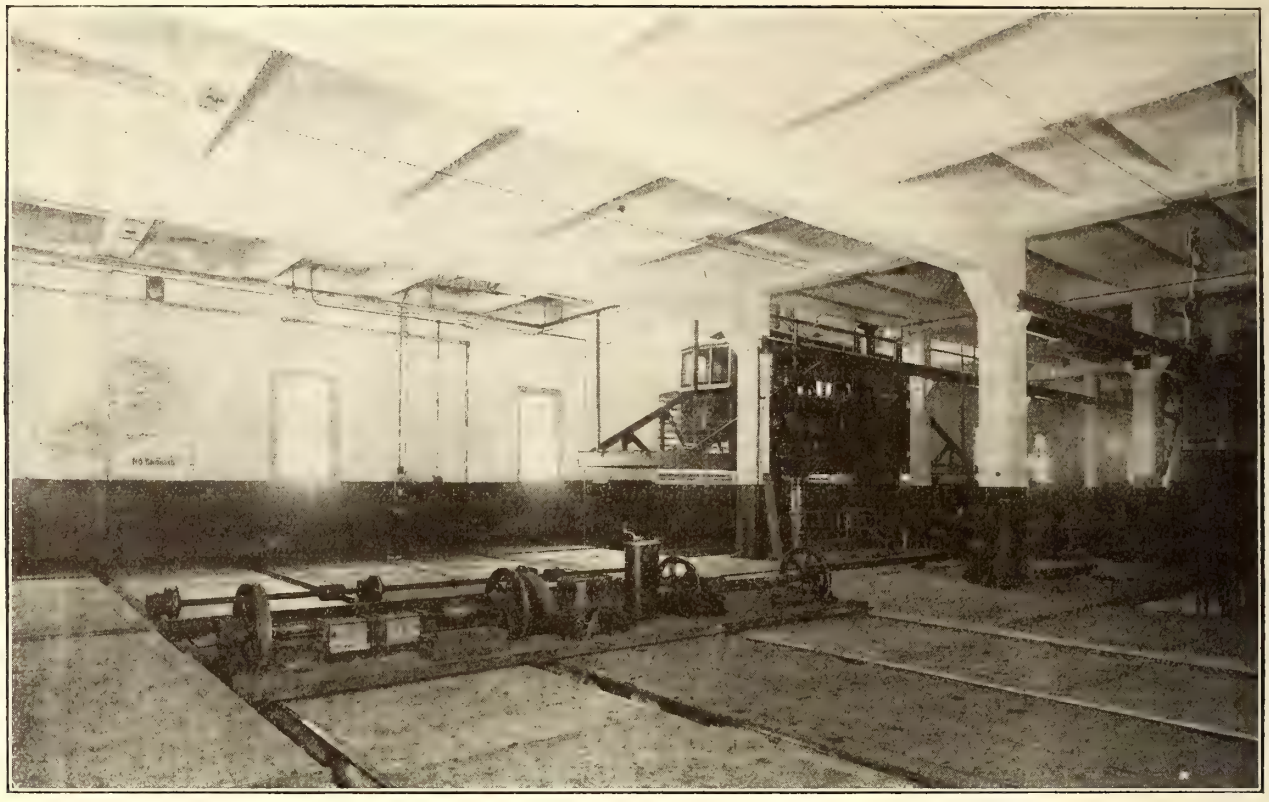


FIG. 1.—PAINT SHOP



FIG. 2.—SUB-STATION INTERIOR

In view of the numerous accidents which have happened to concrete structures lately, it should be emphasized that there need be no hesitancy in using this material. It is necessary, of course, to exercise eternal vigilance as to the materials used

and the method of placing. The cement, sand, and stone may be chosen under the best specifications and with the most rigid inspection, but this is no guarantee whatever that a good building will result. As nothing definite can be determined by inspection after the removal of the forms, the inspection must be unceasing and rigid while the concrete is being placed. This feature must be considered as an inherent weakness in all concrete construction. It can be almost entirely eliminated by vigilance.

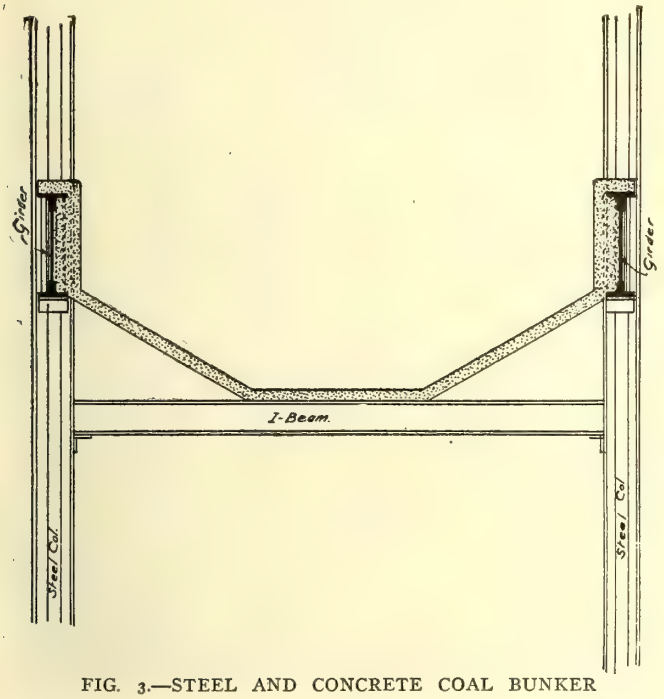


FIG. 3.—STEEL AND CONCRETE COAL BUNKER

Another advantage which concrete has is its ability to take up vibration. No one need fear that even extreme vibration will cause any failure in a reinforced concrete structure. This makes is particularly useful for highway and other bridges where its cost is not prohibitive.

In Fig. 2, it will be noted that the crane girders are made of reinforced concrete. These have been in use for several years and, together with numerous other examples, have shown that it is both safe and advisable to use reinforced concrete in such cases, where all other conditions will warrant it.

On the other hand, there are cases which will be noted where steel is more advisable and where concrete is really not applicable at all. In noting the advantages of reinforced concrete, the very definite advantages of steel should not be forgotten. It is very much less bulky which would be an argument where space is very valuable or hard to obtain. It is entirely unaffected by oils which are frequently found in connection with machinery and engines. It is for this reason that some persons favor steel for turbine foundations rather that reinforced concrete. Numerous experiments have shown that signal oil dripping on concrete soon causes it to lose its strength, and disintegrate. It may, therefore, be possible that concrete foundations under turbines might be seriously weakened if the lubricating oil dripped or soaked into the concrete to any great extent.

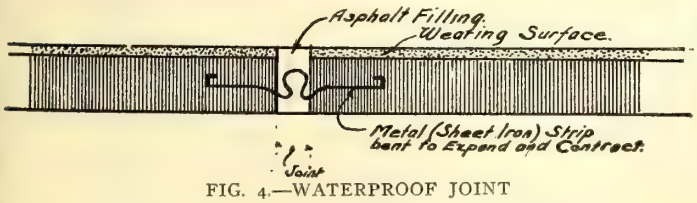


FIG. 4.—WATERPROOF JOINT

As a matter of fact, the joint use of structural steel and reinforced concrete is frequently the best solution of the problem —examples are shown in Figs. 3, 5 and 7. Around the engines and turbines, and for turbine foundations, this will usually be true.

COAL AND ASH-HANDLING

One of the features which has much to do with influencing the cost of operation and which is frequently neglected in the smaller plants is that of coal and ash-handling. Certain circumstances demand an overhead bunker with conveying apparatus while, under other conditions, pockets are more advisable. Where overhead bunkers are used, great care should be taken in the choice of type and material, as otherwise maintenance costs may be very high.

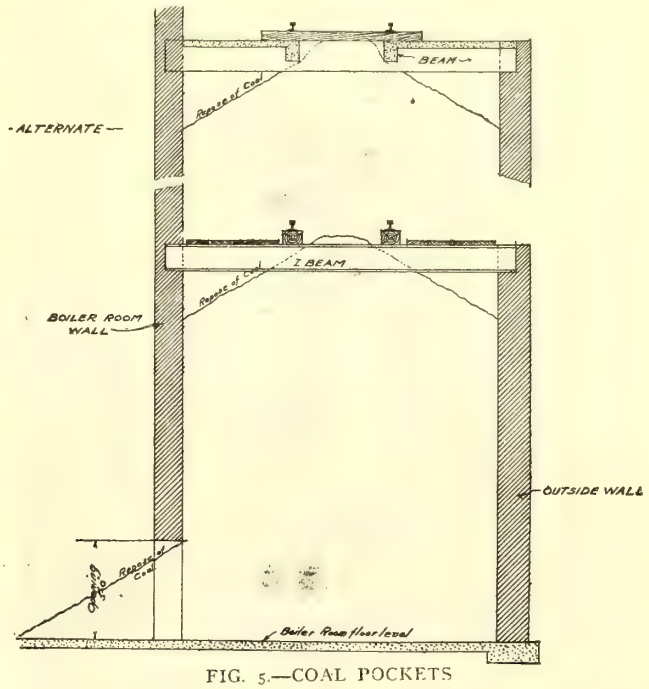


FIG. 5.—COAL POCKETS

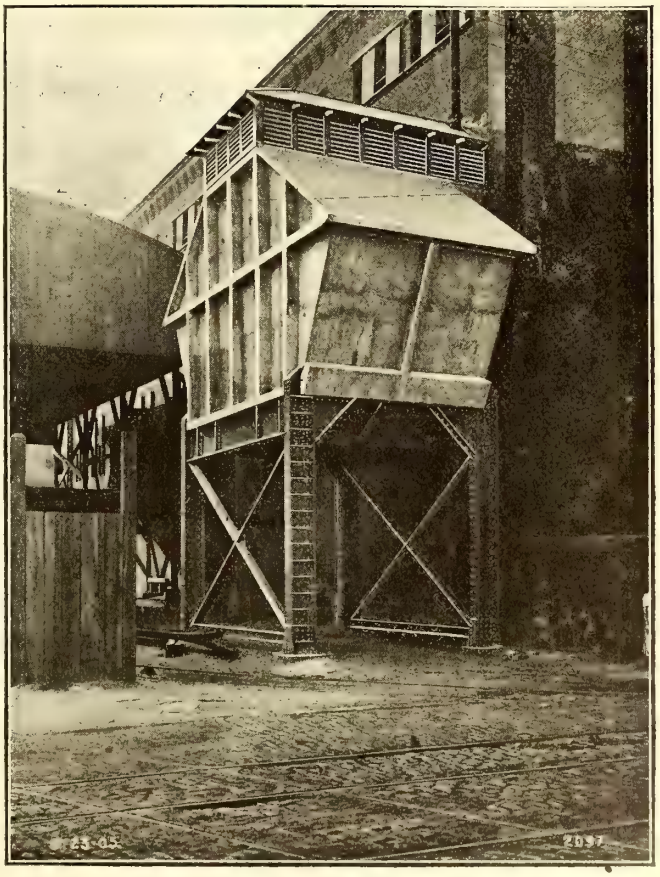


FIG. 7.—STEEL AND CONCRETE ASH BIN

In the suspended, or catenary type, the structure requires frequent painting and, to insure a reasonably long life, a lining is demanded. This lining is usually built of concrete in which a

metal mesh should be placed to prevent, as much as possible, the cracks which arise, not only from temperature variations, but also from alterations in the shape of the structure due to load changes. If long life and low maintenance is to result, the effect of this alteration in shape due to change of load must be carefully looked after in design.

Water draining over coal forms an attacking sulphurous acid. Should cracks and fissures develop in the concrete lining, this acid will enter, not only corroding the steel structure but also eating its way into the more porous concrete and possibly neutralizing its alkaline properties.

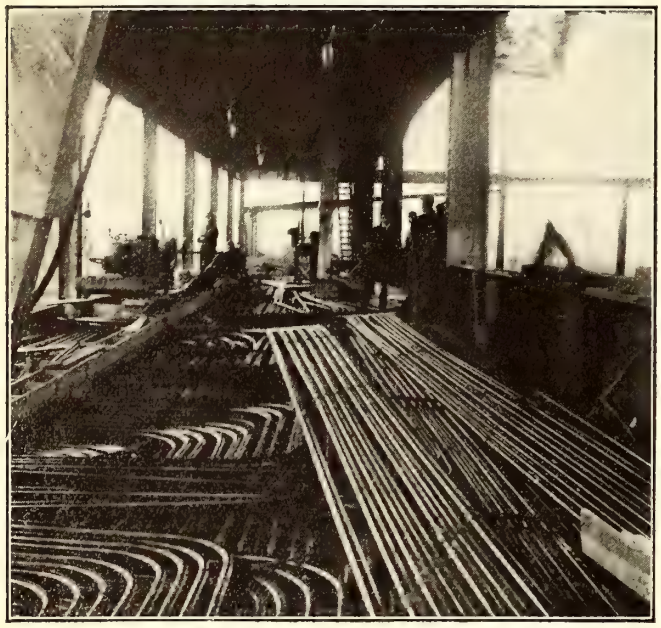


FIG. 9.—DUCT TO BE CONCRETED IN FLOOR

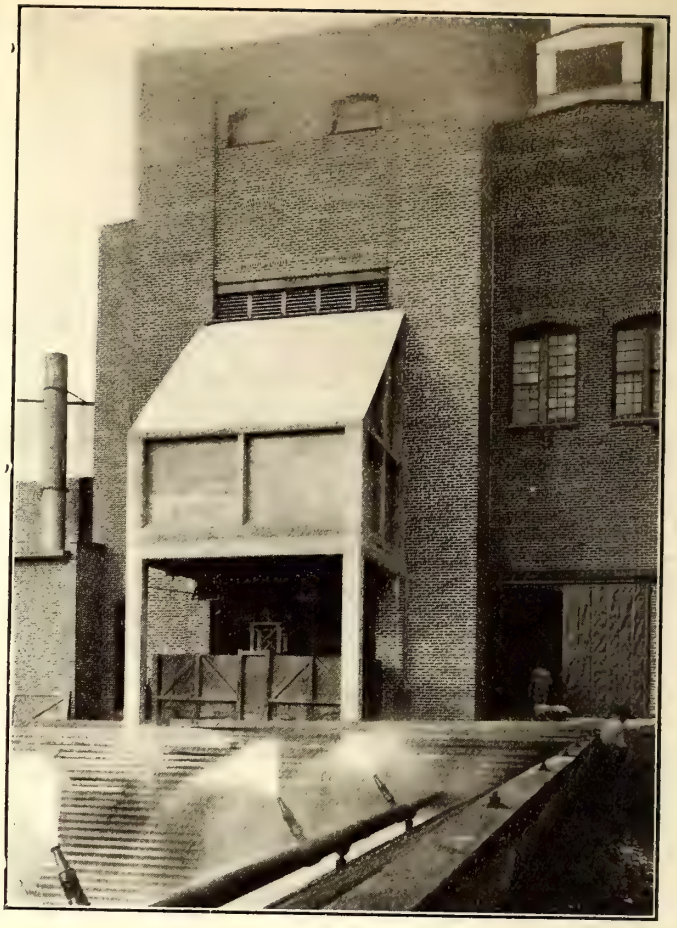


FIG. 8.—CONCRETE ASH BIN

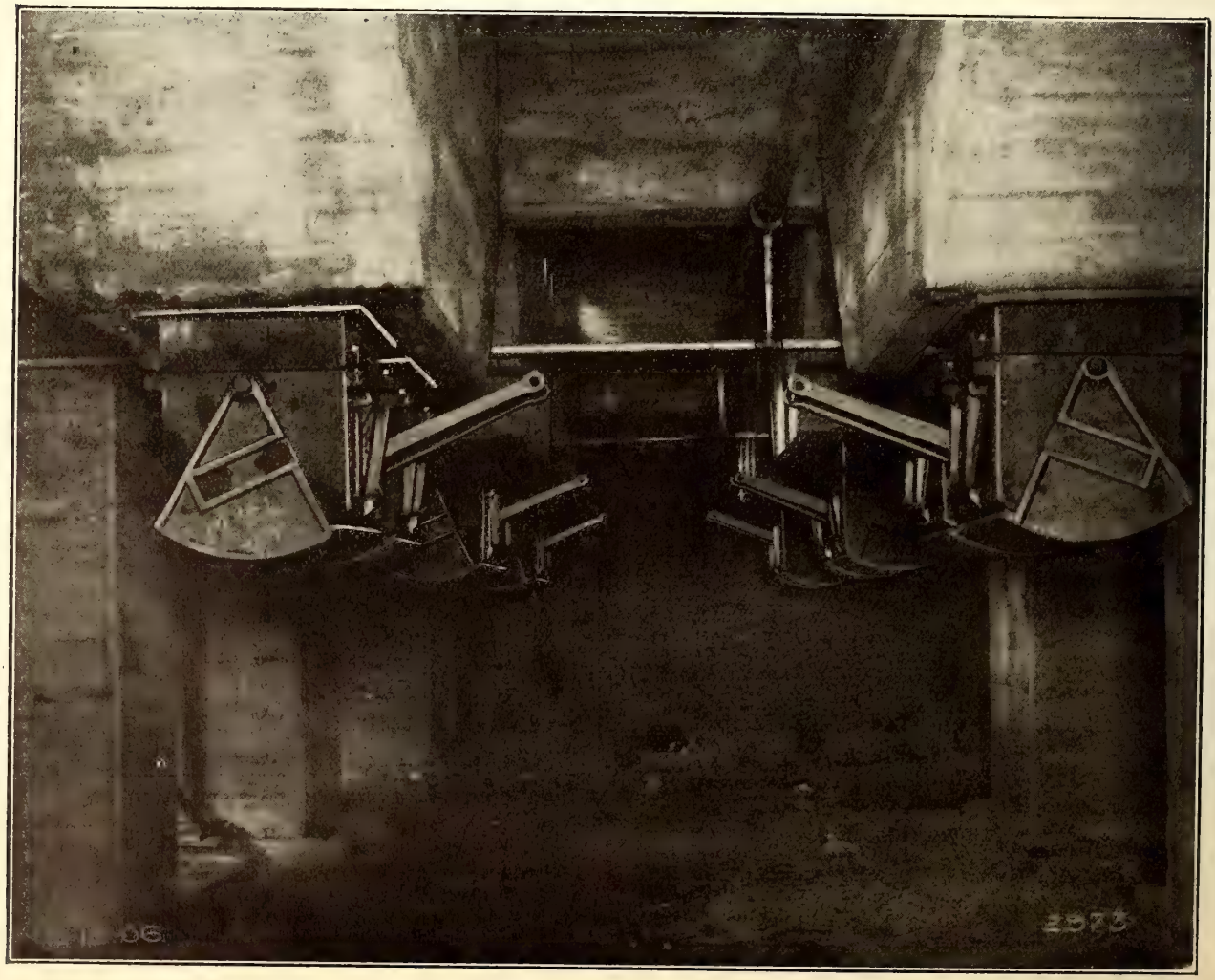


FIG. 6.—SUSPENDED CONCRETE ASH PITS

In the rigid type of bunker, we have other conditions to guard. Fig. 3, shows a typical sketch of this type in which steel has been used for the main supporting members because the loads, or their resulting movements are so great as to make the entire use of concrete inadvisable on account of the great bulk necessary and the expense entailed by its added dead load on the foundations of the structure. The principal danger to be guarded against is its tendency to crack from temperature changes, opening it to the dangers enumerated in the case of concrete linings of steel bunkers, and, furthermore, causing unsightly leaks in

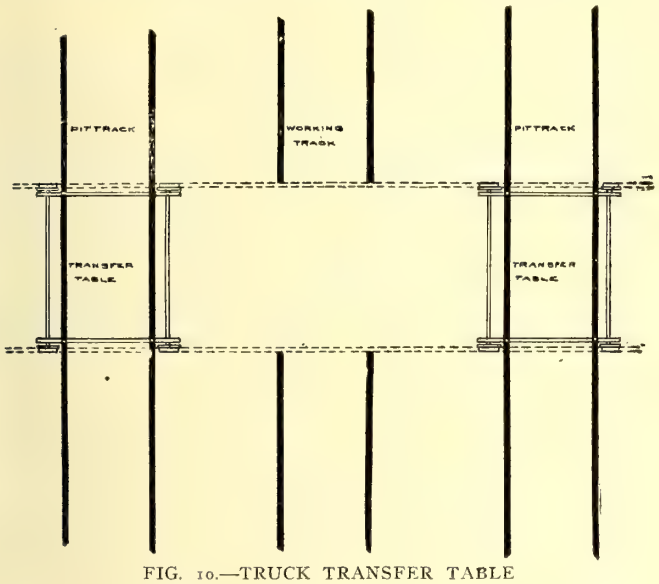


FIG. 10.—TRUCK TRANSFER TABLE

the boiler room. There is also the abrasive action of the falling coals on the surface of the concrete.

The last item can be guarded against by applying to the inner surfaces of the structure a hard, well-rubbed granolithic surface which, if properly applied, will resist such abrasion as a comparatively soft material as coal will cause.

The first objection, temperature cracks, can and should be taken care of in the design. The units of the structure should be in short lengths and a water-tight joint can be provided in a number of ways. Fig. 4 shows one simple and effective way of making a joint.

It is difficult to give any accurate comparison of costs of the two types of bunkers. There is, of necessity, great variation owing to difference of size, design, and amount and kind of coal passing through. The life of the unlined bunker with average coal will be perhaps eight to ten years. The writers took down one and found, by drilling, the metal shell reduced more than one-half in thickness in this time. Maintenance on the rigid concrete type and on the lined catenary type is practically zero, though the rigid type has somewhat the advantage. Depreciation on the rigid type and concrete lined type is practically zero.

What is more surprising, however, is the great lack of attention given to economical handling of coal for hand-fired boilers. We must pass this with only a word. Frequently an overload bunker is advisable. If not, the scheme shown in Fig. 5 is very useful and inexpensive. A series of bins is built using the boiler room wall for one side. The illustration is self explanatory.

In the handling of ashes, there often could be much improvement. Where the ashes drop directly underneath the boilers, pockets can be most effectively and economically constructed of concrete and made a part of the boiler room floor structure as shown in Fig. 6, leaving a comparatively clear basement for the handling of ashes, either by the industrial railway method or by some conveying scheme.

In some cases, pockets of this description have been lined with fire brick but the temperatures are so much under the point where concrete loses its water of crystallization that it seems an unnecessary expense to spend money for this purpose.

In building in the cast iron gate frames, care should be taken to set them in two or more pieces, for if they are set in in one piece, their expansion will certainly cause serious cracks in the concrete pockets.

In storing ashes removed from the boilers for final disposal at such times as best suit the operating conditions of a railway reinforced concrete ash bins have been almost universally adopted on account of the fact that metal structures are not only costly but have a very short life under the trying duty of containing coal ash with its high percentage of corrosion acids.

These concrete structures, too, can be arranged in so many ways to suit local conditions, that they meet requirements that no other material could. Their cost varies considerably on account of location, height, and ratio of wall, floor, and roof area to cubical contents, but a range of from 30 to 50 cents per cubic foot front of contained area will cover most cases. In large structures, the price may be even lower, but as no maintenance of the structure is required, the first cost is the last cost.

Fig. 7 shows one of these bins made of a combination of structural steel and reinforced concrete, while Fig. 8 shows a bin made entirely of the latter material.

SUBSTATIONS

So far as operating costs are concerned, little can be said on substations as structures. They have received much attention and are, on the average, very well designed. Concrete has been used much and advisedly. It is expensive, however, to use monolithic concrete for bus-bar compartments. Brick with either stone or concrete slabs is much better. Concrete is very useful in floors, however, and frequently serves to dispose of the loricated duct problem cheaply and effectively. Fig. 9, illustrates its possibilities for this purpose.

CAR HOUSES AND SHOPS

As remarked before, many roads have an unwarranted investment in rolling stock simply because of inadequate shop facilities. Steam roads have proven in the past—and are doing so yet—that low-operating costs mean good shop facilities. By the latter term are included facilities provided for "road repairs" as well as for "shop repairs." Care for both classes is absolutely essential to success in operating and in this feature alone, more roads fail than in any other.

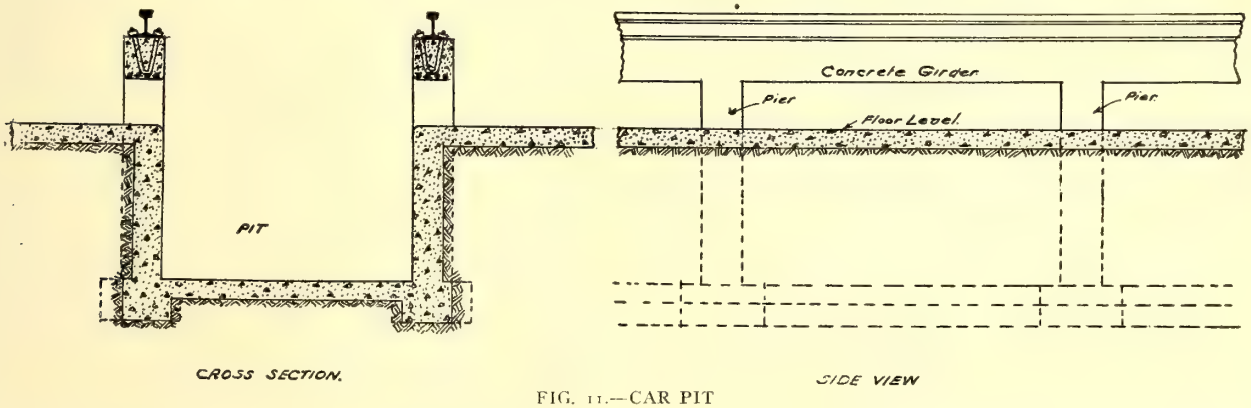


FIG. 11.—CAR PIT

"Road repairs" are naturally made at the car houses, while "shop repairs" are made at some centrally located plant. These buildings should be located and designed relatively to each other so as to provide the greatest usefulness. It is true that an electric car has no strict "stage" but can go on indefinitely

with very brief or no layovers. Nevertheless, this is not a practical method of operation. Cars must be taken off for thorough inspection at regular intervals. This inspection, however, should take as little time as possible, and the shops and houses should be located so as to make this possible. No rule can be given. Simply keep in mind that every hour a car is kept in the shop unnecessarily means loss.

The car houses and shops should be absolutely fireproof. This will be appreciated when it is remembered that cars are largely inflammable and fire usually causes total destruction. In addition, there is always a comparatively large amount of inflammable material around with workmen carrying on operations which require heat or flame. Finally, we have the numerous chances for accidental arcs. At present, reinforced concrete is most popular and will probably remain so. Other materials serve very well, however, and local conditions will frequently prove them more advisable. It is interesting to note the following approximate costs of different types drawn from experience:

	Per sq. ft.
Timber barn, two-track bays, sides covered with corrugated iron	$0.55 to $0.70
Timber barn, three-track bays, brick or stone walls	1.10 to 1.30
Fire-proof concrete barn, three-track bays, concrete or brick walls	1.25 to 1.50
Clear span steel roof, eight to ten tracks, brick walls	1.40 to 2.00

The cost of building is often needlessly increased by including much special track work in the covered house space. Even transfer tables can usually be left outside of the building proper and the cost reduced.

In shops particularly, the space should be nicely proportioned and there should be no backward movement in the progress of the cars through the shops. For convenience, we may divide a shop plant as follows:

Inspection shops with pits and standing space in rear; jacking-up shop with carpenter, machine and blacksmith shops close by; paint shop; erecting shop with pits.

The inspection shops with pits should be ample to receive cars as they come in. The standing space is provided back of the pits so as to allow the superintendent to properly distribute his work to the different shop departments.

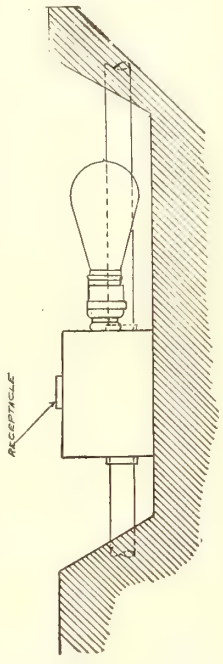


FIG. 12.—PIT LIGHT

The "jacking-up" shop should be well provided with facilities for removing trucks from cars. For this purpose no device is quite so useful as a double crane of sufficient capacity to raise the whole car body in one lift. We shall some day provide for this lifting in the design of a car body and thus avoid even the necessity of slinging the car for lifting.

The paint shop should be in proximity to the carpenter shop though paint-mixing should be done in a well-guarded room—perhaps separate room. Ample space should be provided for the cars while drying, the time for which varies greatly according to the finish.

There has been much discussion on pits but the last word has not been said. Time will be saved by making the pits communicating instead of independent. They should be deep enough to allow a man to work without stooping. Fig. 11 shows a type of construction that is very convenient. It provides ease of working on the car both from the floor of the barn and from the pit. It is very useful in adjusting or replacing brake shoes.

The lighting in pits is usually inconvenient and insufficient. Fig. 12 shows a pit lighting unit which placed every twenty feet staggered on both sides of the pit gives adequate and effective lighting. Extension cords are provided for without extinguishing the general lighting.

STORAGE HOUSES

Proper storage of cars is necessary if costs are not to be increased. Three types of car house have been used.

1. Open car house in which the office, sand compartment, and perhaps small repair shop are enclosed. Generally the cars are entirely in the open.

2. The semi-enclosed car house in which a roof is supported by posts with walls reaching perhaps 6 to 10 feet above the track, the entire front or entrance end being open.

3. The closed car house made up of 4 to 9-track units separated by division walls. The entrances are closed by rolling or sliding doors.

The semi-enclosed car house seems to answer all requirements except, perhaps, fire protection from the outside. Steam men have stored their cars outdoors always, but electric men have usually wanted a roof. This is, perhaps, necessary on account of the equipment, and because they frequently go into service on emerging from the barn without first standing in a closed terminal.

The final structure that has a great influence on cost of operation is the grade or highway crossing. It is surprising how fast we are learning how much we can save by abolishing grade crossings. There are many types in use, but the most available material is concrete. The first cost is usually low, the maintenance is nothing, and the depreciation is zero.

In all new roads, a constantly growing proportion of the estimate is for such highway crossings. The cost of a single accident is frequently enough to pay for several such crossings. The argument is plain.

MR. NEFF'S COURTESIES APPRECIATED

Expressions of appreciation were everywhere heard of the courtesies extended to the delegates by S. S. Neff, general manager of the Atlantic City & Shore Railroad. Mr. Neff caused to be built the temporary track from his line to the board walk, on which were exhibited, as noted elsewhere, the 15-cycle, single-phase locomotive for the Pennsylvania Railroad, the Russell snow plow and the Niles car for the Washington, Baltimore & Annapolis Railroad. In addition the company placed its equipment at the disposal of the associations for the various excursions, and also supplied the 550-volt current on the pier, which was indispensable to the operation of a number of the exhibits. Mr. Neff, besides being manager of the Atlantic City & Shore Company, is in charge of the principal local lines in Atlantic City.

MEETING OF THE MANUFACTURERS' ASSOCIATION

The American Street & Interurban Railway Manufacturers' Association held its annual meeting during the convention at Atlantic City on Thursday afternoon, Oct. 17. President John I. Beggs, of the American Street & Interurban Railway Association, delivered an address in which he expressed his cordial appreciation of the good work of the manufacturers in getting up so fine an exhibit. James H. McGraw, president of the Manufacturers' Association, then presented a report of the executive committee, from which it appeared that since the manufacturers had taken charge of the exhibits themselves it had proved far more advantageous than the old arrangement when the American Association took care of this feature. Treasurer Ellicott presented a report from which it appeared that the membership of the association is now 315, of whom 210 made exhibits at Atlantic City. Both figures exceeded the records of any previous year.

The following gentlemen were elected members of the executive committee for the ensuing three years: W. H. Heulings, Jr., of the J. G. Brill Company; Arthur S. Partridge, of St. Louis; E. M. Williams, of the Sherwin-Williams Company, Cleveland; Otis H. Cutler, of the American Brake Shoe & Foundry Company, and H. F. Martin, of the Pennsylvania Steel Company. These gentlemen take the places of the five retiring members and thus complete the committee of fifteen.

The attendance at the convention by Wednesday night, as given in Bulletin No. 3, was as follows: American Street & Interurban Railway Association, 332; Accountants' Association, 107; Engineering Association, 173; claim agents, 71; associate members, 57; guests, 62; Manufacturers' Association, 1100, and ladies, 753, making a total of 2655.

W. Worth Bean, formerly manager of the St. Joseph & Benton Harbor Electric Railway & Light Company, of St. Joseph, Mich., was among the arrivals Tuesday. Mr. Bean has attended every convention since 1882, the first meeting.

PROCEEDINGS OF THE ATLANTIC CITY CONVENTION OF THE AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION

The fifth annual meeting of the American Street & Interurban Railway Engineering Association was held at Atlantic City, N. J., Oct. 14-16, 1907.

MONDAY SESSION

President H. H. Adams called the meeting to order on Monday afternoon at 2:40 in the meeting room on the Steel Pier.

The president announced that the first order of business was an address by the president of the parent association, John I. Beggs. After the hearty applause following his introduction, Mr. Beggs spoke as follows:

MR. BEGGS' ADDRESS

I am sorry, gentlemen, that your president has misrepresented the character of the few words that I may have to say to you by dignifying them with the title of an address, because I do not intend to "address" you. I have come down here as a matter, first, of duty, but, much more, a matter of pleasure and privilege, to say "God speed" to you in the work in which you are engaged, and as president of the American Street and Interurban Association. Prior to the time when the present plan of administering the affairs of the great street and interurban railway companies was inaugurated, very much of the time of the American Association, under its former, and likewise present title, was taken up by discussions which are now, in my judgment, very much more intelligently and effectively considered by the Engineering Association and its standing committees. This of itself is of very great advantage to the American Street and Interurban Railway Association and the companies holding membership therein. It is of incalculable benefit to all the street railways of the country whether they hold membership in the American Association or not; and it is unfortunate, in my judgment, that all the companies throughout the country cannot be brought to realize the great advantage to themselves, as well as to us who have spent so much time to promote the interests of these properties throughout the country, in taking membership in these associations. I, therefore, trust that as the members of these associations come in contact with the representatives, the officers or the owners of nonmember companies throughout the country, they will impress upon them the great advantages they would derive through membership in these associations, by the contribution of their ideas, their experience, and, not least, their annual dues, though they might be small—that we may be enabled to do a greater and more effective work for all these companies the country over. If there ever was a time when it was imperatively necessary that the representatives of these properties should stand shoulder to shoulder, now is that time, that we may, by the exchange of experiences, give each other words of encouragement. I am one of those who believe that we have nothing in general to apologize for to the national, the state or the municipal governments throughout this country. They owe a debt to those who have staked their capital and their reputations in these various enterprises that they never will pay, and never can pay, much though they may criticize, denounce and abuse those in the active administration of these properties. I say this knowingly, because, possibly, no one in the business has been more freely criticized than myself. One of the first elements that is essential in the successful administration of these properties that come so closely in contact with every one in the various communities in which we operate, is to be able to take adverse criticism without breaking down under it, knowing that we are doing the best that is practicable under the circumstances. I always qualify before legislative or municipal bodies, by specifying not the best that is possible, because the best that is possible would mean the bankruptcy of every company of this kind in the United States, but the best that is "practicable," taking into consideration all the elements, the financial as well as the operative. If they would be more reasonable with these properties, we should be very much better able to give a higher quality of service, which is the constant aim, I believe, of every street and interurban company throughout this country. It is, at least, of every one with which I have intimate association or knowledge. I do not think any one of the affiliated bodies of the American Street and Interurban Railway Association is of so much importance to the public as is the affiliated body to which I now have the privilege and pleasure of saying these few words before your regular programme is taken up. Upon you devolves much of the labor and the method by which it is performed, its intelligence, experience and skill, upon which, in turn, are dependent the comfort, the speed and the celerity with which members of these communities will be transported from one point to another.

I have watched with a great deal of interest during the past twelve months the work and the progress made by your standardization committee. This appealed to me strongly; it still appeals to me strongly, and will continue to, because I feel that you are now only making a beginning. It has been said to me within the last two or three days that you are simply doing what we have been doing in Milwaukee for several years. Well, that is commendation which is very pleasing to me. At the same time, it is very gratifying to know that we are in line with what you gentlemen think is best to be done in standardizing certain appliances and methods of application to the various parts we are compelled to use from day to day, and are using more severely from year to year. I well remember, twelve or fifteen years ago, when it was thought that a 4-in. axle was ample for street car use, and I remember being severely criticized, nearly twenty years ago, when I strenuously arraigned the character of construction of street car bodies that was designed for double motor equipment, which we thought was of such immense capacity in those days—two 15-hp motors, the old No. 6 Sprague. I mention that because I was more familiar with that than some of the others. You know how trifling that would be to-day, when we are constantly reaching out. I am now considering seriously the adoption of motors of practically 100 horse-power, four of them, under our standard city cars. That would have been thought very heavy equipment for our heaviest interurban lines a few years ago, and yet I feel that that is absolutely essential now to give that degree of comfort, safety and speed which is demanded in this rapidly moving age.

I hope that when this committee on standards makes its report it will be able to back up its assertions with unanswerable reasons. This committee means more than simply a better facilitating of shop work or track work. It means to the executives in charge of these properties the finding of a way in which to meet the commercial needs of the roads more satisfactorily. It appeals directly to those who are charged with raising and expending capital, because as we get down to standards we are assisted in reducing costs just as standardization helps to reduce costs in every shop. I remember very well when, about eleven years ago, I took hold of one of the properties with which I am still connected to see whether it was possible to earn its fixed charges. It had come out of bankruptcy only about six months before, and was not then earning the interest on its bonds, after having been scaled down in various ways. When in that shop I think we had nearly every type of motor and every size of axle. For a good many years I know it took some twenty-one or twenty-two different types of brake shoes to keep that shop running. Now, it is much easier for us; we will work much more advantageously. When we get the types of brake shoe down to one or two, and when the standard axle is 5 ins. or 5½ ins. or 6 ins.—say, 5½ ins., possibly, which is our standard at the present time, and has been for several years, it goes directly to the dollars and cents needed to be spent. Consequently, it is further-reaching than may appear simply to the master mechanics or the engineers charged with keeping in repair and in operative condition the equipment on our line. It will likewise enable the management to keep a larger percentage of the equipment on the street, and that is very important from an administrative standpoint. There are roads in this country, though they are becoming less in number, that have a percentage of their equipment constantly in the shop, which would almost bankrupt a small road or a large one, either. If we could keep our equipment on the road

up to a satisfactory percentage, the portion out of repair should not exceed 5 per cent at any time, in my judgment. A well-run shop or road ought to have at all times 95 per cent at least of its equipment ready to carry passengers at the congested hours. There would be a saving in every way, and that is what standardization will do. So we have come down, particularly during the last eleven or twelve years. We began standardizing; have worked toward it constantly. There is much less left to be done than there was then in methods of track construction, of section of rail to be used, and of the other departments that come particularly under those who are here this afternoon, the heads of the shops and of the roadway departments. Of course, I undestand that on some roads the one head fulfills both of these positions. On the small roads he fills a good many others. For instance, this afternoon I know that one of the companies which we have represented here, in fact, two of the larger companies, are represented by the head of the roadway department, and likewise by the head of the shop department, both being entirely independent each of the other. Yet every department is interdependent each on the other. Therefore, I consider that the work that this affiliated association has to do is of vital importance to the executive heads of every company administering this class of business throughout the United States. In other words, you here are the right hands of the executive heads of our companies. It does not make any difference how I may plan, as president and general manager of one or the other of these companies. If we are not able to get the intelligent, the untiring interest and enthusiasm of the men who are at the head of our shops and roadways, it is almost impossible for us to make a success of the administration of these properties; and yet there is so much at stake in these days. On every street corner, in every saloon, in every legislative body, and in every council chamber there are people who are conjuring up imaginary ills that they are supposed to suffer because of the manner in which these public utilities are being operated—and, as I consider it, unjustly so. Consequently, there is all the more reason why these utilities should be so operated as not to leave even the shadow of a suspicion of a lack of intelligent administration. I speak of this matter with considerable feeling because for the past twelve months one of the companies of which I am the head has been grilled by the railroad commission of one of the foremost states—I speak of the state of Wisconsin—in the attempt to tear up corporations upon complaints entered by the Common Council of one of the cities of this country, and later in an attempt by the same city to violate a contract entered into seven and a half years ago, whereby we agreed to the reduction of our rate of fare from a straight 5 cent fare with no obligation on the part of the road to give any transfer at all, although they had been given to a certain extent, with no requirement to carry any of the police or fire department. All those things were conceded, and since that time we have been selling twenty-five tickets for a dollar, and six tickets for a quarter, whichever they preferred—the conductors must be equipped with both classes of tickets all the time—and to give universal transfers—notwithstanding that these great captains of industry that run our city councils (laughter) thought it was incumbent upon them to obtain for their constituents (to permit them the more advantageously to play to the galleries) to instruct their city attorney to demand a 3 cent fare. In fact, they made it a 2 cent fare, but the legal acumen of their attorney prevented him from attempting that. Our books were examined by certified public accountants for the period from Jan. 1, 1897, to Dec. 31, 1906, fully ten years, to show whether or not the earnings were such as would give a fair return upon the capital and enable us to give a lower rate of fare to the city. As I approach the sunset of life, at least possibly, the sunset of my career in this line of active business, it is one of the most gratifying experiences of my life that those accountants commend in the highest terms the manner in which those books were kept for the full period of ten years, never dreaming that they would ever be demanded in an investigation carried on by adverse accountants.

Furthermore, all the facts brought out gave evidence of uncommon ability and capability in the administration of that property, and the most severe criticism that the administration of that property was subjected to is that we have charged operation with too great an amount carried to depreciation reserve. That I consider the highest compliment ever paid to me as the executive head of these properties. We have invested in 5 per cent bonds $350,000 to the credit of our injuries and damage reserve, and $450,000 in 5 per cent bonds to the credit of our fire insurance reserve. The highest amount the company ever charged against operation and carried to the credit of our injuries and damage reserve in any one year was 4 per cent, and during a large part of the period of ten years only 3 per cent. The largest amount we ever carried for fire insurance is 1.5 per cent, for several years only 1 per cent, but the city wishes now to credit these amounts back to profit, to show if we had not charged these amounts up that we might have been able to have afforded the lower rate of fare.

These are some of the reasons why it is so absolutely necessary that you who are associated with the executive heads of these various companies, by the loyalty, enthusiasm and unsleeping energy which you have displayed in the past and will no doubt display in the future, and which is so necessary to enable the companies to make up a record of that kind, may not hesitate if your books are demanded some day to put them on the table and let them see the cards. That is what I feel this organization of engineers, master mechanics, and superintendents of construction and maintenance of way are doing in getting together, exchanging experiences and standardizing methods of operation, which mean the saving of dollars and cents, by keeping a larger percentage of the equipment on the street.

These are the things that count in instructing and educating the engineers of different cities that a much better type of construction would be given by the home roads if they would only permit it. I think that if you will stand together, and when called on to help some other company will do it cheerfully great good can be done. I desire now, and shall do it at the meeting of the American Association, to thank the various companies we called upon in Milwaukee for the willingness with which they permitted the members of their operating staffs to go to the city of Milwaukee and give testimony as to the comparison of service there.

I am glad to be able to say that after the most exhaustive examination before the Railroad Commission of the State of Wisconsin we came out of the ordeal fully and absolutely vindicated. We stand better before the community now than we have stood at any time in the past ten years during which I had been there. All that was demanded of us as the result of the investigation was that we should have to give at least as good service as we had been giving. That is the end to which we should all work. I believe it is the earnest desire on the part of certainly 99 per cent of all of these companies in the country to give just the best service that is practicable.

Now, gentlemen, I desire to express to the officers of your association and to your various members the appreciation of the president and of the members of the American Street and Interurban Railway Association for the fidelity with which this affiliated association has stood up behind the American Street and Interurban Railway Association and your various committees. There has been absolute harmony. There has been no cause for friction, and no friction has occurred. That condition I feel is absolutely essential for the maintenance of the harmonious relations existing and for a continuance of the effective work being done by these associations. I appeal to you to continue in the same line. I will soon be a past officer of the American Association. I certainly trust that I will never have less interest in its welfare and the welfare of your association than I have had during the past year, when I was charged with the responsibilities of the presidency of the American Association. I shall always esteem it a privilege and a pleasure, as a past officer, to be permitted to occupy at least some rear seat in your engineering meeting from time to time, and I desire, Mr. President and gentlemen, to request that you keep constantly in view that the good fellowship existing to-day between the affiliated associations and the American Association may continue the constitution and the fundamental principles that brought these organizations together and must hold them together in the future. To bring this about there should not be attempted even a technical disregard of the constitutional requirements. This I say in a general way, feeling that it is the duty of the president of the American Association simply to throw out this suggestion by way of admonition. You are a very important part of the work being done by the affiliated associations. I thank you for your kind attention, and I am sorry that my many duties did not give me the opportunity of preparing what your president said I was going to deliver to you, namely, an address. (Applause.)

President Adams thanked Mr. Beggs, in the name of the Engineering Association, for his remarks, and particularly for what he said in reference to the work of the Standardization Committee.

Mr. Beggs asked the privilege to be present when the Standardization Committee made its report simply as an engineer and not as president of the American Association.

President Adams then introduced C. L. S. Tingley, the president of the Accountants' Association, saying: "We desire to have some good advice from the head of the association representing the men who are always trying to keep us straight." Mr. Tingley spoke as follows:

I am glad that Mr. Adams said that it would be a few words of advice and not an address, because I am not a good hand at making addresses. The thought which was running in my mind particularly when Mr. Beggs was speaking was as to the pulling together of the various associations and how they are all interwoven. The Accountants' Association, and the accountants of the different roads, are in rather an anomalous position. They are not a revenue producing department, nor do they build property; in fact, we are the historians of the organization, and that our history may be authentic and of value, not only to the management but to ourselves and to you, we must have your cordial and hearty co-operation. In the companies we ask your co-operation that our statistics may be worth something. As an association, our association asks your co-operation that the various plans which from time to time are formulated for the betterment of the accounting, for the making of statistics more valuable, may be properly shaped up on the technical side. As the oldest sister of this happy family, the Accountants' Association extends greetings to you this afternoon and wishes you a most successful meeting.

President Adams said he had invited the past presidents of the association to be present, if possible, but the only one who had come was E. W. Olds, of Milwaukee, of whom he would request some remarks. Mr. Olds spoke as follows:

There was a time a few years ago when we met at Detroit at one of the power houses at a call from a few master mechanics who thought it would be a good idea to have a meeting of the master mechanics and electrical engineers to see what we could do to get together in a meeting of our own, so we might discuss our matters between ourselves to a certain extent. From that small beginning our association was started.

Our work during the past few years, I think, has been the means of bringing results which are gratifying to our presidents and managers. As Mr. Beggs has stated, by our working together with the accountants they are able to bring reports and statistics to us which show us what we are doing. We wish to have these comparative statements, we wish to be able to go to our heads of departments and secure information from them, so we can know just what is being done, and this association is one of the best means through which these results can be accomplished. Mr. Beggs has spoken regarding the work of the standardization committee. That is a grand work. As we look over the programme here at this convention, I wish I had one of the programmes of the conventions we had a few years ago. This programme shows what wonderful progress the association has made, and this is because our president who is filling the chair now is a man who has always done a great deal of work in the interest of our association. He is a leader in this kind of work. I expect this meeting to be the best we have ever had. At this time our programme covers not only the work laid out at our first meetings, but it has been broadened to take into consideration, to a certain extent, the power plants and way department.

We have a large amount of work to do, but can do it if we all work as we should work. As I got in last evening and walked over to the hotel and met so many who were here on Sunday evening, I thought of the time a few years ago when the first day of the meeting of the American Association had quite a small attendance. The engineering association decided that we would have our meeting one day in advance of the parent association. It was thought by a great many that we would not be able to have our meeting on account of a small attendance. It was a pleasant thing to know that the boys were on hand, and our Monday meetings have always been a success, and I am pleased to see that it is so to-day. May the good work continue. Though one of the "has-beens," I am more than pleased to meet with you this afternoon. I wish you continued success and prosperity and will give you a helping hand, the best I can. (Applause.)

President Adams then read the following address:

PRESIDENT'S ADDRESS

It is a great pleasure to attend a convention of this association in whatever city it may meet, but to be able to combine the association enjoyments with the great advantages of Atlantic City makes a very fortunate coincidence. This is the fifth annual convention of this association and the second to be held under its present name, the first three being held under the name of "The American Railway, Mechanical and Electrical Association."

Your executive committee has prepared a programme covering a very broad field. This has been brought about by the assignment of committees to various subjects, in addition to the papers to be presented by the gentlemen who have so kindly consented to honor us.

The advantage of committee work in connection with our association has been impressed upon your executive committee even more forcibly during the past year than ever before. This year the committee on way matters was augmented by several committees, who have reports to present upon important branches of the subject. The work of the standardization committee has also demonstrated the necessity of going further into committee work, as the subject is so broad it is necessary to sub-divide and appoint committees to handle various parts of the equipment. These should be appointed to take care of wheels, axles, brake shoes and heads, motors and other important items, The practice of steam roads in this respect is to have standing committees to care for subjects of this character, and it is equally essential that this association handle these questions in the same manner to obtain the best results.

I desire to call your particular attention to the report of the standardization committee, but before going into details let me say that owing to pressure of business Mr. Wallerstedt had to relinquish his duties as chairman, and it was with great regret that I accepted his resignation. Mr. Wallerstedt, however, kindly consented to remain a member of the committee. This association is greatly indebted to him for his work in the past as chairman of the committee, for under his guidance a great deal of the foundation of this report was prepared. W. H. Evans was appointed chairman to fill the vacancy on July 3, 1907.

The report as submitted by the standardization committee represents the most important one presented in the history of the association, and although the work of the committee has been somewhat slow, it represents not only the views of the operating men, but those of the manufacturer as well. Invitations were extended to the manufacturers interested to be present at committee meetings, upon which occasions all the subjects were fully discussed, and the report may be considered as having the concurrence of the manufacturers.

It shows that certain steps have been taken toward uniform practice in gearing of motors, the committee having met with a cordial response from the motor designers, and further steps in the question of uniform design in certain of the motor parts is only a question of time.

It is exceedingly desirable that definite action be taken on the report at this meeting, that a start may be made in the direction in which we have been looking for a long time. Although the recommendations of the committee may not meet all the requirements of to-day's practice, and may not meet the ideas of all the members even for future practice, it is the earnest desire of the committee that the subject be considered as recommendations covering the best practice It may be necessary to add to or deduct from them in the future, but with a good foundation on which to work the matter will be comparatively simple.

The importance of the adoption of these recommendations from a commercial standpoint alone is very great. For example, the brake shoes and heads that are recommended will reduce to a minimum the number of patterns required, and the stock to be carried will be decreased accordingly, as the manufacturer will be able to supply standard shoes upon short notice. Also, in good practice to-day, brake shoes are scrapped at between 40 and 50 per cent of their original weight. With

the narrow tread shoe recommended the scrap will run from 30 to 40 per cent. Prices will also be affected, as, by reducing the number of parts to be carried, the manufacturer will be able to give the consumer the benefit of lower figures.

If these recommendations are adopted, as I confidently expect them to be, it then rests with the members of the association to put them into practice by their incorporation in specifications for new work and rebuilding. In this way they can be taken hold of with the least possible expense.

In the name of the association I desire to thank the individual members of this committee for the noble work they have done in connection with the report, and the association is particularly indebted to W. H. Evans, the chairman, for his untiring efforts in this direction. The valuable assistance and cooperation given this committee by the representatives of the manufacturers cannot be overestimated, and their efforts are fully appreciated by this association.

The report of the standardization committee is to be presented at the Tuesday afternoon session and a cordial invitation is extended to all railway representatives to be present and enter into the discussion of this important subject.

The report of the committee on maintenance and inspection of electric equipments covers a vast subject in a very able manner and the data presented is exceedingly valuable. The report shows the necessity of further investigation along these lines and several standing committees should be appointed to deal with the same for the future.

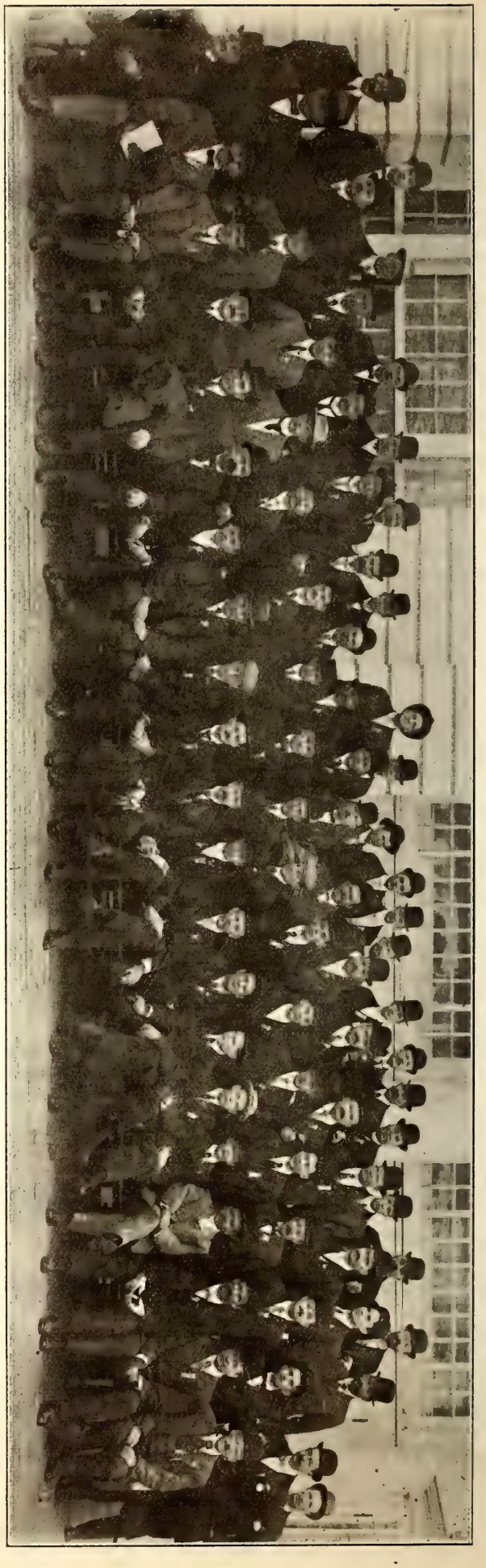
To the reference I have already made to the cooperation of the manufacturers in the work of the standardization committee I wish also to add that they have rendered valuable assistance to several other committees in their work during the past year, and the officers of this association have had a number of inquiries from representatives of the manufacturers regarding the work of the association, all indicating the desire to cooperate with us. This is exceedingly gratifying, as in the problems we have to meet a combination of ideas representing the producer and consumer usually brings a solution giving the best results. We are glad to have this cooperation and we desire the manufacturer to feel that he is welcome at our conferences; in fact, our association has a membership which is intended to encourage this feeling. (I am referring to the "associate membership," which is open to such representatives.)

In the "question box" there is a question that suggests to me an investigation which will be very profitable to this association. Briefly, it is the number of men employed in maintenance upon the various operations covered by the engineering field of railroading. Of course, conditions vary with each system, but take as an example the rolling stock maintenance. It is possible to obtain the number of cars and motors operated, men employed on maintenance, the car or ton miles run and the general character of road and service; then, by making deductions and separating this data into groups, according to population or otherwise, it can be made of great value. The other branches can be treated in a similar manner. I submit this subject for the careful consideration of your next executive committee.

The Manufacturers' Association has surrounded us with a wonderful exhibition, and I understand that this Steel Pier has been the only limiting feature to the size of the same. We appreciate the efforts they have put forth in connection with these exhibits and I thank them in the name of the association.

Throughout the past year I have received great assistance and support from the executive committee and other members of this association, and I desire to take this opportunity of expressing to them my sincere thanks and appreciation of their efforts.

Before taking up the annual report of the executive committee, the president announced that the committee recommended an informal gathering Monday evening at the headquarters of the association at the Hotel Denis, from 7:30 to 9 o'clock, for mutual acquaintance sake before adjourning for the entertainment given at the Marlborough-Blenheim. The executive committee also decided that an official photograph of the Association might be a desirable thing to have. Arrangements were made to have such a photograph taken Tuesday at 12 o'clock in front of the sun parlor on the Steel Pier.



GROUP OF MEMBERS OF THE ENGINEERING ASSOCIATION TAKEN ON THE STEEL PIER, ATLANTIC CITY, OCT. 15

The secretary then presented the report of the executive committee, which embrace the minutes of the various meetings of the executive committee held during the year. The secretary followed with the report of the treasurer, which showed the following financial transactions during the year: Receipts, $1,412.66; expenses, $1,376.08; balance, $36.58.

The next order of business was the appointment of convention committees. The president announced that a committee on nominations would be appointed at a later time.

CONTROL APPARATUS

The committee on control apparatus had no report, but in lieu of the same, the president had requested two of the representatives of the manufacturers to present any data they had upon the latest developments in the control situation. F. E. Case, of the General Electric Company, was one of the gentlemen, and Mr. Cooper, of the Westinghouse Company, the other. Mr. Cooper had notified him that he was detained by an accident, and would probably not be present. Mr. Case then presented the paper printed on page 741 of this issue.

President Adams asked regarding the weight of the K-35 controller as compared with the K-38 type. Mr. Case had not had this particular one weighed, but thought it weighed about 300 lbs., as compared with 270 lbs. in the case of the type K-28. But the later controller is of slightly greater capacity, as it is large enough for four 50-hp motors rated at 500 volts. On a 600-volt basis, that would be 60 hp. The K-28 is limited to 40 hp at 500 volts. This controller may be used up to 750 volts maximum, as its arc rupturing capacity is equal to that voltage.

President Adams asked if the combined weight of the two controllers K-35, as compared with the combined weight of the K-28, with the two contactors would be in favor of K-35. Mr. Case said it would by probably 100 lbs.

Mr. Olds said he had had the pleasure a few weeks ago of seeing the K-35 controllers, and could honestly say they would be well worth a thorough investigation. The parts have been gone into in a very thorough and systematic manner, and to his mind the mechanical as well as the electrical construction is good and the parts very simple. It occupies a little more space, but the railways could well stand this if the manufacturers gave something to take care of the fireworks on the front platform. This controller was certainly a great improvement on the former K-28 type.

J. W. Corning spoke of something in connection with controllers that came under his observation in the Boston Elevated Railway Company, namely, the adjustment of the steps on the accelerating rheostat. It was brought to their attention by one of the officials that there were cases of uneven acceleraion on a number of the cars. This he had noticed from personal observation while on the cars. They investigated with a recording ammeter and found in some instances some very bad setting of the resistance-connections. As an illustration: They were operating some twenty-five old box cars with two G-58 motors and K-10 controller, and it was found that on the last step in parallel, just before going into full multiple, there was a peak of about 325 amperes in accelerating on a grade of about 5 per cent. The average current in multiple on that controller was a great deal larger than the average current in series per motor. By a re-adjustment of the resistances they were able to bring the peak down to about 185 or 190 amperes. There had been a great deal of trouble on that line with flashing of motors, blowing fuses, and short circuits in the controller. Since the readjustment of the resistances that trouble has been practically wiped out. It was found by talking with the motormen that they were afraid to carry the controller to the last notch, because they often blew fuses when they did it. The blowing of a fuse by a motorman was considered a very bad sign; he was called down by the division superintendent and had to explain why it happened, so that most of the motormen remained on the next to the last notch of the rheostat a long while before advancing to the last point. That resulted in numerous cases of burning out of rheostats. By changing these resistance connections, and getting an average current in series and parallel per motor of the same value, they had been enabled practically to eliminate the motor flashing and also the fuse blowing and controller trouble. They have gone over all of the equipment and worked up a standard set of connections for all the motors. With the newer type of equipment, multiple unit control, the companies are furnishing connections to go by, but in all of the old equipments it would seem that the different car-house foremen have made the connections that best suited their judgment.

President Adams said the remarks of Mr. Corning were exceedingly interesting, and bore directly on the subject all were trying to get at—the best method of control. He thought that question took in that of resistance connection, and so forth.

In reply to a question by S. M. Coffin, as to the resistance he got after the tests were made, Mr. Corning said he did not have the figures in mind, but he had blue prints showing the connections and would be glad to send a copy to any one interested.

William Roberts said in reference to the remarks by Mr. Case about the K-28 controller, that they have an equipment of not four 40 hp, but four 65-hp motors 93 Westinghouse, that have not been in the car house for a year and ten months for repairs. They are operated on a baggage car, 52 ft. long, which must be operated over 13 per cent grades, carrying loads that are limited simply by the size of the car. He believed that the secret of the successful operation of a road lies in the thoroughness of the inspection of the equipment. With the new controllers mentioned much better results could be secured. The railway engineers would be working hand in hand with the manufacturers, now striving so strenuously to perfect their apparatus, if they would give more care to inspection. If the superintendents of motive power and the master mechanics would go out to the shops at 2 or 3 o'clock in the morning, unexpectedly, and look over the work that is being done, there would be far better operation of the equipment. He found it a splendid thing to make such visits occasionally, as it keeps the men up to the last notch. Then, the railway man is co-operating with the men who are working to perfect the apparatus. He did not wish to lay particular stress on the case just cited, that it was the Westinghouse equipment which stood for such a long length of time without attention, because they have limited cars operated by G E-57 motors, one of which has not been in the repair shop for two years and eight months. This particular type of car has no other to relieve it, and is working every day.

President Adams said the association appreciated Mr. Case's efforts in coming down with this information. He asked if N. W. Storer, of the Westinghouse Electric & Manufacturing Company, had anything to say on the subject in the absence of Mr. Cooper.

N. W. Storer said in regard to the developments in the last year in his company that it had carried on its development along the same line as shown last year. The com-

pany still has the electric-pneumatic multiple unit control and is using the same contactors for both a. c. and d. c. For the d. c. work they use the battery for the valve magnets, and the same battery and valve magnet apply equally well for the a. c. The only difference between the contactors is in the blow-out, which is modified slightly for the a. c. The greatest advantage comes in the heavy pressures the company's engineers are able to get on their contactors by using compressed air, which, combined with an effective blow-out, makes a very good operating switch. They installed many equipments for the smaller size motors, quadrupled 40-hp and 60-hp motors in the last year, and are getting very good results therefrom. They look for a great increase in this particular development and are great believers in the multiple unnit equipment not only for heavy work but for street car service as well. He believed that train control in cities will do more to increase the capacity of the lines than any other one thing. It is certain, for instance, that operating a three-car train in a city street will give a great deal more capacity than where single cars are operated. The three cars will occupy the street very little longer than a single car, and the delays at crossings will be practically one-third what they are with one car. He believed this would come into practice more and more. The main thing in introducing it is to get the men properly acquainted with the apparatus. After that there will be very little trouble with it.

The next order of business was the report of the committee on maintenance and inspection of electrical equipment presented by L. L. Smith. This report is printed on page 742.

MAINTENANCE AND INSPECTION OF ELECTRICAL EQUIPMENT

Mr. Smith said before presenting the report that in undertaking the work of the committee, Mr. Lindall, the chairman, divided up the work into three parts. Data sheets were prepared for each of these parts, and each of the members of the committee received the replies relating to his part and worked up his report individually. Mr. Wright had one feature, that having to do with the manufacture of coils, impregnating and shop methods in general. Mr. Munger had the care of wiring car equipment and inspection and he had the miscellaneous motor equipment, such as commutators, brush holders, etc. After these data sheets had been received and worked over the committee held a meeting about a month ago at Niagara Falls and prepared the report.

Mr. Palmer, of the Boston & Northern Street Railway, said the report was very valuable and would undoubtedly bring up most profitable discussion. In its consideration it might be divided into two branches, the report and the discussion it brings out. Inasmuch as they had the published report before them in concrete shape, he supposed further papers would be published also; he would suggest the person in charge of the report conduct also a general discussion in opening, rather than having the report read. It seems that the time might be more profitably occupied in the discussion that the paper would bring out.

President Adams thought this particular subject so broad that it was difficult to abstract it. The committee had presented what it had to say in as few words as possible. At the same time they have covered a vast subject.

F. G. Simmons said that what Mr. Palmer evidently objected to was the time consumed in reading a report when that report was in print. He would like to say in explanation that, as he understood it, this report was printed so recently, being distributed that day for the first time, that it was thought advisable to read it, as very few of the members would have had the time or opportunity to do so. The reading of the report would bring points to the attention of the members, thus promoting discussion. The practice which the Engineering Association has intended to follow was not to read reports, but to have them circulated in sufficient time to be read before the convention by each member. It had also been the practice that some one should be assigned the task of opening the discussion of a given paper, and he thought the suggestion would be a good one to have that practice apply to committee reports also. The delay in getting out the papers had caused the trouble in the present instance.

C. B. Fairchild, Jr., asked for a discussion on time versus mileage inspection. He thought there is a very strong tendency to go to mileage inspection. He would like to ask Mr. Smith and others present if it is possible to carry the matter still further and go to a ton-mileage inspection. The heavier roads, for instance the Interborough of New York, have adopted a mileage inspection. He knew a number of interurban roads in the Middle West who are looking into that question with the idea of finding out if it is not possible to go to a ton-mileage basis for records and inspection for the ordinary interurban roads.

Mr. Smith said the matter of ton-mileage as a basis of inspection had not been considered by the committee. In fact, it had not occurred to the committee. If, however, there was any representative present from a road using that system he should be glad to hear about it.

Mr. Roberts said it might seem a somewhat peculiar statement to make that they use about a 200-mile basis for inspection. Of course, as he understood, the term "inspection," as used by Mr. Smith, probably meant "overhauling." Mr. Smith said it did not.

Mr. Roberts said they inspect cars every night in the car house and every day at the terminus for everything. They have on one section about fifty interurban cars, and have about sixty city cars going in to Akron. Every day they inspect the motors on the floor, and if there is any adjustment of brakes to be made they do it. As they operate over a 13 per cent grade, the meaning of this will be readily understood. One section is subject to an ordinance which requires two stops on that grade. Now when a car gets away on a 13 per cent grade it means great care, especially in brake inspection. Then they have a very careful inspection at night in the car house. They have selected one of the best men, who was taken from a day foremanship to be placed in charge of the night inspection with the special object of having that inspection the most thorough possible. He felt quite justified in maintaining that there is not too much inspection, but that there should be a thorough inspection every night.

The president asked Mr. Olds if he was doing anything on the mileage basis.

E. W. Olds said he could simply report progress in that matter. He was not doing it to the extent that he hoped last year. Conditions had come up that have made it practically impossible to carry that out fully, although he was a thorough believer in the mileage inspection idea and frequent inspection. The equipment should be looked after and kept in perfect condition. He believed in a general and thorough inspection of the car that is in regular service. A city car particularly should come at least every four months into the shop, as the brakes could be looked at, the motors opened up and everything gone over carefully. If

that is done the car is in for another four months. Sometimes the car requires very frequent inspection, but it pays.

Mr. Harper, of the Capitol Traction Company, said they overhaul their cars frequently, not letting them remain on the road until they are run down. They always take those in that have made the largest mileage. A certain number of cars have to come to the shop every week for a general overhauling. The night inspection, he supposed, averaged about every fourth night, giving the barn inspector time enough to go over the whole car. The general inspection includes overhauling and everything and averages about six weeks. Sometimes very little need be done to the cars, but at other times little troubles are caught up.

Mr. Evans regretted the report could not have been prepared and circulated earlier. He thought, in looking over the report, that it was one of the most valuable and concise yet presented to the association and could be very well put in the hands of the four men who have to do with the maintenance of the different equipments. They could start with this as an elementary primer and get into shape to give very much better service before another year. He scarcely thought it did the committee justice to attempt any considerable discussion of the report in the limited time at the association's disposal, but, rather, that they take it home and thoroughly digest it at their leisure.

Mr. Olds took occasion to refer to inspection again by stating they try to have frequent inspection in the day time, as much as every fourth day. There seemed to be a misunderstanding as to the general inspection or general overhauling. When he referred to "general inspection" he meant the overhauling the car should get at least every four months, but they have the car in every fourth day. It is gone over then by the day men and is given a more thorough inspection than can be given at night.

Mr. Harvey asked in regard to the amount of day and night inspection whether the committee had any information or whether anyone alse could give any as to what percentage of spare equipment there should be to eliminate night inspection. There were some remarks earlier in the meeting in regard to having 95 per cent of the equipment ready for service. If that is the case it becomes the duty of the mechanical department to do its day inspection, and especially the repairs, with 5 per cent of the equipment. He asked if that was generally considered sufficient.

Mr. Olds said they had been fortunate, or unfortunate, in always having to use practically every car. The frequent inspection he has spoken of, or the frequent overhauling once in four months, enabled them to keep practically every car in service. Having a car give out on the road was a bad proposition. Another thing to be followed very closely was to have all the cars in service and not allow the foreman or the division superintendent to pick out certain classes that they wish to run all the time, leaving the other or older kinds in the house. Keep the cars out. Keep them moving and wear out the old cars. In so doing the equipment is in better shape, better service is secured and it is reliant.

In the different cities he found the condition about like this: If 100 regulars are run 100 extras will be needed, so about 50 per cent of the cars are in the house during the day time, except part of them for morning service and the balance for evening service. Now if the equipment is handled right most of this inspection can be done on the cars and still they will go out for the evening service. By so doing one can keep within the 5 per cent. In fact, very often his company has—unless some car has been in a bad wreck or something of that kind—the 100 per cent ready for Sunday and busy days.

Mr. Evans asked if the 95 per cent was intended to cover all the equipments or simply what is in active service. For instance, what proportion was in the paint shop and what proportion going through general overhauling?

Mr. Olds replied, that was covered by the kind of equipment—for instance, if the equipment is practically all four-motors. His company has twenty cars for the city service that are four-motors. Those twenty cars are the only ones that are not used interchangeably, and they are all kept rolling. The twenty cars to a certain extent are considered scrap. They were new cars eleven years ago this spring, and he hoped to throw them in the scrap heap one of these days. The four-motor equipments gave reliable service, and if they were kept moving the cars could be kept going. Possibly Mr. Evans' company was not handicapped as he is. For instance, they are taking care of a little better than 500 cars in a paint shop that will only receive nine cars, so it is very necessary to have but few cars there.

Mr. Roberts was quite in harmony with the statement Mr. Olds had made, but as to the sort of inspection Mr. Olds meant the same thing that he meant when he said "overhauling." The inspection he meant to refer to is that in the night or in the day, but as referring to the foreman's complete inspection he had used the term "overhauling" advisedly, because he would consider it more of an overhauling than inspection.

Mr. Evans thought in connection with the report of the committee that it would not be out of place to take some action complimentary to the work which it had performed. He therefore moved that the thanks of the association be extended to this committee, that a motion that this committee or a similar one be continued for next year further to pursue the same topics, either as one committee or as several.

Alfred Green seconded this motion.

President Adams asked for discussion on the motion.

Mr. Simmons said that the part of Mr. Evans' motion referring to the continuation of the committee, should be referred to the incoming executive committee for its consideration. Appointing sub-committees to take up or sub-divide the vast amount of the equipment covered would probably be the thing to do. They could extend the work and get out specifications which would be exact and definite, and which could be published and recommended as the practice of the association. Those papers could then be distributed among the shop foremen in so far as it concerns them, and among the inspectors and different people in that line of work. The report and its value had been brought to his attention very forcibly a few moments ago when the assistant general manager of one of the largest roads of the whole country, if not the largest, wanted to know if he could not get a large number of copies of this paper right away, saying that he would take them back to his men and distribute them. Now if they could get this report amplified or reduced to standard and precise specifications, through the appointment of this sub-committee, he agreed with Mr. Evans' motion. He approved the suggestion of a vote of thanks to the committee. He felt that the work should be continued through the incoming executive committee, or in any other way that is proper.

Mr. Green said he had a reason for seconding the motion of Mr. Evans. As committees have been continued before under such motions he did not see that there was anything wrong in doing it now. The committee had taken up lubrication both as to armature and motor, brake equip-

ment, braces and bearings of all descriptions. They had simply gotten deep enough into it to give the association a little smattering of it, enough to make it hungry. In other words, they had not gone deeply enough into one question very important to a street railway. He thought if they continued for another year, the question of lubrication by oil would then be in much better shape for consideration. Lubrication by oil has only been in service on street railways for the last five or six years, and each year it is improving. The men in the depots are improving and being better educated in regard to lubrication, something which was actually required, because when grease was used there was nothing to it except to see that the grease was there. Oil lubrication is a different proposition.

President Adams said there was a little misunderstanding in relation to the committee, as it is a standing committee.

Mr. Olds said that he had been ready to make the same point. His modification was simply along the line of separating the work, or appointing sub-committees. That could be left with perfect safety to the executive committee, who will handle that and apportion the work among those best fitted to handle it.

Mr. Scott reopened the talk on mileage. On the elevated lines of his company they operated several lines on a mileage basis for the past year, and some longer, with good results. He had also done away with the night crews in most of the houses and had good results.

Mr. Evans said since the explanation of the president it was unnecessary to intrude the latter portion of the original motion. The motion was then seconded and carried.

TUESDAY MORNING SESSION

President Adams called the meeting to order at 10 o'clock and announced that the first business was the report of the committee on way matters. He said the report of this committee was covered by papers and reports enumerated on the program. F. G. Simmons, chairman of this committee, confirmed Mr. Adams' statement that the report was embodied in the various sub-committee reports listed in the program. The way committee had been assigned by the executive committee in the early part of 1907 to prepare two papers for the convention. One on electric railway track by George L. Wilson, engineer of the Twin City Rapid Transit Company, would be presented, but the other paper would have to be deferred to a later meeting. The way committee had been instructed to investigate rail corrugations. A circular letter was sent out and a tabulation of the replies had been printed. The committee had also been requested to investigate any progress made in concrete tie work. A circular letter was sent out, but the information secured was so meagre that practically nothing of value was received. The way committee also appointed a sub-committee on rails to act with the standardization committee. This sub-committee had prepared what amounted practically to a report of progress, with some definite recommendations that would be read during the present session.

CARE OF TRACK

Mr. Wilson then presented his paper on the "Care of Electric Railway Tracks," which is published on page 723 of this issue. E. O. Ackerman, engineer of maintenance of way, of the Columbus Railway & Light Company, who was requested to open the discussion, said that Mr. Wilson had brought out points of much interest to the maintenance of way men. One of the first things was the matter of ballast. Right in line with that was the matter of original construction. Of course, the maintenance bills for a long time after the work is put down, depend largely on the original construction. Too many companies have gone through the streets and suburbs and levelled off the ground—whatever it might have been—clay, sand, or what not, put down their construction and where the cities require it, put a little foundation under the pavement and laid the pavement and track. All know the results thus caused such as low joints, low tracks and freezing pavement. This was likewise true with the suburban tracks. In keeping accounts with regard to suburban track, he had been somewhat startled to find that one line they had run into the country, about 13 miles, required a greater maintenance bill for labor than the average city tracks in paved streets, including paving.

Mr. Ackerman said keeping clean the right of way was very important, a point Mr. Wilson had brought out in good shape. When one goes out to take a drive it is natural to select the finest road and it is equally natural to do the same thing when taking a car ride. It is to the advantage of every company to keep its right of way clean and in trim shape. The cleaning of vegetation from the immediate vicinity of the track, which is the universal practice of steam lines, is not the universal practice of electric lines. The vegetation has the effect of decaying the timber, and thus is very detrimental. Again, the inferior ballast which might have been originally used, is detrimental to the timber and any material like sand, which will not dry out readily, is very injurious. He ventured to say that the best of white oak timber would not last half as long under such conditions as on good ballast. One feature not touched upon which he thought all of the companies should act on was that of using some sort of timber preservative. Many railways are forced to put timber in the track under conditions not the best and if the timber is not treated with a preservative it decays very quickly. Another point brought out in Mr. Wilson's paper which he thought it would be well for managements to consider was the track force. Most street railways are getting the worst labor in America. They are largely dependent upon foreign labor, and many are forced to pay less wages than local contractors. The steam railroads employ men largely from the smaller villages and dividing their roads into sections. In this way they are able to get better class of labor at lower cost than the city railways. In his city, they recently had the Board of Public Works pass a resolution making the pay for labor of all city employees 25 cents a day more than any of the street contractors were paying, and the street railway was paying 10 cents a day less than the contractors. One could see the natural result. In his opinion, the street railways should look for the best labor available, for then the most effective work would be done at the lowest actual cost. Certainly, the maintenance of street railways required men of some mechanical ideas, and if the way engineer was without them, he could not maintain his road unless present to overlook every job. He had frequently gone into a street where the men had "completed" work and found bolts loose, bonds not replaced, some work not put up the proper elevation and pavements laid out of surface. He did not take this stand for better wages with a view to increase the cost of maintenance, but to decrease the cost of maintenance.

Regarding hours of labor: He has an Italian foreman who is working about 30 men and pays them $1.65 a day each, or 16½ cents an hour. While other men were paying more money to their laborers, he found his Italians practically were loafing. They thought they were 10 cents a day underpaid, and the result was that they gave about 50 per cent of their labor capacity. He increased the wages 10 cents a day and thus secured the best Italian labor in the

city, with an increase of 30 to 40 per cent in work done. It was startling to him to see the result of this increase of 10 cents a day, for all the laborers were anxious to get in every hour possible.

The matter of maintaining city work had been well brought out in Mr. Wilson's paper, but there might be still further discussion on pavement repairs. All knew that a large percentage of the maintenance bills go to pavement repairs. This is quite frequently caused by defective foundations as well as the wear of the surface. Certainly where a defective foundation exists the pavement will go to pieces in short order. He had found it necessary to remove some old foundations that were hurriedly built and replace them with a better foundation to reduce the maintenance bills on pavements. He thought those who use bolted joints have a great deal of trouble in the care of railway tracks. The joints require considerable labor to keep them in repair. He had practiced the universal plan of replacing the old, worn and out-of-date joints with a modern joint wherever the street is disturbed, but in that manner it takes a long time entirely to re-equip the line with modern joints, yet it was policy to do so. He had one line where the joints were in bad shape. A few years ago these were electrically welded, which process proved a great advantage in holding old work together.

C. H. Clark said, referring to Monday's discussions, he would just talk along the same line, namely, inspect, inspect, inspect; and he would add, machinery, machinery, machinery. Instead of trying to do the work with brawn and muscle, he believed in using brains a little and machinery. On a road with which he had been connected they had lots of machinery and would have had more if he could have secured it. There were a couple of derrick cars and two big derricks in the yard; stone crushers and other things to eliminate manual labor. He found, for instance, that a little derrick car could go out and replace a switch with about six men. The derrick car takes the whole switch out and throws the new one in; it is simply bolted up and the work is done. With the derricks in the yard, of course, they had to buy broken stone delivered on freight cars and unloaded with a hoist grab bucket for about a cent a ton. By hand it couldn't have been done for less than 7 or 8 cents. They had a big stone crusher, so all the stone taken off the street was carried to the yard and crushed. Mr. Kirwin, of Detroit, told him of a scheme he had for cutting the weeds along the right of way. He dragged twenty-five 40-ft. chains behind a car over his right of way; just sent that car over the different suburban lines, and by the time it had gone from one end of the system to the other, the weeds were pretty well knocked out.

Mr. Simmons agreed with Mr. Clark that machinery would tend largely to reduce not only the cost in track construction and maintenance, but also to make the work more exact, because if the machines are properly designed to do the work, there need be no dependence on the uniformly bad judgment of the laborer and usually of the sub-foreman in charge of doing the same work by hand. But he believed in amplifying even the use of the machinery by preparing, through the office and engineering forces, written specifications and blue prints, covering every item of the work and in sufficient number for every one to be supplied with them. The division roadmaster knows what he is doing, and there is only one man to do it. If these specifications were coupled with the machinery and also applied to such work as could not be done by machinery, the results would be uniform. As to beautifying the roadway, his company had opened in the standard classification of accounts, an account described as Parking and Beautifying of Roadway. At the various stations where there is any extra ground they make a sward and plant flowers in beds. At one point on their system he was about to put in some greenhouses to raise plants and shrubs for that purpose. They also go to the extent of painting all poles in a given way, namely, white with a black base to a certain uniform distance above the level of the rail. He believed all of this work will pay, because people will ride over one of these interurban lines, see the little beauty spots here and there, and on returning they will say unconsciously, that they had an enjoyable trip. They will go again and so will their friends. Thus, the people themselves promote the traffic.

The question of track walkers was also an important one, particularly for the interurban roads. His company has track walkers and is preparing specifications and instructions for them, which include not only the inspection of the track, the joints and various conditions pertaining to the mechanical features, but also the closing of the gates along the right of way, and many other things of that kind. Hence, the track walker will not become a burden, as enough important items of work are laid out for him to more than warrant his wages. Each track walker will carry a copy of the specifications and do his work in the same way.

As to paving repairs on city streets, Mr. Simmons said that was largely a tradition handed down from horse-car days. The present cars do not wear out the pavement, although some city authorities justify the placing of those repairs on the companies by saying the tracks and joints go down and the pavement rises through frost and other things. All this would be eliminated if the track and pavement were laid right and if the standard specifications are used, it can be done equally well with T-rail as with any other rail. He knew this was heresy with a great many of his Eastern brethren, but it had been proved in the West in very many instances. They would be glad to show tracks which have been in for years and are just as perfect as any grooved girder rail they have in any other place in the country. The whole question comes back to doing the work well, doing it uniformly and understanding the specifications. He hoped the association would go into the matter of standard specifications very thoroughly because that, he thought, is the key to perfection in all lines of work. At the present time it was more particularly applicable to the Way Department, because that department had been run in a more haphazard fashion than other departments of the companies. A few years ago a foreman on one section was doing his work one way, and the foreman on another was doing his work in a very different manner. The result was that on the same system the drainage ditches at the side of the right of way were 2 ft. from the fence line in one case and 4 ft. in another. Specifications for digging ditches would make everything uniform.

The question of help has become a difficult one, particularly as applied to the large cities. The padrone system among the foreign laborers is very detrimental to securing of good work, and like some of the others, he believed paying the best wages offered to the common laborer is one of the ways to get at the subject. If the railway pays the highest scale of wages it will find that the laborers prefer to work for a large corporation where they receive a monthly check without any difficulty to working for the ordinary city contractors, a great many of whom do not always pay, or if they do, do not pay promptly; but those peo-

ple do not think very far and if the railway's offer is a little lower than the others the laborers leave to work for the contractor. If at least as high wages as any contractor pays is granted the probabilities are that a uniform class of help can be retained. On the interurban lines this was not so hard a proposition, as most of the help could be secured from the small towns or villages, and by having the section gangs stationed at outlying points, one was able to secure a far better class of labor. To encourage the feeling of interest in the work suggested by Mr. Wilson, they offer to the section foreman annual or semi-annual prizes for the best showing. This has been in practice for a couple of years past, and has had a very good effect among the section foremen. The latter compete with one another as to the general appearance of their lines. Mr. Beggs, the general manager, himself participates in the inspection which decides the prizes.

President Adams thought Mr. Simmons's remarks on the question of uniform specifications in the maintenance of way question very pertinent.

M. Schreiber said that Mr. Wilson's paper was interesting from the point of view of the data gathered on obligations of the different railroad companies as to the removal of the débris from the streets and for sprinkling. The speaker had occasion recently to investigate the advisability of using water, oil or tar on a particular property. It was found that the cost of water, using ordinary sprinkling tanks, was about half a cent per running foot of single track per season, and for oil three or four cents per running foot per season. Water-gas tar was also investigated. This is quite a fluid material and runs readily, especially when it is distributed in the sunlight. It lends quite an asphaltic finish to a macadam paving and increases the durability to a considerable extent. Its cost is somewhat less than the oil. However, the water was used on account of the great advantage in cost. As to machines in connection with track work, all were coming to that. There was no department of railway service so far behind the times in machinery as the track department. One great disadvantage in using track machinery on the street is the trouble from interfering with traffic, such as scaring horses and the complaints of the authorities. Recently they had a concrete mixer that seemed to be very promising, but the first time they had it out two or three horses ran away and they were not allowed to bring it on the street again.

Speaking about rules, Mr. Schreiber said he had noticed a book of rules for maintenance of track on several roads. This is distributed to the foremen and sub-foremen and everybody else from the roadmasters down. He was sure Detroit has such a code and believed it would be interesting for a special committee to get out a standard code. Construction could not be included very well, because every property would be different, but in maintenance of track there are a great many things where the mode of procedure is more or less common.

F. G. Simmons took the chair after Mr. Whipple, chairman of the entertainment committee, had made an announcement regarding the entertainments.

On proceeding with the discussion of Mr. Wilson's paper, W. Boardman Reed was given the floor. He had noticed that Mr. Wilson took up snow removal. As that interested all city railways, he would explain the method used in New York for the past four or five years. The system was conceived by Major Woodbury, the Commissioner of Street Cleaning, and the matter gone into very thoroughly by him with others who had had experience in the line. For years the snow was removed from the streets both by the street railway company and the city under an agreement whereby the street railway company cleaned certain streets from building line to building line, and the amount that they were under statute obliged to clean throughout the entire snow-cleaned districts. Tickets were issued for each cartload of snow removed and a great many evidently were issued for snow not removed. Then Major Woodbury proposed paying for snow removal by inch of fall, which struck him as a very fair way to get at it, as it would stop stealing entirely so far as the city or the railway company was concerned. He thought it wise to have the city try the system for one or two years before his company adopted it. The city paid the first year something like 27 cents per inch of fall, which was equal to about 60 cents per cu. yd., a tremendously high price. His company estimated that in the City of New York the average shrinkage was somewhere between 70 and 80 per cent. The contracts for the last few years have been let for 20 cents. The railroad company was able to let the contract for from 12 to 14 cents per inch of fall, and making a computation at the end of the season, found it cost a little bit more than the old method of removing by cartload, but the streets were cleaned; whereas by the old method, if so many yards of snow were left on the streets, so much money was saved. A big improvement was made as the streets were so well cleaned that they were able to get up to the full earnings in a very short time. This was a matter well worth thinking about by those obliged to clean any amount of streets by the contract method. In some places the railroads are able to remove snow by cars, which has seemed to be impracticable in New York at the present time. It is something of a gamble. In a snowfall, when the temperature is low, 50 per cent instead of 20 per cent has to be carted away, and the contractor that takes it for 14 cents per inch of fall loses money; whereas in a storm that comes immediately before a thaw, the contractor makes money. In justice to the contractor in every case where the snowfall exceeds 4 inches, he should be allowed for the amount of snowfall, the amount being obtained by the official reports of the Government Bureau in New York.

E. N. T. Ryder took up drainage in connection with ballast. Sometimes it is very difficult to get good ballast, but generally, on interurban work, it is possible to dig a good ditch, although it is not always done. From an operating point of view, if the ditches are dug deep enough to keep the water off the surface of the track, the operating men are frequently satisfied, but for maintenance purposes it seems to be very necessary to dig the ditches deep enough so they are at least below the bottoms of the ties. In city work, of course, it is out of the question to dig ditches. The question he wanted to raise was how far could that work be replaced by laying tiled drains between the tracks if it is double track or alongside with single track. There seem to be many kinds of soil which make very poor ballast if left alone; but which make very decent ballast if the water is taken out of it rapidly. Sometimes that is complicated, in eastern cities, by the fact that the sewers are on a separate system, so that it is not permissible to connect these drains directly. Where that is done, it is usual to get a connection point every few hundred feet and use small sizes of ordinary tile drains and by so doing avoid the very expensive ballast which would be necessary by digging out below the ties. He asked for an expression of opinion as to what the position of those drains should be. In double-track work, they are generally laying them so that the top of the tile is about 6 ins. below the bottom of the ties. A

certain amount of good ballast material is brought in to lay around the tile in the ditch. In single-track work, they have generally laid them alongside of the track rather than under the track, with the idea that it would be easier to replace them and look after them; but of course it does not give quite as good drainage because the water has got twice as far to go to the pipe. In some cities, where the conditions are the worst, they had gone so far as to lay a concrete foundation and tiling under the track, and then 3 ins. or 4 ins. of gravel ballast, with the ordinary cross tie and rail construction on top of that. The latter construction was in ground which was practically brick clay where extraordinary precautions had to be taken.

Mr. Ackerman said they sometimes placed the tile 2 ft. below the base of the rail in the space between the two tracks, and then filled over the tile with broken stone to admit the water. Some provision should be made to take the water away from the track, wherever the cities have objected seriously to putting the water into the sewer. As they always do object to its going into the sewer except through the catch basins, those drains are led to the catch basins and go into the sewer through that basin, the same as the storm water from the street goes into the sewer.

M. J. French said their franchise compelled them in relaying and reballasting a certain piece of double track, to place the rail on a level with the curb on the side of the street. This places the ties practically 5 ins. below the curb. The matter of drainage was going to be a very serious one with them, as they are on the side of a road that slopes up. The only way they see to accomplish this is to put a line of sewer between the tracks for the whole length of the strip and maintain drainage ditches on the side to take the water, with small catch basins, say about every 200 ft. or 300 ft. They hope to prove to the Commissioners that the conditions they have imposed under the franchise are absolutely absurd, but as yet we have not been able to convince them of this. He believed an open trench the best and did not think tiled drainage good. Mr. French was greatly interested in obtaining and keeping accurately the cost of doing work when dealing with foremen who can scarcely write their own names and keep accurate track of the different classes of work a gang is doing. He wanted to know how the larger systems obtain their cost data for the different kinds of work. Regarding material from jobs in the city streets a great amount of money could be saved if the old material is put to good use, especially the paving blocks and concrete. During the past year on one piece of work when they rebuilt a single-track line with double track 9-in. girder-rail construction, he was surprised to find they could rebuild almost the entire line without new stone by breaking up the old concrete and the paving blocks. His experience with the concrete was that it cost from 40 to 45 cents per cu. yd. to break up. The paving blocks cost 60 cents per cu. yd. They found they could save much more money by redressing them for 55 cents per sq. yd., and although the block is much lighter, it comes in for very good service in repaving streets where there is not very much traffic.

W. J. W. Griffin said he had had charge of the maintenance of an interurban branch of the Rochester Railway. Their system of getting cost has been to have a daily report from the different foremen; all of these reports are subdivided into the different parts they wish to keep, as work upon the track, roadway, ballast, ditching, fencing, road-crossings, etc. In the report space was also given for material used in the different parts. By checking up with the stock department and the timekeeper, it became very easy to divide up the difference maintenance charges as minutely as desired.

Mr. Wilson said he would like to make a résumé of the points raised by the different speakers. With regard to preserving ties, his road has made some practical tests of the creosoting process of preserving ties. It was very fine but too expensive. That method costs, in the northwest at least, from 40 to 60 cents per tie, depending on the amount of oil used. They believed it to be the only thoroughly satisfactory method of treating the ties. The question of contractors paying one rate and the railway having a large crew of men at a different rate, is one that the speaker had some little experience with. His road has been paying $1.75 for ten hours and it has run up in a number of cases where contractors were paying $2 and $2.15 and run right alongside of them and also where the cities were paying $2 for eight hours work. When one comes to run up against a city crew getting $2 a day working eight hours, while the railway men are working ten hours for 17½ cents, it is necessary to keep busy to keep the men. Sometimes the men are furnished transportation, which helps out a little. The company pays every two weeks, which also helps again. The cities do not begin their work quite as early in the season as his company and this enables him to get crews started early in the season; but in the ultimate analysis, the men must be put on the same basis as those of the adjoining contractors and cities. The question of welding old rail, etc., was one the speaker had some little experience with, as a good deal of the old rail on his system has been welded. They have secured a very much longer-lived rail and the paving has been kept in repair without any expense. His company believes in the T-rail, and if any delegates visited the Twin City, he could do a little missionary work to convince the people that the T-rail can be laid and an excellent pavement alongside of it satisfactory to any one. He heartily endorsed Mr. Clark's remarks in regard to more machinery needed on the track system. As to Mr. Simmons' remarks about specifications, he said, he had been getting up just such a specification as that to govern track laying and other work of the kind. He was very much interested in the question brought up by Mr. Reed in regard to the manner for paying for snow removal in New York. So far as the drainage on city streets is concerned, the cities in which his company operates are perhaps rather more favorably situated in regard to the sewers being altogether built on the combined plan, so that the railway is able to carry its drainage from the paved streets to the sewer. In the paved streets they have no trouble at all with putting in track drips and carrying the water from them to the nearest manhole or catch basin. A good many times it requires catch basins. As to drainage or subdrainage of a clay ground, he presumed that the only satisfactory method was the use of tile drawn in or under the ballast material.

The cost-keeping system used by the Twin City Company is to have the time keepers classify the work and the time spent on the work by the various men. As a rule, the time keeping is entirely done by timekeepers, and whenever a piece of work is about to be commenced the timekeepers are given instructions as to what classes of work are to be kept separately. Then they return their accounts, and the auditing office divides the expenses and keeps the accounts of each different item of work separately. This system seems to give very satisfactory results.

M. Schreiber said that in keeping costs of different work

in the Public Service Corporation of New Jersey, it is only a question of proper accounting. They have no more trouble in knowing the cost of work, although there are 3000 men working in the summer against 150 men in the winter. The general scheme is that all material is brought in and handled from one point. Over night the foreman on each particular job makes out his store-room order and sends it in to the storekeeper and when the orders get to the storekeeper he puts the charges on. Every job has a number. The keeping of time on his road is run on the same basis as explained by Mr. Wilson, namely, the timekeeper makes out the distribution, and the time of every man is charged against a certain number. At the end of the month these accounts are made up and every job is listed so one can tell exactly what it costs.

RAIL CORRUGATION

The report of the sub-committee on rail corrugation, published on page 729 of this issue, was then presented by Mr. Simmons. At its conclusion he mentioned the work of the Street Railway Journal on this subject in securing data as to the structure of the rail and the various elements entering into its composition. He suggested that further investigation would rightly belong to such committees as handle the question of rails in all their details.

G. L. Wilson, in opening the discussion, said his company has had a good deal of difficulty within the last two years, and apparently in an increasing ratio, with the corrugated rail. The trouble seems to develop with the more recently rolled rails, those which have been in service for the longest time not seeming to be the most seriously affected. He noticed that the committee included reports from companies describing their troubles with corrugated rails, in which the girder rail seemed to be the most largely affected. The same trouble exists on the T-rail unfortunately, so that it is not due to any one class of rail. So far as the foundation is concerned, it seems to be a curious fact that while the trouble is ascribed to a defect in the foundation, yet almost all the cases of corrugated rail occur in paved streets. On earth streets, or on open track, it very seldom, if ever, occurs. This condition of things seems to be not only uniform among the different cities of the United States, but the foreign writers on the same subject seem to find that the corrugation is confined almost entirely to streets with a very firm and solid stone ballast or with a rigid foundation of some kind, so that it does not seem to be a question of the defective foundation alone. He thought the question of investigating corrugation should be continued by the committee on rails, because it is certainly one of the worst troubles existing to-day and it is going to cause more trouble. He had experimented somewhat with filing off the corrugations as described in the report of the Philadelphia Rapid Transit Company, and, in fact, obtained the device from H. B. Nichols, the company's engineer of way. They were very successful so far as simply removing the evil existing was concerned, but did not prevent its recurrence. Some English firms manufacture machines to grind off these corrugations. His company has recently procured one of these, but as they received it only a few days ago, he was not able to say anything about its use.

C. Voynow said there was one possible cause for corrugations which he had never heard mentioned and which appeared to him as probably the most reasonable one. He was almost convinced that it is the principal reason. On tracks tamped on dirt, as on T-rail tracks, where the rail can move in all directions, corrugations occur very seldom; at least he had seen corrugations under those conditions, but they are of a different character from the corrugations which give trouble. Corrugations, however, do occur mostly where the rail has a firm foundation. The firmer the foundation and the heavier the traffic the quicker the corrugations occur. This had brought out, in his mind, the idea that the corrugations are caused by the elongation of the upper surface of the metal under traffic. When the rail is free to give, the elongation may form a vertical curve, and that curve, as a matter of fact, goes back sometimes; but when the foundation is firm and unyielding, the surface metal, the metal which is elongated on the upper surface, is probably pressed together in irregular humps and these are being taken off by the rear wheels of a single-truck car. The reason he thought this to be the case was that after a corrugation is thoroughly filed the surface generally is hardened under the rolling and the corrugation does not occur again. In one case where a new track was bedded in concrete without any chairs, the corrugation occurred four months after the rail was laid and they became so deep and so high that he thought they would have to do away with the rail in two and a half or three years after it was laid. However, they filed the rail thoroughly and took off the surplus metal from the top two and a half years ago. Since then there has been no further trace of corrugation. Then comes the question: "Why did not the surface of the rail elongate further, and why did not the corrugation occur again?" It is possible that the metal has been knitted into a firmer consistency, and therefore does not come up in lumps again.

Mr. Simmons said the experience in Milwaukee with corrugated rails had been very slight. While it would seem to bear out the remarks of Mr. Voynow there was one peculiar thing about it, which gave rise to other questions in his mind—the corrugations appeared on tracks supported on ties at the regular spacing with their method of concrete construction, which consists of six inches of concrete below the tie, between the tie and around the rail up to within about four inches of the surface. This track after having been in a year showed very slight corrugations. The city had laid in an inferior manner the abutting pavement against the track and the concrete on the top which came up around the rail. During the following year this pavement and concrete loosened up somewhat and as it loosens the corrugations disappear. The peculiar circumstance in connection with it was that this condition appeared at three different places on the system and at these three places the rails laid were all of one rolling. That brought to his mind the idea that possibly something in the composition of the rail or the method of preparing it was at fault to some extent. Hence, he thought that the corrugation question and the question of specifications for the rail may be interwoven and the rail committee therefore would be the proper one to carry on the further investigation of the subject.

E. W. Olds said he was not in the track department, but as one of the people who have the care of the cars, he was interested in having smooth track. During Mr. Voynow's talk, the thought came to him to ask whether he had noticed any peculiarities of the corrugation—whether they were inclined to creep forward. Generally speaking, he understood, it occurred on the tracks where the cars are always operated in one direction.

Mr. Voynow replied that the formation of the corrugations is most peculiar. In the beginning the corrugations are perpendicular to the gage line, that is, directly across the rail. In the course of time the corrugations are at an angle to the gage line, say, 45 degs. angle, and not in

regular waves, but the maximum wave is somewhere about ¾ in. away from the gage line. When the corrugations continue to increase they take the form of a cone produced when rain drops on shallow water. It comes up in cones or nipples, and when the car comes along only around spots are seen. This marks the maximum corrugation. He had made notches opposite corrugations that occurred after the rail had been laid for four months, and a year or two later they had changed their position with reference to these notches, but it was hard to tell whether they were creeping or not. If the direction of the traffic be taken, then the corrugation in 80 per cent of the cases is at an angle to the gage line in the direction of the traffic.

I. E. Matthews said that in Rochester they have had only one case of rail corrugation that gave trouble. It was on a double track on a 3 per cent grade. Corrugations appeared at the foot of the grade on about 150 feet of track, of up track and down track, both seeming to be affected equally. The rail was apparently rolled out as though it was soft. He had drillings taken out of the high spots and the low spots of the rail and chemical analyses made of them. There did not seem to be any difference between the high spot and the low spot in percentage of carbon. The rails showed 3 per cent carbon. He took a similar 9-in. girder rail on an adjoining track which had given good service, took a drilling from the web and tread, and found no perceptible difference in the percentage of carbon; but the rail which gave no trouble showed .51 per cent, a much larger percentage of carbon than the corrugated rail. Hence he concluded that the rail being low in carbon was soft and that the low places had started up by the spinning of a wheel or brake. The truck passing over that low spot would set up a vibration in such a way as to carry this corrugation on. They took the rail out and put in a new one.

Mr. Voynow said corrugations had not been studied in any systematic way. It is not a question of chemical composition of the metal; it is the physical condition more than anything else. To investigate the corrugations properly the tracks should be built from the same class of rail, from the same manufacture, laid in different ways, with concrete ties or otherwise, and placed in the same service. Only under such conditions could any absolute results be attained.

President Adams wanted it understood that the association's study of the subject did not end with the report of the way committee. He understood that the matter was still in its hands and would be further investigated.

RAILS AND RAIL MATTERS

The next business was the report of the sub-committee on rail and rail joints, which was presented by Mr. Clark. Before this report was read Mr. Simmons said that there was a minority suggestion by one member of the committee which would alter the form of the report as made at the present time. In that connection the way committee wished to suggest further recommendation regarding the report at the conclusion of the abstract of the report.

Mr. Clark then presented the report of the committee on rail and rail joints (published on page 757), and said: "We say in our report, substantially, that the selection of the best type of rail is up to the city—if the city will let us we will put in the best type of rail, but we do not say definitely that it is the best construction. We therefore desire to amend our report to make it read as follows: Your sub-committee on rails and joints, as a result of its study, recommends as the best practice and as standard for city construction in paved streets the use of a 7-in. T-rail known as the Lorain section No. 95,400 and the Pennsylvania Steel Company's section 272."

Mr. Simmons said the way committee believed that the recommendation should be that this certain section of T-rail for use in paved streets is recommended as best practice, without regard to the fact of whether or not certain cities permit the use of it. The report goes on to provide for those cities where the use of T-rail, due to various causes, probably the city engineer's ideas and of those unfamiliar with the science of the question, prevail, and the T-rail is not permitted. The other types of rails are provided, the effort being to reduce these types to some reasonable minimum. At present there are probably anywhere from 50 to 100, or possibly more types of rails, being used in the various cities, each city to a greater or less extent having a type of its own. Now, if these can be reduced to two or three types, varying only in height or weight to suit local conditions, provision will have been made for those cities where the particular conditions prevail, but the committee did wish to recommend the T-rail as the best practice.

President Adams closed the morning session by announcing the committee on nominations, as follows: C. H. Clark, Buffalo, chairman; George L. Wilson, Minneapolis; Charles Hewitt, Philadelphia; George J. Smith, Kansas City; W. D. Wright, Providence, R. I.

TUESDAY AFTERNOON SESSION

Chairman Adams called the meeting to order at 3 p. m. and announced the report of the committee on standardization by Chairman Evans as the first order of business. He recommended that the report be discussed topic by topic, and then that the question of the adoption or rejection of the same be taken up after completing the discussion.

Mr. Evans then read the report published on page 737 of this issue. With reference to motor axles he added that the distinguishing feature, in fact the only variation in dimensions between the axles indicated as EB and EB-1, and also EC and EC-1, is the diameter of the motor fit. It was originally thought best to recommend an axle 5½ ins. and 6½ ins. for those two sizes; but after further consideration it was considered desirable to specify a particular axle which would have a 5-in. motor fit and also a 6-in. motor fit, so that really but four standard axles with that particular variation are recommended for adoption. With regard to the journal boxes he said the illustrations are not intended to constitute working drawings. Only the principal dimensions are supplied and the detail dimensions for the most part can be obtained from the master car builders' standard drawings where they are not shown in these drawings.

DISCUSSION ON STANDARDIZATION

President Adams in calling for the discussion on the standardization report told how hard and faithfully the committee had worked to complete the report. They deserved the utmost credit for the report presented. President Adams then asked that the subject of axles be discussed first and invited the representatives of the manufacturers as well as the members to give their views.

N. W. Storer, of the Westinghouse Electric & Manufacturing Company, said there were two points about axles which directly concern the manufacturers of railway motors. The first is the distance allowed between the wheel hubs, and second, the length of the gear fit. The report finally adopted was satisfactory to his company,

although not exactly in accordance with its recommendations. He understood fully that the conflicting requirements of the truck builder, wheel manufacturer and motor builder do not always conduce to the very best in any particular line. He believed that the report as adopted gives the best compromise for all concerned. One point to which he wished to call attention was the gear fit, especially to the position of the gear face with reference to the flange of the wheel or to the position of the motor on the axle. It was determined by the committee that this gear face should be in a standard position on the different axles that motors of different manufacture could be placed on any axle; that is, that the motors would be interchangeable as far as gears and axles are concerned. That, he thought, was one of the most important decisions arrived at in connection with the subject. The following little point he believed it would be an advantage to change: An oversight had been made on the part of his company's representative at the meeting in New York as to the overhang of the gear hub on the gear for the small axles; that is, the axles having 48 ins. between the hub. The Westinghouse company would like very much to see that gear flush on the motor side of the gear, and have the 1⅛-in. overhang on the wheel side. That gear would then be the standard which is in use on a great many of its motors. Many thousands of its equipments are built in that way, and he understood that ⅛ in. overhanging on the motor side is not in use at present on any motor in the country. He would like very much to have the committee consider this matter of ⅛ in. at the next meeting if it was possible to make this slight modification.

E. D. Priest, of the General Electric Company, was called upon to say something in connection with the point brought up by Mr. Storer. Mr. Priest replied that he was not prepared to answer about that. Possibly the change will be all right.

Mr. Evans said the point Mr. Storer had raised was quite a good one, since the change corresponds with many equipments already in service, but he thought that since the representatives of both the Westinghouse and the General Electric companies had been at the previous meeting, and since Mr. Priest's assistant, Mr. Schermerhorn, who acted in his absence, did not give enthusiastic support to the proposed changes by Mr. Storer, the committee thought it well to carry this point over until after the convention. In the meantime it possibly could harmonize any difference between the designing engineers of the two companies. At the same time he wanted to express the committee's appreciation of the fact that the General Electric Company and the Westinghouse Electric & Manufacturing Company had so enthusiastically sent such bright representatives as Messrs. Storer and Priest to confer at the meeting.

President Adams said the particular point raised was a small one affecting the gear design, and he would suggest that it be left for the consideration of the next year's report.

E. W. Olds said he was glad to give the suggestions on axles his hearty support. Some of the axles recommended are those which his company has used for a number of years in Milwaukee. Only one is new to it. There is a little difference in the diameter of the wheel fit from their standards, but that is a mere detail which can readily be changed to meet the conditions. By adopting standards the railways will be able not only to get better equipment, but to change their equipment. It will make it possible to change one motor for another on the same truck.

Mr. Ayers said it was more important to get these things standardized than just to get the best possible dimensions. He did not want even to suggest that any of these dimensions ought to be changed at the same time. When he saw these axle dimensions he did not like the appearance of them, simply because they are so far from their practice on the Boston & Worcester Street Railway. As he understood, the purpose of making the diameter of the axle at the gear seat considerably larger than the diameter at the motor bearing is to get room for the keyway and to get increased strength to make up for the weakening of the axle which comes from cutting the keyway. He thought the diameter of the axle at the wheel fit is dictated with reference to the idea of getting that just a trifle smaller than the diameter at the gear seat. On his road the practice is to have practically only two diameters for the axle altogether, one diameter at the journal box and the rest of the axle one other diameter. On their smallest size of interurban equipment they use the GE-57 motor and an axle 4½ ins. in diameter everywhere except at the journal. There is no keyway, the gear and the wheel being pressed on. The fact that the keyway is omitted seemed to him to remove the reason for having the axle large at that point. In their larger equipment they use a 5¼-in. axle, 4¼ ins. at the journal box and 5¼ ins. everywhere else. Some of the truck manufacturers object that you cannot press on a gear over the wheel fit and have them both of the same size. That is a mistake; his company does it in its shop right along. It is entirely satisfactory and they do not get loose. Of course, the practical feature of that form of axle is that it is cheaper to make, especially in the shops of an operating company. There may be some reason for increasing the size of the axle at the wheel fit, perhaps in connection with the strains in the metal and to secure the necessary strength. He did not see any such reason. Of course most broken axles fail —at least in his experience practically all of them—at the wheel hub, at the end of the keyway. They never had them break there because they have no keyways. This practice is a recent standard with his company and it has not been tried long enough to ascertain its character. In his opinion the effect of the keyway in the axle was to cause the strains to accumulate at that point and break the axle there. He was not sure that a larger axle, an axle increased in diameter at that point, is any stronger or even as strong as the axle of uniform diameter throughout its length. He thought it certain that the bending to which any axle or shaft is subjected has a tendency to localize at a point where there is a sudden change in diameter, or at a point where the metal has been cut for any reason. The keyway is worse than a change in diameter. Probably where the wheel is pressed on with a great many pounds pressure the localization may take place at the end of that hub just as it would if the axle itself were suddenly enlarged at that point. He was inclined to think that there is less danger of crystallization in a case where there is a sudden increase of diameter due to the pressing on of an exterior collar of metal, that is, the hub, than there is in the case where the increased diameter is made by turning it out of the solid axle.

Mr. Ayers did not want to raise any objection to the report of the committee, but simply to present his view that for high-speed work the solid gear without key should be used. The gears can be pressed on so they will not move. It seemed to him where that fact is taken into account, the need of the increased diameter of the axle at the wheel seat and gear seat disappears. Concluding his remarks,

Mr. Ayers said it was evident that in some instances it will not be possible to use the standard dimensions for a long time. They probably never will be employed where open cars are used in city streets, where very short radius curves have to be taken, because the length of the bearing has to be kept down below the standard indicated to make the truck narrower and have it swing readily.

John R. Dickie stated in regard to the two form of gears, that it is absolutely necessary to have the enlarged gear seat. For instance, if a manganese gear rim with a cast-iron center is taken and forced over the wheel seat, when it is gotten on to the gear seat, it will not hold the pressure at all. The only gear one can get over there is a cast-steel gear and even then one is not quite safe in the pressing. He thought for that reason the enlarged gear seat is absolutely necessary.

Mr. Ayers replied that if it is necessary only a small amount, such as 1/16 in. would be required to accomplish it. Mr. Dickie answered that was all they allow.

Mr. Ayers asked if he meant 1/16 in. thicker than the rest of the axle, and Mr. Dickie said the gear was relieved of all expansion, due to pressing it over the wheel seat. It is put right on to the gear seat.

President Adams said that, all things considered, it would be difficult to reconcile a report of this character to the practice of every individual road. The report of the committee is a report of the best recommended practice.

C. S. Sergeant said he supposed every committee on standardization has always encountered the difficulty that nothing is standard, and that standards cannot be adopted in practice until a long time after they have been adopted in theory. But it seemed to him that unless standards to work toward were suggested, one would never arrive anywhere. He believed that in almost every department of electric railway work there had been suffering for years from a lack of standards. He sincerely hoped that the report would result in approximating something that will become standard later.

E. G. Connette said in looking over the standards recommended for axles, it reminded him of a road in Western Massachusetts that had two or three accidents on account of loose wheels. They attributed the accidents to the depth or length of the hub of the wheel being less than the diameter of the axles. They sued the wheel manufacturer and recovered the amount they had to pay on account of the accident, claiming it was the fault of the wheel manufacturer who pressed the wheels on the axles. It developed, however, in the course of the lawsuit, as he understood it, that the wheels and axles were made from drawings furnished by the street railway company. He noticed that axles EA and EB provide for a length of hub of 7½ ins.—they are the smallest sized axles—while the two large sized axles just below provide for a hub 6½ ins. in length, while the diameter of the axles first mentioned (EC 6 15/16), while the larger one, or ED is 7 15/16 in diameter. He asked the committee whether it considered this good practice.

Mr. Evans said the difficulty occurs from a rather selfish motive on the part of the motor designers. They had quite a little difficulty to get them to release as much as 50 ins. of the axle, as they wanted 51 ins. and 51½ ins., but the committee was fortunate in calling the truck builders, axle makers and wheel manufacturers to its assistance. They insisted they must at least have as much of the axle as the committee was giving them. It has been rather an accepted standard that the length of the wheel fit should not be less than the diameter, but he did not know that has ever been worked out in making the axle, and, in fact, the wheel makers assured him there is absolutely no question that a wheel can be fitted to the larger diameter axles and be absolutely safe. The committee has the same assurance from the cast-wheel makers for the smaller axles. The opinion of the committee was that for the present at least the steam wheels would be used on the larger diameters. In reply to what has been said about the keyway, the committee has not recommended that a keyway is always necessary. In fact, he thought he voiced the sentiment of the majority that the keyway is not necessary but it is deemed advisable since a great many roads are using the keyways to give the dimensions which the committee considers to be the very best practice. To Mr. Ayers and also to Mr. Sergeant, he would say that it was found that the recommendations in general very nearly coincide with the standards as adopted by many of the largest systems of the country. It was very gratifying to know that in comparing these recommendations with what had been the general shop practice for many of the larger manufacturers, it was found that these recommendations almost exactly correspond. Consequently, the axle recommended is not an experiment. The point raised in regard to the wheel fit not being larger where it enters the wheel is one which was exploded some years ago. It is necessary that the axle be much larger where it enters the wheel fit, as that is where the stresses and strains concentrate, whether it is a motor or simply a carrying axle.

N. W. Storer said in regard to the point raised by Mr. Connette, whether it was good practice to have a longer wheel fit on the small axles than on the large ones, that it can be overcome by releasing a couple of inches more of the small axle for the motor builder.

Mr. Priest called attention to one small point on the subject of axles. While in general in hearty favor of the report of the committee, the point had not been called out, whether the gear manufacturer or axle manufacturer should allow for the pressing fit. It is a small point, but an important one to know, so there can be some general standard to follow. Sometimes the axle manufacturer allows for the pressing fit and at other times the gear manufacturer allows for it. It should be definitely decided whether the gear manufacturer or the axle manufacturer should provide for the fit.

Mr. Dickie said it was usually the practice for the axle to be turned of the size and the wheel or gear to be pressed on is bored a certain proportion smaller, it being most convenient to have it done that way. Mr. Estep said that was his company's practice.

President Adams suggested to Mr. Priest the point raised by him be left for the incoming committee. It will probably make some record of that matter in the next report, and anyway it is a good point to have on record.

Mr. Adams thought one reason the gear manufacturers should make the allowance is they know what kind of metal they are making their gears of; whether it will expand easily, and if so, they can allow a greater variation. He thought the axle should be turned to standard dimensions, and the gears should be made to apply to these standard dimensions of axles.

Mr. Evans told Mr. Priest he did not think there is any room for any discussion on his point, as the committee specifies the dimensions of the axle. It will be necessary for the wheel maker or the gear maker, to bore his gear a

sufficient number of thousandths of an inch smaller to press on the axle specified. If they turn up an axle to the required dimensions the railways will have to have the wheel of the required tonnage to press on.

Mr. Priest said, that point had been brought up a number of times and that was his reason of calling attention to it. He had no criticism to offer of the practice of making the allowance on the gear. It merely occurred to him that it would be a good thing if it could be definitely understood that the gear manufacturer would see to doing it.

Mr. Estep said that when a gear is ordered of a certain diameter, it means so much allowance for pressing or fitting. In answer to the remark made by Mr. Ayers in regard to the fit of the gear, his company had this demonstrated to it fully where the axle is the same diameter for the gear fit and for the wheel fit; when the gear reaches the gear seat it has lost the amount of pressure necessary to put it on in the first place. His recommendation was to reduce the wheel fit so that one could pass over that without pressure.

In taking up the discussion of journals and journal boxes, Mr. Evans said the question of journals probably was cared for in passing on the recommended diameters of axles. The journal box recommendations very nearly correspond to what has been the practice.

A. H. Weston said that the association in adopting the journal box standard as recommended will confer a very great benefit on the traction companies, greater than on the journal-box manufacturers. One of the most discouraging things to the journal-box manufacturer up to the present time has been the great variety of patterns he had to carry to supply the traction company demands, with the result that the car builders in receiving orders for repair parts got more than their share of the profit. He did not believe it will be imposing any greater hardship on the truck builders and car builders to design their trucks to suit a standard journal box than to suit a standard axle.

President Adams said the subject seemed to have been very well covered by the committee, and if there was no further discussion upon journals and journal boxes, they would proceed to the next topic, the exceedingly important one of brake shoes and shoe heads. The committee had recommended shoes and shoe heads that will fit the requirements of almost every road in the country whether they are using a wide tread wheel or a narrow tread wheel. It has put forth a recommendation that will save the roads of this country a tremendous amount of money.

Mr. Evans said, speaking for C. S. Sergeant and other representatives of the brake-shoe manufacturers, that the recommendations seemed to meet with their entire approval They have experienced the same trouble as mentioned by Mr. Weston in regard to journal boxes and they are very anxious, indeed, to get the number of patterns reduced as much as possible. While they do not commit themselves to say so, and he did not know that he should say it for them, they did intimate that it will be commercially a great advantage to have standard pattern brake shoes. The A brake shoe recommended is adaptable to use on any steam railroad equipment which any of the properties may be operating. It is interchangeable with the regular steam road pattern, but the narrow shoe is recommended simply to take care of the narrow wheels in service. The discussion on th next topic, "Standard Section of Tread and Flange of Wheel," was opened by Mr. Voynow, who called attention to that part of the report stating that a wide flange, etc., avoids the necessity for flange bearings on special work. He did not see how it would change the condition from a right-angle crossing and would like an explanation.

C. H. Clark laughingly remarked that the rest of the members did not live in Philadelphia where they have nothing but right-angled crossings. Mr. Voynow thought the clause should be modified to read "some special work," not "all special work."

Mr. Ayers thought there should be one more style of wheel with the 2½-in. tread and the ⅞-in. flange. On his road, as a matter of fact, they are using that wheel now. In their effort to come to a standard, they would not like to have to use as shallow a flange if they had to continue a narrow tread. It seemed to him it would be a good idea to show that as on additional standard where it is possible to use the deeper flange.

Mr. Evans replied with regard to the question of the ⅞-in. flange and 2½-in. tread, that if Mr. Ayers is using 2½-in. tread, with a ⅞-in. flange, there is no reason why he cannot use 3-in. tread with ⅞-in. flange. He might possibly be inclined to contradict him, but as evidence of that he found that his company put into service 3-in. tread and ⅞-in. flange, where it was previously thought almost impossible to operate a wheel tread as wide as 3 ins. If the conditions permit of a flange ⅞ in. deep, he certainly would not advise the use of a 2½-in. tread. In this connection, he thought there has been a prevailing tendency to use a much narrower tread than what the increased weight of the cars in city service require. If one visits almost any city where the very narrow tread is used, a wonderfully bad state of special work will be found. In that particular the wear of the special work is self-evident; but it is very difficult to estimate the damage that that special work does to the equipment in the way of broken axles, broken motors, wrecked frame, etc. For that reason the committee favors the employment of a wider tread wheel. With regard to what Mr. Ayers said about 3½-in. tread, it was worked out by the representatives of the special manufacturers that 3½-in. would be of very material help; in fact, avoid the necessity for flaws in the special work.

Mr. Ayers replied he was thoroughly of the opinion that a wider tread is desirable, and would much rather use the 3½-in. than the 3-in. On his system they run over three different companies' lines with the same cars, and in nine different municipalities, so it is pretty hard work to do just what the company thinks ought to be done. He hoped he would be able to use the standard with the 3½-in. tread some time.

Mr. Simmons said there will be many cases similar to Mr. Ayers's where probably for a long time it will be impossible to increase the width of the tread or the depth of the flange, or entirely to change the special work to avoid the carrying of the load on the flanges; but if the association adopts a standard which is held up simply as a goal, and all work toward it, good must result.

C. Loomis Allen asked if the committee, in recommending the 3-in. tread for interurban service had given safety its fullest consideration. It struck him that a 3-in. tread for interurban service is not quite as wide as it ought to be.

Mr. Evans replied that 3½ ins. was recommended for interurban service; but as some interurban cars operate where they cannot have 3½ ins., 3 ins. is considered sufficient under those circumstances. Where it is possible, and steam railroad conditions prevail, the committee rather took it for granted that the regular Master Car Builders' section would be employed. It did not consider it necessary to

have intermediate sections between its recommendations and those of the Master Car Builders.

Mr. Olds said regarding the size of the wheel and flange, that his company started out years ago in Milwaukee with a flange 5/8 in. deep by 3/4 in. thick. It had been gradually increased until now it is practically the same as recommended for the smaller wheels. It would be impossible for them to go to very much deeper flanges until their old special work and much of the old rail is removed from the street. Their new wheels have a 13/16-in. flange. Were it possible for them to use a deeper flange than the 7/8 in. recommended, or the wider tread, he certainly would recommend using the M. C. B. standard, as that is really the goal that should be aimed at and one that will be attained in the not very distant future. The interurban cars at present are using the 2¾-in. tread, which was not as wide as he would like. They started out with a 2½-in. tread, but have grown a little year by year, so that the city cars have the 2½-in. tread and the interurbans a 2¾-in. tread. He thought by the time another year rolled round he would be able to state that the city cars were using a 2¾-in. and the interurbans a 3-in. tread.

F. H. Lincoln moved that the report be adopted by the association and was seconded by J. N. Smith.

President Adams suggested that as the report was to be presented to the American Street & Interurban Railway Association for final approval, that condition be embodied in the motion.

William Roberts said before passing on the motion, that he would like to mention one matter that had not been noticed. They are using 3-in. tread for interurban work and so far as the cities are concerned have a very troublesome consideration about the pavement. For the city service they are using a 2¾-in. tread and the tendency now is to confine the tread of wheels to 2¾ ins. It is impossible to get a wider tread with a ¾-in. flange over 2¾ ins. A little while ago he expected to be called upon to use some of the city wheels, but what they have been using were 2⅞ ins. He though a suggestion should be made to the J. G. Brill Company that it make some arrangement so that the wheels can be gotten in the trucks after the railway has decided to use the 3-in. tread for city service.

President Adams replied that the Brill Company had a representative at every meeting of the committee and appreciated fully the point brought out by Mr. Roberts. The matter had been thoroughly considered by the committee. Mr. Lincoln's motion that the report be accepted, adopted and recommended for the approval of the American Street & Interurban Railway Association was unanimously carried amid applause.

President Adams thanked the members for backing up the work of the committee so enthusiastically. They certainly deserved it, and he thought there would be no question about the approval of the American Association. Mr. Evans also expressed his gratification but pointed out that resolutions could be adopted and drawings and standards made until they were black in the face, but if they did not go home and put them into practical use the work lost its value.

Mr. Smith then moved that the committee be extended two votes of thanks, which was unanimously carried.

OPEN VS. CLOSED TERMINALS

The next order of business was the report of the committee on open versus closed terminals for car houses, which was read by Martin Schreiber. (This report is published on page 733 of this issue.)

Mr. Schreiber in continuing said the thought had come to the committee since submitting this report that still another design that has never been tried might be considered, that is to take a car house laid out with one-third of the cars covered and protection for officers and men's quarters, and then to build on the other two-thirds a sort of cheap umbrella-type protection. The details of this he was not ready to describe, but was confident it could be done. However, the same problem of separating the car house into compartments is met if the storage is a large one.

William Roberts thought the committee had fully covered the ground. In the spring of 1907 he had asked for two rather large appropriations for putting in new shops, but now he was not altogether sorry he had not received the money, because he had learned very much from this report and he would be largely guided in his future recommendations by the plan mapped out by the committee. For one, he felt personally very grateful for this work.

W. J. Harvie said they are now building some new shops in Syracuse. He understood, however, this arrangement applied particularly to car houses or storage yards. Their experience in Utica has been that varnish deteriorates very rapidly in open storage, but in the city of Syracuse they have just finished a storage yard of quite good size with nineteen tracks for open storage. He would watch the results with a good deal of interest because they practically are fixed for open storage in Syracuse.

The next order of business was a report of the committee on operating and storage car house designs, but Mr. Bushnell, in charge of this committee, had not been able to prepare anything for definite presentation.

QUESTION BOX

The final business was the question box, which is published on page 747 of this issue. Fifty-five questions were included in this question box and there were a very large number of answers to some of them and some to all of them, making the paper too long for reading at the session.

J. W. Corning, referring to question 21 on fuse lightning arresters, asked if any members had experience with lightning arresters composed of a high resistance rod, such as graphite or similar material, on the market; also as to the disposition of lightning arresters along the line and whether there is any generally adopted plan of placing them at certain intervals.

Vice-president Simmons said his road endeavors to place lightning arresters at least every half mile on all its interurban lines. P. Mitchell said they place lightning arresters in deep railroad cuts and on high spots they found most subject to lightning.

William Roberts stated his company's practice is to cluster lightning arresters on high spots and very thickly around the power house. On every pole around one power house at Cuyahoga Falls that is particularly susceptible to lightning he has placed twenty-four lightning arresters. They have used during this last summer quite a number of a new type of lightning arrester. Last year they lost thirty-eight armatures on high speed cars between Akron and Cleveland. This year they lost only three. He believed that favorable result due to the new lightning arresters and their grouping around the power house. They have had only two hard shocks in the power house during the entire year. Their large central station in Akron, where they operate both the high and low tension d. c. and a. c., they have been troubled seriously only once with lightning. The storm on that occasion was so heavy and the lightning so concentrated around the city that he rushed to the power

house and shut down the whole station. There were seven shocks, three on the d. c. end and four on the a. c. end. One came in on the 22,000 transmission line and burned about four feet out of one of the three-phase wires.

The station was shut down twenty-five minutes, but no apparatus was injured. The damage was confined simply to the destruction of a few feet of wire. He had never found any definite statement as to the best place to locate lightning arresters, but from the fact that their armature losses have dropped from thirty-six to two or three he attributed entirely to the placing of the lightning arresters around the power house, and also to this fact that on one of their long distance lines they have a station storage battery and on the other a line battery. The batteries are the best lightning arresters in the world. He had stood in Bedford, about eighteen miles from this Cuyahoga Falls power house, and had seen a shock come in twelve miles up to the power house at Bedford, go through the power house and through the storage battery, and no harm done. Of course, they had no trouble from a lightning discharge if the static did not make a path for the dynamic. He would advise any engineers having lightning trouble to find where it starts and then group the lightning arresters. They should not be afraid of spending money on lightning arresters and placing them all around the power house.

Mr. Mitchell said that they began some years ago the keeping of a map and noting on it the locations where lightning strikes the cars or line. Certain spots are found more liable to lightning than others. The arresters are placed there and the losses greatly cut down.

WEDNESDAY AFTERNOON SESSION

Vice-President Simmons called the meeting to order and said the first item was a paper entitled: "A Year's Experience with Gas Engines," by Paul Winsor. Mr. Winsor, unfortunately, could not attend the meeting, and Charles Hewitt, of Philadelphia, was kind enough to read his paper. The discussion was opened by G. W. Farmer, who inquired if the figure of 3.477 lbs. of coal per kw-hour was the average of all the Boston elevated steam plant consumption?

POWER DISCUSSION

J. W. Corning, of Boston, replied he thought that would be the average of all but one old non-condensing plant, used only on peak loads.

Mr. Farmer asked if comparisons were available as to the total cost of power per kw-hour delivered from this gas plant and the average steam plant, including supplies, repairs, etc.

Mr. Corning said undoubtedly there are figures of that sort, but he was unable to say whether they were available.

J. R. Bibbins thought it might be of interest to have these figures confirmed. He had in mind two plants that are giving practically the same figures, one is the gas-power plant of the Norton Company at Worcester, Mass., 500-hp outfit which on the regular ten-hour day load averages about 2 lbs. per kw-hour, including coal for all purposes, building fires, etc., and furthermore, this economy is obtained with an engine-load factor of about 73 per cent. It corresponds quite closely with Mr. Winsor's figure, 83.3. This is one of the recent plants put into service, using horizontal double-acting type of engine, and the results seem to compare closely with those given by Mr. Winsor.

Mr. Chilton then read this paper, "Some Practical Points in Steam Turbine Construction, with Particular Reference to the Parsons Type." He was followed by August H. Kruesi, who read a paper on "Operating of Turbines in Railway Service."

Mr. Roberts referred to the last part of Mr. Kruesi's paper relating to the guarantee of the boilermakers or manufacturers of 200 lbs. for a boiler practically guaranteed for 150 lbs. He had the pleasure of working out some few problems on turbines with Mr. Kruesi. So far as the superheated steam is concerned, he thought that an increase of 50 lbs. would be advisable; but whether the boiler manufacturers would stand by the tubes or not under those conditions he questioned very much. He thought if the boiler pressure is to be increased there will be some different construction for boilers. If the superheated steam is avoided, he thought it would be working to advantage. Mr. Kruesi failed to point out that the great increase of maintenance means a great drawback to the use of both economizers and superheat. One thing should be pointed out to those contemplating the purchase of turbines, and that is that under varying loads at varying steam pressures they can depend upon the turbine to do work that a reciprocating engine cannot. A few days ago they had a heavy load on their line and were running seven 300-hp boilers with natural gas, the remainder of the plant, five 300-hp boilers, was being fired up, as they had no coal conveyors in operation. The pressure went to 85 lbs. of steam, yet the turbine was operating at that pressure and carrying all possible, while the 1500-hp and 800-hp reciprocating engines were working with the valves wide open and were inclined to "lie down." He would advise by all means the avoidance of water-step bearings. The first turbine they had had an oil-step bearing and they had no trouble. The trouble with the water-step bearing is that though they have practically pure water, eight gallons of water per minute are used on the step bearing, which at 6 cents per 1000 cu. ft. amounts to an expenditure of about $7 in 24 hours, which would pay for a great deal of oil. Besides, very slight impurities in the water seriously affect the face of the bearings. On analyzing this water they found per gallon 2 grains of sulphate of manganese, 7 grains of carbonate of lime and 7 grains of sodium chloride. This was so deleterious to the bearings that they required frequent renewal. Above all things, in relation to a turbine, one should be careful about auxiliaries. If he had his way to go over again in putting a turbine into operation, he would not have a steam-driven circulating pump. He would have a barometric tube condenser. They are operating theirs without a dry vacuum pump and are getting from 28 ins. to 28½ ins. at 1080 ft. above sea level. That is practically 29 ins. The trouble is to to get the water over without a dry vacuum pump, but once the water is over, the vacuum is assured. Feed valves should be put in by all means. Electrically, not steam, driven pumps should be used.

Mr. Mitchell said they have two turbines in operation and use water entirely for boiler feed.

Mr. Roberts said the water from the step bearing goes into the discharge end of the turbine and is lost, while Mr. Mitchell said his ran into the service connections.

Mr. Mitchell also stated that the surface condensers have been most satisfactory to them and give the best of boiler water. The cooling water is very dirty and they are obliged to use a surface condenser to get good feed water.

Charles Hewitt said they are using water-step bearings and oil-step bearings, barometric tubes and surface condensers, but did not know there was very much one way or the other to say regarding them. He doubted very much whether Mr. Roberts's trouble with his water-step bearings

is due to the water. His company has used water containing the ingredients mentioned by Mr. Roberts, and he believed they are very commonly found in water and are not very corrosive. He has had no trouble for two years with water-step bearings.

F. E. Henshaw thought it might be interesting if Mr. Roberts, who advocated electrically-driven auxiliaries, would expound a little further on that point. There are some who think they are rather dangerous. The efficiency of the electrically-driven auxiliaries is not as good as that of the steam-driven auxiliaries, and there are also a good many reasons why it is better to have steam-driven auxiliaries, rather than to go all around to the secondary source of power. With regard to the high speed required for the pump, it does not appear to be any particular objection to running the pumps with a turbine. He had recently seen boiler-feed multiple stage pumps driven by steam turbines in the New York Edison Waterside Station, New York City.

Mr. Roberts said their auxiliaries, that is, the pumps, are driven by a vertical engine. When a vertical engine goes over 300 r. p. m. one has what might advisedly be termed a natural speed. Now, the speed they want to run at on these pumps is 480 r. p. m., which is a perfect natural speed for an a. c. motor. They have to speed up the engines occasionally to get the water over the head to 430 or 435 r. p. m. That is why he is in favor of motors. They have a barometric tube condenser. They have another plant, a pump driven by a motor, lifting the water 15 ft. to the pump, driving it horizontally 750 ft. and lifting it 54 ft. at the end of the drive. He was quite sure they had not been shut down on that plant four hours a year on account of any trouble with the motor-driven pump.

C. F. Baker thought the troubles mentioned by Mr. Roberts might be overcome by changing the motor of the pump and reducing the speed thereby; by increasing the size of the rotor in the pump the revolutions would be reduced so it could be easily operated by an engine.

Dudley Farrand said they had changed the water step to oil, and they think they get a little better results. They had no serious trouble with the water, but find better results are secured with the oil; that is, they are able to run with greater clearance and find the oil a better lubricant. They are using a surface condenser with all turbines because they have ample condensing water, but not boiler water, which must be bought. With the change from water to oil on the step bearing they do not get quite the temperature in the condenser water as when they used water, because they got the heat units out of the step and it is necessary to make up that difference. Then surface condensers and heaters were designed for use with the water step, but the change to oil has made no trouble. The turbines have been running over three years. The first was installed in an ordinary steam plant, built for 175 lbs. pressure and they were able to give it only 140 lbs. of steam, but allowing for the difference it comes up to approximately its guarantee. They have had no trouble with the turbine itself.

As to first cost, Mr. Farrand did not see how any company can afford to put in anything but turbines in the large installations. The difference in first cost would provide a very much greater capacity, and talking on the investment side of the question alone there is no doubt about the value of the turbines. So far as the high-speed steam pumps are concerned, he preferred to install pumps of sufficient capacity so that they may be run at low speed. He also expressed a preference for steam rather than electric auxiliaries.

Mr. Mitchell said in the Edison station in New Orleans, all the auxiliaries were electrically driven, but were supplanted by steam-driven apparatus.

Mr. Farmer stated that the Old Colony Street Railway has been through a somewhat similar experience. They have some 10,000 kw-capacity Curtis turbines installed at Quincy, and three 500 kw machines installed at the Newport lighting station. In Quincy all the auxiliaries were electrically driven, but their experience was such that they soon changed one of them to steam and when the fifth unit was installed they put it in with steam also. They expected great results from operation with electrically-driven units, but after some practical experience with them, found it very advantageous to have steam. The condition of the plant operated entirely by electrically-driven auxiliaries, when current is off, can be easily imagined. The operation is much more flexible with steam-driven units and besides that the steam is needed to heat up the feed water. So far as step bearing is concerned, they have water in one plant and oil in the other. They were forced to use surface conductors at Quincy plant. The feed water is expensive and has to be bought and the circulating water is salt. It is therefore an object to use the surface condensers. The step-bearing water discharges directly into the condenser and so far they have had no experience which would lead them to seek a change. The same thing could be said of the oil-step bearing at Newport. Of course, in the latter case, the oil must be paid for, whereas in the case of the water-lubricated-step bearing they have to add about so much water every day to the hot well to make up. Hence it may be said that the step-bearing water costs nothing. Of course, a higher feed-water temperature is secured by its use.

Mr. Farmer asked Mr. Kreusi if the figures quoted for the percentage in gains in economy for steam pressure, vacuum and superheat, are those which apply generally for all sizes of machines; for instance, 2000 kw, 5000 kw, etc.

Mr. Kreusi said this applied substantially to all sizes, so did the 1 per cent for every 12.5 degs. of superheat.

Mr. Kreusi, in replying to Mr. Roberts, said in regard to water-step bearings that he was safe in saying there are over 100 machines operating satisfactorily in various parts of the world with water-step bearings. Similar reports have been made of satisfactory operation with oil. He thought Mr. Roberts's trouble was due to the deposit of salts on the lower wheel, caused by the spraying of the water in passing the turbine which would throw the latter out of balance. A similar case arose where good water was not available in Cuba and one or two other places, and it may be necessary to design oil-step bearings for these machines. The following paragraph in his paper would answer Mr. Roberts's question: "The step bearings of these machines are now lubricated with oil instead of water which was formerly employed. The change to oil involves the use of an additional shaft packing, where the turbine shaft passes through the base, but as this packing has only to seal against the atmosphere, its duty is relatively light and its operation simple. The upper bearings of these machines are now being lubricated under pressure from the step-oiling system, dispensing with tanks and sight-feed glasses. The pressure lubrication enables the bearings to be supplied with any quantity of oil desired. It is found that a flooded condition of lubrication in the guide bearings materially improves the operation of machines as regards freedom from vibration. The oil is filtered continuously and

an ordinary grade of mineral engine oil is satisfactory. Its specific gravity at 20 degrees C should be about 0.89 and its viscosity between 0.6 and 0.95 measured by the pipette viscosimeter."

Mr. Roberts has had some difficulty with boiler tubes, and on the other hand, any number of instances might be cited where satisfactory operation has been had with boilers at 175 and 190 lbs. pressure in connection with steam turbines. In the same way he believed it to be an error to condemn engine-driven circulating pumps, because in one particular instance the pump was designed for too high speed. A circulating pump for the conditions such as Mr. Roberts had to deal with can be designed for a wide range of speed, and there is no reason why it could not be designed for 75 r. p. m. even.

The question of motor-driven or engine-driven auxiliaries was too large to be entered on. Motor-driven auxiliaries are open to the same objections as motor-generator exciter sets. Sufficient steam could be had for motor-driven auxiliaries by taking steam from the first or second stage. All Curtis turbines are furnished with openings so that if any one desires to heat water in that way it can be done. The turbine uses the steam down to the point where all of it is abstracted, and has a higher efficiency than most of the engines which would be used for driving auxiliaries so that it would be economical to use no steam-driven auxiliaries. There are certain objections on the score of reliability with motor-driven auxiliaries which would off-set that. He thought the turbine-driven auxiliaries are absolutely reliable. They have been used in several instances, and he expected very rapid increase in their number.

Mr. Roberts had stated that with regard to reliability of operation the engines are still to be preferred. There again is the danger of drawing general conclusions from a particular instance. Many things due to the auxiliaries are laid to the turbine, just because they went in at the same time as the turbine. He thought many of Mr. Roberts's troubles were really condenser troubles. Mr. Roberts also said that the steam consumption of the engine is to be preferred. In answer he would quote a statement from the last report of the turbine committee of the Edison Association that the engines are no longer in the same class with turbines as to steam consumption.

With regard to the figures of superheat, pressure and vacuum, Mr. Kreusi said such statements as he had made here must naturally be general unless he gave tables applying to each particular turbine the percentage of improvement to be gained from a given amount of superheat. This would depend upon the size of the turbine, because a 1000 kw, for example, would have a water rate of about 20 lbs., whereas a 5000 kw turbine would have a water rate of 17 lbs., and naturally 1 per cent on 17 lbs. is different from 1 per cent on 20 lbs. He could make statements as to the gains obtained from superheat, which would naturally be different from that guaranteed. There must be a margin in the guarantee. No conservative manufacturer will guarantee up to the full limit of gain which he knows will be realized, and that might account for the difference between 12 and 14 degs.

Mr. Roberts then presented a quotation from a work on steam turbines by Lester G. French, in which the writer says:

"Comparing these figures with those of table XVIII., it seems probable that the reciprocating engine will, under exceptionally good condition, show a little better economy than the turbine, when running at its most economical load; but that what we have called the 'average high-grade engine' appears to about equal the turbine in its rate of steam consumption at most economical loads. In the next chapter the question of variable loads will be considered."

(A footnote reads as follows:)

"In discussing the paper by Parsons, Storey and Martin, before the Institution of Electrical Engineers, May, 1904, E. J. Fox said: 'Taking figures of steam economy as given by Mr. Parsons, for different sizes of turbines, there is no difficulty whatsoever in the reciprocating engine giving equally good results up to the 1500 kw size. From 100 up to 1000 kw, the results obtainable with reciprocating engines are better. When you come to the 1500 kw size, there is very little difference between the two; and finally with the 3000 kw size, I think there is no doubt a considerable difference in favor of the turbine.' "

J. R. Bibbins, engineer of the Westinghouse Machine Company, then read an abstract of his paper on "Recent Developments in Steam Turbine Power Station Work," published on page 758 of this issue. In conclusion, he presented some results of the test on the turbine installed in the New York Edison Company's Waterside station No. 2, published in the Street Railway Journal for Oct. 12.

President Adams thought the members could not do justice to the paper in an attempt to discuss it in the little time at their disposal. Mr. Evans said the members had been very greatly handicapped at this meeting from the fact that the papers were not printed and distributed earlier. It was certainly due Mr. Bibbins, who had no doubt given a great deal of time and attention to the paper, to have it distributed sufficiently early so that all could have become familiar with it; he felt they were partly to blame. He therefore offered a resolution that all papers and printed matter to come before the next convention be printed and in the mail at least thirty days before the meeting of the convention.

Mr. Hewitt said it seemed to him that this was a matter belonging to the officers of the association. Those who had experience know it is almost impossible to get papers in time to have them printed, and to offer a resolution that shall do certain things that cannot be fulfilled seemed useless.

Mr. Evans, in support of his motion, said that Sept. 14 comes around the same as Oct. 14, and if it is known positively that the reports must be prepared by Aug. 14 he was quite sure they could get the papers prepared.

Mr. Simmons said Mr. Evans's motion could be effective as a recommendation to the incoming executive committee, and as such he was strongly in favor of the motion. The motion was then unanimously carried.

GENERAL BUSINESS

President Adams said in reference to the resolutions to amend the by-laws that the passing officers of the association should be honorary members of the executive committee:

He found their by-laws required that an amendment should be submitted to the members thirty days in advance, so they would not be able to take action upon this question at the time. He would therefore leave the same for the consideration of the incoming executive committee.

Mr. Farmer said that in preparing papers the subject of the means and methods by which the power generated in the stations is gotten out and used in the cars had been neglected. The question covering the various problems of maintenance and construction of overhead lines were grave and serious ones. He suggested that the executive

committee in arranging the programme for the coming convention be requested to have some papers prepared—perhaps a question box—covering the lines indicated.

President Adams thought Mr. Farmer's suggestion excellent and if there were no objection he would let that matter go through to the incoming executive committee.

NOMINATING COMMITTEE REPORT

Mr. Clark, chairman of the nominating committee, then announced the nominations, as follows:

President, F. G. Simmons, superintendent of construction and maintenance of way, Milwaukee Electric Railway & Light Company, Milwaukee, Wis.; first vice-president, Paul Winsor, chief engineer of motive power and rolling stock, Boston Elevated Railway Company, Boston, Mass.; second vice-president, F. H. Lincoln, assistant general manager, Philadelphia Rapid Transit Company, Philadelphia, Pa.; third vice-president, W. H. Evans, master mechanic, International Railway Company, Buffalo, N. Y.; secretary and treasurer, J. W. Corning, Electrical engineer, Boston Elevated Railway Company, Boston, Mass. The executive committee consists of the officers and W. J. Harvie, electrical engineer, Utica & Mohawk Valley Railway Company, Utica, N. Y.; William Roberts, superintendent of motive power, Northern Ohio Traction & Light Company, Akron, Ohio; E. O. Ackerman, engineer, maintenance of way, Columbus Railway & Light Company, Columbus, Ohio; John J. Murphy, electrical engineer, Chicago Union Traction Company, Chicago, Ill.

Mr. Olds moved that the secretary be instructed to cast a ballot for the officers as nominated, and that the nominating committee be tendered a vote of thanks. The motion was seconded and unanimously carried.

President Adams said that before turning over the chair to Mr. Simmons he wanted to thank the members for the support he had received as presiding officer for the past two years. In reference to the retiring secretary, he said he had been with the association since it was organized in Detroit and had given his best efforts to its progress. (Applause.) Mr. Adams then introduced F. G. Simmons, the new president.

Mr. Simmons said the honor conferred on him was certainly beyond his deserts and accorded him through good fellowship by the gentlemen he had been working with; but he assured them he would do all in his power during his incumbency in office to promote the best interests of this association. He believed that the thanks of the association and of the incoming officers were due to Mr. Adams to the fullest extent for his untiring energy during the past two years. (Applause.)

Mr. Evans also spoke to the effect that he very much appreciated the honor of serving among the executive officers. He wanted to add a word of commendation for Mr. Adams's untiring efforts in connection with the work of the association.

Mr. Olds then made a few remarks about the growth of the association. The work of the past two years during the reorganization period had been grand, and really exceeded the hopes of the most sanguine. To a very great extent it was due to the efforts of Mr. Adams. During the day the thought had come up to the members to make a little present to him in remembrance of his assistance and advice to them. He then presented to Mr. Adams a fine French clock.

Messrs. Roberts and Baker also made some appreciative remarks.

Mr. Simmons explained that when this matter of making a fitting present came up it was decided to get a clock, but in canvassing Atlantic City they found that it was impossible to secure one of sufficient merit, so that the present clock simply represented what they wanted to do and a much more elegant one would be given later.

Mr. Adams expressed his gratification and said the work he had done in connection with the association has been done from the bottom of his heart. He had the sympathy of the work with him all the time. He felt in turning this work over to Mr. Simmons that it would be advanced considerably. This was due to the fact that the members were just getting acquainted. It was a great pleasure to him to have been able to direct the work for the past two years at least. (Applause.)

Mr. Corning said he appreciated very much the honor conferred upon him in electing him secretary and treasurer.

President Simmons, just before announcing adjournment, called for a meeting of all the members of the executive committee at the Dennis Hotel Thursday morning at 9:30, and asked that the retiring president, Mr. Adams, and the retiring secretary, Mr. Moore, be present.

ELECTION OF OFFICERS BY THE AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION

The final meeting of the American Street & Interurban Railway Association was held in the Sun Parlor on the Steel Pier Friday morning. After the reports and papers scheduled for the meeting had been presented the committee on nominations presented the following names as officers for the coming year. They were unanimously elected.

President, C. G. Goodrich, vice-president and managing director of the Twin City Rapid Transit Company, of Minneapolis; first vice-president, James F. Shaw, president of the Boston & Worcester Electric Company; second vice-president, Arthur W. Brady, president of the Indiana Union Traction Company, of Anderson, Ind.; third vice-president, Thomas N. McCarter, president of the Public Service Corporation of New Jersey.

FUEL AND STRUCTURAL MATERIAL TESTS OF THE GEOLOGICAL SURVEY IN PROGRESS AT THE JAMESTOWN EXPOSITION

The United States Geological Survey Fuel-Testing Plant, and a section of its Structural Material-Testing Plant, located within the Jamestown Exposition grounds, near Norfolk, Va., are now in operation and conducting various investigations relating to fuel efficiency and economy, and the strength of cements and of reinforced concrete beams. The authorities of the Exposition Company have designated, on the occasion of the annual inspection of the plant by the national advisory board, Oct. 25, 1907, as "Fuel and Cement Day." It has been arranged to have all the branches of the fuel-testing and cement-testing plants in full operation, and the Geological Survey hopes that engineers and others interested will take this opportunity to visit them, and witness the various tests and investigations being conducted. J. A. Holmes is the expert in charge.

Theodore E. Burton, who is the Republican candidate for Mayor of Cleveland, Ohio, in opposition to Tom L. Johnson, is the subject of a character sketch in the Saturday Evening Post for Oct. 19. In view of the principles for which Mr. Burton stands on the subject of the street railway franchise, which is the main issue of the campaign, the article is especially appropriate.

PROCEEDINGS OF THE AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION, OCTOBER 16, 1907.

The 1907 convention of the American Street and Interurban Railway Association was held at Atlantic City, N. J., Oct. 16, 17 and 18, 1907.

WEDNESDAY'S SESSION

President Beggs called the meeting to order at 10 o'clock and said it was because of the ample and superb hotels in Atlantic City as well as the liberality displayed by the Hotel Men's Association of the city that the associations were induced to have their annual meeting there. Mr. Beggs then introduced Mayor Stoy, of Atlantic City, who said the steel pier exhibit impressed him as a junior Jamestown Exposition. The citizens of Atlantic City realize the importance of this convention and many others similar to it, and pride themselves in saying they have the convention city of the United States. He referred to the possibility of having in Atlantic City a convention hall equal to take care of anything. The Hotel Men's Association and a number of other enterprising citizens have taken the matter up and propose to provide a hall for this purpose.

Mayor Stoy concluded with a hearty invitation to see the association again in Atlantic City.

President Beggs thanked his honor in behalf of the association. Mr. Beggs then presented the annual address, as follows:

PRESIDENT BEGGS' ADDRESS

I sincerely hope that you may all find Atlantic City to be what your officers and Executive Committee intended and expected it would be to you, one of the most enjoyable and suitable places in which we have ever met. Very careful and exhaustive investigation was given to the location of this year's convention. Before a selection was made, we had under serious consideration Boston, Baltimore, Washington, Norfolk and Atlantic City. We visited Norfolk in a receptive frame of mind, hoping that it might be practicable to hold our convention either on the grounds of or near the Jamestown Exposition, but after carefully considering the matter from all points of view, we were afraid that neither the hotel accommodations nor space for our exhibits was available at Norfolk and vicinity. We finally selected Atlantic City because of the ample hotel accommodations and the admirable provision made for our exhibits, there being but few cities in the country that have sufficient space of suitable character in which to house the exhibits. This matter is becoming of more importance year by year, and suggests the thought to many of those who are charged with the responsibility of the administration of your association, as to the necessity of locating at some one city where ample hotel accommodations and suitable space for exhibits are available.

Since our last annual convention your officers and executive committee have obtained commodious and admirably adapted permanent offices for the association, in the new United Engineering Societies' Building, at 29 West Thirty-Ninth Street, New York. This change subjects the association to considerably increased rental, but it was absolutely necessary to have larger and better adapted offices for the secretary and treasurer, and for the statistical library, in order to carry on the work of the association on the broader lines contemplated for it by the adoption of our new constitution and the perfection of the organization of the affiliated associations. I feel that the rental arranged for in the Engineering Society's Building is as reasonable as we could have obtained in any first-class office building in New York City, and locates the headquarters of the association with the several engineering societies of the country.

During the year the secretary and treasurer has more than maintained the record made during the preceding year, in the amount and value of the work turned out of his office, and it is with great pleasure that I bear testimony to his untiring energy and efficiency. From the statistics gathered in the secretary's office he has been enabled, during the year, to render valuable service to a number of companies holding membership in the association. That these services have been of great value and highly appreciated is evidenced by the fact that one of the companies to which this service was rendered sent to the secretary and treasurer a check for a substantial amount in recognition of his work. This check the secretary and treasurer voluntarily and properly returned to the company. This prompts me to suggest that in cases where the companies feel that the service they have obtained from the office of the association is of such great value to them, it would not be amiss for them to make a contribution direct to the association, to be used in enlarging the scope of its work. Your officers have been constrained to keep expenses down as much as possible, notwithstanding they recognize that additional help could be employed with great advantage to the secretary and treasurer. I hope that the finances of the association will justify the incoming officers and executive committee during the ensuing year to authorize the additional expenditure necessary.

At this time I desire to repeat the suggestion that additional effectiveness could be given to the office of the secretary and treasurer at a minimum of cost if the working position of the secretaryship of the several affiliated associations—I mean particularly the accounting, the engineering, and the claim agents—were placed in the office of the secretary and treasurer of the American Association. The position of secretary of those three associations should be an honorary one. This would enable a statistician and additional clerical force to be employed in the permanent office of the association, its work to be done by one of the assistants of Professor Swenson, and the honorary position held as is held the other executive offices of this association, who, as a matter of fact, do much more work than the secretaries do. The large amount of the labor of these associations is done in the office of the secretary and treasurer of the American Association, the greatest amount being preparing and getting out the annual reports of those associations. This will give a larger corps of employes in that office, enable some one to be assigned so that Professor Swenson himself would be able to leave his office more frequently without feeling that the work of the association was suffering, to go to some one of those cities where statistics gathered or his experience or evidence might be given in cases where it was needed. This I commend to the serious consideration of the three affiliated associations.

While upon that subject, in order that you may better comprehend the solicitude your officers feel respecting the necessity of administering the financial affairs of this association with care, I might state that the receipts of the association for the last fiscal year was $24,724.77, and that the expenses, kept down, as they were, amounted to $25,963.72. This association should have annual dues coming in to an amount of from $30,000 to $35,000 per annum to enable it to perform the work the way it should be done to the greatest advantage of the association, which means its individual members. In line with making this amount of money go as far as possible I suggest the consolidation of the salaried officers of the various affiliated associations. The presidents of those three affiliated associations are members of the executive committee, and they have been better consolidated so far as the executive heads go under our new constitution than was that of the secretaryships. We have two years' experience back of us now, and I think some of the apprehension, at least on the part of those who were so deeply interested in the welfare of these affiliated associations, has possibly been set at rest.

It is gratifying to be able to report that notwithstanding the increase in the dues that all of the larger companies which are called upon for the larger amount of dues, have continued their membership in the association, and that the total membership at the close of the fiscal year, Sept. 30, 1907, was 227, as compared with 200 at the beginning of the fiscal year, Oct. 1, 1906, and notwithstanding that the expenses of the association increased during the year to the extent of $2,991.75, the balance to the credit of the association at the beginning of the ensuing fiscal year, Oct. 1, 1907, is $6,137.95, as against $6,976.90 twelve

months previous. The associate membership in 1906 was 113; in 1907 it is 148, a gain of thirty-five.

Passing from the business affairs of the association to that of the companies holding membership therein, it is to be earnestly regretted that the association cannot report more favorable conditions existing between many of the companies and the communities in which they operate; largely owing to the continued unreasonable, vindictive and demagogic attitude of many of the public officials and politicians in the various localities where our companies operate. While I believe that this wave of unreasoning prejudice, denunciation and unwise legislation is at its crest, if it has not already commenced to recede, nevertheless it is a period when the greatest ability, courage, perseverance and patience are required successfully to withstand the attacks from all sides that are heaped upon those charged with the trying, exacting and perplexing responsibilities incident to operating public utilities at any time, but particularly in times such as we are now passing through.

No consideration appears to be given to the fact that while every element entering into the operation and maintenance of electric railways and other public utilities has greatly increased in cost, the companies not only cannot increase the charges for the service rendered, but in many cases unjustifiable and unreasonable demands are made for reductions in charges for the service rendered, notwithstanding the amount possible to be earned upon the capital invested does not, in many instances, equal the amount that could be realized on investments in mortgages or other classes of property not subject to the risks incident to investment in public utilities. I venture to predict that until a very radical change is worked in the minds of the general public it will be almost impossible to obtain additional capital to make the extensions and additions necessary to give to the cities and towns the transportation and other public utilities their increasing growth demands and renders necessary. This condition is, in my opinion, likely to continue until the several states provide for the creation and appointment of commissions with power intelligently and impartially to investigate and regulate the conditions of operation and the charges to be made by public service corporations to remove them from the exploitation of local politicians. Further, I venture the statement that there is no calling or profession in the world so difficult to fill successfully and with credit as that of administering the means of transportation in our large cities, be they surface, overhead or underground railways, where several hundreds of thousands, and in some cases millions, of people must be handled daily, and the bulk of them within a limited time during the hours of congestion in the morning and evening. Instead of receiving the hearty and intelligent co-operation of public officials to enable this service to be well performed, the corporations are frequently handicapped by unreasonable and impracticable regulations, and the failure to enact legislation and ordinances which would properly regulate traffic on the streets of the towns and cities and enable the public to be transported more safely and speedily.

The magnitude of the business of the street, suburban and interurban electric railways of the country may be judged by the fact that at the close of the year 1906 the total capital liabilities of these companies in the United States amounted to $3,765,317,875, being an increase of pracically $400,000,000 during the year 1906. The total mileage of these roads at the close of 1906 was about 36,932, an increase of 3782 miles during the year.

Since the last annual convention of the association great progress has been made in heavy electric traction on the steam roads, notably on the New York, New Haven & Hartford and the New York Central entering New York City, the details and progress of which have been watched with great interest by electrical engineers and the executive officers of the steam and electric railroads throughout this country; hence I will not take your time to go into them in detail; likewise standardization.

Since our last convention the development of single-phase alternating equipment has made gratifying progress, greatly facilitating and rendering less expensive the construction of high-speed electric interurban lines over outlying, sparsely settled territory, thereby rendering unnecessary the large investment required for sub-station and feeder construction for d. c. transmission. There has likewise been gratifying progress in the development of more efficient types of motors for d. c. operation.

It gives me great pleasure and satisfaction to bear testimony to the good work done by our affiliated associations, which will be evident to any one attending their meetings or reading their proceedings, and I particularly desire to commend the work done by the Engineering Association in its efforts to standardize apparatus and methods of using the same, and also the work of the Accountants' Association in still further perfecting the forms and methods of accounting.

A matter of great importance, and one which I do not think has been given that degree of attention which it merits by a large number of companies or by this association, is that of depreciation and amortization, and I feel it is time the companies recognize the vital importance of this question and take means to set aside funds to provide for the continual wear that is going on, as it is neither proper nor practicable to make good this wear by new issues of capital. Furthermore, companies having limited franchises should, in my judgment, make provisions for the repayment to the investors in the stocks and securities of these companies at the expiration of the franchises. In connection with one of the large companies which I have managed for some ten or eleven years past, I commenced, some years ago, setting aside a fixed amount of the gross receipts monthly—after charging to operation and maintenance current repairs and renewals—out of which has been paid extraordinary replacements and renewals. This company has been for many years subjected to the attacks of politicians and notwithstanding that the company entered into a contract with the city nearly eight years ago whereby many concessions were made by the corporation to the city in consideration of a few years extension of the franchise, among which were the sale of twenty-five tickets for $1, or six for 25 cents, the granting of transfers, the free transportation of policemen and firemen, etc., the City Council some months ago instructed the city attorney to institue proceedings to bring about a further reduction of fare to 3 cents. In pursuance of this instruction, the city attorney employed a firm of well known public accountants to make an exhaustive examination of the books of the company for a period of ten years, from Jan. 1, 1897, to Dec. 31, 1906. A large force of expert accountants were kept on this work for several months, and as a result the firm has presented to the city authorities possibly the most exhaustive report that has ever been made upon a street railway company in this country. Among other things the report says: "We found the books and records of the company to have been kept with unusual skill and accuracy, and we were accorded at the hands of the company every courtesy which would facilitate our work, and we are pleased to give here an expression of our appreciation of the consideration shown us. The attitude of the management in this respect is creditable, in view of the fact that our visitation was not at the instance of the company, nor was our work presumed to be for its benefit." They further state that "it is proper at this point in our report to observe that from the standpoint of the stockholder the books disclose results which mark the management of this company as being of uncommon capacity. From the same standpoint there is little left to be desired, since, in addition to the payment of good dividends, the property has been so well kept up that it probably is in better condition at the end of each year than ever before, while ample reserves have been accumulated with which to meet every contingncy which may reasonably be expected to arise in the conduct of the business. The standpoint from which we view the matter, however, is essentially different from that of the stockholder, since the interest of the public, represented in this inquiry by the city government, is not necessarily conserved by large returns to the stockholders, but is centered in the question of how cheaply may good service be given."

These expert accountants, acting for the city, and looking at the matter purely from an accounting point of view, and having no experience as to the operation of electric railways, practically take the position that we are not justified in creating the reserve funds which we know are absolutely necessary properly to maintain and keep up the property and to provide for the demands which are inseparable from the proper administration of this character of properties. For instance, by careful and close management, which the accountants denominate as of "uncommon capacity," and a familiarity with the fire insurance business, I felt that it was good policy to charge a small percentage—1 per cent of the gross receipts monthly to operation and carry it to a fire insurance reserve

fund, out of which all fire insurance premiums and losses not covered by insurance have been paid, the balance being invested to interest bearing securities, with the result that at the present time the company has in this fund $450,000 of first-class 5 per cent bonds, interest on which is likewise credited to the fund. It is unnecessary to state to you, gentlemen, who are experienced in placing fire insurance on these properties, how much influence the fact that the company has this invested fund has upon the rate the company is accorded by the old line fire insurance companies. This charge against operation, the expert accountants think was unnecessary, and propose to credit it back to net earnings. They likewise attack and propose to carry back to net earnings an amount of $350,000 the company has invested in first-class 5 per cent bonds to the credit of injuries and damages reserve; this fund having been accumulated out of a maximum charge of 4 per cent of our gross receipts. For several years of operation, however, the amount charged against operation and carried to the credit of injuries and damages reserve was only 3 per cent. This amount it is likewise argued by the accountants should be credited to net earnings, all for the purpose of showing that the company might have been operated for so much less money as to have permitted a fair dividend to have been paid upon the capital of the company and yet a lower rate of fare granted.

The absurdity of this will be evident to any manager of a large company who knows how long it would require to settle up and the amount of money necessary to pay for the injuries and damages that are hanging over these large companies, and which could not under any circumstances be settled in any reasonable manner in a less period than from five to seven years. I say that these companies should be so administered that if they were to go into liquidation at any time, they would have a fund created from month to month as accidents occur which would approximately discharge all claims pending against the company for injuries or damages either to person or property. I feel very sure that when these matters are properly presented to a court of equity the position of the company will be maintained.

I commend to your consideration the advisability of revising to some extent the schedule of dues as provided for in the constitution adopted two years ago. Some of the larger companies feel that the amount they are called upon to pay is out of proportion to the value they receive, as compared to the advantages of the association to the smaller companies. This is a matter worthy of your most careful consideration, as it now requires approximately $25,000 per annum to meet all the requirements of the association, and a larger amount could be expended with advantage to the member companies.

To the officers and executive committee, as likewise to the standing committees and to the past presidents of the association, I hereby tender my hearty acknowledgements and thanks for their zeal and attention to the business and interests of the association during the past year, and I bespeak for the incoming officers and committees equally enthusiastic, loyal and self-sacrificing service, for there never was a time when it was more necessary to stand shoulder to shoulder in protecting and advancing the interests and welfare of this great industry.

In connection with his reference to the satisfactory work done by the affiliated associations, President Beggs amplified his report by saying that the claim agents were also entitled to the same commendation; that they were in session on Tuesday for some five or six hours and had present forty-five members, which was the largest meeting they had ever had. Referring to the work of the officers, he said it would appear from the minutes of the executive committee that at one meeting of the executive committee during the past year five past presidents came to attend. That fact prompted him to suggest that there should be some official recognition given to the gentlemen who had filled these positions and performed the work of presidents, for no one had any idea of the amount of work there is to be done until he has passed through it. He had therefore suggested that the past presidents should be constituted honorary members of the executive committee, but without a vote therein, that this association may continue to avail itself of their position as representative men in this business. He also suggested that there should be special badges provided for the past presidents to distinguish them from the active members.

W. E. Harrington asked what steps were necessary to carry out the suggestion to the placing of past presidents on the executive committee.

President Beggs replied it would be necessary to present an amendment to the by-laws.

The secretary and treasurer then read the annual report of the association for the fiscal year ended Sept. 30, 1907. This showed a total of member companies in good standing on Oct. 1 of 184; of new member companies in good standing, 33; of reinstated companies in good standing, 10, making the active members in good standing total to 227, while the associate membership reached 148 on Oct. 1. The total receipts to Oct. 1, including balance from last year, were $31,701, while the expenditures were $25,563, leaving a balance on hand of $6,137.

The report of the executive committee presented an abstract of the minutes of the meetings of the committee at Columbus on Oct. 19, 1906, at New York on Jan. 28, 1907, and May 20, 1907, and at Atlantic City on Oct. 15. The minutes of the meetings on Oct. 19, Jan. 28, and May 20 were in printed form and were distributed to the members.

The president announced that a four-page circular would be distributed among the members containing a proposition from the Atlantic City hotel men.

President Beggs then introduced in turn Messrs. Tingley, Adams, Bradley and McGraw, presidents of the Accountants', Engineering, Claim Agents' and Manufacturers' associations.

Mr. Tingley endorsed Mr. Beggs's previous remarks about depreciation, Mr. Adams urged the acceptance of the standardization committee's report and Mr. Bradley pointed out how the operating department could help the claim department by adopting the best railway devices.

James H. McGraw, president of the Manufacturers' Association, said he was glad to stand up and be counted in behalf of the Manufacturers Association. Four years ago it was decided by the officers and the executive committee of the American Association that the old policies and methods were no longer useful and adequate in the development of this association, and back of it in the development of this great industry. Therefore, President Ely, at that time president of the association, and his associates on the executive committee, undertook the reorganization of the American Street Railway Association. The suggestion came to the manufacturers from the parent organization itself that they organize and lift the burden that had settled down upon the shoulders of the association in the way of the exhibits and the entertainments supplied by the local companies at those conventions. It had become a burden because the local company in inviting the convention also invited the manufacturers, and in a large measure was supplying the space for the exhibits at that time. The manufacturers organized and for four years have taken care of the exhibits and entertainment. At St. Louis it was not necessary to have an exhibit, as the exhibits were all placed in connection with the exhibition. At Philadelphia, Columbus and Atlantic City the exhibits grew better and better. Now some 75,000 sq. ft., exclusive of aisle space, is covered with exhibits. Therefore he felt that the Manufacturers' Association has justified its existence, and was proud to be a part of and co-operate with this magnificent association of electric railway men that has at last taken its proper place among the foremost scientific

bodies of America. He thought no one would question his statement that the American street railways have done and are doing a work for the people far greater and more important than has been done or undertaken by any other single industry. (Applause.)

He then thanked Mr. Beggs and his associates on the executive committee for what they have done for the Manufacturers' Association, and also thanked the Hotel Men's Association of Atlantic City for their hearty co-operation.

Mr. McGraw said he would like to add one word in regard to the test car used by the Railroad Test Commission of the Louisiana Exposition. The Commission had requested all the manufacturers who had loaned or given apparatus to that car to continue that loan indefinitely, but the Commission had now been out of existence for some time. If that car is important to the American Street and Interurban Railway Association he felt that the manufacturers will be glad to supply this apparatus without cost.

President Beggs presented the following data concerning members admitted since Oct. 1, 1907: Member companies Oct. 1, 1907, 227; new members admitted since Oct. 1, 1907, 15; old member company reinstated, 1, making a total of 243 member companies.

An invitation was received from the Asbury Park Convention Bureau asking that the next annual convention be held in Asbury Park. This was referred to the incoming officers and executive committee.

Under the order of new business C. D. Wyman offered the following amendment to the by-laws, to carry into effect the suggestions made with reference to the past presidents. The amendment was that paragraph A of article VI of the by-laws of the American Street and Interurban Railway Association be amended to read as follows:

"The entire charge and management of the affairs of the association shall be in the hands of the executive committee, which shall consist of the president, the vice-president and one member appointed by each affiliated association and all the past presidents of the American Street and Interurban Railway Association and its predecessor, the American Street Railway Association, these past presidents to be honorary members of the executive committee, but without power to vote at meetings of the committee. The executive committee shall make arrangements for carrying out the objects of the association."

The amendment was carred.

The report of the committee on compensation for carrying United States mail was deferred owing to the absence of the chairman of the committee, G. Tracy Rogers, who was expected next day.

Richard McCulloch, chairman of the committee on subjects, said it was hardly necessary to submit a formal report, as it consists of the schedule of arrangements and the papers submitted at the convention. The committee recommended that the new committee on subjects should lay out the programme for 1908 at once, so the work of selecting authors for the papers may be entered upon without delay.

Ralph Sweetland, as chairman of the committee on car wiring of the Underwriters' Association, said his association will be pleased to receive any suggestions from the American Association in reference to car wiring matters.

President Beggs said the railway men recognize that the interests of the two bodies are mutual. There have been many exacting regulations formulated by the underwriters in the past years simply because those who understood better the hazards and the method of preventing fires in our properties were not sufficiently frank with the underwriters.

The report of the committee on standardization of equipment was then read by the president. The report recommended was the one considered by the Engineering Association. While many possibly would find the recommendations are not just in accordance with their practice, he hoped they would find them the best to do in future. He therefore recommended that the report receive favorable consideration.

A. E. Lang said it would be an evidence of progress on the part of this association to put the stamp of approval upon the work of the standardization committee. He moved that the report be adopted as the standard for the guidance of the members of this association. The report was adopted by unanimous vote.

The next order of business was the paper entitled "The Technically Trained Man and the Electric Railway Profession," by Prof. H. H. Norris, Cornell University, Ithaca, N. Y. This paper is published on page 766.

W. Caryl Ely inquired if it is not worth something to the managers and the owners of the street railway organizations and companies throughout the United States to bring this organization up to a plane of dignity and efficiency where it commends itself to the men who are working in the various branches of higher education throughout this country and throughout foreign countries. Was it not beneficial for the association to get in touch with men like Professor Norris?

Henry W. Blake then presented the following contribution to the discussion:

Prof. Norris' discussion on the technically trained man and the electric railway profession is the first paper which I recall presented at a street railway convention by an active professor in one of our larger universities. In view of the large number of men who are graduating as electrical engineers from our technical schools into other branches of the electrical business, it is very desirable that a paper of this kind should be presented before the association, and it is appropriate that the topic should be suggested by one who has done so much for the street railway industry and association as Prof. Norris. Courses in engineering other than those required by military or civil engineers have received university recognition for a few decades only. But the tremendous demands during the last twenty or thirty years for technically trained men in all branches of engineering has resulted in the establishment of new scientific institutions and the expansion of the engineering department of most of the older universities. These courses have proved so popular that the engineering students, who formerly constituted only a small percentage of all those enrolled at the older universities, now equal in number the students in the academical departments if they do not exceed them. A tabulation was made last June by the editor of the "Electrical World" of the different schools engaged in engineering education. It showed that after omitting all manual training schools, as well as all colleges and universities which taught electrical theory only as a part of a course in physics, there were in this country 117 schools which have electrical engineering courses. Omitting from this number those institutions in which the electrical course is embryonic only, or is purely academic in character, there remain at the present time 96 schools which teach electrical engineering either as an entirely separate branch or as a specialization in mechanical engineering. These schools had, in the year 1906-07, 8929 electrical engineering students and had graduated 10,959 men from their electrical engineering courses. Of this number, 1358 men were graduated in 1907. No statistics were obtainable as to how many of these graduates had entered the electric railway field or how many of the undergraduates were expecting to do so, but it is safe to say from the specialization of electric railway engineering in a number of schools, and the large amount of time given to it in all of them, a considerable percentage of the undergraduates are prepared to do good service in this branch of electrical engineering. The practical question

then arises whether the electric railway companies are prepared to utilize the devices of these men to the same extent as they are sought in other branches of the work. To some it may seem that 1400 new electrical engineers a year, soon probably to rise to 2000 or more, will be greater than the absorptive qualities of the general electrical field, vast as we know it to be. This would probably be true if their activity should be confined to purely engineering work, but this is by no means the case. The demand for technically trained men from manufacturing, commercial, operating and, to some extent, financial corporations as well, is probably greater than ever before. In fact it may fairly be doubted if the schools are turning out nearly as many men as can be utilized with benefit to the electrical industry and with profit to the graduates. Experience has shown that the technical training which a man receives in any one of our higher class engineering institutions gives him a grounding in scientific principles and a discipline of mind which will enable him more easily to adapt himself to any department of work than if he had not enjoyed that advantage. This fact has been clearly recognized by the manufacturing companies, most of whom offer especial inducements to college graduates to become associated with them. To cite an example, one large electrical manufacturing company took on its force 243 new college graduates this summer. A successful manager of a number of electric lighting properties has made a college degree a condition of employment to any position looking forward to responsible work, whether connected with the engineering or the operating departments of his various corporations. He says that the mental discipline received in a university enables the graduate to adapt himself quickly to practically any department in which he may be placed, and that the chances are greater that he will develop the ability requisite for the work than one who had not received the same technical training. Many of the steam railroad companies make a special effort to secure technical men to recruit their ranks.

Prof. Norris' paper suggests a concrete plan by which the results secured by other companies in utilizing the college graduate may be carried out by street railway companies. His apprentice course of some 18 months should form an excellent method for learning the practical application of the principles acquired at the university, and the establishment of a trained corps of men in the way suggested by him should be of great future assistance to the railway companies.

Mr. Blake was followed by Professor Richey, of the Worcester Polytechnic Institute, who said that when in Indiana it was his company's policy to offer positions to technical graduates. Some of those men, besides making good for themselves, make good for the company, and in the Indiana Union Traction Company now the heads of at least two of the important departments are filled with those men, and with very few exceptions the Indiana Union Traction Company got its money's worth out of men who left to go with other companies. The apprenticeship course, Professor Norris suggested, is a very good one. Worcester Polytechnic Institute, which is a small institution, compared to many others through the country, has just completed a laboratory which with its equipment represents an investment of about a quarter of a million of dollars; between one-third and one-fourth of that investment represents equipment devoted exclusively to electric railway work. Ten men who are taking post-graduate work in electrical engineering this year are all taking the electric railway engineering course. Three of those ten men were interested enough in the association to come down from Worcester at their own expense. The technical schools can only give a foundation in electric railway engineering, for the men must have experience before they make engineers of any sort.

C. S. Sergeant said he had been interested for a great many years in utilizing technical graduates so long as they could be prevailed upon to remain with his company, but they were birds of passage. If one were to criticize at all it would be as to the brevity of the course in each department. The railway business is becoming more specialized all the time, and there is danger that the young man who flits about from a couple of months in one department to a month and a half in another will think he knows it all in a year or two. Nevertheless he believed in rotation from one department to another.

Mr. Wyman said his firm had been fortunate enough to secure for, what it calls, its school from ten to twenty graduates from Cornell, the Massachusetts School of Technology and other technical institutions. In their school they endeavor to give them first some practical education along the line of investigating statistics derived from the operation of their various companies. After having gained a broad and general view of the principal lines of work they are willing and anxious to undertake practical work with some of the different companies his firm controls. They start, perhaps, in shops and through there on up through the superintendent's departments, going into all the departments according to certain lines of education, and become superintendents, managers and presidents of the various companies. The practical courses which the technical schools and some of the universities are establishing along the lines suggested should be aided in every way possible by the street railway men.

W. H. Evans said it occurs to him the scheme would fail entirely, or at least in part, if there were but one apprentice at a time. If there were several much better results would be attained. Very much indeed depended upon the personality of the apprentice himself. He has used only this summer as many as four in the shop, but those apprentices will fail in the first step unless they get down to the level of those with whom they associate. They must disabuse their mind of the fact that they are there to gain all and to give nothing, because Jack and Bill and Mike and Tom are not going to unbosom themselves to a fellow who impresses them with the idea of his great superiority.

W. Caryl Ely said, in regard to the overalls, dirty hands and dinner pails, that there is an idea prevalent that men who are technically educated have to be taken down a peg in some way to make them accustomed to the things they would come in touch with in the shop or in the practical department. He thought there could not be a more erroneous idea, based upon the things one sees at Cornell and other institutions where men receive instruction in mechanical arts, engineering, etc. Why, they work hours and hours. He had known men to do sixteen hours of laboratory work at Cornell, and the overalls, grime, dirt and dinner pails were their regular daily accompaniment throughout the four years of their course. It is a mistake to think that a man has to be born with a red flannel shirt on him to enable him, if he has been through a course of instruction, to get down to good hard common work that greases his hands and smuts his face. (Laughter.)

C. L. S. Tingley thought too small a period of time was allotted to the man in his department, namely, the accounting end. Two months is entirely too short a time to give a man an insight into the details and working of a very important part of the railway business.

Ralph Sweetland then read the paper on "The National Fire Protection Association and Its Work in the Street and Interurban Railway Field," printed on page 770 of this issue.

Mr. Staats said Mr. Sweetland's report mentioned a great many leading associations who are members of the National Fire Protection Association, and later he said

practically every insurance association of importance throughout this country and Canada. That was covering some of the greatest underwriting institutions in America. He had in mind the Associated Factory Mutual Fire Insurance Company of England, and the American Railway Insurance Company, which was the first organization to take steps toward promoting the interests of the electric railway and lighting companies. One last feature to which he would make reference was the absence of any offer by the National Fire Protection Association to reduce cost of insurance after all these appliances so strongly recommended have been introduced.

Mr. Sweetland said the question Mr. Staats brought up would naturally appear in discussing the construction and equipment of a particular device.

At the suggestion of Mr. McClellan the paper by Mr. Campion and himself, published on page 771 of this issue, was read by title. The convention then adjourned until Thursday.

The detailed proceedings of the Thursday and Friday sessions will be published in the next issue of the Street Railway Journal.

PROCEEDINGS OF THE AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION

The second annual meeting of the American Street & Interurban Railway Claim Agents' Association was held at Atlantic City, Oct. 14-16, 1907, with President Henry C. Bradley in the chair.

The Monday meeting, Oct. 14, was opened with an address by John I. Beggs, who spoke as follows:

It affords me pleasure, gentlemen, to see here at this opening session of the Claim Agents' Association a number so greatly in excess of what I had the pleasure of seeing and addressing twelve months ago, and I think twelve months before that. I am glad to see that there is that interest manifested on the part of the various companies who are members of the American Street & Railway Interurban Association, which induces them to send so many of you here to meet together at least once a year and exchange experiences as to how best to counteract the efforts of the ambulance chasers and the various attorneys that in every community are attempting to make a great number of people believe that they are badly injured whether they are or not.

I think that one of the best things that railway corporations can do is to permit the heads of their claim departments to make occasional visits to the offices of other companies to exchange experiences and see the method employed by others in dealing with the claims. In the companies that I administer I have realized the value of that and not only have permitted but requested the heads of the Claim Department, the chief claim agent, the attorney and the surgeon to make visits to other cities to see whether there was not something that could be learned from them that had escaped us in our efforts to check the exactions of the general public, who usually applaud any successful claim against a corporation. The general public does not realize that this is a species of grand larceny. It will applaud any one who has been sufficiently skilled to defraud one of these companies in an injury and damage case.

My advice to the Claim Department of any company is to try to keep as many cases as possible out of the courts. I am well aware that what I am about to say is directly the opposite of the policy pursued by many companies. The principle which I impress upon our Claim Departments is, first, to get all the evidence, not only that which is favorable but that which is unfavorable. Many times companies are subjected to great and unnecessary expense simply because the investigators in the Claim Department get only the favorable side of an accident case and rest upon that, and the evidence is prepared upon that. I lay down the fundamental principle that while it is highly important to get all the favorable conditions, it is quite as important, and in fact more important, to get the worst side of the case that the executive head of the company may be able to determine whether it is one that ought to be settled or whether it is one to take into the courts.

In support of this general policy (which I know is contrary to that pursued by many companies), is the fact that one of the companies which I administer has not had a case in court but which has finally been sustained by the higher courts in a period of three years. At the end of each of those three years we have had fewer cases on the dockets of the courts of that city than we have had at the beginning of that year. That is the direct result of the policy I have outlined.

In my judgment every policy should be based upon the principle of right. If we know that through the negligence of our employes a person is injured, we are legally and equitably liable to pay for it. We should determine whether there is such liability existing, and then if it can be settled upon any reasonable basis settle as quickly as possible. It will stand you good in court. It is a valuable asset in the trial and settlement of these cases before the judges and before the general reputable lawyers of any community, that in any case having merit it is not necessary to take it to court.

On the other hand, if you are convinced that there is fraudulent intent, my directions to the Claim Departments are that "if that case can be settled for $500 and it will take $5,000 or ten times $5,000 to defend it, defend the case!" (Applause.)

In the Milwaukee company, ever since I have been connected with it, I have pursued one course, and that is that all connected with the Claim Department must come from the platform of a car. We do not employ young or half-boiled attorneys as investigators. We employ the brighest and keenest and most intelligent of our motormen and conductors, and there is no other avenue into the Claim Department. A claim agent who has been a motorman can check up the motorman in an accident. It sometimes happens that a motorman will try to put the blame on some one else, and sometimes the man who is in charge of sending out the cars will try to lessen the company's blame for the accident.

On conclusion of Mr. Beggs' remarks the treasurer reported that during the year ending Sept. 30, 1907, the total receipts were $922, from which had been expended $912.74. The chairman of the employment committee reported that he had received various applications for employment. The secretary then presented a report which outlined his work during the year, a large part of which was the notification letters concerning fraudulent claims, etc.

TUESDAY'S SESSION

The morning session was occupied by the reading and discussion of the following papers: "The Policy of the Claim Department to the Injured Employe," by R. H. Sheenen, claim agent, Lehigh Valley Transit Company, Allentown, Pa.; "The Claim Agent of To-day and His Work," by H. K. Bennett, claim agent, Fitchburg & Leominster Street Railway Company, Fitchburg, Mass.; "How I Manage Bad Cases," by Harry P. Vories, claim agent, Pueblo & Suburban Traction & Lighting Company, Pueblo, Colo. Mr. Vories's paper was read by Dr. Lemon, in the absence of Mr. Vories, who was prevented by illness from attending the convention.

Russell A. Sears, claim agent of the Boston Elevated Railway Company, in behalf of the Alliance Against Accident Fraud, made a plea to the members of the association and the question of the Claim Agents' Association becoming a member of the alliance was referred to the executive committee for action and report.

The afternoon session of the convention took up first a paper by Ellis C. Carpenter, claim adjuster, Indiana Union Traction Company, Anderson, Ind., on "The Selecting and Training of Investigators and Adjusters for the Claim

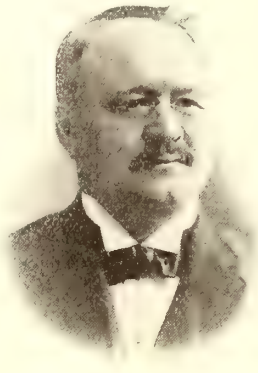
Department." After the paper was discussed, the question box was opened and the questions read and discussed.

The executive committee having in charge the consideration of the nomination of officers for the ensuing year, reported the following nominations: H. R. Goshorn, general claim agent, Philadelphia Rapid Transit Company, president; A. J. Farrell, claim agent, International Railway, Buffalo, N. Y., first vice-president; W. F. Weh, claim agent, Cleveland Electric Railway Company, Cleveland, Ohio, second vice-president; J. S. Harrison, claim agent, Jacksonville Electric Company, third vice-president; B. B. Davis, claim adjuster, Columbus Railway & Light Company, secretary and treasurer. The convention instructed the secretary to cast a unanimous ballot for the nominees.

WEDNESDAY'S SESSION

The Claim Agents' Association was called to order Wednesday afternoon at 2:30 by W. F. Weh, claim agent of the Cleveland Electric Railway, the second vice-president.

C. B. Hardin, claim agent of United Railways Company of St. Louis, St. Louis, Mo., read a paper on "The Claim Department, and What Should Be Done to Make It Effective." This paper appears on page 714 of this issue. Then a paper on "Instruction of Employees in Accident Work" was read by F. W. Johnson, assistant general claim agent Philadelphia Rapid Transit Company. This paper is published on page 711. Both papers were followed by discussion.



H. R. GOSHORN

H. R. Goshorn, the new president, was then introduced. Mr. Goshorn made a brief address in which he said: "There are many things which should be done, but probably the most important to which the attention of this association has been directed is a system of exchange of records and interchange of information, with reference especially to fraudulent claimants. The man who will devise the simplest, most comprehensive, least expensive and most practical method of doing this, will be entitled to the gratitude of the street railway owners of the United States. It means much to all of them and it is up to the claim men to produce such a plan. You all have a chance to make good. Think it over. Your idea may be the very one that will commend itself, but if you fail to give it expression it can never be known. One of the various systems now in operation may be found to answer all purposes, but your executive committee will consider all of them, together with any plans proposed by members of our association, as per instructions given yesterday by resolution of this body."

President Goshorn then announced the appointment of the following committees:

Executive Committee—Peter C. Nickel, New York City Railway; Charles B. Hardin, United Railways of St. Louis; E. C. Carpenter, Indiana Union Traction Company; Eugene R. Roberts, Knoxville Railway & Light Company.

Employment Committee—B. B. Davis, Columbus Railway & Light Company; H. V. Brown, Public Service Corporation; T. B. Donnelley, West Penn Railway Company.

Ways and Means Committee—William Tichenor, Indianapolis; M. S. Rausch, Milwaukee; Louis Lipphardt, Wheeling, W. Va.; H. K. Bennett, Fitchburg, Mass.

PROCEEDINGS OF THE ACCOUNTANTS' ASSOCIATION

The eleventh annual meeting of the American Street and Interurban Railway Accountants' Association was held at Atlantic City, N. J., Oct. 14-16, 1907.

TUESDAY MORNING'S SESSION

President C. L. S. Tingley called the meeting to order at the Hotel Chalfonte at 10 a. m. on Tuesday. After the approval of the minutes of the last convention, President Tingley made the following address:

PRESIDENTIAL ADDRESS OF C. L. S. TINGLEY

It is with great diffidence that I arise to address you at this our eleventh annual convention. A wise man has said that there is nothing new under the sun, and when I look back over the list of my predecessors in office, I realize to the full the force of that saying. Yet, as your president, I have a few things to say to you, and I beg your forebearance if they are not new. The first duty of an executive in his annual communication is to give an account of his stewardship. I therefore submit a brief resumé of the events of the past year.

At the Columbus convention the sale of our Standard Classification of Accounts to the general public was authorized, and the price suggested by the executive committee was $1 per copy. Acting upon this authority, I have instructed the secretary to sell the Standard Classification at that price, and a number of copies have been so sold. The question as to whether a reduced price shall be made on these in quantities will be brought before you in the report of the executive committee. At the close of the Columbus convention the president of the American Association handed me a letter from Prof. H. C. Adams, statistician of the Interstate Commerce Commission, asking that the American Association appoint a committee to confer with him, looking to the preparation of a form of report to be used by roads electrically operated, which, under the provisions of the Hepburn Act would come under the jurisdiction of the Interstate Commerce Commission. The president of the American Association requested me as president of this association, to confer with Prof. Adams as to the appointment of such a committee. During the course of my correspondence on the subject with Prof. Adams, the scope of the question was broadened by him so that our co-operation was asked with the representatives of the Association of American Railway Accounting Officers, in an effort to harmonize the standard classifications of accounts used by steam and electric railways. This correspondence resulted in the appointment of a special committee consisting of W. F. Ham, F. E. Smith and your president, which met in Washington, consulted with Prof. Adams, and met the Standing Committee on Disbursements of the Railway Accounting Officers' Association. This conference developed the subject, and recognizing its importance, and also its difficulties the committee summoned to their aid the Standard Classification Committee. After thoroughly going over the whole question, and a further conference between your special committee and the Committee of Seven of the Railway Accounting Officers' Association, your committee finding that there were fundamental differences between them and the steam railroad men, which did not seem to be adjustable, withdrew from the conference, notifying Prof. Adams of their action, with the reasons therefor, and that we would proceed at once to the preparation of a scheme of accounting and form of report to be submitted to him.

As for some time past there has been criticism from some of the interurban railways that our standard classification did not make proper provisions for their accounting, it seemed wise to the chairman of the special committee and your president that a Committee of Interurban Accountants be appointed to suggest to the Standing Committee on Classification of Accounts such changes and amplifications of our standard as would cover their needs. Your president accordingly appointed W. H. Forse, Jr., A. C. Henry and A. B. Bierk such committee. The matter received careful consideration at their hands and their report was submitted to the Committee on Standard Classification at a joint meeting of the two committees, and the results of their deliberations will be submitted to you in the report of your Standing Committee on Classification of Accounts. This is one of the most important and far-

reaching questions that has ever come before this association, as it not only affects those roads which come directly under the jurisdiction of the Interstate Commerce Commission, but also, indirectly, all roads, as the various states will undoubtedly be guided largely by the action of that body. As an indication of what the Commission is doing in this direction I would call your attention to an article which appeared in the *Railway World* on Aug. 9, which says: "Under the direction of Prof. Henry Adams, the statistician of the Commission, an expert of the accounting division of the Commission, S. L. Lupton, has been sent out to confer with the various state railroad commissions. His purpose is to ascertain the views of state commissions in regard to harmonizing the accounting systems for the railroads required by the general government and by the states. The National Association of State Railroad Commissioners has already given this subject some attention, and has committees at work upon it. They will report at the next meeting of the association in October. Mr. Lupton is expected to be through with his investigations by that time, and to have some interesting views to present to the association. Probably the most important matter in this connection relates to the division of the revenues and the expenses of the roads by States. Prof. Adams hopes to bring about an understanding between the state commissions and the Interstate Commerce Commission on this subject, whereby the same system of computation will be used throughout. The subject is one of great moment in reference to railroad taxation. Prof. Adams and his aides have already worked out what they consider is a fair and equitable method of dividing the expenses of railroads as between states. They have not as yet worked out the method of dividing the revenues. This is a more difficult matter. It is something in which the state railroad commissioners are much interested, and Mr. Lupton, among other things, is getting the ideas of the state commissions upon it. If a scientific system of dividing the receipts and expenditures of roads as between states is reached and enforced, the labor of state assessment and state taxing bodies will be made much more easy, and comparative figures as to what railroads are doing by states will be of much more value. It will also be of great assistance to the Interstate Commerce Commission and the various state commissions to have the accounts of interstate roads made up on the same basis as the Interstate Commerce Commission requires of interstate roads." This, of course, applies primarily to the steam roads, but in the logic of events will also apply to those electrically operated. Your president therefore bespeaks your most careful attention to the report of the Classification Committee and is sure that you will meet this question in a broad, enlightened spirit.

Closely related to the above is the question of interurban accounting; and, as has been stated, some of the interurban members have expressed the feeling that their special line of accounts have not received due attention at the hands of the association, and suggested the consideration of such topics as interline billing, interline tickets, station accounts, etc., at this convention. This suggestion was received some months after the program had bene completed, and could not be acted upon at this time and is referred to the incoming Executive Committee. In reply to the implied criticism, I would call the association's attention to some history, namely, that at Columbus last year all of the papers were applicable to both urban and interurban companies; that at Philadelphia in 1905 two of the four papers were purely interurban; that at St. Louis in 1904 the entire program was applicable to both, and that in 1903 and 1902 one exclusively interurban paper was present each year, so this phase of our work has not been entirely neglected.

At the Columbus convention last year we resumed the discussion of a most important question, depreciation. Some of you will remember that at the meeting in 1897, H. G. McJilton, of Baltimore, read a paper on this subject, and several of your presidents have adverted to it in their annual addresses, but no consecutive work has been done on the question. Your executive committee, believing that the time was opportune and the subject worthy of a fuller discussion, has again placed it upon your program. I have heard some questioning of the propriety of this association discussing this question on the ground that it is one of policy to be determined by the directors of the several companies and not by accountants. It is quite true that there is a question of policy here, and that it lies in the province of the boards of directors to say whether or not depreciation shall be accounted for and at what rate. This association does not assume to say to any board of directors that it must account for depreciation, but it can with propriety say to the electric railway fraternity that depreciation is a fact and that it should be accounted for. In my humble judgment, this association and the individual members thereof will be derelict in their duty to their board of directors, their stockholders and the public if they evade this question. It is as much an accounting question as it has been treated as is the question of what should be charged to construction and what to maintenance. Furthermore, it is a question that will not down; it demands an answer. Sooner or later it will be forced upon us by governmental authority and it behooves us to be ready with our answer when the time comes. The only way a proper answer can be given is by discussion, such as was had last year at Columbus, and such as I hope we will have in this room on Thursday.

As your representative your president attended the convention of the National Electric Light Association held in Washington, June 4 to 7 last, being invited by the president of that association to discuss the report of a special committee on a standard classification of accounts for electric lighting companies. A very voluminous report was submitted, giving evidence of much hard work on the part of that committee, but the form and grouping of accounts as suggested by them diverged widely from our form of accounting, so that as your president I suggested that it would be unwise for that association to adopt such a classification, for the reason that many companies, particularly among the smaller ones, were engaged in both classes of business, that it would be annoying and tend to confusion to be dealing with classifications diverse in form and grouping. The National Electric Light Association referred the report of its committee back for further consideration. As an outcome of this meeting there was sent out a circular letter to all members of this association, asking for information as to the number of companies that were engaged in both electric railway and lighting business, also as to what companies were engaged in business other than electric railway and lighting. Replies were received from ninety-two companies, fifty-three of whom did both railway and electric lighting; thirty-seven did railway only; one railway and gas; seven did a heating business in addition to railway and lighting; twenty did a gas business in addition to railway and lighting; one operates a ferry; two operate water companies; two operate ice plants; two are preparing to do a lighting business, and one operates railway, gas and water. From the above figures and from the interest displayed by a number of the companies, it would seem to your president to be the part of wisdom to ask for a conference with the National Electric Light Association on this most important subject. Mr. Edwards, chairman of the National Electric Light Association's committee, is in attendance at the meeting of the association to-day as our guest, and will be asked to speak to us on this question.

Our relations with the affiliated associations have been most cordial, and as your representative on the executive committee of the American Association, your president has attended all the meetings of that body and assisted in the selection of the place of holding the convention.

The question of standardizing shop reports has not yet been settled. Your president took up the matter with the president of the Engineering Association, but that body was not prepared to take up the work in time to report to this convention. I would, therefore, recommend that the incoming executive committee confer with the Engineering Association, looking to this most important question being considered during the coming year and reported on at the next convention.

C. F. Bryant, elected as second vice-president of this association, at Columbus, severed his connection with the Connecticut Railway & Light Company last winter and tendered his resignation, which was accepted with regret. Frank R. Henry, auditor of the United Railways Company, of St. Louis, was elected his successor.

I regret that our finances are not in a more flourishing condition. We have received from the American Association during the past year the sum of $1,250, being $250 less than received during the previous year, although the same amount was appropriated for our work by that association. We have kept within our means, but only by again trenching upon our surplus from previous years. The details will be given you in the

report of your treasurer, to which I ask your careful attention. It is only fitting that I should express my great appreciation of the loyalty and co-operation of the executive and other committees of this association, without which little would have been accomplished during the year.

Upon concluding his address Mr. Tingley introduced John I. Beggs, president of the American Street and Interurban Railway Association, who spoke as follows:

It has always been a source of pleasure to me to meet the accountants when convened for the purpose of advancing the science of the accounting of these properties to which many of us have devoted the best years of our life. I am here to-day as a duty devolving upon the president of the American Association, but I consider it in a higher sense a privilege to be here as one who spent many years back of the accounting desk and, as preliminary to that, in instructing young men in the science of accounting. Consequently I have always taken a very deep interest, first, in the organization of the Accountants' Association, and since that time, at nearly every meeting, I have trespassed upon the time of this association for a few minutes. I shall not take much of your time to-day, because my views upon most of the questions that have come before you in the past and are likely to come before you this year, and possibly in the future, are very well known to quite a number of the older members. I do not mean older in years, but those who have been attending the sessions of the Accounting Association from its organization. The company that I represent has the honor of having supplied a president to your association. I speak of H. C. Mackay, who I regret was not able to meet with his old-time associates here to-day, he having transferred his allegiance, as is known, to the steam railroad business, not an advancement by any means, I think rather a retrogression; but his health would not permit him to continue in the arduous service of the street railway business, so he got something easier. (Laughter.)

I have listened with a great deal of pleasure to most of your president's address, and am very glad to see the manner in which some of these matters have been touched upon, particularly that of depreciation; and there might be added to that the word "amortisation," which is quite as important. I agree with your president that it is a delicate subject to take up for general discussion, particularly in the Accountants' Association, because outside of the executive heads of these companies, I do not think there is any one in their organizations who is so allied to a realization of the importance of this matter of making provision for depreciation and amortisation as the accountants, who are brought daily in contact with these questions. Being thoughtful men, they must of necessity look into the future and begin to cast about for what is to be done with these properties, many of which have been created anew within the last few years, and on which the element of wear does not seem as yet to have made very great impression. Nevertheless, it is going on all the same. On very few roads of the country, unfortunately has any provision been made thus far to provide for the replacement or the making good of that wear when it shall have gone to such an extent that the rails and overhead equipment must be renewed, and likewise the rolling stock. It is not fair to assume that when that time comes a new batch of bonds shall be put upon the properties; that is not right. One of the proper elements for upkeep, for the maintenance of these properties, is the wear that is going on on the equipment from the first day that it is put into operation. Many of these roads over the country have been unloaded onto unsuspecting investors upon a showing that a very large percentage, in some cases I have seen it put as high as 70 per cent. of the gross receipts, as net earnings over and above operation, when directly the opposite figures were the fact under a proper system of administration and accounting. Thirty per cent in many cases was not realized when the 70 per cent was made to appear. This is largely the work of promoters, gentlemen, who do not go into this business as some of us who have spent our lives in studying it. We have our fortunes in it and are not running one line of business and making investments in another. There are many of that class in this industry. Therefore I agree with your president that it is a matter which must be approached judicially and judiciously. Yet many of these properties are struggling through sparsely settled territory; I am speaking now of the outlying suburban and interurban lines that ultimately will build up a good business. I recognize that it is not possible for those roads to adopt this method. It is not possible for all those roads immediately to set aside the amount that we know is necessary to make provision for the wear that will be so evident in twelve or fifteen years from now, and that must be made good; but after those roads have been built up in earning capacity, then that which was not set aside in their earlier years should be set aside in greater amount in the after years. Instead of paying large dividends and driving the price of the stock and the securities up, they should take hold and set aside these funds that are absolutely needed and are just as much a legitimate operating cost as is the replacement of a pair of wheels that have slid flat or broken a flange or of an armature that has burned out.

But, as your president suggested, these are largely questions of policy, and particularly in these times we approach it with a little more hesitation even than we would have twelve months ago. It is not necessary to say to you, who are making the entries on our books, how difficult it is to-day to secure the necessary capital to build the additional lines and ends of lines to give a longer ride for a nickel to accommodate the public. They did not take into account the capital involved in the building of every new mile of road and of every additional car put onto the line. I do not mean replacement. In these days I do not know where you can turn to any banker or banking community to obtain that capital, and that is a condition brought about by the very people who are clamoring for these additional facilities and the increased length of ride. It is because of the unreasoning, abusive clamor of the public of the localities through which these properties are operated. It began with one class. It cannot stop there. It is bound to go on. Therefore, I throw out the suggestion that you approach this subject carefully. It is a difficult task for those charged with the larger affairs of these companies.

One of the properties of which I am the head has been for the past twelve months, nearly since the last annual convention of these associations, going through a very severe and drastic drilling by the Railroad Commission, in the first place, passing upon complaints made by the Common Council of the city, and later by the city attorney of that city, in an effort to compel that company to reduce its rate of fare from 4 cents to 3 cents. Some of you gentlemen who are familiar with this class of business know how difficult it is to administer one of these properties on a 4-cent fare where about 80 per cent of your entire business is done on tickets sold at twenty-five for $1 or six for 25 cents. And yet that does not suffice, notwithstanding that we believe that it is a duly entered into contract. One of the things demanded was that our books for a period of ten years be opened up to the city authorities, and the books of the Milwaukee Electric Railway & Light Company were taken from Jan. 1, 1897, to Dec. 30, 1906, a full period of ten years, just the time I have been intimately connected with the company and chargeable with its administration. That was only a coincidence, however, but they took a period of ten years to try to show that the company's receipts had been such during that time that we might give a lower rate of fare and still return a fair amount on what they considered the value of the property, taking in simply its replacement value to-day, nothing allowed for the acquisition of a streak of rust and some franchises for which originally millions of dollars were paid and for which capital had to be issued, that capital still being outstanding and to continue outstanding until by some means of amortisation we may provide out of the earnings funds to repay the holders of those securities. That is what I mean by an amortisation fund. Companies with limited franchises must take this into account and make provision at the end of that time so those investors, their heirs and successors, the children of some of us who have put our all into these properties, shall be secured. I have had faith enough in these properties to put nearly everything I had in the world into them, because if I had not that faith I could not have acquiesced in seeing others put their money into it. Therefore, gentlemen, as accountants, it is highly important in these days, when some city authorities or some railroad commissions demand that your books and accounts be spread before them going back for ten years, to see to it that these accounts are kept in such a way that you will not shrink upon turning the entire mass of books, records and statements of the company into a room with a corps of expert accountants, as was done with the Milwaukee Electric Railway & Light Company. And I consider it one of the highest compliments that I have ever received in the administration of any business that in one of

the most voluminous reports that I have ever seen, comprising 100 and odd pages of a folio possibly 30 ins. long and 14 ins. or 15 ins. in depth, and then another report of nearly 200 pages of 12 ins. x 14 ins., filled with figures, every figure in connection with that company for the full period of ten years, prefaced with a written report of thirty pages, going in and giving very astute analysis of the business; that in one of the first paragraphs of their report they commend the company for the manner in which all these books and accounts have been thrown open to them and the facilities that had been given them to obtain all the information that they desired. In the next paragraph they commend the skill and accuracy with which those books as a whole had been kept for the entire period of ten years. (Applause.)

Now, I do not wish to go back forty years to the time when I was lecturing before some 500 students in Philadelphia, which we are now so near and from which I have been so many years gone, when I was a teacher in Bryant & Stratton's Commercial College in what was then the old Temple Building, at Tenth and Chestnut Streets, and which is brought back to my recollection when I get talking before this accountants' association; but I urged them, and I have urged in every business since with which I have been connected, that every accounting room should be run in such manner that if the Angel of Death appeared between sundown and sunrise and translated every one of them to a sphere where they do not run on trolley wheels, but where we are to be given wings, that a new set of accountants coming in the next morning could take up those books, ask no questions, but go ahead with them. That, gentlemen, is accounting. It is not running simple columns of figures. It is understanding the principles of debit and credit and of honest, straightforward accounting, and that is the way these companies ought to be run. If they were all run like that, and had all been operated like that in the latter years, some of us would not be blushing today because of what the newspapers are heralding over this country. We are all suffering for it—and must all suffer. We cannot help it. We must stand together to a certain extent. The securities of every company of this character in this country must suffer when any one of the prominent companies suffers. We stand together, and that is what I have urged in these associations for all these years that I have been so active in them. We must set an example. They go on furthermore to commend the uncommon capacity of the company, and that leads up to what? Nothing left for the stockholders to desire, or the investors; that notwithstanding good dividends had been paid for many years on a property which eleven years ago was bankrupt; that notwithstanding good dividends had been paid, and the property better at the end of every year than ever before, that depreciation reserves had been built up, and they in their great wisdom as duly certified public accountants, did not think that these reserve funds were necessary. Therefore, in their method of accounting and arriving at what we might do and what the city might demand, they said these amounts created over a period of ten years, should be carried back to profit and loss to show that after the payment of these dividends there was a sufficient amount accumulated that might warrant a reduction in the rate of fare. This, of course, is great wisdom, gentlemen. It is fortunate they are not the court of last resort.

Let me tell you what one of those funds is. I have pursued, as some gentlemen here know, a rule of thumb in many of these things. I have a rule of thumb, as they call it; see through a mass of papers and pick out the flaws. Well, that is possibly a matter of long experience and not any special ability; but the largest amount that that company has ever charged against operation and carried to what I call our Injuries and Damages reserve, is 4 per cent of our gross receipts, and that for possibly the last five or six years prior to which that charge was 3 per cent, so that it has run somewhere from 2 per cent up to as high as 4 per cent, which is the maximum ever charged against operation and carried to this Injuries and Damages reserve fund. Against that fund are charged all payments for injuries and damages to persons or property, all the legal expenses, all the expenses of physicians and surgeons and hospitals, claim agents, and of every kind and nature. In the administration of that one item, the Milwaukee Electric Railway & Light Company has accumulated and invested in high grade 5 per cent bonds $350,000, the interest of which is likewise carried to that fund which I propose to continue to increase. Now, in their great wisdom, they say that is not necessary. We all know, gentlemen, that if that company went into liquidation to-day it would have to be administered very judiciously indeed, with the injuries and damages always hanging over us. My belief is that these companies should have created, month by month and day by day, the amount necessary to enable them, if they went into liquidation to-day, to do so without calling for additional capital to take care of that liability, because that is as certainly a liability as any which is placed against a company.

Another item they attack: We charge 1 per cent on gross receipts against operation and carry it to our fire insurance reserve. We have been doing that for a considerable length of time, and are in the fortunate position to-day, and I do not believe the city will take that from us, of having in that fund $450,000 of high grade 5 per cent bonds. Against that fund we charge every dollar of insurance premiums paid, and if we have any small losses that are not covered, and no insurance policy ever covers them all, we charge it all against that. We simply have permitted these accretions over a period of ten years. The very existence of that fund probably saves 50 per cent on our fire insurance premiums, because we are not beggars before the old-line fire insurance companies. I have finally got myself into a position where, if need be, we can carry our own insurance to the extent of $450,000, which will cover any possible loss we can have. With our properties spread over a city of a great many miles in area, we can afford to do it. Ultimately that is what we will do; that is what we have been preparing for. Yet these expert accountants say that fund is unnecessary, and so with other funds. But this is a character of accounting which you may be called upon to defend some of these days.

Now, they have attacked our depreciation reserve. That fund I have not deemed it necessary or advisable to invest, because it is one we are spending month by month and year by year. There has been a time when on the books of the Milwaukee Electric Light & Railway Company that account was on the wrong side, when we had spent more than had been carried to it, after keeping up our property. It is a question of policy with many companies, whether they shall do it as we do, or whether it shall be done in some other way. Some managements have deemed that it was more accurate carefully to value every branch of the company's property and carry a certain percentage. I have chosen to apply what I call my rule of thumb and to take a certain percentage of our gross receipts every month for what we call repair renewal of property, which has been for several years past 10 per cent. It began eleven years ago at about 15 per cent, because then we began charging a fixed amount. The property was in a condition of collapse, and when we got down to where we were charging $180,000 a year, it was about 15 per cent of our gross receipts. When the earnings were about $1,800,000, I began charging 10 per cent and carrying it to depreciation reserve fund month by month. When we had gone to scrap or sell for junk a lot of old cars, antique or obsolete, and replace them with modern equipment (notwithstanding that modern equipment is sometimes twice the capacity of the old, the old cost more), we charge that to depreciation reserve. When we relay any section of our tracks throughout the city that has already been laid once (when I went there I think we had something like 76 miles of 56-lb. Johnson girder rail on chairs that has nearly all been replaced mostly with 7-in. 97-lb. T-rail), we charge that against depreciation reserve. Consequently that fund is a changing one, built up during the winter season and running down during the summer season when we are doing our construction work. We consolidated 5 miles or 6 miles of car lines. I took up the old strap rail and used it for guard rails and replaced it with the other; but it had cost more in the original capitalization and construction. That is one of the ways in which we avoid the water, and that is what I call rule of thumb. It is not getting scientifically down and charging 2⅞ per cent on one thing and 7 8/9 per cent on something else. These accountants, I believe, figure out that while we have been charging 10 per cent, they think 8 per cent is enough. Well, I think if we had had sufficient earnings I would have liked to charge off 12 or 15 per cent.

Now, there is a fund we have not started at all, and that is the amortisation fund—provision for the securities that are out. The time comes with the companies that have limited franchises when that must be taken care of. You know how much consideration you would receive from a city to-day when a franchise has expired. I think some of the gentlemen before me here are up against that proposition now. They receive prac

tically no consideration whatever at the hands of the municipality. They do not consider that there is a mutual obligation there, one of honor at least, if not in law, that ought to be recognized.

I trust that you, gentlemen, will pardon this reference to one property, but I only take it as one of a type, and one with which I am familiar. I know what is going on in other cities. One of the other companies we came into the administration of some two and a half years ago we are administering on the same general principles. It is more than a policy, it is a principle of administration, and I think it is high time that it received attention. While you gentlemen of the accounting department are powerless in most cases to dictate the policy that shall be pursued, you can make yourselves felt by constantly bringing to the attention of the executive heads of these companies these statements showing month by month the analysis of these accounts in a quiet, unobtrusive way. Of course, the bankers see these properties from an entirely different point of view than we do. They go in for a quick turn. They want big dividends which enable them to turn the securities over quickly and get out; then they are ready for something else. But we who are administering these properties have to stay with them. With us it is a matter of principle; our reputations are at stake. Some of us who have given the best years of our lives to building up these properties in an earnest desire to have proper methods of administration and of financing and accounting followed, are very deeply concerned in these questions. Therefore, it is a matter of pride and of honor, and you can do much in your quiet way, not necessarily here in convention, but in your accounting offices, when you take your statement month by month before the executive heads who possibly appear before the bankers or board of directors in these various companies that they may have these facts before them; that they may not in the years to come say that this never was presented to them in this way. There is a great deal in the way figures are read. It is an old and trite saying that figures will not lie but that they can be so arranged in juxtaposition as to be very misleading. It is not everyone who has the faculty of taking a mass of figures and analyzing the points in them. That is one of the things that you, gentlemen, as trained accountants, can do, and when I use the word "accountant," I use it in the broad, general sense.

Recently I had occasion to take a statement from my pocket and say here were some smaller properties. We could not begin a depreciation reserve fund with those. I took one up in Central Wisconsin, for instance, around the Fox River Valley. We took a lot of old properties, including a gas company as well as electric light and street railway. This company for several years did not have any surplus, no net earnings. We had tc get these properties rehabilitated practically out of themselves. We could not afford to set aside any depreciation reserve fund up until 1907. In the year 1906 that property showed earnings on the entire capital stock out against it of between 6 and 7 per cent after keeping it up well. We had never paid any dividend. Then, at the beginning of this year we charged against operation 5 per cent of our gross receipts, and will increase that amount annually to the extent of 1 per cent until it gets up to at least 10 per cent. This will make that property show somewhat less net earnings during the year 1907 than it did during the year 1906, but it will not be very much, because of the growth of the business. Then I believe for the next five years we will about keep on the steady keel of practically 6 per cent on the stock, but each year setting aside a larger amount to the depreciation reserve fund, so that when a part of that track that was all new some eight or nine years ago begins to wear out, we will have some funds against which to charge that renewal and replacement. I have done that with a number of small companies, and did it with our own big traction company outside of the city of Milwaukee. We were not able for several years to set aside any reserve fund for that property, because to have done so would have shown a deficit year by year. Now, then, as soon as that company began to make money, before it began to pay dividends, we began creating this depreciation reserve fund, four years ago. This year I think we are charging 9 per cent of our gross receipts to depreciation. Next year it will be up to 10 per cent. Then it will be up to my standard. I am a believer in charging a percentage of your gross receipts. On an interurban line, for instance, when your summer receipts are two and three times what they are in the winter season, you are getting two or three times the amount carried to the creation of that fund, when the earnings can stand it, that you get in the winter when most of these interurban properties are earning less and when you are charging a much smaller amount against depreciation. So you have a much more uniform method of comparison month by month than you would have on a fixed percentage, which on some of these smaller properties would make the deficit seem very large indeed. It is not necessary to say to those running interurban lines here that their net earnings are made in about four or five months of the year, that from about the first of January up to June many of these interurban properties running through sparsely settled territory lose money. Then is the time when you want to ease up as much as you can on the charges to them. That is only general, however, but I mention it because of the points touched upon in your president's very able address here, that it is necessary to bring these two lines of accounting together. We in our properties have done it because we have had the interurban properties all the time and we have amalgamated our accounts. That is one of the reasons they vary somewhat from the standard system of accounts of the Accountants Association. We likewise have injected into ours the gas business as well as the electric lighting, which have added a much more difficult problem than either of the other two. We have three or four companies in which we own the gas, the electric light and the railways, all running as one property. We have been working many months trying to get up a consolidated sheet that will show the earnings from all of these earnings and properly apportion the general expenses and capitalization to the various branches of it. I am very glad indeed to know that the Accountants Association is going to lend its experience, its skill and its great industry to bringing about a standard system of accounts in these matters; will be very glad to see how far we have gone from the point where we should have stopped in trying to bring these accounts together. Now, I desire to convey to you, an expression of appreciation from the American Association for the degree of loyalty we have had from this and each of the other affiliated associations. I desire to bear testimony that your President has been at every meeting of the Executive Committee that has been called. Wherever it has met, he has been there, ably representing the Accountants Association, loyally standing by the American Association, which, in its first years of our greatly increased expense is a somewhat complex problem to keep going in harmony and to make the finances hold out. As you all know, the expenses of the American Association have been very greatly increased indeed and I think the results abundantly justify the expenditure. It has been located in commodious, well-appointed offices; it has at its head a secretary and treasurer, a man able, loyal and industrious, who is gathering a great amount of data of inestimable value, not only now but for the future. Therefore it is highly gratifying to be able to say after two years that so much has been accomplished, because there were some misgivings at Philadelphia two years ago, when this Constitution was under discussion, as to how the affiliated associaitons would amalgamate with the American Association. It has worked out much better than even the most sanguine of us could hope to bring about, and it is largely due, gentlemen, to the loyalty, to the earnest, conscientious work of the Executive Committee, which is composed of the presidents of these affiliated associations, along with the officers of the American Association.

The secretary then read the annual report of the executive committee; also of the secretary and treasurer, which showed a total membership of 246 and a gain of 46 since the last convention; total receipts for the year, $1,785.30; disbursements, $1,446.43, and a balance of $338.67.

C. F. Balch, special examiner of railway accounts for the Interstate Commerce Commission, briefly addressed the association. He was followed by W. J. Myer, representing the second district of the New York State Commission, and by H. M. Edwards, representing the National Electric Light Association.

Frank J. Pryor, Jr., comptroller American Railway Company, read a paper on "Park Accounting," published on page 701. This paper was discussed at length by C. N. Duffy, C. S. Rogers, A. L. Linn, Jr., W. F. Ham, Frank Dabney, C. L. White and Frank P. Henry, of St. Louis.

W. M. Steuart, of the Division of Statistics and Accounts of the Bureau of Manufactures of the Department of Commerce and Labor, then addressed the convention and was granted the opportunity of presenting at a later session some questions which he desired to discuss in relation to the approaching census.

On motion of F. E. Smith, the president was authorized to appoint a committee pursuant to the suggestion made by H. M. Edwards, to meet with the committee of the National Electric Light Association and of the gas association to agree upon a standard form of reports applicable to all the interests concerned.

On motion of A. L. Linn, Jr., a similar authorization was made in respect to the committee suggested by Mr. Myer, to act with the New York State Commission, that committee to be comprised of members of the standard classification committee, at a conference to be held at Albany on Tuesday next, the committee being given power to act. The president appointed the following committees:

On nominations: W. B. Brockway, D. Dana Bartlett, R. D. Sims, S. C. Rogers, H. C. Walters.

On resolutions: P. S. Young, Frank Dabney, A. H. Kayser, P. J. Balagner, W. G. McDole.

An adjournment was then taken to reconvene at 2 p. m. in the Chevy Chase room of the Hotel Marlborough for luncheon. This luncheon was largely attended and was most enjoyable.

The association reconvened Wednesday afternoon at 3 o'clock. The first order of business was an amendment to the by-laws recommended at the morning session of the American Association, constituting past presidents members ex-officio of the executive committee, which was referred to the incoming executive committee to be formulated, and in order that due notice may be given that the amendment will be considered at the next annual meeting.

William M. Steuart, chief statistician of the Bureau of Manufactures, addressed the association on the census to be taken next year. Copies of the tentative schedule were presented.

Mr. Steuart said that the information furnished by each company would be considered by the census bureau as absolutely confidential. The data will be used only for the statistical purposes for which they are furnished and no publication will be made whereby the financial operations of any company can be identified. The form of accounting promulgated by the Accountants' Association will be used in collecting the financial statistics. Mr. Steuart added that he was very much disappointed, however, at the last census to find that probably not more than 15 or 20 per cent of the companies used the form.

F. E. Smith, auditor for the receivers of the Chicago Union Traction Company, then read his paper on "Mechanical Devices and Other Office Appliances." This paper appears on page 703.

The committee on "Standard Classification of Accounts and Form of Report," then made its report.

The morning session on Thursday was taken up with the consideration of the tentative report of the committee on "Standard Classification of Accounts and Form of Report." The consideration of this matter was concluded at the afternoon session and the following resolution was adopted:

"Resolved, That the tentative classification of operating expense accounts submitted by the committee on 'Standard Classification of Accounts,' in its formal report, be approved as amended and referred back to said committee for final revision with power to act."

In the absence of J. H. Neal, auditor of disbursements, Boston Elevated Railway, his paper, "Where Maintenance Ends and Depreciation Begins," was read by W. F. Ham, of Washington, D. C. This paper is published on page 700.

In the discussion Mr. Ham agreed with the writer of the paper that it was by picking out individual instances that a proper idea of depreciation could be reached. He further thought that the trouble in the past had been that the question had not been looked at from that standpoint.

F. R. Henry thought that the point instanced by Mr. Ham could be further illustrated by looking at the question of replacing storage batteries, which was a specific item with a specific cost on which a very close estimate as to its life could be made. He saw no reason why the rate of depreciation could not be determined for other items.

W. B. Brockway said that he wished that Mr. Neal had stated which of the seven plans mentioned in his paper he favored. It seemed to the speaker that the greatest safety lay in method No. 2, erroneously headed No. 3 in the paper. He said there were methods other than the seven enumerated for arriving at the total amount to lay aside each month or each year, and asked that Mr. McDole would explain the method employed in Cleveland, based on the car-mile plan.

W. G. McDole said they had gone back for ten or twelve years and compiled the cost of maintenance, and on this basis, on track and equipment, for instance, charged out so much per car-mile, and on the power houses so much per kilowatt-hour output.

President Tingley said he thought that was the right principle, and that he had been making some studies himself along those lines.

W. H. Forse, Jr., Indiana Union Traction Company, emphasized the differences in properties with relation to depreciation. One property would be upon an established operating basis, such as most city lines, and another would be building in a new country.

The president appointed the following committee, pursuant to action taken at the first session, to confer with the National Electric Light Association on a common form of reports for both railway and lighting companies, and also to confer next week with the Public Utilities Commission of New York for the second district. This committee is constituted from the "Standard Classification" committee, and consists of W. F. Ham, C. N. Duffy and F. R. Henry.

The following officers were then elected:

President, F. R. Henry, auditor United Railways Company, St. Louis, Mo.

First vice-president, R. N. Wallis, treasurer Fitchburg & Leominster Street Railway, Fitchburg, Mass.

Second vice-president, W. H. Forse, Jr., secretary Indiana Union Traction Company, Anderson, Ind.

Third vice-president, S. C. Rogers, treasurer and auditor Mahoning & Shenango Railway & Light Company, New Castle, Pa.

Secretary and treasurer, E. M. White, treasurer Birmingham Railway Light & Power Company, Birmingham, Ala.

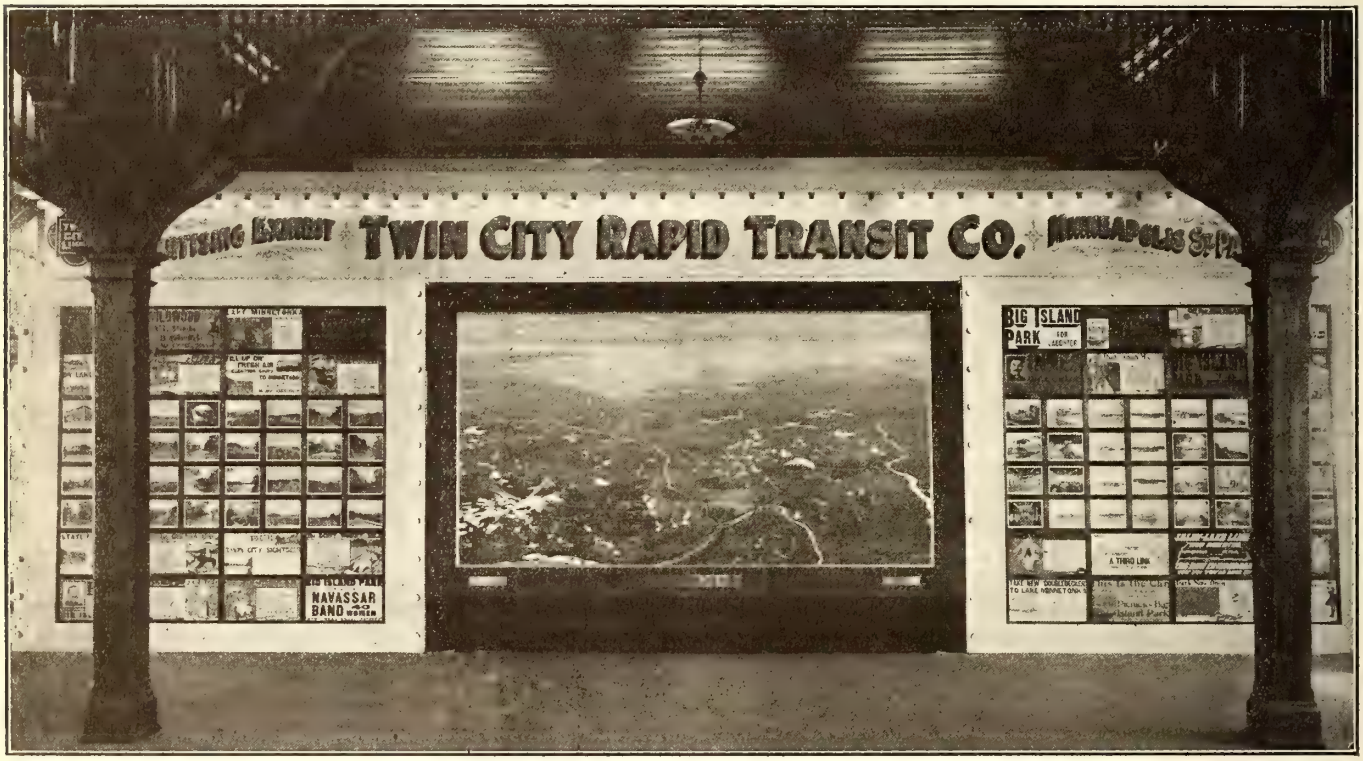
Executive committee—The officers and C. L. S. Tingley, second vice-president American Railways Company, Philadelphia, Pa.; A. L. Linn, Jr., general auditor Rochester Railway Company, Rochester, N. Y.; A. R. Patterson, general auditor Savannah Electric Railway Company, Savanna, Ga.; H. E. Wells, secretary and treasurer, Tri-City Railway Company, Davenport, Ia.

The convention then adjourned.

THE TWIN CITY EXHIBIT

A. W. Warnock, the general passenger agent of the Twin City Rapid Transit Company, who has gained an enviable reputation by the advertising matter he has turned out from time to time in the interest of the company, had an exhibit at the convention that is characteristic of the man and bespeaks the progressive methods of the company with which he is identified. It was an immense perspective in water color of the scenic country in and around the Twin Cities. It shows in detail the beauty of this great territory, 1500 sq. miles of which is traversed by the Twin City lines. Far away to the northern horizon is shown the Rainy River district and the Canadian border, while in the upper right-hand corner is shown the southwestern extremity of Lake Superior, where is located Duluth, Minnesota's third city. The river within vision to the extreme right is the St. Croix, on which are located the thriving cities of Stillwater, Minn., and Hudson, Wis. The larger bodies of water lying to the north are Mille Lac, Leech and Winnibogoshish lakes. In the foreground are the gorge of the Mississippi River ("Father of Waters"), which with its tributary lakes and streams is unsurpassed for industry and pleasure. On this river are located the Twin Cities, from which the Twin City Company's lines reach out into many suburban directions. The lowlands along the Minnesota River show at the extreme lower edge of the picture, while at the confluence of the Minnesota with the Mississippi is famous old Fort Snelling. Here also is the quaint old village of Mendota ("The Mingling of the Waters"), and below it Pike Island, on which was signed a treaty with the Sioux Indians, conveying to the United States the sovereignty of much of the territory shown in this map.

On both sides of the picture were shown in ivory frames, with mahogany trimmings, sixty-four large platinum-tint photographs of interesting features of the Twin City lines together with a large assortment of colored posters, which are used by the company in all its publicity work. The story of "Hi Jinks, the picnic person," illustrated in the Street Railway Journal recently, was also presented. The entire exhibit was lighted with eighty-five frosted incandescent globes. The company went to the expense of making the exhibit in order to show the character of its equipment and permanent way and what it is doing to develop business. An excellent idea of the main feature of the exhibit and the tint photographs is conveyed by the accompanying engraving.



THE TWIN CITY PERSPECTIVE AND TINT VIEWS ALONG THE COMPANY'S LINES

PROMOTION OF TRAFFIC IN CINCINNATI

The committee on trade extension of the Business Men's Club of Cincinnati, appointed some time ago to devise means for extending local trade in that city, has incorporated in its report a feature that is of much interest to the interurban railways. In order to get the best results from the numerous electric railways that enter the city, the committee advises the authorities to give such companies easy access to the business district and arrange for a central terminal station. The committee had written to Columbus, Cleveland, Dayton and a number of other cities for information on this point, but at the time of making the report had heard only from Dayton. This report showed that for the year ending July 31, 1,750,000 passengers had been handled by the interurban roads centering in that city, and that the people came from within a radius of one hundred miles of the city. All of the roads enter the heart of the city, bringing the passengers close to the stores and other business houses. This is absolutely necessary in order to secure the best results from the people who come to the city on the interurbans. Trade follows the lines of least resistance, says the report, and the best way to stimulate it is to make it easy for interurban passengers to reach the heart of the city. In order to accomplish this, the roads should be granted an entrance to the city and should be centered in a central down-town station.

PROPOSAL OF ATLANTIC CITY INTERESTS

The proposition submitted to the American Street & Interurban Railway Association and its affiliated associations and mentioned by Mr. Beggs at the meeting on Wednesday morning is contained in the following letter to the executive committees of the association by the Atlantic City Hotel Men's Association. The latter body also proposes to submit the same proposition to The American Railway Master Mechanics' Association, The Master Car Builders' Association and The Railway Supply Manufacturers' Association:

Gentlemen:

The Atlantic City Hotel Men's Association believes that no city in the country equals Atlantic City in the number and excellence of its hotels at the service of large conventions. There is also no city with better transportation facilities or more convenient to the large centers of population. There is lacking at present an ideal exhibition hall; but nowhere, so far as the association knows, is there a permanent structure perfectly designed and equipped as an exhibition place for a steam or street railway convention.

It is true that the location over the ocean of the Steel Pier in Atlantic City is unique and attractive, and the experiences of the Railway Supply Men in June, 1906 and 1907, indicate that it is a very desirable exhibition place in the absence of rain and high winds. An exhibition covering a period of eight days can, however, hardly fail to include one or more days of unfavorable weather. Any outdoor location then becomes uncomfortable, and both exhibitors and spectators lose valuable time.

Furthermore, the growing tendency towards heavier exhibits will eventually require a special hall for railway exhibition purposes. While the Steel Pier is able to carry heavy loads, the weights now proposed are approaching those of the heaviest cars and locomotives. In fact, the ideal structure must necessarily be so strong that it may as well also carry the track exhibit. The combination of track and regular exhibits which such strength would make possible, would add greatly to the interest and value of the convention.

It should also be remembered that in making the arrangements for the 1906 convention on the Steel Pier, the restrictions of the Boardwalk Easement Deed caused some embarrassment. While this was largely overcome, and in 1907 a better understanding of conditions prevented similar difficulties, nevertheless, the ideal exhibition hall should not be subject to the easement deed.

These facts have led the Atlantic City Hotel Men's Association to consider what might be done to afford the exhibitors ideal facilities.

That the citizens of Atlantic City, as a matter of public spirit, will provide the unusual structure and equipment needed by the railway conventions can hardly be expected. The interest in control of Young's Ocean Pier on the Boardwalk at the foot of Tennessee Avenue, are, however, preparing to improve their pier and will provide an exhibition Hall of the type desired, if satisfactory arrangements can be made. There is, therefore, an opportunity to secure through a private corporation suitable accommodations, provided that assurances from the Railway Associations warrant the expenditure necessary to the development of the plans in detail, and that additional assurances from the individual exhibitors justify the cost of the heavy construction and special equipment essential to the peculiar requirements of these exhibitors.

These conveniences may be used by the Pier Company in July, August and September for exhibits by the general advertisers of the country. Some exhibitors who are members of the association will undoubtedly wish to take part in the summer exhibitions. A special part of the structure will be set aside for those who maintain a continuous exhibition during the June conventions, the summer exhibition and the October conventions. The revenue from the summer exhibition, together with what may reasonably be expected from June and October, will warrant the necessary investment.

An Exhibition Hall with the following location, plan and equipment is proposed:

(a) The site of the Exhibition Hall will be the central portion of Young's Ocean Pier. This pier is located on the Boardwalk between Tennessee Avenue and New York Avenue. The Boardwalk is not only Atlantic City's chief thoroughfare for visitors, but is so directly connected with her most important hotels as to be an integral part of them. The site proposed adjoins the outside of the Boardwalk. The hotels, the Boardwalk and the Exhibition Hall will therefore form one complete plant for convention and exhibition purposes.

(b) The Exhibit Building will have a net area of exhibit space of approximately 150,000 sq. ft., or more than twice that now used. Of this, as much as exhibitors contracts warrant will be built at once, and such additional areas added from year to year as the demand justifies, until the total amount is built.

(c) The building will be a long and comparatively narrow structure, approximately 90 ft. wide, with a 15-ft. exhibit space next the wall on either side, two 15-ft. aisles, and two 15-ft. exhibit spaces back to back between the aisles. Thirty-ft. exhibit spaces may be obtained by throwing two such center spaces together.

(d) At the far end of the building, rooms for the meetings of the Railway Men will be provided. Every exhibitor will thus be satisfied with his location, because every railway man, in going to and from the meetings, will pass every exhibit.

(e) Good light and good wall space will be secured by lighting the exhibit room with windows at least fourteen feet above the floor.

(f) For handling heavy cases, machinery and so forth, there will be over the double central exhibit space, and perhaps over the other spaces as well, a traveling crane of heavy capacity running the entire length of the building.

(g) There will be high pressure steam connections to a number of spaces, compressed air outlets in a still larger number and electric feeder and telephone wires in every space.

(h) The spaces will all be equipped with standards, columns, counter, sign cornices, railings and so forth, and the whole building will be decorated in accordance with a general scheme. Thus each exhibitor need bring only his exhibits and such special forms of decorations and accommodations as he may desire.

(i) If a proper franchise can be secured from the city, it is proposed to run a railway track giving direct outside railroad connections with the pier. In this event, tracks will be laid below the deck of the pier in such a way that the rails can be covered when not needed. Tracks will be laid in the fifteen-feet aisles; and also, for track exhibits, on platforms on both sides of the pier outside of the building.

(j) In addition to the exhibit spaces and aisles, there will be provided suitable rooms for the secretary and his assistants, for meetings, for storage of crates, boxes and other paraphernalia, for lavatories and for miscellaneous purposes. Most of these rooms will be created in the main structure by means of movable partitions and will be adjustable in size.

(k) An approach to the pier and a considerable proportion of the Exhibit Hall will be built to carry the heaviest locomotives and other equally heavy loads. For the remainder, such a construction will be adopted as seems best after consultation with exhibitors.

(l) The Exhibit Hall will be heated.

(m) No extra charge will be made for janitor service, heating, general lighting, local telephone service, standard booth signs, use of traveling crane, and steam, electricity and compressed air for power purposes. Sign lighting will be charged extra.

(n) The Exhibit Hall will be fireproof and of the highest standard in every respect, including structure, facilities and equipment. It will be operated in the best possible manuner and all exhibitions appearing in it will be the leaders in their respective fields.

Such a plan provides a specially designed building along the lines which the Supply Men have themselves suggested. Each exhibitor will receive the full equivalent of his payment in exhibit space at a cost not materially greater than that to which he has been accustomed. These results will be obtained without the annoyance and difficulties incident to the purchase of a site, and the construction of suitable buildings and equipment by the exhibitors themselves.

The Atlantic City Hotel Men's Association desires the criticism and suggestions of those interested, and also an expression of opinion as to whether the following financial proposition will meet with the approval of your association, and whether your individual exhibitors may reasonably be expected to make contracts for the equivalent of sixty thousand feet per annum for each convention for five years, payment to be made in advance.

The proposed financial arrangement is as follows:

For space in the Exhibition Hall during October and including the Convention of the American Street & Interurban Railway Manufacturers' Association.....$1.00 per sq. ft.
For the month of October, as above, during five consecutive years, 1909, 1910, 1911, 1912, 1913, if paid in advance before the building is first opened, the sum of.....$3.75 per sq. ft., equal to 75c. per year.
For the month of June, including the Convention of The Railway Supply Manufacturers' Association....$1.00 per sq. ft.
For the month of June, as above, during five consecutive years, 1909, 1910, 1911, 1912, 1913, if paid in advance before the building is first opened, the sum of.....$3.75 per sq. ft., equal to 75c. per year.
For the months of June and October, as above for five consecutive years, 1909, 1910, 1911, 1912, 1913, including both Steam and Street Railway Conventions in those months, if paid in advance before the building is first opened.....
.....$6.00 per sq. ft., equal to 60c. per month, per year.

Space reserved in the Exhibit Hall for the association will not be let during June or October except to qualified exhibitors; provided, however, that if a minimum amount of space is not taken by the association or the individual members comprising it before a date to be mutually agreed upon, the balance may be let to others. Under certain restrictions contracts with exhibitors may be cancelled in order to protect the reputation and standing of the pier.

The subject is now submitted for consideration in order to obtain assurance that the Associations of Railway Men will hold their meetings in Atlantic City during a period of five consecutive years, beginning with 1909, provided the Exhibit Hall shall be constructed for the Conventions of 1909, and in order also to obtain from the Manufacturers' Associations their approval of the facilities andd the financial arrangement proposed so that individual exhibitors may be encouraged to enter into contracts with the Pier Company. If these essential conditions are granted by these associations, the Pier Company will undertake to secure the proper engineering and architects' plans and to enter into suitable contracts with the individual exhibitors. Should they be successful in this, as anticipated, the work will proceed promptly. If the desired arrangements cannot be made and a proper number of contracts secured, the whole subject will be dropped and the associations entirely released from their obligations. In any event, it is not intended that any association, as an association, shall assume liability for the payment of rent for exhibit space. Arrangements for exhibit spaces will be made entirely with the individual exhibitors and be contingent upon sufficient contracts being signed to assure the success of the plan.

Should the association agree to meet in Atlantic City for five years, it is intended that the members of the Atlantic City Hotel Men's Association shall enter for the whole five years into contracts regarding hotel rates and other matters.

In short, the interests in control of Young's Ocean Pier and the Atlantic City Hotel Men's Association will, if your association and the other associations addressed:

(1) Determine to meet for five years in Atlantic City for the customary length of time in 1909. 1910, 1911, 1912 and 1913, provided the terms of this proposition are carried out; and

(2) Signify your approval of the general scheme proposed above.

Make detailed plans along the lines indicated and endeavor to enter into contracts with the individual exhibitors and others.

Atlantic City Hotel Men's Association.
By A. T. Bell, President.

It was decided to refer the matter to the incoming executive committee of the American Street & Interurban Railway Association with instructions to take the subject up with the American Street & Interurban Railway Manufacturers' Association and the other bodies interested. The executive committee was given power to act in the premises.

The large consulting engineering firms in the country were well represented at the convention. One of them, J. G. White & Company, had an exhibit, and the gentlemen representing that firm are mentioned in the list of exhibitors in this issue. Stone & Webster were represented by C. D. Wyman, W. G. Dimmock, J. B. Lukes, Charles L. Wallace, D. P. Robinson and Lee H. Parker. Among the representatives of Westinghouse, Church, Kerr & Company were Carl M. Vail, H. R. Kent, W. D. Smith, A. H. Twombly, W. B. Trowbridge, C. G. Wilson and Wallace Franklin.

AN UNDERHUNG INSULATOR

The Locke Insulator Manufacturing Company of Victor, N. Y., is now making a suspension type insulator which is sometimes called the underhung insulator. It consists essentially of several unit insulators of moderate size attached mechanically so as to form a string of insulating units of great mechanical and electrical strength. Its main advantage lies in the fact that it permits indefinite expansion by the addition of units, and as the distance between the transmission line wire and the earth is very great, static strains are reduced to a minimum, whereas in the ordinary pin type of insulator there is considerable static strain between the line wire and support, due to the fact that they are ordinarily not more than three inches apart. As its name signifies, the suspended insulator depends from the under side of the cross arm or structural steel support. The method of application is clearly shown in the accompanying illustrations.



THE UNDERHUNG INSULATOR—CLOSE VIEW

ACCELERATING PASSENGER MOVEMENT

The accompanying cut is a reproduction of a 10-in. x 18-in. poster printed in red, which is placed in the open cars of the Kingston Consolidated Railroad Company. It will be seen from the text that the responsibility of passengers in helping to keep the cars to schedule is brought out in no uncertain way, and a special attention is given to the "end seat hog." C. Gordon Reel, general manager of the company, states that these posters have proven very effective in making the passengers realize how much they really are concerned in making the service effective.

IT'S UP TO THE PASSENGERS

TO KEEP THIS CAR ON SCHEDULE TIME.

MOVE QUICKLY WHEN GETTING ON AND OFF BUT ALWAYS WAIT UNTIL THE CAR STOPS.

DON'T MAKE PEOPLE CLIMB OVER YOUR KNEES TO GET ABOARD, BUT MOVE OVER TO THE CENTER AND LEAVE THE ENDS CLEAR. FIVE TO A SEAT.

DON'T BLAME THE COMPANY WHEN TIME IS LOST IF THESE SUGGESTIONS HAVE NOT BEEN FOLLOWED.

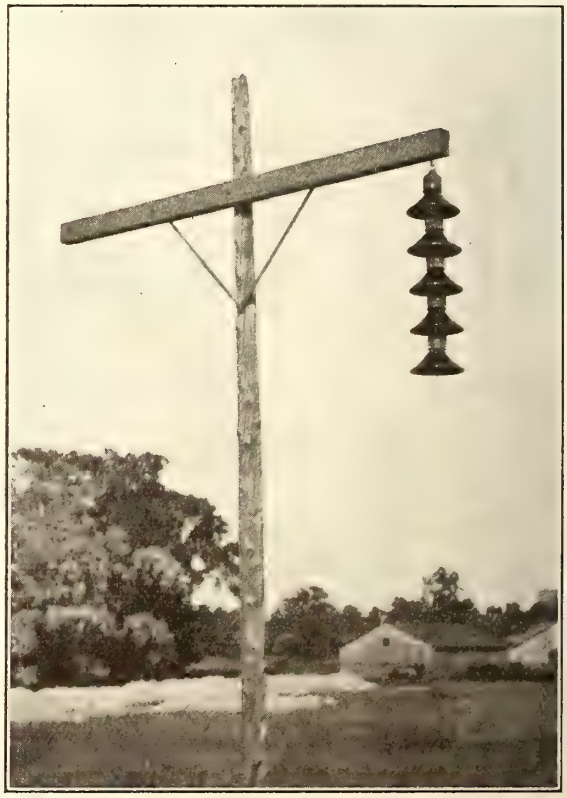
KINGSTON CONSOLIDATED R. R. CO.

KINGSTON CAR POSTER

NEW STYLE OF VESTIBULE

In connection with the problem of vestibuling closed cars for the protection of motormen and conductors from bad weather, J. P. Sjoberg & Company, of New York, have recently made several improvements in their three and five-light vestibules. Instead of hinging the center sash as has been the practice heretofore, it is mounted on an angular steel track overhead. Any degree of curvature is taken care of as the sash is provided with swivel sheaves, which adapt themselves to the curvature of the track while the sash moves diagonally across the angle. The sash is further guided at the bottom in each corner by plates with rollers running between guide strips, permitting the sash to operate freely above these guide strips. When closed the sash is held in position by a sash fastening which also serves as a handle to operate the sash. The side lights are fastened directly into the stanchions or frame of the vestibule. Narrow wooden or brass channel stiles are employed in constructing the center sash, thereby giving the motorman a maximum amount of light. The portable vestibule projects a few inches over the dash, thus giving the motorman a free swing of the controller handle.

All closed cars of the Brooklyn Rapid Transit Company are provided with this type of vestibule. The Brooklyn & Coney Island Railroad Company also has 200 five-light vestibules of this type in service. The New York City Railway Company has 600 in use and the manufacturer is now completing an order for 1400 more. When this is delivered nearly every closed car in Greater New York will be equipped with the Sjoberg vestibule. This type of vestibule is conveniently placed on the car out of the way of the headlight and gives free play to the brake and controller handle.



UNDERHUNG INSULATOR AS IT APPEARS ON LINE

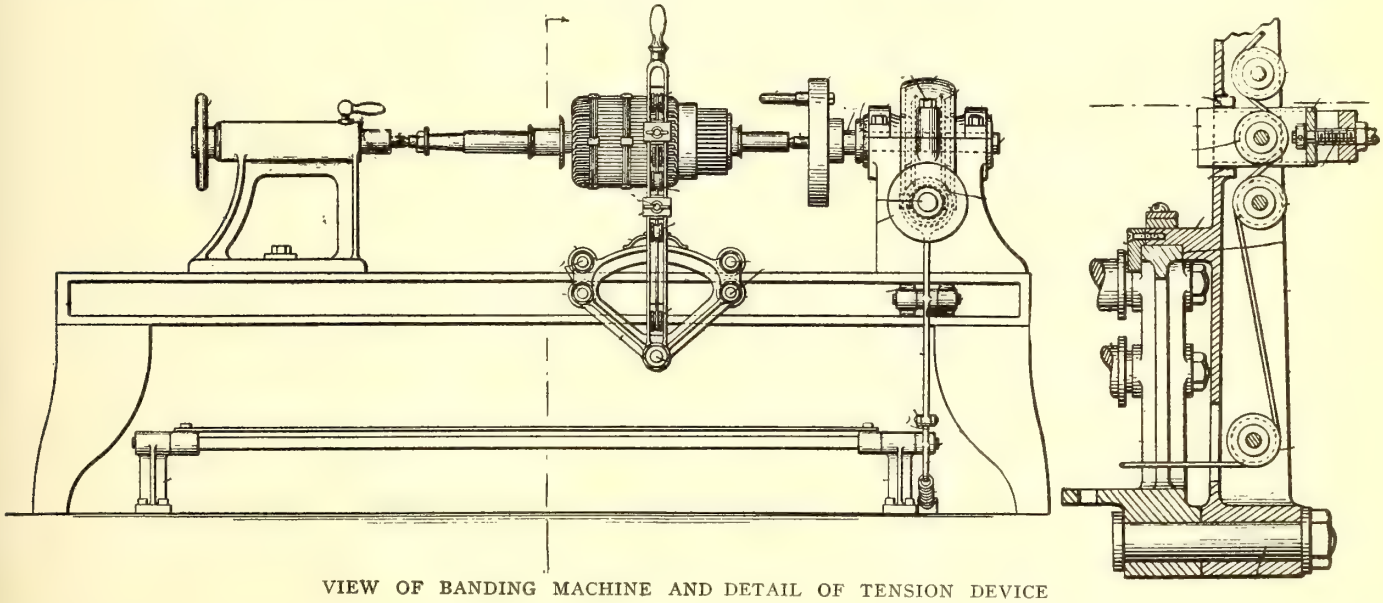
NEW BANDING MACHINE

The American General Engineering Company of New York has added to its extensive line of manufactures the improved banding machine shown in the accompanying drawing. The bander may be operated by any form of power and its movement stopped by releasing the treadle to disengage a friction clutch from the pulley.

The tension device is mounted on the carriage to move with it, and so that during the operation of winding it will move automatically with relation to the carriage and thus lay the successive turns of wire side by side properly. The tension device consists of several guiding and tension sheaves supported on a wire-feeding arm pivoted on a stud to one of the side frames of the carriage. Two guiding sheaves are provided, one located below the tension sheaves and guiding the wire to the tension sheaves, and the other located above the tension device and guiding the wire therefrom to the work. The five tension sheaves are arranged so that the second and fourth are adjustable, whereby they can be staggered with relation to the others to vary the tension. To provide for this adjustment the sheaves are each mounted in a sliding support movable between guides and engaged at its outer end by the adjusting screw shown in the detail drawing.

In winding, the carriage is moved by hand along the rails to a position in line with that portion of the armature or other work to be banded, and when the carriage is in its proper position the wire will be connected with the work and the latter then rotated. As the banding increases the pivotally mounted carriage arm will swing automatically on the carriage in the direction in which the wire is wound and thus cause the several turns to be laid successively in proper position. This carriage arm has an inward extension carrying a spring bearing against the upper edge of the carriage side frame. The engagement of this spring with the upper edge of this frame retains the carriage arm frictionally in the position to which it may be moved.

The wire is supplied from a bobbin carried by an extension of the base plate of the carriage. This extension is located on the side of the machine opposite to the side on which the arm is pivoted. The wire passes from the bobbin through a guide located on the side frame to the lower guiding sheave, then between the tension sheaves and around the guiding sheaves to the armature or other work.



VIEW OF BANDING MACHINE AND DETAIL OF TENSION DEVICE

CARS FOR GULFPORT & MISSISSIPPI COAST TRACTION COMPANY

Since the opening of the new line between Biloxi and Gulfport travel on the Gulfport & Mississippi Coast Traction Company's lines has steadily increased and it has lately been found necessary to add a number of open cars to the equipment similar to the one illustrated. The American Car Company is the builder. These cars, like the Brill semi-convertibles with arched top windows previously shown in these columns, will be operated over the famous shell-beach road in fine weather. At present the system connects Biloxi, Mississippi City, Gulfport, Long Beach and Harbor View, making a trackage of 25 miles.



OPEN CAR FOR SOUTHERN SERVICE

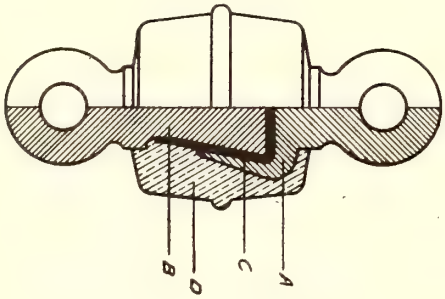
The chief dimensions of the new cars are as follows: Length over the crown pieces, 40 ft. 4⅜ ins.; over the sills, including the sheathing, 7 ft. 9½ ins.; over the posts at the seat ends, 8 ft. 2 ins.; size of the side sills, 4¾ ins. x 7 ins.; end sills, 3½ ins. x 5⅞ ins. The lights are arranged most effectively by placing single lights along the lower ventilator rails and down the center of the car instead of having clusters. The trucks are of the Brill No. 27-G1 type with 4-ft. 6-in. wheel base.

The American Locomotive Company advises that the figure of 16,000 lbs., given by it for the article on page 683 of the Oct. 12 issue as maximum carrying capacities at center plate of its high speed truck, should have been 60,000 lbs. The minimum carrying capacities at center plate of arch bar type locomotive should have been 15,000, instead of 1500 as printed.

NEW STRAIN INSULATOR

The accompanying cut shows the new type of strain insulator first exhibited at the Atlantic City convention by the Ohio Brass Company. It consists of a cup casting *A* compressed on a metal cone *B* with a heavy section *C* of formed sheet mica between the cup and cone on all sides. The device is finally covered entirely with a body *D* of "Dirigo" insulation as a weather protection.

Tests made upon the sample insulators before the "Dirigo" composition is put on show that the elongation between the eyes is not measurable even when the load is run up beyond the breaking strength of the largest steel cable with which the insulators could be used. This construction, therefore, removes all strain from the insulating compound, placing the strain directly upon the sheet mica and distributing it over the entire bearing surface between the cup and cone. A pressure of over sixty tons is used in compressing the cup, hence it is evident that the mica cannot be further compressed by any load which could be applied to the ends of the insulator.



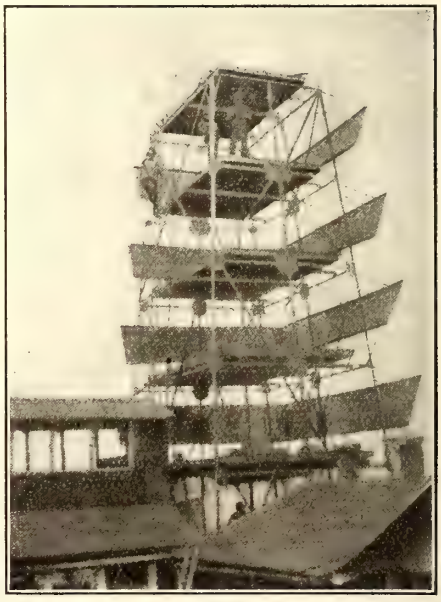
NEW STRAIN INSULATOR

Electrically the insulator is said to leave nothing to be desired. The best sheet mica is used in sufficient thickness to insure against puncture under any and all operating conditions. The "Dirigo" composition serves perfectly as a weather protection. Under test these insulators generally are over before puncture occurs, proving their great electrical strength. More than eighteen months have been spent in demonstration and test work on these insulators, so that in placing them upon the market at this time the company does so feeling absolutely that they will meet fully the most severe requirements.

SECTIONAL COOLING TOWER AND SPRAY PREVENTER

The principal difficulties that have been experienced in the operation of cooling towers of the open, natural draft type, have been the limited exposure of the water to the air currents, due to the spray in the outer portion of the tower blanketing the inner portions of the tower, and the loss of water in spray blown by the wind beyond the limits of the tower. These have both been eliminated, it is claimed, in the new design of tower construction recently perfected by B. Franklin Hart, Jr. & Company, New York, which is here illustrated. The feature of the new tower is the use of a new form of sectional cooling tray with serrated edges, causing the water to fall from stage to stage in finely divided streams and yet permitting the general distribution of air currents throughout all portions of the tower between the sectional trays. The sectional trays as installed are long shallow troughs, a few inches wide, which are built in any length required by the capacity of the tower and located in the tower in stages with small spaces between edges. While ordinarily built of galvanized iron they may be built of wood or cast-iron where the liquid to be cooled might attack the sheet metal, it only being necessary that grooves be cut in both edges at frequent intervals through which the water may run over the edges in finally divided streams and thus be caused to break up into fine sprays. The trays are accordingly of light construction and are supported at the various stages by convenient structural iron framing, the attaching bolts at either ends of the trays serving as the spacers between edges. This permits them to be easily removed at any time desired for replacement or for change in arrangement. In fact, the entire construction is well adapted to installation in old towers which have been proven in operation to be of insufficient capacity or where tower construction is not permissible and it is necessary to install the system in ill-adapted spaces. Owing to the spaces between trays the efficiency of this type of construction in operation is claimed to be greater than that of the other forms of construction, and it is also claimed that greater uniformity of results in cooling between towers of the larger and smaller capacities will be secured.

The spray-preventer construction involves the use of galvanized iron baffle plates or enclosures, which are hung outside of the tower at each stage and on such sides as to catch the spray carried outside by strong prevailing winds. The baffles are hung some distance out from the tower so as not to interfere with the wind currents of ordinary intensity, and are inclined inward toward the bottom which is flanged into a gutter to collect the water and deliver it back to the tower again. These baffles, or spray catchers,

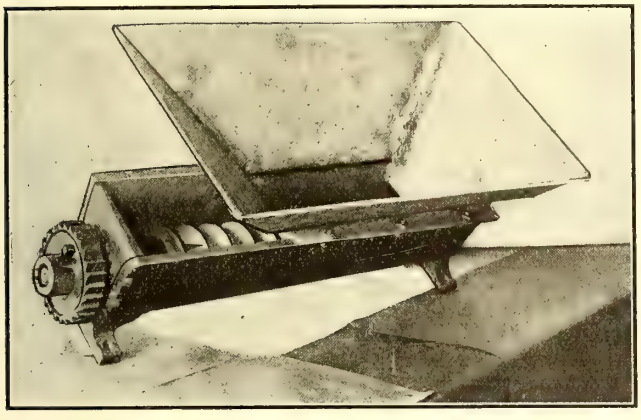

TRAYS SUPPORTED BY STRUCTURAL IRON FRAMING

are hung alongside of the upper portions of the stages, there being a fine mesh screen enclosure around each group of trays lower down. These spray catchers are ordinarily mounted on the lee side of the tower so as to be effective in catching the spray from all prevailing winds.

These improvements in tower construction were designed and patented by B. Franklin Hart, Jr., who has an extended experience in cooling tower practice. The tower is intended for the cooling of water and liquids for any purpose, and is effective without the use of fans or moving machinery.

A NEW SAND BOX

The Worcester Railway Supply Company, of Worcester, Mass., is now making a new sand box on which a patent was recently granted. The box proper consists of a cast-iron case in the bottom of which is a screw roll so constructed that when it is revolved the sand is forced to one end and drops through the sand pipe onto the rails. There is a ratchet on the outside of the case into which a pawl works, the pawl being connected to a bar which extends to



SAND BOX SHOWING SCREW ROLL

the front of the car. By the pushing down of a pin which goes through the floor of the car by the side of the motorman, the pawl is moved up and down thus revolving the screw. A sheet-iron hopper on top holds the sand. Wet or dry, coarse or fine, sand can be used with this box, as there is no caking of the sand.

SNOW-PLOWS FOR HEAVY SERVICE

The electric railways in the snow belt of the United States and Canada have, since 1892, adopted many of the principles of snow fighting which the steam railroads have found to be so effective. The Russell Car & Snow-Plow Company, Ridgway, Pa., has made plows for both steam and electric lines and has developed a line of snow-fighting equipment for electrical railways very similar to that used on steam railroads. Four sizes are built to meet the varying conditions on the electric roads:

Size 3, with flanger for trolley feed, is of the same general design as the company's double-end plow for steam roads for single or double track, right or left hand running. It is considered especially suitable for high-speed interurban lines having serious snow conditions. The brake and flanger are operated by air.

Size 4 is for third-rail feed and is designed for service similar to the Size 3 plow, except that it has a flanger in the nose of the plow. It is suitable for high-speed interurban lines having serious snow conditions. The brake and flanger are operated by air.

Size 6 is a combination car and snow-plow with detachable and adjustable steel noses designed for single or double track urban and interurban service. It may be equipped with ice diggers and levelers. The body is suitable for baggage, freight and express service while fighting snow. It is equipped with M. C. B. automatic couplers, and when the noses are detached may also be used as an electric locomotive, thus making an all-the-year-round equipment. The brake and noses are operated by air.

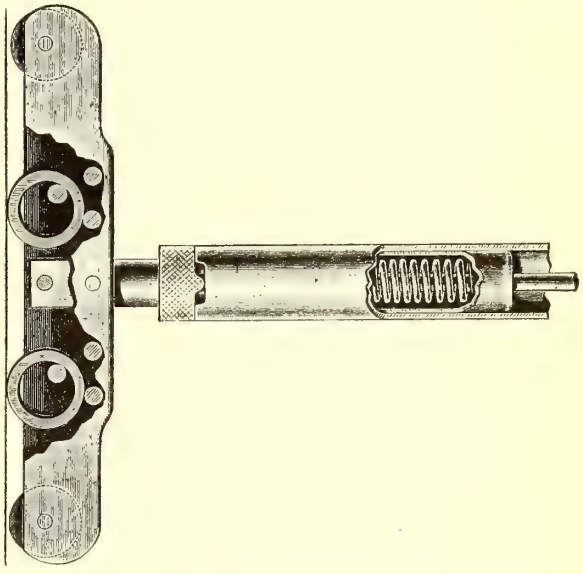
Size 6, pedestal plow, is provided with adjustable steel noses operated by air, and is designed for urban and interurban service, having moderate snow conditions.

A NEW CURTAIN FIXTURE

The Curtain Supply Company of Chicago and New York is offering a new ring fixture, style No. 88, for curtains for closed cars. It can be operated by grasping the curtain anywhere along the bottom, and it is immaterial whether the grooves be rough or smooth, varnished or unvarnished.

The ring fixture has the same internal construction as the Forsyth roller tip fixture, including the adjustable and locking features of that device. The ring fixture requires the same grooves as the company's other fixtures, viz., ⅜ in. wide x ⅜ in. to ½ in. deep.

The head of this fixture in its holding position is shown in the accompanying cut. The upward tendency of the curtain causes the two little rings in each shoe to rock or jam against the bottom of the grooves, and no jar or movement of the car can make the fixture creep upward. At



HEAD OF FIXTURE IN HOLDING POSITION

the same time the curtain can be pushed up or pulled down by the hand without injuring the fixture or forcing it out of the grooves. When the curtain is pulled down the little rings recede or rock away from the groove bottoms, and the fixture then rests on the anti-friction rollers at either end of the shoes, and is free to run in an easy manner. The moment the hand is taken away from the curtain the upward pull commences, and the rings immediately rock against the groove bottoms, and the fixture is held firmly in place.

NEXT MEETING OF A. S. M. E. TO BE HELD IN NEW YORK ON NOV. 12.

The American Society of Mechanical Engineers will hold its next regular monthly meeting on Tuesday evening, Nov. 12, at 8:15 o'clock, in the building of the Engineering Societies, 29 West Thirty-Ninth Street, New York. The principal address will be made by Charles R. Pratt and will treat of features of construction and operation of the gearless traction electric elevator, which is being installed in the Singer and Metropolitan Life, New York's two highest buildings. The paper will be discussed by engineers and architects from New York, Philadelphia and Chicago. It is expected that the subject will be very exhaustively treated from the view of the architect and the engineer. The members of all professions are cordially invited to attend.

EXHIBITS AT THE ATLANTIC CITY CONVENTION

Full advantage was taken by the manufacturers of the opportunity afforded at Atlantic City for an elaborate display of apparatus with the result that the exhibits transcended any that have heretofore been held in connection with the meetings of the association. As the treasurer of the Manufacturers' Association said in presenting his report to that body, some 210 exhibitors took space, establishing a new record. As to the value of the exhibits to the operator, that is inestimable, though it may be said that hearty appreciation was individually expressed by the delegates of the opportunity that the excellent display afforded them of keeping abreast of the latest developments. That the exhibits are profitable, considered from the standpoint of the manufacturers, is borne out by the steady increase in the membership of the Manufacturers' Association and of companies seeking to display their products. While the accompanying notes are not elaborate, they serve to convey an idea of the extent and variety of the different exhibits:

THE WESTINGHOUSE TRACTION BRAKE COMPANY exhibited its AML quick-action, automatic brake system; electro-pneumatic brake system; portable blowing outfit; the SME equipment which combines the advantages of straight-air operation with the essential protective feature of the automatic brake; the AMM equipment designed to meet the requirements of a high-class interurban service, where trains of from one to five cars are operated under mixed city and interurban conditions.

THE WESTINGHOUSE AIR-BRAKE COMPANY explained its angle cock with self-locking handle; and the EL electric locomotive air-brake equipment combining the straight air brake (independent brake valve) and the automatic brake.

THE WESTINGHOUSE ELECTRIC MANUFACTURING COMPANY showed the large single-phase electric locomotive which is one-half of a complete unit. It represents the type of apparatus supplied by this company for heavy railway service, either freight or passenger, and showed the kind used on the New York, New Haven & Hartford Railroad. In addition to the complete equipment there were individual parts arranged for more minute inspection than is possible on the locomotive. The control equipment was also exhibited apart from the locomotive, showing the method by which the voltage is reduced on the car to the amount suitable for the motors, as well as the method of varying the voltage applied to the motors. The catenary line construction used on the single-phase roads was also shown suspended as it appears when actually installed. The pantagraph trolley was also set up on the floor connected to a compressed air supply so that the trolley could be raised or lowered exactly as in the complete equipment. There was shown also direct-current-line material, as well as the control used on the cars. Full repair parts for the direct-current motors were also included. One portion of the exhibit contains the complete unit switch control, used in the control of electric trains operated either by alternating or direct current. In addition to the above there were several standard direct-current railway motors and two interpole railway motors. In conjunction with the Westinghouse Machine Company a steam turbine generator set was displayed on the first floor for inspection.

THE WESTINGHOUSE COMPANIES.—The following persons of the different Westinghouse Companies were in attendance. From the Wesingtouse Air Brake Company: A. L. Humphrey, general manager; J. F. Miller, vice-president; S. C. McConahey, assistant secretary; E. A. Craig, Southwestern manager, Pittsburg; S. D. Hutchins, Columbus; W. V. Turner, Pittsburg; Robt. Burgess, Richmond; P. H. Donovan, Pittsburg; T. L. Burton, New York; E. L. Adreon, Southwestern manager, St. Louis; C. P. Cass; J. R. Ellicott, Eastern manager; C. R. Ellicott, F. M. Nellis, W. G. Clark, F. V. Green, E. H. Dusen, Geo. H. Martin, W. S. Bartholomew, Western manager; E. J. Olmstead, and H. S. Clark. From the Westinghouse Electric & Manufacturing Company: L. A. Osborne, vice-president; W. M. McFarland, acting vice-president; C. S. Cook, manager Railway & Lighting Sales Department; H. A. Coles, Atlanta; L. N. Reed and G. C. Ewing; Thos. Cooper and H. H. Van Staagen, Philadelphia; J. C. Kyle, Baltimore; J. A. Brett, Cincinnati; H. C. Stier, Pittsburg; C. P. Billings, Cleveland; Q. W. Hershey, Syracuse; J. W. Busch, Chicago; O. T. Smith and J. N. Dubarry, New York. From the Westinghouse Machine Company: E. H. Sniffin, vice-president; L. C. Bullington, H. Van Blarcom, L. A. Phillips, H. P. Childs, S. M. Broman and E. L. Clark. From the Canadian Westinghouse Company, Ltd., H. D. Bayne, manager Montreal office. From the Westinghouse Company's Publishing Department, J. C. McQuiston, manager.

THE STANDARD STEEL WORKS, Philadelphia, Pa., showed the following: One pair of cast-steel center, steel-tired wheels; tires of the standard bolted section; one center with extended hub, upon which is fitted a solid cast-steel gear; wheels mounted on hammered-steel axles; the above being the type used by the West Jersey & Seashore Railroad Company under their fast electric trains from Camden to Atlantic City. One pair of cast-steel center, steel-tired wheels; tires of the standard bolted section; mounted on hammered-steel axles with solid steel gear. These wheels are the type used by the Annapolis, Washington & Baltimore in the fast electric service between Baltimore and Washington. One pair of solid rolled-steel wheels mounted on hammered-steel axle, with the new type of built-up gear, consisting of a cast-steel center with a forged tire-steel rim, with the teeth cut in this rim. This is the type of wheel used in the New York subway. One pair of solid rolled-steel wheels mounted on hammered-steel axle, with solid cast-steel gear; these wheels being used on the Fonda, Johnston & Gloversville Railroad Company in New York. One pair of solid rolled-steel wheels mounted on hammered-steel axles, with split gears. These wheels are used on the fast shore-line cars running from Atlantic City to Pleasantville and Absecon. This type of wheel could be seen in use on the cars which run to the foot of Virginia Avenue, directly opposite the Steel Pier. The company also exhibited a steel-gear center and steel-gear rim with the teeth cut, such as is mounted on the pair of New York subway wheels referred to above. This is practically a new kind of gear, and has the advantage of permitting the purchaser to replace the rim without being compelled to discard the entire gear. In addition, it should show much greater strength than the cast-steel gear, as the rim is of forged and hammered tire steel. There also was exhibited one solid pressed-steel gear made completely of tire steel. This is of the same material as enters into the solid rolled-steel wheels. This gear has not been placed on the market, being simply an experiment. This, the company considers, to be the ideal gear for use in all traction service. The company showed in addition the various operations for manufacturing solid rolled-steel wheels.

WM. WHARTON, JR. & CO., INCORPORATED, of Philadelphia, Pa., had space Nos. 101, 109 to 101A-109A. Four distinct types of manganese steel special track work were shown by samples of tongue switches, mates and frogs. First: The standard renewable hard center construction for girder rail track, further illustrated by sections showing the method of fastening the centers. Second: Solid manganese steel construction in which the pieces are formed throughout of solid manganese steel castings in one piece. This is a new departure for girder rail work. There was also a 9-in. high square crossing of this construction cast all in one piece, which seemed a remarkable piece of work. All the running surfaces on this work were carefully finished and trued by grinding. Third: Solid manganese steel T-rail work. This has successfully been on the market for a number of years and has been shown before. Fourth: Manganese steel insert construction for T-rail. This is a new improved construction in which the manganese steel is placed just where needed and so arranged that the inserts take the strains within themselves, which would otherwise come on the bolts. An improved style of steam railroad crossing of this type was also shown. The Wharton standard heelless type of tongue switch is used in all except the last named construction and was further illustrated by a model. Various tongue-locking and operating devices were attached to the tongue switches shown. A housed point-split switch made entirely of manganese steel and intended for a large layout for the Chicago Union Elevated Railway formed another part of the exhibit. Numerous blue prints of large track layouts, furnished by the Wharton Company to various roads in this country and abroad, and tasteful decorations added further interest to the exhibit. The company was represented by V. Angerer, vice-president; L. R. Ashhurst, Jr., manager; R. C. McCloy, sales agent; W. McLain, Pittsburg representative; A. S. Partridge, Western representative; J. C. Robinson, New England agent; J. W. Stringfellow, Southern representative; G. R. Lyman, C. H. E. McDermott, engineers.

THE AMERICAN LOCOMOTIVE COMPANY, New York, occupied space Nos. 114, 116, 118 and 120. The exhibit consisted of two different designs of motor trucks, one the company's standard high-speed truck built for the Hudson Valley Railway Company, and the other its standard arc-bar type truck for express and freight service, built for the Schenectady Railway Company. Both of these trucks were described in the Current News Section of the Street Railway Journal for Oct. 12. William Wampler, of the electric locomotive and truck department, was in charge of the exhibit, with headquarters at the Hotel Traymore, and was assisted by Raymond H. Baker, of the sales department.

THE ATHA STEEL CASTING COMPANY, of Newark, N. J., displayed "Titan" steel motor gears, both for high-speed electric service as well as the ordinary electric railway service. These gears are made of manganese steel, and it has been found that they will wear from three to five times as long as ordinary cut-tooth gears The plan the company has been pursuing is to ask the various roads interested in effecting economies to order a few of the gears for trial, keeping a record of same in comparison with the ordinary cut-tooth gear, which record will readily demonstrate the superiority of the manganese steel gear. It already has trial orders from about 65 different roads, while a number of these have adopted the gears as standard. There are about 1500 already in service. The company also is working on a manganese pinion, and as soon as the special machinery for grinding is completed, the company will be able to furnish pinions as well as gears. The company would be very much pleased to have railroad representatives interested in this gear call at the works and inspect the process of manufacture. The company also showed cast-steel body and truck bolsters used by electric roads for surface as well as elevated cars. It makes all kinds of open hearth steel castings for railway use.

THE H. W. JOHNS-MANVILLE COMPANY, of New York, was well represented with an attractive exhibit. Among the materials exhibited were the following: Victor combination meters, both portable and switchboard types, overhead line materials, "Noark" fuse devices, Transite asbestos fireproof lumber, etc. The exhibit of supplies included moulded mica weatherproof sockets, arc lamp hangers, high-tension insulators, rail bonds, J-M friction tape, Transite doors for transformer stations, controller linings, etc. The exhibit of overhead line material included a complete line of ears and clips, together with several new forms of insulated cross-overs, section insulators, etc. The other products of the firm, such as pipe covering, roofing and packing, were also represented. The company has recently made arrangements for the sale of asbestos wood, a material largely used in fireproof construction of buildings, cars, etc. Samples of asbestos wood showing its various applications were on exhibit. The following representatives were on hand: J. W. Perry, manager Electrical Department, New York; H. M. Voorhis, manager Electrical Department, Philadelphia; H. M. Frantz, manager Electrical Department, Chicago; R. R. Braggins, manager Electrical Department, Cleveland; M. H. Crosswell, manager Electrical Department, Milwaukee; S. P. Russell, manager Electrical Department, New Orleans; D. T. Dickson, manager Philadelphia branch; E. D. Sparks, sales manager Philadelphia branch; S. G. Meek, salesman New York office; H. S. Corey, salesman New York office; E. F. Quirke, Southern representative, New York office; W. F. Little, electrical engineer, New York; E. B. Hatch, president The Johns-Pratt Company, Hartford, Conn.; C. W. Shultz, salesman, Philadelphia branch; G. A. Saylor, salesman Milwaukee branch; H. R. Tarinor, manager Boston branch; F. J. Jewett, superintendent, Brooklyn factory; W. R. Seigle, assistant superintendent Brooklyn factory, and A. E. Brown, assistant superintendent The Johns-Pratt Company.

THE EUREKA AUTOMATIC ELECTRIC SIGNAL COMPANY, of Tamaqua, Pa., was in booth No. 437, one of the long outside booths near the aquarium. Frank P. Boas, traveling representative, assisted by Robert Gerhardt, had charge of the exhibit, but officers of the company also were in attendance during portions of the week. The new apparatus exhibited, in operation, consisted of a complete set of Eureka two-wire semaphore signals, of which a considerable number of installations have been made during the past eighteen months, together with a track operated crossing bell.

H. B. UNDERWOOD & COMPANY, of Philadelphia, had a display composed of the following articles: One portable boring bar, reboring a Greene engine cylinder, and one portable milling machine, milling the steam seats on Greene engine cylinder. Both were driven by one of the company's two-cylinder, 2-hp air motors, and marked this company's first operating convention exhibits. It had also two other machines, a portable crank pin turning machine, and a Corliss valve seat boring bar; improved vacuum dash pots for Corliss engines. In addition to the above, the company had models of its St. John self-adjusting cylinder packing and also some old St. John packings that have been running for some ten to fourteen years and are still in good condition. Edwin J. Rooksby and Edwin W. Whitaker were in attendance.

THE AMERICAN BRAKE SHOE AND FOUNDRY COMPANY showed brake shoes for electric railway equipment ranging from the flanged and unflanged shoes of the MCB Christie type, similar to steam railroad practice, to the narrow tread wheels of street railway equipment. There were brake heads and brake shoes for wheels with 3-in. tread and over, the brake heads being such as to take MCB Christie type of brake shoes, and the brake shoes applicable to any MCB Christie brake head; thus the shoes and heads are interchangeable with steam railway equipment as regards the attachment of brake shoes to the head. These shoes were shown with the types of wearing face in general use on electrical equipment made up with steel backs and wrought lugs for reinforcement and with the ordinary cast lugs with reinforcement. For the narrow tread wheels the company has a narrow brake head to apply to the back of the shoe for narrow tread wheels outside of the flange. These shoes are made up with or without steel backs and wrought lugs, as may be desired. The exhibit showed both kinds, with a variety of brake heads for Peckham, Brill and Taylor trucks, all of which take a common shoe and a common brake head key. This narrow tread shoe and head are coming into use where it is desired to reduce the number of brake shoe patterns and to use a shoe which can be reversed in the head to reduce the loss from taper wear. It is the idea to abandon this narrow tread head and shoe just as soon as equipment is changed to take the wider tread wheels, which will permit brake shoes and brake head which will interchange with MCB practice. The exhibit fully illustrated the brake shoes and brake heads proposed by the standardization committees of the American Street & Interurban Railway Association and the Central Electric Railway Association, and all interested were cordially invited to visit the booth and see for themselves what can be done, and how the proposed brake shoes and brake heads for wheels with 3-in. treads and over interchange with the MCB standards. The company has over seventy-five designs of brake heads for narrow tread wheels, all of which take the same brake shoe and replace seventy-five distinct types of combined heads and shoes or separable heads and shoes which are not interchangeable. It is prepared to design brake heads to take a common shoe for any railroad that wishes to reduce number of patterns and cost of brake shoe maintenance. The representatives were as follows: Otis H. Cutler, president; W. S. McGowan, Eastern sales manager; Frank L. Gordon, Western sales manager; F. W. Sargent, chief engineer, and James S. Thompson, E. L. Janes, E. B. Smith, E. J. Searles, representatives. The exhibit, as usual, was in charge of the chief engineer, who was on hand to explain to all interested the question of standard practice. The company distributed several attractive catalogues, one of which illustrated the new standard brake head and shoe for 3-in. and narrow-tread wheels.

THE BALDWIN LOCOMOTIVE WORKS, of Philadelphia, had an exhibit consisting of two class 90-40 motor trucks, part of an order for forty-nine trucks recently completed for the Washington, Baltimore & Annapolis Railway, and were exhibited in connection with the Niles Car & Mfg. Company, builders of the car bodies on the same order. The principal features of these trucks are as follows:

Wheel base, 90 ins.; weight, 14,500 lbs.; wheels, steel tired, cast steel plate center, 4¼ ins. width of tread, 1¼ ins. width of flange, 1 in. depth of flange; axles, diameter at motor bearings, 6½ ins.; diameter at wheel seat, 7 ins., and diameter at gear seat, 7½ ins.; journals, 5½ ins. x 10 ins.; frames, solid forged iron 4 ins. wide, 2½ ins. thick.

H. W. Sheldon, Clarence Dodson and J. R. Dickey represented the company.

DOSSERT & COMPANY, of New York, were on hand in booth 317, with a full line of their solderless connections and couplings. H. B. Logan, president of the company, is at his

desk again after two months' absence through illness. Mr. Logan was one of the victims of the recent epidemic of typhoid fever attributed to impure water supply on board the S.S. Northwest, of the Northern Steamship Company, plying between Buffalo and Duluth. Mr. and Mrs. Logan made the trip during the latter part of July in company with two Buffalo friends, and out of the party of four only one escaped the typhoid infection.

THE ELMER P. MORRIS COMPANY, of New York, installed approximately 1000 ft. of catenary construction along the north side of the pier trolley wire and messenger extending from the pier over the water, with brackets dropped on the iron poles so that the catenary construction was about 6 ft. high and could be carefully examined. Forty-two poles were installed for this work. Each pole was equipped with malleable iron cross arm for carrying feeder wire to the various exhibits and various types of ornamental and plain pole tops and arc lamps attached to each pole. In addition to this there was a full line of overhead material, cross arms, insulators and catenary parts shown in one of the sun parlors on the north side of the pier.

THE U. S. METAL AND MANUFACTURING COMPANY, of New York, was represented by F. C. Dunham and Thomas Beaghen, Jr. The articles exhibited were the Victor cast steel and Perfect pressed steel car replacers, the Victor in sizes Nos. 2, 3 and 4 and the Perfect in sizes Nos. 1 and 2; also the improved and original Columbia lock nuts.

THE CROCKER-WHEELER COMPANY occupied double exhibit space, having taken sections 464 and 466. The company supplies for street railway service a direct-current generator which has become standard for this work, and exhibited large photographs of installations in this line. The Crocker-Wheeler Company specializes on the generating end of the street railway system and has made a special study of the requirements of this severe service. Crocker-Wheeler alternating-current generators are in use in important street railway plants, notably that of the California Gas & Electric Corporation, of San Francisco, where three 4000-kw generators, driven by gas engines (the largest alternators ever built for gas engine drive) are installed. Photographs of the California plant were shown. The company was represented at Atlantic City by Julian Roe, manager of the Chicago office; S. Russell, Jr., manager of Philadelphia office; R. N. C. Barnes, manager of Boston office; L. S. Horner, manager New Haven office, and R. J. Randolph, Jr., and Rodman Gilder.

THE RAILWAY AUDIT AND INSPECTION COMPANY had booth No. 133. The following representatives were in attendance: H. N. Brown, vice-president and general manager; C. E. Horney, assistant treasurer; T. C. Cary, superintendent; Chas. Goble, manager electrical and mechanical department.

THE RAMAPO IRON WORKS, of Hillburn, N. Y., had desk room in booth 462, and were represented by Arthur Gemunder, W. B. Lee and J. B. Strong.

THE OHIO BRASS COMPANY had a notable exhibit in spaces 209-218, inclusive, containing 2000 sq. ft. of floor space. The various sales divisions under which the extensive line of products of this company is classified were well represented, including the high-tension division, rail-bond and third-rail insulator division, overhead line material division, car-equipment division, and the mining division. Among the important products of the company on exhibit were the Tomlinson automatic radial car coupler in the M. C. B. Knuckle; the Lintern car-signal system, which is a system of car classification and rear-end signaling using electric lamps as a source of illumination, made independent of the condition of the trolley voltage by an auxiliary battery of dry cells; and the Nichols-Lintern pneumatic track sander, also in actual operation. To show the latest developments in O. B. Company catenary construction, a catenary line about 100 ft. in length was installed in the exhibit space. Porcelain insulators, of which this company manufactures a complete line for all practical working voltages, were much in evidence and many samples shown, from small porcelain telephone insulators up to the big, four-piece, cemented, 60,000-volt types. The well-known "All Wire" rail bond, both compressed and soldered types, was on exhibition, and the method of application to the rail explained. In this section was shown also a complete line of third-rail insulators for electric railways and industrial railways. These insulators are constructed with a body of "semi-porcelain" which has thus far proved to be most efficient, electrically and mechanically, for third-rail insulator work. Numerous other devices and materials were on exhibit, including a complete line of hangers, trolley ears and clamps, pullovers, construction tools, etc., car-equipment specialties such as the Armstrong journal oiler, Genuine bell-metal motor bearings and track brushes. Appropriate souvenirs were distributed among the delegates. The company chartered a sloop yacht, in which sailing parties were taken out each day. For the further comfort and pleasure of its friends the company rented a limited number of rolling chairs. The following were among those representing the company: C. K. King, vice-president and general manager; A. L. Wilkinson, secretary; C. E. Young, Nathan Shute, P. A. Hinds, C. H. Tomlinson, G. A. Mead, A. L. Price, F. S. Denneen, A. W. Dee, E. F. Wickwire, F. A. Strail, C. E. Delafield, W. H. Bloss, home office; N. M. Garland, manager; R. M. Campbell, S. H. Mattson, New York office; E. C. Brown, manager; F. E. Johnson, St. Louis office; F. H. Jameson, manager; A. L. Havens, F. V. Cook, G. W. Cooper, Chicago office; J. E. Slimp, manager, Atlanta office; S. K. Colby, of Pierson, Roeding & Company, Pacific Coast agents.

THE DEVICE IMPROVEMENT COMPANY, of Hanover, Pa., had on exhibit in spaces Nos. 668-670 all of the shop appliances, of which many have been illustrated in the Street Railway Journal. A new appliance on exhibit was the Peerless multiple fuse box. This device consists of a cast-iron box, asbestos lined, and practically water-proof. It contains the insulated wooden spool, asbestos faced, upon which are mounted the revolving contacts carrying the fuses. The stationary contacts are pressed against the revolving contacts by heavy springs and are hinged at the back to blocks. To these blocks the in and out going positive wires are fastened. When a fuse blows the handle is turned, thereby instantly bringing a new fuse into position. These proper positions are felt by a pin engaging notches at the right place. This change can be made in five seconds to half a minute, dependent upon the location of the box on the car. With the single fuse box in case of blown fuse, the car will not move in from five minutes to half an hour. There are other bad features also. The company was represented by Robert E. Manley, general manager, and Walter Gemmill.

THE SAMSON CORDAGE WORKS, of Boston, Mass., had an exhibit comprising Samson spot and Massachusetts waterproofed trolley cord, and Samson bell and register cord. The trolley cord was shown in all sizes from No. 8 to No. 12, inclusive, and the bell and register cord in a variety of sizes and colors, including mahogany, drab, fancy and others. A particular feature was the Samson mahogany wire center cord, used a great deal now as register and bell cord. The same stock is used in this cord as in the regular Samson goods and the addition of the galvanized steel wire cable center makes it very durable and prevents stretching. As souvenirs, pencils with a celluloid cover, representing Samson spot cord, were given away. F. J. Coakley and R. G. Whiting were on hand to welcome visitors.

THE PENNSYLVANIA STEEL COMPANY greatly added to the interest of the delegates in its products by displaying a number of excellent drawings showing track material installed in various parts of the country, and its representatives called attention to the fact that all the hard center frogs, switches and mates for M. C. B. wheels, as well as all the special work in and around Atlantic City, has been furnished by this company. On the West Jersey & Seashore Railway work has been furnished in the line of turnouts, branch-offs and crossovers built of 141-lb. girder rail with "Manard" rapid renewable centers at Atlantic Avenue and Florida Avenue, Atlantic Avenue and Georgia Avenue, and Atlantic Avenue and Mississippi Avenue. The Central Passenger Railway has its work constructed of heavy T-rail and girder rail, consisting of crossings, curves, crossovers, turnouts and derail switches in many locations in Atlantic City. The Atlantic City & Suburban Railway has turn-outs at Florida Avenue, between Atlantic and Pacific Avenues. The display made by this exhibitor showed a number of novelties in track equipment, among them being an all-manganese frog with a renewable point and wings, a feature that will appeal strongly to all maintenance-of-way men. There was also a new style of switch stand, the "Steelton Positive," with a semaphore blade

that folds out of sight when the main track is clear, thus eliminating all possible chance of signals being misunderstood. The target works on a planetary gear and the mechanism of the switch stand is as simple as can be devised. Other features were an automatic derail and a positive derail.

HAROLD P. BROWN, of New York, occupied spaces 111, 113, 111A and 113A, fronting on two aisles near the shore end of the Pier. He had various types of rail joints bonded with standard plastic bonds, plastic plug bonds and semi-plastic plug bonds and showed the same under test with a current of 3000 amperes. He also presented an electric drill and magnetic clamp for rebonding rails without removing angle plates or disturbing pavement, and demonstrated the efficiency of his contact alloys on switches, bus-bars, trolley wheels, controllers, contactors, etc. Mr. Brown was assisted by James Hollowood, G. A. Kroener, J. Maxwell Coote, Daniel A. Kelley, William Temple and John Roche.

THE MASSACHUSETTS CHEMICAL COMPANY, of Walpole, Mass., had a full line of samples, descriptive literature and souvenirs. A. T. Baldwin, L. O. Duclos and A. E. Duclos represented the company.

THE BLAKE SIGNAL & MFG. COMPANY, of Boston, was represented by E. J. Burke, C. C. Blake and George S. Hastings. It had in spaces 228 and 230 a complete working exhibit of standard signal apparatus together with a trained and competent train dispatcher, various types of railway telephones and standard blanks, etc., for telephone train dispatching.

THE COMPOUND MAGNETIC BRAKE COMPANY had an exhibit of its electric brake, which is operated by a controller on the front platform. This makes connections through solenoids which are under the car and are connected to the brake rigging. The special claims made for the brake are that it costs less to manufacture, install or maintain than the air-brake and is not affected by damp, heat or cold, is efficient in operation and can be arranged so as to be connected with the hand-brake handle if desired. The brake weighs, complete, about 400 lbs., and at a test made some years ago of different brakes by the New York State Railroad Commission was given the highest percentage in order of merit. The company was represented at Atlantic City by Thomas Sturgis, president; T. J. Nicholl, vice-president; Anthon Duttler, inventor, and Mr. Henderson, electrical engineer. Mr. Nicholl also had on exhibit the Holmes adjustable trolley head. This head was invented by Garnet B. Holmes, of Wellington, New Zealand, and in its original form was devised for the side trolley wire suspension used in Wellington and on some British railways. The principle, however, has been adapted for use with the ordinary trolley wire. The advantages claimed are that it adjusts itself to the position of the trolley wire on curves and hence reduces sparking, liability of coming off the wire, etc. In fact, it is claimed that with the wheel it is possible to carry the trolley wire as far as 8 ft. from the center of the track. The invention consists in the form of harp used. The head of the harp is extended and carries in two guide-ways the journal boxes in which the trolley wheel shaft revolves. The guides are at an angle in the vertical plane of the wire and the boxes are kept normally in line with each other by springs. These springs give a flexible contact between the wheel and the wire, and also permit the wheel to adjust itself to irregularities in the alignment of the wire. Mr. Holmes, the inventor of the trolley head, was also present at the convention.

THE CONSOLIDATED CAR-HEATING COMPANY, of New York, was represented by Cornell S. Hawley, general sales agent; W. S. Hammond, Jr., district manager Western territory; S. Butler Keys, district manager, Eastern territory, and T. M. May from the New York office. For space the company had the entire stage in the ballroom on the Steel Pier and exhibited in addition to its standard heaters and switches some new types of electric heaters, including a portable vestibule heater, locked switches, an automatic cab heater switch and switchboards. It also showed the following for the first time: A signal system to enable passengers to signal to the motorman or conductor. No dry batteries are required, the signals being operated by current taken from the trolley line of any voltage; also an air-motor system for operating doors of electric cars, operated by compressed air and a pipe connection to the air reservoir used in connection with the air-brake apparatus.

THE R. D. NUTTALL COMPANY, of Pittsburg, had a full line of gears, representing the types now considered standard for modern high-speed service. It also showed several of its special XX grade pinions, also test pieces, etc., illustrating the quality of the material. In addition to this it had a full line of trolley harps and wheels and two or three of the more prominent types of trolley bases. A new line of material to which it called particular attention was gears and pinions for street railway air compressors, of which several different types were shown. Among the motor gears was one of the new type with cast-steel center and rolled-steel rim, as used by the Interborough Rapid Transit Company, of New York. This gear also represented in a way the style of gears now generally used by electric haulage locomotives, where applied to interurban service on steam railroads. The representatives were F. A. Estep, Charles N. Wood, Geo. M. Provost, T. M. Cluley, C. M. Kirschner, Milton Rupert and the Electric Service Supplies Company.

THE DURKIN CONTROLLER HANDLE COMPANY, of Philadelphia, had an exhibit consisting of its regular type of controller regulators. Edgar W. Baird, W. S. Taylor, John P. Durkin and Patrick Loughery were in charge of the exhibit.

THE LORD ELECTRIC COMPANY, of New York and Boston, exhibited a rotating-type lightning arrester and abnormal-potential discharger; the Shaw non-arcing lightning arrester; soldered rail bonds and an automatic car seat heat deflector. They had also an aerial advertising outfit, consisting of a captive balloon and electric sign with the retaining cable used as the electric conductor. The representatives on hand were F. W. Lord, E. M. Hamlin, F. W. Erickson and G. B. Crane.

THE LOCKE INSULATOR MANUFACTURING COMPANY, of Victor, N. Y., exhibited at space No. 700-702 a steel transmission tower with three of its 100,000-volt insulators erected in place. These insulators are entirely new, and in view of the radical advance in transmission voltage they indicate were very interesting to the attendants. The company also showed some of its smaller insulators in the exhibit of the Electric Service Supplies Company. W. T. Goddard, electrical engineer; A. S. Watts, ceramic engineer, and John S. Lapp, secretary and treasurer, were in attendance.

SECURITY REGISTER AND MANUFACTURING COMPANY, of New York, announced that it would be impossible to get its exhibit in position at Atlantic City and called the attention of its friends to the fact that any information they may desire regarding its product, in the way of description, catalogues, prices, etc., will be furnished them on application at the office, 42 Broadway, New York City. The reason for this inability to attend the convention and make an exhibit was owing to the fact of negotiations under way largely to increase the company's machinery and shipping facilities.

THE OHMER FARE REGISTER COMPANY, of Dayton, Ohio, had four new appliances, namely, a three-fare register for city work, a thirty-fare register, twin registers to work in combination with each other, and an appliance to operate a register by electricity, which is an entirely novel device. Representing the company were John F. Ohmer, president and general manager; E. B. Grimes, assistant general manager; J. H. Stedman, secretary; C. W. Ketteman, general agent for the Middle West; C. V. Funk, general Eastern agent; W. S. Heaton, general Western agent, and H. Tyler, general Southern agent.

THE W. T. VAN DORN COMPANY, of Chicago, showed one of the heaviest types of couplings ever built for any electrical service, and also a new style of coupling, called the No. 27, which has some new points. There were in addition a steel kunckle, applied to the company's head, which couples automatically to the M. C. B. type of coupling, together with several other couplings. W. T. Van Dorn and Mrs. Van Dorn attended the convention. Mr. Van Dorn was assisted also by several gentlemen from the East.

THE RIVERSIDE METAL COMPANY, of Riverside, N. J., has an exhibit including German silver, phosphor bronze, Cupro nickel and brass, in sheets, rods, wire and castings.

THE LACKAWANNA STEEL COMPANY had a display, consisting mainly of a device for reinforcing angle-bar rail points, known as the Abbott rail-joint plate. Joints suitable for various size rails from 60 lbs. to 100 lbs. per yard set up with angle-bar joint plates and ties complete were shown; also models showing different ways of applying the joint plates and a method of insulating. These plates are adaptable to all

types of electric railway track made of either heavy girder or standard rails. Another part of the exhibit consisted of a new composite railroad tie with improved rail bearings and fastenings. There was also an exhibit of a new type of plate called track gage plate, whereby rails can be fastened to ties without spiking in contact with rail base, and a model of a new reinforced rail section and reinforced rail base plates. The exhibit was in charge of D. H. Van Pelt, of the inspection department, Buffalo works.

THE GRIP NUT COMPANY, of Chicago, was represented by E. R. Hibbard, J. W. Hibbard and B. F. Stewart. The exhibit was in space 323 and consisted of a full line of grip nuts from 5/16 in. to 1¾ ins., hexagon and square, of the company's latest product from the new manufacturing equipment of its recently enlarged mill.

THE AMERICAN FERROFIX BRAZING COMPANY, of Philadelphia, presented a line of brazing torches and miscellaneous apparatus for performing the work of restoration of broken and cracked machinery by the Ferrofix process. It also had a demonstration of the process, showing all its features except the application of the blast flame, which, unfortunately, it was unable to provide on account of the fact that no flame of any kind was permitted in the exhibit. All this exhibit was new at this convention. The representatives were G. H. Taylor, F. A. Saylor and E. N. Gould.

L. M. BOOTH COMPANY, of New York, was represented by L. M. Booth, H. H. Sutro, A. J. Donniez and N. T. Booth. The exhibit included drawings, photographs and printed matter illustrative of the Kennicott water softener. The company also was prepared to demonstrate its method of control of quality of softened water by chemical tests.

THE STAR BRASS WORKS, of Kalamazoo, Mich., showed the Kalamazoo trolley wheels and harps. Messrs. Crockett and Johnson represented the company.

THE PEERLESS RUBBER MANUFACTURING COMPANY, of New York, exhibited a full line of mechanical rubber goods, including hose, packings, step treads, etc., and was represented by C. S. Prosser and F. O. Donnell.

THE MARYLAND RAILWAY SUPPLY COMPANY, of Baltimore, Md., in addition to its spike strut rail fastener, showed the Witherbee storage battery and distributed circulars for Monarch brand metal polish, for which it is sales agent. Charles Elliott, sales manager, represented the company.

THE NEW YORK CAR & TRUCK COMPANY, Kingston, N. Y., exhibited the new No. 24 M. C. B. short wheel base truck, the new 14-D-5-X maximum traction truck and the new No. 47 M. C. B. heavy track for high-speed interurban roads. F. W. Curtis, general sales manager, and Warren L. Boyer, superintendent, were present.

THE GLOBE TICKET COMPANY, of Philadelphia, pioneers in the electric railway ticket field, has recently made many improvements in tickets and transfers. It claims the greatest advance in the transfer situation has been made by the Pope patent p. m. coupon transfers, which have overcome many of the abuses prevalent under the older styles. This form is being adopted by many street railways, as the advantages of a transfer which unmistakably indicates whether it was issued during a. m. or p. m. hours are self-evident. They eliminate round tripping and are quickly issued. At the present time this company is printing over four hundred million transfers annually of this style alone. The new Globe ticket destroyer, operated by hand or power, effectually destroys used or canceled tickets. The company has just completed its special machines for printing mileage books. They are able to furnish all the valuable features included in the present styles and also have made improvements which will be readily appreciated by street railway companies. An innovation in the handling of tickets by passengers is shown by the Livermore ticket holder. This unique device is of great assistance to the traveling public, as the tickets are safely and conveniently carried in the small cylinder composing the holder, and are easily extracted, one or as many as are required at a time, by the very simple mechanism. In cities where commutation tickets are sold its simplicity and usefulness will without doubt commend it to the public and the street railway companies. The company also offers a new form of package ticket shown for the first time. These tickets are for commutation use and can be supplied in strips of any desired quantity. They are printed with non-counterfeitable tint face and back, and numbered. All the above features were shown at the convention.

THE WESTERN ELECTRIC COMPANY'S representatives had their headquarters at the Hotel Islesworth. The exhibit was in booths Nos. 480 and 486 and covered a full line of electrical railway supplies.

THE GOLDSCHMIDT THERMIT COMPANY'S exhibit occupied spaces 664-666 of the Music Hall, where were shown specimens of work done, such as rail joints, welded motor cases, truck frames, sections of welded pipe, etc. Besides these the company had specimens of different metals, such as manganese, chromium, molybdenium, welded in by the aluminothermic process. In addition to the regular exhibit there was a demonstrating space situated at the truck exhibit on Virginia Avenue, within half a block of the Steel Pier. Here a mechanic did welding for any of the delegates who wished to have a demonstration. G. E. Pellissier, C. F. Gailor and W. R. Hulbert represented the company.

THE CONSOLIDATED CAR FENDER COMPANY, of Providence, R. I., exhibited its Providence fenders, Models A and C mounted on car dashes. In connection with Model C was shown the company's new emergency valve for dropping the fender when applying the brakes. Fenders equipped with this arrangement are now in process of installation for use in regular service. The Narragansett Machine Company, which is managed by interests identified with the Consolidated Car Fender Company, exhibited at the latter's booth a cabinet of standard steel lockers. The types shown were the expanded metal front and the solid front, sides and back of the single and two tier kind. Both companies' interests were looked after by A. J. Thornley, general manager, and Geo. Hollingworth.

THE ELECTRIC TRACTION WEEKLY, of Cleveland, was represented by C. B. Fairchild, Jr., editor; Geo. S. Davis, associate editor; Hiram Kenfield, business manager, and R. M. Standish, eastern manager.

THE CAR HEATING & VENTILATING COMPANY, of Boston, Mass., showed a section of a car equipped with its heater and arranged to take 4 amperes and 6 amperes with means for combining to make the consumption ten amperes. The feature of this device is that it takes in fresh, cold air from underneath and heating it expels it through the panels into the car. On raising the seat cushion the entire heating arrangement was opened to view. The heaters are installed under a guarantee. Joseph E. Dozier, assistant general manager, and E. E. Porter, electrician, represented the company.

SEMON BACHE & COMPANY, of New York, showed their glass in Sjoberg vestibules, made by J. P. Sjoberg, of New York. F. J. Goertner, M. D. Traub and P. J. Sjoberg were much in evidence.

BERRY BROS., of Detroit, Mich., merely had a small space and a sign to call attention to their products. As is the practice of the company, several representatives were on hand to extend a cordial welcome to friends and patrons. This year this work was entrusted to F. W. Hormann and T. J. Lawler.

THE STANDARD PAINT COMPANY, of New York, had on view a complete line of air-drying varnishes, insulating tape and preservative paints. An armature was exhibited treated with P. & B. finishing varnish. Core plates and coils finished with core plate and coil varnishes were shown, as were also samples of insulating paper and Ruberoid colored roofing and flooming. The company made a special feature of its flexible iron paint for trucks, steps and fenders. C. E. Smith, J. H. Thomas, George Wilms and F. F. Vandewater had the company's interests in charge.

THE McCONWAY & TORLEY COMPANY, of Pittsburg, Pa., had models of two car frames showing what can be done in coupling cars when the company's Janney Radial M. C. B. coupler is used. The company also showed the Cox rail joint, of which it is the sole manufacturer. In attendance as representatives of the company were E. M. Grove, treasurer, and I. H. Milliken.

THE WASHBURN STEEL CASTINGS & COUPLER COMPANY, of Minneapolis, Minn., had its standard M. C. B. type traction coupler and its light type of traction coupler on view. In addition, and along somewhat different lines, were its heavy type of electric locomotive coupler and the M. type

coupler for ballast cars. Stanley Washburn, general sales manager, and J. L. Hopper, special representative, were in charge of the affairs of the company.

THE CHICAGO PNEUMATIC TOOL COMPANY, of Chicago, Ill., showed a full line of pneumatic tools, hammers and drills to several of which it called special attention, and a complete line of Duntley electric tools, including 500 volt drills and grinders, which were shown in operation. A new combination electric track drill and the Duntley electric drill with automatic release for driving screw spikes were the subject of many inquiries. Toward the end of the week the company had on exhibition an electrically operated vacuum sweeping and scrubbing machine for cleaning cars. The company also showed Duntley electric hoists of 1000 and 2000 lbs. capacity in operation. The company was represented by J. W. Duntley, W. O. Duntley, Thos. Aldcorn, G. A. Barden, Howard Small, C. B. Coates and Paul R. Severn.

THE JOSEPH DIXON CRUCIBLE COMPANY, of Jersey City, N. J., was somewhat up in the air; that is, its booth was on a platform some four or five feet high in the center of the pier and was accessible by a short flight of stairs at the top of which one encountered an old horse-car recently taken from service, which bore well-known Dixon signs. To this car a pass was given by the representatives of the company. The Dixon graphite products displayed consisted of graphite brushes, graphite greases and Dixon's silica graphite paints. Ferns in Dixon graphite pots were used to decorate the booth. The decorations were in red, white and blue, a goodly number of lamps of these colors being used for illumination. Pencils, dice pails and aluminum thimbles were distributed as souvenirs. Chas. H. Spotts, Neville J. Rowand, John J. Tucker, L. H. Snyder, J. H. Condit and Ralph R. Belleville represented the company.

J. R. McCARDELL COMPANY, of Trenton, N. J., had a trolley wagon on hand, equipped and ready for service. M. J. MacDonald and Cherles Leek represented the company.

JOHN W. MASURY & COMPANY, of New York, were represented by T. E. Mulford, who greeted users of Masury products and extolled the virtues of the company's products.

THE BURDETT-ROWNTREE MANUFACTURING COMPANY, of Chicago, Ill., showed its compressed air door-operating mechanism by means of a section of a car with the panel of the first seat from the door removed, exposing the operating mechanism. A sign conspicuously displayed called attention to the fact that the apparatus is now installed and in use on the following roads: Boston Elevated, Boston & Worcester, Old Colony Street Railway, Hudson Company, Philadelphia Rapid Transit, Philadelphia & Western Railroad, Metropolitan Elevated Company of Chicago and the Northwestern Elevated Railroad of Chicago. J. B. Burdette, B. Rowntree and P. R. Forman illustrated the operation of the device.

THE FRANKLIN ELECTRIC MANUFACTURING COMPANY, Hartford, Conn., as promised in the Street Railway Journal of Oct. 12, demonstrated the qualities of its Novi street railway lamps by means of a vibrating machine. The company also showed Franklin tantalum and Franklin metalized filament lamps, such as would be used for station and terminal work. At the back of the booth was the company's registered Novi label, 4½ ft. in diameter, illuminated by 704 Franklin miniature lamps of ½ cp. The Holophane Novi railway reflectors for distributing and concentrating were shown in an improvised dark room. P. S. Klees, G. O. Curtis, Chas. Leonard, Chas. N. Thorpe and H. M. Lauritzer were in charge.

THE KINNEAR MANUFACTURING COMPANY, Columbus, Ohio, displayed a full-size car house steel rolling door operated by a chain hoist and a full-size steel door operated by an electric motor. The company also showed a section of its wood rolling door. The company was represented by S. R. Hewitt, F. C. Schmidt and F. B. Billheimer.

THE JAS. G. WILSON MANUFACTURING COMPANY, of New York, showed rolling steel car house doors, rolling wood doors and sliding swing fire doors. The rolling doors were all operated with chain hoists, the company merely showing its electrically operated doors by means of drawings and photographs. A. H. Dodge, Geo. W. Loflin and Victor Loflin represented the company.

THE ELECTRIC RAILWAY IMPROVEMENT COMPANY, of Cleveland, had one of its complete bonding cars for electrically brazed and copper welded rail bonds, showing the whole outfit operating and installing bonds for the ball of the rail, foot and web of the rail. The company also had within easy reach rail sections with bonds, as specimens of the work turned out. The company also showed its electric power grinders. A sign mounted on the top of the welding outfit called attention to some of the roads for which the company has done work. W. B. Cleveland, Geo. Long, J. M. Gallagher, W. E. Huber and J. A. Cadle were all on hand in the interest of the company.

THE PHILADELPHIA AIR BRAKE & MACHINE COMPANY, of Philadelphia, Pa., had a working model of its system mounted on uprights showing Duplex jam cylinder, compressor and automatic cut-out, all exposed to view. A. Lambert and Thomas F. Kelly were in charge of the company's affairs.

THE RECORDING FARE REGISTER COMPANY, of New Haven, had a very complete line of its products on view. It showed recording registers of two types, the round and the square, and the round non-recording register. A new device of the company that claimed attention was its zone recording register. The company also showed a regular line of register trimmings and car fittings, and its center ringing device for operating one or two registers per car, as in use on the lines of the Rhode Island Company and the Public Service Corporation. Of trolley wheels there was also a full line, including a new self-oiling wheel, which is oiled when leaving the factory and needs no further attention until it is worn out. The company in addition showed a full line of trolley cord and conductors' punches and the Baldwin-Rowland recording signal, which records the number of cars entering a block, and which the company is handling. M. De Forest Yates, vice-president; F. B. Kennedy, secretary, and R. O. Carnahan represented the company.

THE UNITED UNIFORM COMPANY, of Brooklyn, N. Y., had a full line of uniforms on figures, showing the patent support front. Thomas F. Harvey was in charge.

THE BUCKEYE ENGINE COMPANY, of Salem, Ohio, had a goodly collection of photographs of its engines conspicuously posted in its booth, not attempting a live exhibit. Floral souvenirs and buckeyes were distributed, the floral souvenirs especially being appreciated by the ladies. C. H. Weeks was in charge.

THE KALAMAZOO RAILWAY SUPPLY COMPANY, of Kalamazoo, Mich., showed the Root snow scraper and flanger, Root fender and wheel guard, the improved pressed steel wheel, track drills, drill bits, track gages and levels. A full-sized car sill was used to show the manner of fastening the fenders and scrapers. A push car was also shown. Representing the company were John McKinnon, F. N. Root and D. A. Moore.

THE TAYLOR ELECTRIC TRUCK COMPANY, of Troy, N. Y., had these articles in its exhibit: one 8-in. wheel base single truck, one Taylor improved S. B. double truck, one Taylor H. L. B. truck, one Taylor M. C. B. triple spring truck, also a full line of coil and elliptic springs for electric railway service and its T. M. C. steel-tired wheels. The representatives in attendance: John Taylor, president; C. H. Dodge, Western sales agent, of Chicago; Thomas Thorne, foreman; W. E. Taylor, assistant foreman.

THE AMERICAN MASON SAFETY TREAD COMPANY, of Boston, Mass., was represented by its treasurer, Henry C. King, and its Philadelphia agent, L. H. Myrick. President William S. Lamson was there a part of the time. The exhibits included samples of Mason safety tread with both steel and hard brass base, and filling of both lead and carborundum; safety sidewalk or vault light of Mason construction; coal hole covers with Mason safety tread tops; combination safety tread and cork composition for inclined ways, stairs, vestibules, etc.; safety running boards and car steps and Karbolith car flooring.

THE ATLAS RAILWAY SUPPLY COMPANY, of Chicago, Ill., was represented by J. G. McMichael and G. M. Huber. It exhibited Atlas rail joints, compromise joints, Atlas special joints for raising the worn or pounded receiving rail, insulated joints, Atlas braces and tie plates, and the Atlas improved

switch stand. The latter has no padlocks, as the locking device is enclosed in the handle. It also has an adjustable throw.

THE PHILIP CAREY MANUFACTURING COMPANY, of Cincinnati, Ohio, displayed a sample line of its products, including Magnesia flexible cement roofing, roofing paints and roofing materials. Among the representatives present were H. C. Hutchinson, Buffalo, N. Y.; Frederick Collins, Jr., and J. G. Howley, of Philadelphia, Pa.; F. H. Shipe, Richmond, Va., and W. I. Kelley, New York.

THE COOPER HEATER COMPANY, of Dayton, Ohio, displayed one each of its Nos. 1, 2, 3 and 4 heaters for street and interurban cars. The meritorious features of these heaters were explained by J. D. Hunter, president; W. L. Blackwell, general manager, and J. B. Cooper, special representative.

CHARLES I. EARLL, of New York, had four different styles of retrievers on exhibition, as follows: No. 5 with compulsory set and emergency release; No. 4 with compulsory set, but without the emergency release; No. 3 non-compulsory set with emergency release, and No. 2 non-compulsory set without emergency release. These retrievers, except for some slight improvements in minor details, were the same as exhibited last year, experience having shown that no change was desirable. In addition to the retrievers, Mr. Earll showed a new trolley catcher. The trolley catcher is furnished either with or without the emergency release; it fits the same socket as the retriever and can be converted into a retriever merely by substituting the retriever drum and parts attached to it for the catcher drum. The representatives at the convention were C. I. Earll, C. A. Coutan and Ernest Miller.

THE GIBSON IRON WORKS COMPANY, of Jersey City, N. J., had an exhibit consisting of the Gibson commonsense dumping grate, Gibson non-warpable shaking grate and Gibson spiral steam blower. The president of the company, Edward Gibson, as well as Ralph Conrad were present.

J. A. HANNA COMPANY, of Cleveland, gave away a detailed descriptive card with plan and elevations of the Washington-Baltimore-Annapolis car the Niles Car & Manufacturing Company had on exhibit on the track near the Steel Pier. The following representatives of the Niles Car & Manufacturing Company were at the convention: F. C. Robbins, president; J. A. Hanna, sales manager; F. A. Richards, sales agent, and A. W. Schall, superintendent.

THE MORAN FLEXIBLE JOINT COMPANY, of Louisville, Ky., displayed all metal flexible ball joints for steam, air, gas and liquids, and a trolley catcher operated by gravity, thus doing away with spiral springs. Neither of these has been exhibited at these conventions before.

THE PITTSBURGH POLE & FORGE COMPANY, of Verona, Pa., showed trolley poles, span wire poles, electric light poles and brackets. The Pittsburg standard trolley was exhibited for the first time.

COOK'S STANDARD TOOL COMPANY, of Kalamazoo, Mich., was represented by Eugene Cook and Chas. Richardson. The exhibit included the Standard track tool grinder, the Standard track drill, the Climax track drill, the Standard car and track jack, the Standard wood-steel cattle guard, etc. Of these appliances the Climax track drill was the only one brought out since the last convention. The novel feature of this drill is the crucible steel gears. These are an innovation, as ordinary gray iron has always been used heretofore. Another feature is the feed device, from which all friction has been removed. This is the same feed device that has made the Standard drill so popular. The Standard track drill has been improved since the last convention by making the column clamp-shaped. Another feature is the carborundum wheel, which is a combination wheel composed of two different grades of grit, both coarse and fine.

THE SCHOEN STEEL WHEEL COMPANY, of Pittsburg, had an exhibit of considerable size, in which were included quite a number of the various finished types of surface, elevated and subway solid pressed and rolled steel wheels that have been manufactured by this company up to the present time. The interests of the company were represented by the president, C. T. Schoen, M. R. Jackson, W. M. Johnson and N. B. Trist.

THE SHERWIN-WILLIAMS COMPANY, of Cleveland, displayed among many other items the following: Car body colors; roof, floor and truck paints; headlining colors; swing catalogues; hand craft stains; rattan seat enamel; Ajax insulating varnishes and impregnating compounds; dry colors, etc. The Ajax insulating varnishes and impregnating compounds were a novel feature. The headlining color display was particularly complete. The company has found that there is a big demand for fiber board for use on headlinings. The different paints which it displayed are particularly adapted for this kind of work. The swing catalogue referred to was a reproduction of the company's general street railway catalogue. The leaves of this swing catalogue were 6 ft. long and 4 ft. wide. The car body colors showed in detail the various operations in painting a car from the wood up. The representatives were E. M. Williams, F. A. Elmquist, H. E. Billau and R. Clitz.

THE STANDARD MOTOR TRUCK COMPANY, of Pittsburg, exhibited one O-50 Type short wheel base (4 ft. 6 ins.) high-speed double truck for city and suburban service. This truck has a carrying capacity of 50,000 lbs., or 25,000 lbs. at each king pin. One C-50 Type long wheel base (6 ft. 6 ins.) high-speed double truck for city and suburban service. This truck has a carrying capacity of 50,000 lbs., or 25,000 lbs. at each king pin. One O-45 Type maximum traction double truck for city and suburban service, with a carrying capacity of 45,000 lbs., or 22,500 lbs. at each king pin. One C-60 Type "Interborough" high-speed double truck, with carrying capacity of 60,000 lbs., or 30,000 lbs. at each king pin. The following representatives were on hand: A. W. Field, general sales agent, Pittsburg, Pa.; A. Christianson, chief engineer; W. G. Price, engineer truck department; W. C. Cory, sales agent, New York office, and E. C. Buschman, superintendent truck department.

THE ROOKE AUTOMATIC REGISTER COMPANY, of Providence, R. I., was represented by the inventor of the register, Geo. F. Rooke, who demonstrated its simple working.

THE ACME SUPPLY COMPANY, of Chicago, was represented by R. E. Slagle, who explained the good features of the company's car shade rollers and curtains.

THE FRANKLIN CAR HEATING COMPANY, of Syracuse, N. Y., showed several city and interurban types of heaters. The company was represented by K. D. Hequembourg and G. H. Brown.

THE PIKE ADDING MACHINE COMPANY, of Orange, N. J., had several of its machines on view. J. T. Langhorne, J. F. Calef and B. C. Alexander were present.

THE DANVILLE CAR COMPANY, of Danville, Ill., had an exhibit in Elmer P. Morris Company's quarters, consisting of a car section with steel sides and windows arranged for either roof or side storage. Besides Mr. Morris, E. J. Lawless and Henry Vogel were on hand.

THE ELECTRIC SERVICE SUPPLIES COMPANY had a tastefully furnished parlor where guests could make themselves at home in the easy wicker chairs. The exhibit comprised so many items that only a small part can be mentioned here. These included Keystone insulation, Imperial headlights, Overton-Daniels lightning arresters, Protected bonds, automatoneers, hydraulic rail bonding tools, Lyon sheet steel gear cases, Kant curtain fixtures and Keystone vestibule shades. Liveliness was added to the display by the numerous signs and by the efforts of the following representatives: C. J. Mayer, J. W. Porter, J. V. E. Titus, Max Berg, A. H. Englund, E. R. Mason, T. H. Henkle, H. G. Lewis, F. C. Peck, Ernest Boehme, W. D. Hamer, C. H. Bristol, Robert Montgomery, John Pollock, James H. Stewart, George Watts, Edw. Hammett, Vincent Rhea, John McSorley, T. F. McKenna, W. A. Armstrong, F. B. Massey, H. R. Swartley, E. B. Ross, C. B. Harvey, G. C. Hart, C. H. Bristol and W. D. Hamer.

THE UNITED STATES ELECTRIC SIGNAL COMPANY, of West Newton, Mass., showed two completely wired block signals, type E-1, ready for demonstration. Among the roads now using these signals are the Boston Elevated Railway, Boston & Northern Street Railway, Columbus Railway & Light Company, Tacoma Railway & Power Company and Worcester Consolidated Railway Company. The company is also doing a large foreign business. The exhibit was in charge of J. J. Ruddick, consulting engineer.

THE LUMEN BEARING COMPANY, of Buffalo and Toronto, displayed the Ideal trolley wheel and specimens of its

bearings. The representatives on hand were E. P. Sharp and C. W. Stimpson.

EVANS, ALMIRALL & COMPANY, of New York and Boston, distributed circulars descriptive of their work and showed pictures of installations. They were represented by Douglas Sprague and Benjamin Kauffman.

THE NEW DEPARTURE MANUFACTURING COMPANY, of Bristol, Conn., presented a wide line of gongs, harps and sleet cutters, in charge of De Witt Page and M. J. Horton. A feature of the exhibit was the award of a silver loving cup to the most popular lady attending the convention.

THE CLIMAX STOCK GUARD COMPANY, of Chicago, Ill., offered clay cattle guards, expanded metal guards, farm crossing gates, etc. F. W. Stewart and F. V. Stewart were on hand.

THE WALLACE SUPPLY COMPANY and QUINCY-MANCHESTER-SARGENT COMPANY had a common exhibit on both sides of the pier where they displayed numerous specialties, among which were the Q. & C. Stanwood car step, rail joints, gongs, racks, door and other car fixtures, etc. Those in charge were Emil Metterhausen and W. Meeteer.

THE HOWE RUBBER COMPANY, of Trenton, N. J., exhibited many kinds of packing specialties, insulated wire, N. B. O. black sheet packing and combination cap valves. A. R. Foley, H. M. Royle, C. E. Stokes and Elmer Bainbridge were in attendance. An imitation house-fly was the ever-popular souvenir given out by the company.

THE T. H. SYMINGTON COMPANY, of Baltimore and Chicago, showed a variety of journal box designs to suit different conditions of truck construction, Baltimore ball-bearing center plates and side bearings, and a new lid especially adapted to electric cars operating almost exclusively over city streets. This lid is applied to and removed from the box by a short bar used as a lever. It is of simple construction, consisting only of the lid and a helical spring, the spring being fastened to the lid but so located as to be entirely protected from possible blows by wagon hubs. There is no projection on the outside face of the lid except a small lug near the top, which serves the purpose of a handle. The representatives were T. H. Symington, J. F. Symington, C. J. Symington, D. Symington, W. W. Rosser, Carll Tucker, A. H. Weston and E. J. Nichols.

THE UNITED STATES ENGINEERING Company, of Philadelphia, Pa., exhibited the Nachod automatic signal with a model circuit. C. P. Nachod, president; Louis P. Scott and Gifford Scott, salesmen, were on hand.

THE BAYONET TROLLEY HARP COMPANY, Springfield, Ohio, showed specimens of its detachable harps and trolley poles, together with its self-lubricating trolley wheel and Butterfly sleet cutter. The company was represented by J. M. Olinger, R. A. Garlough and G. W. Olinger.

THE ELECTRIC TRACTION SUPPLY COMPANY, of St. Louis, had an extensive display of headlights, trolley wheels, insulators, overhead fittings, arc lamps, etc. The company was represented by O. W. Uthoff, A. Cook and H. G. Paro.

THE BALL & WOOD COMPANY had some interesting photographs of its installations to show, together with specimens of its piping work. O. M. Jones and G. H. Jewell were on hand.

O. M. EDWARDS & COMPANY, of Syracuse, N. Y., showed twenty odd styles of car window fixtures installed on windows. There were also displayed platform trap-door fixtures, tin barrel spring rollers, locks and other car fixtures. The company was represented by O. M. Edwards, G. G. Norris, E. F. Chaffee, Edward Laternauer and F. C. Nicholl.

THE CHICAGO VARNISH COMPANY had an exhibit consisting of a variety of varnishes and stains. These were effectively shown on sample boards of mahogany, ash, bird's-eye maple and other woods used as inside finish for cars. Visitors were cared for by H. J. Green, F. L. Olds, Geo. S. Bigelow and O. S. Ford, all of the railway department.

THE WESTON ELECTRICAL INSTRUMENT COMPANY, Newark, N. J., exhibited its standard types of voltmeters, ammeters and wattmeters. The special feature of the exhibit was a new line of alternating-current switchboard ammeters and voltmeters. Many switchboard instruments were exhibited to advantage on several marble switchboard panels. The exhibit, which consisted of 350 instruments of various types, was shipped to the Exposition on a special car. The booth was ornamented with diplomas obtained by the company at various Expositions and by a large picture of the factory. Dr. Edward Weston, president of the company; Caxton Brown, general manager; F. A. Gilbert, C. P. Frey and Edward Everett were in attendance at the booth.

THE UNDER-FEED STOKER COMPANY was represented by Chas. S. Crowell, district manager for the Middle Atlantic states. The company had a working exhibit of its stoker, consisting of a Jones under-feed stoker, with blowing and automatic attachment, showing how coal and air fed to the furnace are automatically controlled by the steam pressure. The special feature of this stoker is the smokeless combustion of bituminous coal. W. T. Jordan, manager of the New York & New England district, was in evidence at the booth of the company toward the end of the week.

WENDELL & MacDUFFIE, of New York, representing the Indestructible Fiber Company, the Falk Company, the Russell Car & Snow Plow Company and Keasby & Mattison, showed the specialties of each of these companies. For the Indestructible Fiber Company were shown a variety of headlinings, a section of the roof of a car being used to show the application of the fiber. A line of gears and pinions was shown for the Falk Company. The exhibit for the Russell Car & Snow Plow Company consisted of a plow on a short stretch of track, opposite the pier. The plows proper are operated by compressed air, and the working up and down and in and out of the noses was shown. The asbestos sheating of the Keasby & Mattison Company was shown adapted to underlining for cars. A feature of the products of this company, as shown, were two panel boards on which were mounted asbestos shingles as they might be used for railroad terminal stations and other structures. The representatives of Wendell & MacDuffie present were Jacob Wendell, Jr.; R. L. MacDuffie, H. E. Oesterriech, O. C. Ferens, F. C. Field and Messrs Kline, Logan and Carr.

THE COLUMBIA MACHINE WORKS & MALLEABLE IRON COMPANY, of Brooklyn, had on exhibition a full line of its various specialties. Its snow-sweeper broom-filling device was shown, together with a complete broom exposed so as to show how the rattan is secured in place. Adjustable armature winding stands, two armature banding machines, one with 24-in. sweep and the other with 34-in. sweep, an axle straightener, air-pit jacks, wire tension machine, armature coil lead flattener, field coil taping machine, babbitting device pinion fuller and armature truck were among the other machines on exhibition. The company called especial attention its axle straightener, which has adjustable heads which always keep the axle in the center. Among the specialties of the company on exhibition were commutators, bearings, adjustable controller handles, trolley poles, trolley wheels, etc. The company was represented by J. G. Buchler, president; James Grady, vice-president, and W. R. Kerschner, second vice-president and manager of sales.

THE NORTON GRINDING COMPANY and the Norton Company, both of Worcester, Mass., had a small but attractive exhibit showing their products, and the results attained by their use. The main feature of the exhibit of the Norton Grinding Company consisted of a pair of steel wheels mounted on an axle which had been ground on the company's wheel grinder, the accuracy of the grinding being shown by a recording device rubbing the wheels as they turned and recording inaccuracies in the grinding to the thousandth of an inch. A car axle ground on the company's plain grinder also was shown. The Norton Company had two wall cases displaying Alundum wheels and India oil stones. H. N. Cudworth represented the Norton Grinding Company and Geo. C. Montague the Norton Company.

THE J. G. BRILL COMPANY, of Philadelphia, had a very complete exhibit as usual. Its products on show extended from full-sized sections of its cars to the company's well-known specialties. The full-sized section of the pay-as-you-enter car, perhaps, deserves attention first, as this type is attracting special attention at this time because of the orders recently placed in Chicago and other cities. The section as

shown was the same as for the 300 cars for the Chicago City Railway. The other sections of cars shown were the Brill full convertible car, the patented semi-convertible and the Narragansett. A new device of the company for compelling passengers to face forward in getting off cars was commented on favorably. It is a grab-handle so arranged that it turns when the seat is turned, and the passenger must face forward as he has no means of support in getting off the car if he turns toward the rear end. The trucks shown were the No. 27E 3 double truck with an extra solid forged side frame, the No. 27FE 2 double truck, of which 600 are building for the Chicago City Railway, the No. 27GE 1 double truck with an extra forged side frame, the No. 21E single truck with extra forged frame. A full line was exhibited of Brill "Winner" seats, with rolls of rattan-seat covering. The specialties shown were the Dumpit sand box, Dedenda gong, noiseless brake hanger, patent seat end panel for open cars and noiseless, patented brake-hanger arrangement for Eureka traction truck. A full line of elliptical and helical springs was on show. Biograph views of the pay-as-you-enter car showed the car in operation. Representatives present were: James Rawle, president; Samuel M. Curwen, vice-president and general manager; Wm. H. Heulings, Jr., assistant secretary and sales manager; Geo. M. Haskell, sales agent; Geo. H. Tontrup, D. B. Dean, A. N. Hargrove, J. Elwood Brill, Frederick Brill and Byron Brill. R. D. Apperson, of Lynchburg, Va., president of the Lynchburg Railway & Lighting Company, showed at the Brill space his automatic headlight, reversing switch and mechanical trolley hangers for keying the trolley to the car without the use of solder.

THE STANDARD ROLLER BEARING COMPANY, of Philadelphia, Pa., had on exhibition the car journal bearing which made the remarkable record in service, noted in the Street Railway Journal for October 12. In addition the company had a miscellaneous collection of journal and thrust bearings of all descriptions on exhibition. A chart at the back of the booth, much in evidence, gave the result of a test of roller bearings on the turbine in power house No. 2 at Niagara Falls. A variable speed motor equipped with the company's ball bearings was in continuous operation. W. H. Hansell, sales agent, and Wm. C. Webber and T. J. Hiller represented the company.

THE LORAIN STEEL COMPANY'S exhibit had to do principally with the company's more recent development in tongue switches. In addition to standard tongue switches, it showed a long radius pinless tongue switch with an adjustable tightening feature at the heel of the tongue and a tongue switch made of solid Guarantee steel. The tad-pole heel switch was another of the company's products in prominence. This switch is designed without a pin and the important feature is largely increased bearing surface at the heel, where heavy cars destroy the track structure. All of these switches are made with the wearing surface of Lorain Guarantee steel or solidly of the same steel. The Philadelphia type of street railway crossing, made of rolled rails and Guarantee steel, was also shown. Among the other things exhibited were solid Guarantee frogs or combination frogs with wearing surfaces only of Guarantee steel, the balance being of cast steel and cast iron. On a panel at the back of the booth were mounted 75 standard sections of straight and curved track from 6 in. to 9 in. in height and weighing from 60 to 149 lbs. to the yard. The company was represented by H. C. Evans, S. P. S. Ellis, A. L. Verner, Wm. W. Kingston, A. S. Littlefield, S. P. McGough, F. J. Drake, Jos. MacCarroll, Jr., Carroll Burton, P. M. Boyd, E. B. Entwistle, H. C. Stiff, H. F. A. Kleinschmidt, H. B. Frye, Jr., and Jesse B. Heller.

THE CARNEGIE STEEL COMPANY, of Pittsburg, and the American Steel & Wire Company, of Chicago, occupied the same space. The American Steel & Wire Company showed a complete line of rail bonds and bonding tools, its American railway fencing, concrete reinforcement, electric wires and cables, also its galvanized and strand trolley wire and trolley springs. The most interesting feature of the Carnegie Steel Company exhibit was a section of track, showing the application of the company's steel ties and Duquesne splice bars. This track was of standard construction, and so arranged that it showed successively the beginning of operations on the track, the foundation all in and the completed section. The representatives of the American Steel and Wire Company in attendance were : J. B. Southerland, G. A. Cragin, C. S. Marshall, C. R. Sturdevant, J. M. Holloway, C. S. Knight, F. A. Keyes and L. A. Dietrich. The representatives of the Carnegie Company were: W. P. Seibert, W. G. Clyde, John W. Dix, R. B. Woodworth, N. M. Hench, J. B. Bonner, Frank W. Jones, C. C. Cluff, Frank C. Llewellyn, F. A. Dilworth.

THE WILSON TROLLEY CATCHER COMPANY, Boston, exhibited the Wilson trolley catcher. Chas. N. Wood, treasurer of the company, was in attendance.

THE FLEXIBLE COMPOUND COMPANY, Philadelphia, exhibited "Flexible Compound," which is a waterproof liquid binder which, when mixed with oils, paints and varnishes, imparts its properties to them. Literature was distributed setting forth the uses of the liquid. S. F. Osbourn, Thos. W. Downward and Wm. Simpson represented the company.

THE SOUTHERN EXCHANGE COMPANY, of New York, had an exhibit consisting of long leaf pine octagonal poles, southern white cedar round poles and Georgia long leaf pins and cross arms. The rear of the booth was occupied by a panel of excellent photographs, showing the mills and yards of the company in North Carolina and Georgia. Occupying a prominent position was a large water-color drawing of a long leaf yellow pine pole, representing the north pole of the earth, which attracted considerable attention. The booth was tastefully ornamented with the green tops of Georgia pine trees. E. G. Chamberlin, president, and W. E. Mitchell, sales manager.

THE ADAMS & WESTLAKE COMPANY exhibited incandescent and arc headlights, signal lamps, basket racks, brake handles and car fittings. The company was represented by E. L. Langworthy, A. S. Anderson, J. A. Foster, F. N. Grigg and B. L. Compton.

THE McDONALD TICKET & TICKET BOX COMPANY, of Cleveland, exhibited the McDonald ticket box, cash fare receipts and hat checks. The company was represented by M. McDonald, president; T. J. Reynolds, T. J. Owens and C. H. Hatch.

THE TRACTION RAILROAD EQUIPMENT COMPANY, of New York, had on exhibition a new type of Hipwood fender, which sets under the car. A trip under the dash drops the fender when struck by a body. The fender may also be dropped by the motorman. The standard Hipwood fender was also shown. An interesting feature of the exhibit was a mutoscope, showing the action of the Hipwood fender in picking up bodies. Patrick Egan, president of the company, explained its operation. He was assisted by Charles T. Brown, vice-president and treasurer; Charles A. Frueauff, secretary, and George Hipwood, superintendent and inventor.

THE DEARBORN DRUG & CHEMICAL WORKS, of Chicago, showed different boiler and elevator compounds. Oils and greases for elevators were also exhibited. An interesting portion of the exhibit was a display of tubes showing pitting and corrosion due to impure water, and a collection of deposits and scales removed from boilers. In one portion of the booth was an interesting group of views of the company's laboratories and offices in Chicago and New York. Wm. B. McVicker, second vice-president, Grant Spear, third vice-president; H. G. McConnaughy and G. F. Duemler were in attendance.

THE NATIONAL LOCK WASHER COMPANY, of Newark, N. J., had an exhibit consisting of assorted sizes of lock washers, car curtain fixtures, sash locks and sash balances on frames. The curtain fixtures were shown in position on models of car windows. W. C. Dodd, president; John B. Seymour, Western sales agent; B. F. Archibold, Eastern sales agent, and Daniel Hoyt, mechanical superintendent, were in attendance.

THE EUREKA TEMPERED COPPER WORKS, of North East, Pa., exhibited commutators, commutator bars, brush holders, controller parts and trolley wheels and ears made from tempered copper. O. C. Hertzel, manager, and Fred Rundell represented the company.

THE DRESSEL RAILWAY LAMP WORKS, of New York City, displayed a general line of electric headlights for interurban and street railways, also oil-burning headlights. Another portion of the exhibit consisted of signal lamps and switch lamps for steam and electric roads. A feature of the display was a headlight of the type used on the New York Central locomotive. There was also shown an electric headlight similar to those with which the cars of the West Jersey & Seashore Railroad are equipped, and a reversible marker lamp used in the New York subway. F. W. Dressel, president;

Robert Black, vice-president; H. S. Hoskinson, secretary, and F. W. Edmunds, sales agent, were in attendance.

THE WESTERN TUBE COMPANY, of Kewanee, Ill., made a special feature of "Kewanee" union specialties, consisting of union ells, tees, flange unions, swing check valves, union valves and boiler couplings. A line of "High-Duty-Metal" valves, for medium and extreme pressures, attracted considerable attention, as did also the exhibit of malleable and cast iron fittings, heavy flanged valves, and fittings for power plant equipment. The walls of the booth were ornamented with a series of pictures showing the growth of the factory at Kewanee, Ill. In attendance at the booth were L. F. Hamilton, advertising manager, and F. E. Olin, sales agent; H. C. Brown and N. J. Higenbothan, all of New York.

G. T. BLOOM, of Ford & Kendig Company, Philadelphia, made his headquarters at the exhibit of the Western Tube Company.

THE NEWMAN CLOCK COMPANY, of Chicago, exhibited portable electric and stationary watchman's time detectors, employes' time recorders, signal clocks and track walkers' clocks. Chas. E. Renshaw, treasurer; Geo. Baldry and August H. Nanz represented the company.

THE F. P. HARRISON ELECTRIC & MANUFACTURING COMPANY, of New York, had an exhibit consisting of insulating materials, coils, asbestos, tapes and cloths, and motormen's coats. There was also shown a special armature coil, insulated with the "Challenge Brand" insulation. F. P. Harrison and E. H. Cook represented the company.

PRATT & LAMBERT, of Buffalo, displayed large sections of California borrough wood finished with varnish of the company's manufacture. Other features of the exhibit were a collection of gums from which varnishes are made, and heads of native gum diggers carved out of gums. In attendance as representatives of the company were J. P. Gowing, Joseph Maycock and M. B. McNulty.

THE INTERNATIONAL REGISTER COMPANY showed registers of various types mounted on a frame to permit of their being operated. Included in the exhibit of register fittings was the International cord ringing device just gotten out by the company. Heeren enamel badges and waterproof trolley cord constituted another portion of the display. John Benham, vice-president; Albert L. Tucker, secretary; William Kirchhoff, superintendent, and A. N. Loper represented the company.

THE CROUSE-HINDS COMPANY, of Syracuse, made a special exhibit of a midget arc headlight, known as the "Imperial Junior," which was shown at the convention for the first time. In addition to a full line of "Imperial" headlights, a new mine arc headlight was on exhibition. In all twenty-seven different types of arc and incandescent headlights were shown. Several were mounted on a frame and shown in operation. In addition to headlights, there were exhibited harpoon guy anchors and a full line of condulets. H. B. Crouse, president; A. F. Hillis, F. M. Hawkins, Frank Buchanan and Daniel C. Gridley represented the company.

THE SPEER CARBON COMPANY, of St. Marys, Pa., had on exhibition a new reinforced brush, together with a complete line of brushes for various types of machines. The company was represented by G. B. Fryling, J. S. Speer and J. Clyde Duble.

THE EGRY REGISTER COMPANY, Dayton, Ohio, exhibited the new Nicholl car dispatching system and types of apparatus used in the Egry system of dispatching. M. C. Stern had charge of the exhibit.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, of Rochester, N. Y., had as the chief feature of its exhibit a telephone dispatching system connected up for service. In addition there were shown two styles of portable telephones and several of the standard type. H. A. Jones represented the company.

THE NATIONAL CARBON COMPANY exhibited carbon products, including a full line of brushes and the new "Laclede" brush, designed for heavy suburban work. This brush is claimed to combine the highest conductivity and longest life with the least wear on the commutator. J. S. Crider, secretary; O. T. Weaver, F. D. Kathe and W. B. Brady represented the company.

THE BUHNE METAL PACKING COMPANY, of New York, exhibited fibrous babbitt steam packing. C. Pilz, secretary, and T. M. Remington were in attendance at the booth.

THE WHITMORE MANUFACTURING COMPANY, of Cleveland, made an exhibit of Whitmore gear protective composition. Two General Electric 81 motors were connected up for operation. The gear case of one was packed with the Whitmore composition while the other gear case was supplied with a competitor's gear lubricant. The difference in the composition was shown by operating the motors. The exhibit included some gears that had been in service for several months, which showed the difference in the wear resulting from the use of Whitmore composition. S. W. Whitmore, of Cleveland; E. G. Fisher, of Chicago, and W. M. Lawyer, of New York, represented the company.

EMIL CALMAN & COMPANY, of New York, showed a line of insulating varnishes and compounds. The exhibit included "Ohmlac," a compound manufactured expressly for the insulation of motors subject to overload and high heat. The company was represented by H. Lee Bragg, Walter A. Conway and Augustus Wulfing.

THE NATIONAL BRAKE COMPANY, of Buffalo, had a very attractive booth in which the several styles of the well-known Peacock brake were shown. G. S. Ackley, president of the company, was in attendance, as were also W. D. Brewster, secretary; F. D. Miller, treasurer; W. W. Miller, St. Louis representative, and John N. Akarman, who has recently joined the company as its general agent.

THE STANDARD VARNISH WORKS, of New York, exhibited insulating varnishes and compounds. Among those shown was Voltalac, which is well known to electric railway men. There was also displayed samples of solid compounds for use in connection with vacuum drying and impregnating apparatus. Various types of impregnated field, magnet and armature coils were shown. John C. Dolph, L. Robinson and E. M. Heckscher represented the company.

THE AMERICAN BLOWER COMPANY'S exhibit included an 80-in. steel plate fan, a pressure and a volume blower, a bank of heating coils, a model of a dry kiln and a 7-kw generating set, consisting of a vertical engine and a 220-volt generator. C. W. Olds, R. B. Bedford and G. O. Schoenfield represented the company.

THE NATIONAL BRAKE & ELECTRIC COMPANY showed a complete line of all air apparatus manufactured by it. The exhibit included several motor-driven compressors, including the new a. c.-d. c. type. There was also shown two portable compressor outfits adapted for shop use. A sectional compressor and sectional emergency valve were operated in such a manner as to show the working parts. The company's new type A governor occupied a conspicuous place in the exhibit. Probably the most interesting feature of the exhibit was the MSA and the TSA schedules which included all the latest types of control apparatus which were mounted on frames and connected up for operation. The company was represented by R. P. Tell, vice-president and general manager; S. I. Wailes, manager sales; J. T. Cunningham and G. C. Anthon, of New York; W. H. Gobel, of Philadelphia;; C. N. Leet, W. R. Crawford and B. S. Aikman, of Chicago; W. M. Bisel, southern representative; W. J. Richards, chief engineer; G. J. Johnstone, superintendent, and J. R. Petley, purchasing agent.

FRANCE PACKING COMPANY, of Philadelphia, displayed metallic and fibrous packings such as used in the Interborough (New York) Rapid Transit Company's power houses and elsewhere. A. W. France, L. T. Safford and John Rutherford were on hand.

THE D. & W. FUSE COMPANY showed an interesting line of fuses and other of its specialties. The merits of its products were explained by W. S. Sisson, secretary; L. W. Downes, manager of the company, and Messrs. Adams and Steer, sales representatives.

THE HEANY FIREPROOF WIRE COMPANY, of York, Pa., had specimens of its fireproof tapes and other materials to show, in care of H. L. Owen and T. A. Shock.

THE VAN DORN ELECTRIC & MANUFACTURING COMPANY and the VAN DORN & DUTTON COMPANY,

of Cleveland, showed armature and field coils, commutators, gears, pinions, drills, etc. W. H. Dutton, H. L. Schneider and C. I. Cartwright were in attendance.

THE WALWORTH MANUFACTURING COMPANY, of Boston, Mass., showed different types of valves and other piping specialties, including their high-pressure flange joint. The company was represented by L. V. Joyce and H. L. Rideout.

THE ADDRESSOGRAPH COMPANY, of Chicago, New York and Philadelphia, exhibited the addressograph in operation. This is a complete card index and addressing machine in one. E. D. Dorsey, manager of the Philadelphia office, was in charge.

THE A. & J. M. ANDERSON COMPANY, of Boston, presented many specimens of its Ætna insulation, together with switches, etc. The representatives of the company were T. M. Anderson, E. Woltman and W. W. Hincher.

THE RAPID READY CHANGE CARRIER, made by Chas. F. Etter, Harrisburg, Pa., was displayed in considerable numbers. The Chicago City Railway Company has adopted this means for the new pay-as-you-enter cars to facilitate change-making. Mr. Etter was in charge of the booth.

A. GROTHWELL, of New York, had several cans of Mogul paints and varnishes, and also showed specimens of work done with them.

THE COIN COUNTING MACHINE COMPANY, of Chicago, had a specimen of its Johnson's coin counter in care of C. H. Birdsall and W. P. Butler.

THE U. S. GRAPHITE COMPANY, of Saginaw, Mich., besides displaying its products, had some attractive posters. G. S. Richardson, eastern representative, and Gordon Douglas, of Chicago, western representative, were on hand. Playing cards were the souvenirs.

THE PETER SMITH HEATER COMPANY, of Detroit, Mich., had installed five specimens of its heaters in charge of Peter Smith, E. J. Smith and D. W. Smith.

THE YALE & TOWNE MANUFACTURING COMPANY had a fine exhibit of chain blocks, hoists, overhead trolleys, a model of a jib crane, etc. Advertising literature was distributed by C. W. Beaver, Wm. Hazelton, F. J. Ford and F. A. Hull.

THE UNION ELECTRIC COMPANY, of Pittsburg, had several boards with samples of bonds, headlights, fuses, lamps, etc., together with glass, pinions, and trolley stands. Geo. W. Provost, R. M. Kerschner and T. M. Cluley were in charge.

THE BURROUGHS ADDING MACHINE COMPANY, of Detroit, had several of its machines on view, in charge of F. A. Willard and Ward Gavett.

THE GOULD STORAGE BATTERY COMPANY, of New York, had a fine display of batteries and panels of elements together with photographs of installations. Visitors were cared for by W. E. Winship, Charles H. Bradley, Jr., and H. N. Powers.

ECLIPSE RAILWAY SUPPLY COMPANY, of Cleveland, showed an improved model of the Eclipse life guard attached to a car front. A novel feature was a mutoscope series showing the successful use of this fender in saving life. Benjamin Levy was in charge.

THE UNIVERSAL ADDING MACHINE COMPANY, of St. Louis, displayed nearly a dozen samples of its calculating devices.

THE LOS ANGELES SWITCH & SIGNAL COMPANY demonstrated its devices on a model double-loop-track equipment to show the use of its oil-controlled switches. Seven of the company's switch-tower equipments are now in use in Los Angeles. W. J. Bell and R. B. Sumner were in charge.

THE DOLDT COIN HANDLING MACHINE COMPANY, of Portland, Me., had two coin-sorting machines, one for pennies and the other for coins up to and including half dollars. The demonstrations were made by H. T. Holdt and J. E. Doldt.

THE STREETER JOURNAL BEARING COMPANY'S interests were cared for by its eastern representative, Fred W. Roth.

THE MAGANN AIR BRAKE COMPANY, of Detroit and Toronto, was represented by E. C. Rutherford and Frank Harrison, who described the company's storage air brake system.

THE PALMETTO METAL COMPANY, of Chicago, Ill., showed babbitt metals in the care of John H. Colvin, Wm. E. Ackley and H. C. Igel.

THE GEO. W. LORD COMPANY, of Philadelphia, maker of boiler water purifying compound, was on hand to welcome visitors in the persons of B. O. Lawrence, Capt. J. E. Doughty and Col. Nat. P. Lane.

THE DUFF MANUFACTURING COMPANY, of Allegheny, Pa., and New York, showed many sizes and types of jacks which were in charge of Geo. A. Edgin, representative of the Eastern office.

THE PANTASOTE LEATHER COMPANY had a rack with different styles of Pantasote car curtains with Forsyth fixtures and several car seats upholstered in Pantasote. The company was represented by J. M. High and D. E. Bonner.

THE HALE & KILBURN MANUFACTURING COMPANY, of Philadelphia, Pa., showed several types of car seats equipped with plush, rattan or other covering. An interesting specialty was the Hale & Kilburn all-steel car door. The representatives present were: A. F. Old, H. T. Bigelow, B. F. Pilson and S. A. Walker.

THE GALENA SIGNAL OIL COMPANY, of Franklin, Pa., arranged a reception parlor appropriately furnished. Among the many representatives who entertained visitors were: Geo. Barnes, assistant manager; Alfred Green, J. V. Smith, C. H. Thomas, Wm. Trubee, J. E. Southwell, E. H. Baker, Wm. Westcott, Geo. Smith, Wm. Walsh, E. V. Sedgwick, assistant manager mechanical department.

THE GOLD CAR HEATING & LIGHTING COMPANY displayed a great many types of electric-car heaters, junction boxes, etc., in position. The company was represented by E. E. Gold, J. M. Stayman, A. E. Robbins and E. B. Wilson.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, had an interesting exhibit. Among other materials were shown one element of type 71-R in a containing tank sufficiently large to hold eighty-three plates of this type, the tank showing the standard method of reinforcement used on cells at the end of rows. A twelve-pole carbon regulator, recording hydrometer, recording and signalling hydrometer, automatic cell filler and compensating hydrometer will be shown, with examples of positive and negative plates of the different types. The representatives present were: Charles Blizard, third vice-president; Albert Taylor, manager New York office; G. H. Atkin, manager Chicago office; E. L. Reynolds, manager Philadelphia sales offices; H. B. Gay, manager Cleveland office, and Robert C. Hull, district engineer.

THE RAIL JOINT COMPANY, of New York, had exhibits consisting of "Base Supporting" type joints, known to the trade as the "Continuous," the "Weber" and the "Wolhaupter" rail joints. The representatives present were: Benjamin M. Barr, New York; Geo. W. Smith, Baltimore, Md.; H. C. Holloway, Cincinnati, Ohio; G. M. Hagar, Chicago; Wm. A. Chapman, Troy, N. Y., and J. C. Barr, Boston.

THE STERLING VARNISH COMPANY and PITTSBURG INSULATING COMPANY, allied companies, made a joint exhibit of the insulating varnishes and the protective iron coatings manufactured by the Sterling Varnish Company and the insulating linens manufactured by the Pittsburg Insulating Company. The representatives of the company in attendance were: James Todd, president; Walther Riddle, Ph.D., vice-president; S. C. Schenck, general manager; A. S. King, Eastern manager; C. L. Cool, manager paint department; W. V. Whitfield and C. A. Barker.

THE GENERAL FIREPROOFING COMPANY, of Youngstown, Ohio, had an exhibit in charge of M. E. Murray, manager of the lug bar department, and associated with him were the New York manager, J. L. Sharkey; the Philadelphia manager, F. C. Fowler; F. P. Kafka, of New York, and E. W. Hunting, of Youngstown, members of the engineering force. The principal exhibit consisted of a steel truss, representing one side of a car house roof. This truss was 8 ft. wide, 16 ft. long with Trussit attached to the purlins. The Trussit is divided into three sections, the first section showing the metal with no

covering; the second section showing the top coat of cement plaster applied, on the under side of which the key of the plaster through the Trussit could be seen; the third section showing the finished roof slab with waterproof coat applied. There was also an 8-ft. slab of Trussit, 16 ins. wide, plastered with cement. This slab was used for test purposes, being placed on supports 4 ft. on centers and heavily loaded, to afford a demonstration of the great strength of the Trussit. The company also had a sample partition construction of All-united steel studding and Herringbone expanded steel lath, the sides plastered so that the key could be seen from the back side. As souvenirs, the company gave sections of the cold twisted lug bar for paper weights and nickel-plated sections of Trussit for pen-racks. It also had commercial samples and literature of its different materials, none of which have been exhibited at previous conventions of the Association.

THE STERLING-MEAKER COMPANY, of Newark, N. J., had a fine exhibit of the following: Sterling safety brake, Giant brake, Sterling trolley base, Sterling sand-box, Berg sliding fender, Sterling fender or life-guard, Berg folding fender, Sterling modern fare registers, Sterling register fittings (including the Sterling patent center operating system), the F. & B. car destination sign, conductors' punches, the S-M register cord, trolley cord, etc. The centerpiece of the exhibit was a double-end car platform on which the two brakes, the three fenders and sand-boxes with both pedal and hand lever were mounted. The trolley base had a pole attached to demonstrate the evenness of tension at all angles. Among the articles named, the Berg sliding and folding fenders and the F. & B. sign were shown for the first time. The representatives at the exhibition were: J. Albert Stowe, R. T. M. Stowe, George E. Willis, W. E. Hinmon and F. D. Willis.

THE AMERICAN MULTIGRAPH SALES COMPANY exhibited its multiple typewriter and office printing press, the Gammeter multigraph. Any form within the dimensions of 8½ ins. x 17 ins. can be printed with the Gammeter multigraph on any kind of paper from tissue to cardboard. Any style or size of type desired can be used. The saving of multigraphing as compared with the regular printer's charge is said to average 50 per cent. For printing from work where the typewritten effect is not desired, a direct inking attachment is used in place of the ribbon. The machine is easily operated by any office boy or girl, and takes up no more room than a typewriter. The exhibit was in charge of J. F. Howison, manager of the Philadelphia office. He was assisted by a staff of salesmen and demonstrators. H. M. Horr, advertising manager from the home office in Cleveland was also in attendance.

THE GARLOCK PACKING COMPANY, of Philadelphia, Pa., exhibited for the first time its line of Garlock fibrous and Pitt metal packings. Garlock packings are widely known and used through the entire mechanical world. Particular attention was called to the Pitt metal packings for stationary engines, the metal packings for gas engines and Tauril sheet packing. Each of these packings is said to be particularly fitted for modern power-house service. The representatives at the convention were L. E. Adams, W. R. Haggart, D. Newhall and E. C. Adams.

THE RIDGWAY DYNAMO & ENGINE COMPANY, of Ridgway, Pa., was represented by H. S. Thayer, president, and H. A. Otterson, sales manager, from the main office, and by S. Bowman Wheeler, manager of the Philadelphia office. The company had no exhibit, but had a complete line of printed matter to distribute.

THE ELECTRIC RAILWAY REVIEW, of Chicago, again published a daily edition during the convention, Monday to Saturday inclusive, which was greatly appreciated by those in attendance, as it contained many timely notes. The paper was printed in Philadelphia, and although copy had to be sent to that city the care with which the details were all carried out was remarkable. The issue for each day contained all that transpired the previous day and was to be had at the different hotels before breakfast. The company was represented by Hugh M. Wilson, Daniel Royse, L. E. Gould, John B. Bennett, C. R. Mills, E. J. Hunt, W. P. Padget, John N. Nind, Jr., Harold F. Lane, F. Nicholas, B. M. Kimball, Miss Jennie Boyd and Joseph A. Kucera.

J. G. WHITE & COMPANY, of New York, had an exhibit where albums of photographs were shown illustrating properties and construction work of the company. A list of those in attendance included the following: L. C. Bradley, general superintendent Eastern Pennsylvania Railways Company; C. E. A. Carr, general manager Helena Light & Railway Company; T. F. Wickham, operating auditor; J. W. Pardee, operating manager; W. A. Heindle, railway engineer; F. H. Gay, mechanical engineer; W. Ray Thompson, railway engineering department; C. G. Young, superintendent of railway construction; H. A. Larduer, general manager of engineering; C. F. Conn, commercial engineer; H. J. Douds, commercial engineer; J. T. Huntoon, superintendent railway department in City Railway and Light Company.

THE PRESSED STEEL CAR COMPANY, of Pittsburg, had no exhibit, but was represented at the convention by W. H. Wilkinson, who distributed a pamphlet entitled "The Modern Car for Passenger Transportation." It was an excellent example of good typographical work, and contained descriptions and illustrations of steel cars recently built by the company for electric railway service. A view and description of the works of the company at Allegheny, Pa., were contained in the publication.

THE UNITED COPPER FOUNDRY COMPANY, of Boston, had on exhibition trolley wheels and bushings, trolley harps, bearings and composition bronze castings. F. Harry Seaver represented the company.

HEYWOOD BROTHERS & WAKEFIELD COMPANY exhibited plush, rattan and slat seats for electric cars. The company was represented by C. W. H. Frederick and Bertram Berry.

THE GENERAL ELECTRIC COMPANY'S exhibit occupied one of the largest spaces on the pier, and its location gave ample opportunity for an arrangement of machinery so that it was easily inspected by visitors. The Curtis steam turbine was illustrated by a 1000-kw, 12,000-volt, 60-cycle machine, dismantled, so that every part was displayed. The company also devoted special attention to presenting a complete installation of the emergency straight air brake outfit, including motor car and trailer car equipment and air compressor. For the first time at any convention a commutating pole motor was shown in operation and undergoing test to demonstrate the remarkable commutation features of this design. This was done by means of a booster set which furnishes voltage up to 950 volts. Full load on the commutating pole motor was provided by a GE-90 railway motor direct coupled to it, and operated as the generator with water box load. By means of the variable voltage supplied the commutating pole motor demonstration was given of its sparkless operation under unusual conditions. A collection of contactors, and similar devices used in railway equipment, were exhibited, and the new K-35A controller, which is designed for four 50-hp motors at 500 volts, or four 60-hp motors at 600 volts, and includes new features making possible the handling of such large motors by a comparatively small controller. Various other devices of interest to electrical railway engineers were installed, such as the multiple gap lightning arrester for 10,000 a. c. circuit, and a direct-current lightning arrester, type M, form D-2, for 600 volts. Power circuit arc lamps for railway use were shown, a feature of this exhibit being two direct current arc lamps of the company's recent design, mounted at the front entrance to the exhibit. The company's reception headquarters on the pier were arranged inside with illumination by new Tungsten lamps with Holophane reflectors. A very complete exhibit of bonds and line material was displayed, as well as the company's latest design of catenary line material. As actually demonstrating the use of catenary construction a straight line was run across the exhibit space and a curved line started from the same point and run to the diagonally opposite corner. The company's headquarters outside of the exhibit were at the Marlborough-Blenheim. The company, as usual, had a large representation at the convention, including: J. G. Barry, manager of the railway department; W. J. Clark, manager of the traction department; W. B. Potter, engineer of the railway and traction department; E. D. Priest, F. E. Case, A. H. Armstrong, engineering department; C. C. Peirce, Boston; J. J. Mahony, S. W. Trawick, New York; R. E. Moore, Philadelphia; H. L. Monroe, Chicago; G. D. Rosenthal, St. Louis; E. H. Ginn, Atlanta; H. C. Houck, Cincinnati; H. N. Ransom, W. G. Carey, Schenectady; F. H. Gale, in charge of advertising.

The General Electric Company's exhibit occupied about 3000

sq. ft. opposite the main entrance to the pier. It is arranged, as usual, with a view to permitting easy examination of all the material on exhibition, and an attractive reception room is provided at one end.

Among the interesting features of the exhibit may be noted a 1000-kw Curtis steam turbine for developing 12,000 volts at 60 cycles. This machine is entirely dismantled and furnishes a most conclusive argument in favor of the simplicity and rugged construction of this machine.

There are many other features about this exhibit of particular interest to street railway men which will be further described in subsequent issues of the Daily.

In the General Electric Company's exhibit is a frame supporting all of the parts of the Sprague General Electric type M automatic control, of the type adopted exclusively on the Elevated and Subway Divisions of the Philadelphia Rapid Transit Company. Like other features of this exhibit it is arranged for operation and furnishes a very interesting demonstration of multiple unit control, which has now become practically standard for heavy railway work.

THE ST. LOUIS CAR COMPANY was represented by A. H. Sisson, F. McCoy and A. Cook and showed one of the Forest City Railway type cars mounted on the company's 47 truck.

THE NATIONAL RAILROAD TROLLEY GUARD COMPANY, of New York, had installed at its booth trolley guards of various designs and metal for protecting cars from becoming stalled at steam railroad grade crossings. L. J. Mayer, O. W. Pierce and W. K. Page represented the company.

THE WHEEL TRUING BRAKE SHOE COMPANY, of Detroit, had on display several types of wheel truing brake shoes. J. M. Griffith, president and general manager of the company, was in attendance.

CHAMBERLIN, CONNOR & HARRINGTON, of Colorado Springs, Col., showed the Harrington anti-straddling and safety device for split channel point and all movable tongues or points on switches or frogs.

ALLIS-CHALMERS COMPANY occupied approximately 1400 sq. ft. The company's exhibit contained a very extensive line of air brake apparatus, together with photographs and other representations of steam turbines, Corliss engines, gas engines, hydraulic turbines, condensers, generators, rotary converters, motors, and power and electrical machinery of every kind such as constitute complete traction equipments for power houses, sub-stations, cars, etc. One of the most interesting features was the new Type "J" emergency valve for use with straight air brake equipments. The principle advantages of the straight air brake system, as is well known, lies in its simplicity and in the fact that the brakes may be applied and released gradually; but it formerly had one serious defect, for, when two or more cars are run in a single train having this equipment, if the train should break apart, the brakes would not be applied automatically. Moreover, in the ordinary straight air system the control of the train is in the hands of the motorman alone, whereas with the automatic system the brakes can be applied by the conductor in case of emergency from any one of the cars in the train. The Allis-Chalmers Company's straight air emergency valve was designed to overcome these two points of deficiency in the straight air brake system, so that it is now possible, by using the emergency valve, to equip with straight air trains of two to four cars which will have all of the advantages of the simplicity and positive action of that system and, at the same time, possess the automatic safety features to be applied in case of a break in couplings or hose connections. This, it will be readily seen, puts the control of the brakes in the hands of the conductor as well as in those of the motorman. Another object of especial interest was the new Type "OB" pneumatic governor. The exhibit was in charge of W. S. Heger, assistant to the president, and J. H. Denton, manager of the company's air brake department. Others in attendance were various district managers of the company and as many of the salesmen of the several offices, particularly from the East, as could be spared from their regular duty, among them F. C. Randall, manager New York office; W. W. Power, manager Philadelphia office; W. G. Clayton, engineer air brake department; Lt. John Chilton, engineer steam turbine department; J. F. Dixon, selling force, New York; H. W. Rowley, selling force, New York; A. E. Peck, selling force, New York; J. B. Nicholson, selling force, Philadelphia.

THE McGRAW PUBLISHING COMPANY, publishers of the Street Railway Journal, the *Electrical World* and *The Engineering Record,* occupied space E, opposite the enrollment committee and at the entrance to the pier proper. Here copies of the souvenir edition of the Street Railway Journal, published in honor of the convention, were at the disposition of delegates as were also copies of the "Dictionary of Electric Railway Material," both of which were distributed among the exhibitors. Extra copies of the plan of the exhibit space were also distributed, and although this plan was modified somewhat at a late hour, it was on the whole substantially correct and greatly assisted those in attendance in locating exhibits that particularly appealed to them. A line of books was also shown, especially selected with the requirements of the occasion in mind. In attendance from the company were James H. McGraw, H. W. Blake, J. M. Wakeman, W. K. Beard, C. T. Walker, C. A. Babtiste, H. S. Buttenheim, W. H. Onken, Walter Jackson, Cale Gough, Frank Meyers, C. J. Doyle, Jr., and G. J. MacMurray.

THE AMATEUR VAUDEVILLE ENTERTAINMENT

The amateur vaudeville and dramatic entertainment which was originally scheduled for Wednesday evening was given at Young's Pier Theater on Thursday evening and was very largely attended. Admission was by badge and the performance was equal to any supplied at theaters in the large cities. The programme follows:

Overture—

Manufacturers' Quartette

By Courtesy of

John H. Thomas, First Tenor.....Phillip Cary Mfg. Co.
F. H. Shipe, Second Tenor.....Standard Paint Co.
F. F. Vandewater, First Bass.....Standard Paint Co.
John Lloyd Wilson, Second Bass.....The Burnet Co.

What I Know of Some One of Us (unter uns)..The Burnet Co.
By Courtesy of The J. G. Brill Co.

Humorous Musical Artist.....Clinton E. Weston
By Courtesy of W. E. Baker & Co.

Monologist.....A. H. Atkinson

CAST:

Col. The Hon. Sir Robt. Carteret, V. C.....Jacob Wendell, Jr.
Sir John Middleton, M. P.....Walker Marcus Dennett
Lieut. Robt. Carteret, 1st Hussars (Bobbie)..Chas. G. Bush, Jr.
Billings (Col. Carteret's Butler).....Harold W. Gould

Scene—Room in Col. Carteret's House, London.
Time—During the Boer War.

Produced by Courtesy of Mr. Jacob Wendell, Jr., of Wendell and MacDuffie.

What Lew Dockstader might have been.....Joseph McKenna
By Courtesy of General Electric Co.

Reminiscences of the late Chas. H. Hoyt....John Lloyd Wilson
The Garlock Wizard.....E. Clinton Adams

"If you are satisfied with being mystified you will be mystified until you are satisfied."

By Courtesy of Garlock Packing Co.

That Same Quartette.....In a Grand Closing

The association badge this year was along the old lines with the added feature of a symbol in the shape of the Absecon lighthouse, appropriate to the place of meeting. Miniature flags of the United States, Canada and Mexico indicated the international character of the body. The name of the association was in gold letters on a blue scroll with the name of the convention city and the date to complete it. The different association classes of membership and the guests were all distinguished by ribbons of different colors as follows: For delegates representing members of the American association, blue; associate members of the American association, purple; members of the accountants' association, orange; members of the engineering association, brown; members of the claim agents' association, green; members of the manufacturers' association, red; for guests, ladies and gentlemen, white. For the officers and executive committeemen of all five associations the badges proper were suspended from double bars inscribed with the name and office.

THE B. R. T. OPERATING FIGURES AND BALANCE SHEET

The operating figures presented herewith of the Brooklyn Rapid Transit Company for the year ended June 30, 1907, supplement the general figures published in the last issue of this paper in connection with the remarks of President Winter, of the company, to the stockholders of the company on the general condition of the property. The pamphlet report was unusually complete, and affords an excellent example of the lines along which such a document should be drawn to be of the greatest general benefit. The details of the various improvements under way were all gone into, with the result that an excellent idea was conveyed of the present condition of the property and of the requirements of the future. First was given the resume of the operating figures. This was followed by the subject of additions and improvements, the remarks of the president being closed with a reference to taxation as briefly outlined in the STREET RAILWAY JOURNAL for Oct. 12. Under the subject of additions and improvements the questions were considered of rolling stock, both elevated and surface, repair shop improvements, power and sub-station improvements, elevated structure and tracks, including station improvements, interlocking signals, etc., surface structures and tracks, the Brighton Beach improvement and car service. As recorded in the accompanying tables, the report shows the total earnings from operation to be $19,381,587, an increase of 4.92 per cent over the previous fiscal year. The percentage of operation to earnings is 59.16 per cent, as compared with 56.52 per cent for the year ending June 30, 1906. The net earnings from operation are $7,915,882, a decrease of $116,068. The amount of surplus after making all deductions is $2,002,598, equal to 4.45 per cent on the capital stock of the company. There were carried 511,839,437 passengers, an increase of 59,235,234, or 13.1 per cent over the previous fiscal year. The average gross earnings per passenger are 3.60 cents as compared with 3.89 cents for the preceding year, a loss per passenger of 7.5 per cent. The average net earnings per passenger (with no deductions for special appropriations or fixed charges) are 1.48 cents, as compared with 1.70 cents for the previous year. This deduction in net per passenger is accounted for partly by the increase of 41.2 per cent in number of transfers collected. The average number of cars operated daily for the twelve months ending June 30, 1907, is 2093, as against 1922 for the previous year, an increase of 9 per cent. The total passenger car mileage is 68,273,181, an increase of 4,615,858, or 7.2 per cent. In considering the increase in the average number of cars operated daily and the average

COMPARATIVE SUMMARY OF OPERATIONS FOR YEAR ENDING JUNE 30, 1907

	1907.	1906.
Gross earnings from operation	$19,381,587.15	$18,473,328.10
Operating expenses	11,465,704.76	10,441,377.37
Net earnings from operation	$7,915,882.39	$8,031,950.73
Income from other sources	555,165.93	323,935.62
Total income	$8,471,048.32	$8,355,886.35
Less taxes and fixed charges	6,026,386.72	5,612,934.23
Net income	$2,444,661.60	$2,742,952.12
Out of which was taken for betterments and additions to property	442,063.37	580,342.87
Surplus for the year	$2,002,598.23	$2,162,609.25
Add for judgment recovered from city of New York account wire privileges	39,798.33	.....
	$2,042,396.56	$2,162,609.25
Surplus for June 30, 1906-1905	$2,075,562.81	$984,723.20
Surplus June 30, 1907, and June 30, 1906	$4,117,959.37	$3,147,332.45
Of this amount there has been appropriated:		
Old accounts written off	.....	522.98
Depreciation adjustments	12,127.65	.....
For discount on bonds sold	371,825.24	571,246.66
Contingent reserve fund	.....	500,000.00
Total appropriation	$383,952.89	$1,071,769.64
Balance surplus June 30, 1907, and June 30, 1906	$3,734,006.48	$2,075,562.81

COMPARATIVE SUMMARY OF OPERATIONS FOR YEAR ENDING JUNE 30, 1907

Gross Earnings	1907	1906
Passenger	$18,443,983.27	$17,586,721.57
Freight, mail and express	349,538.93	309,554.67
Advertising	148,424.16	145,807.50
American Railway Traffic Co.	439,640.79	431,244.36
Total earnings from operation	$19,381,587.15	$18,473,328.10
Operating Expenses		
Maintenance of way and structure	$860,075.38	$815,147.34
Maintenance of equipment	1,786,731.06	1,642,799.00
Operation of power plant	1,655,400.38	1,609,534.19
Operation of cars—trainmen's wages	3,238,970.65	3,036,966.45
Operation of cars—other expenses	1,554,849.58	1,214,370.83
Damages and legal expenses	1,126,248.34	973,103.94
General expenses	643,898.78	603,288.52
Freight, mail and express—expenses	233,667.33	203,961.90
American Ry. Traffic Co.—expenses	365,863.25	342,205.20
Total operating expenses	$11,465,704.76	$10,441,377.37
Net earnings from operation	$7,915,882.39	$8,031,950.73
Income from Other Sources		
Rent of land and buildings	$68,490.32	$59,656.41
Rent of tracks and structure	125,865.31	97,302.93
Miscellaneous	360,810.30	166,976.28
Total income	$8,471,048.32	$8,355,886.35
Deductions		
Taxes	$893,782.44	$882,862.02
Interest and rentals—net	5,132,604.28	4,730,072.21
Total deductions	$6,026,386.72	$5,612,934.23
Net income	$2,444,661.60	$2,742,952.12
Special appropriations	442,063.37	580,342.87
Surplus	$2,002,598.23	$2,162,609.25

Divisional statement given below shows comparative gross earnings for the last three fiscal years:

Passenger:

	1907.	1906.	Increase.	Per cent, 1907 over 1906.	1905.	Increase.	Per ct, 1907 over 1905.
Surface	$11,323,084	$11,531,125	— $208,041	— 1.80	$10,345,111	$977,973	9.45
Elevated and bridge	7,120,899	6,055,597	1,065,302	17.59	5,304,289	1,816,610	34.25
Freight, express, mail, etc.	789,180	740,799	48,381	6.53	560,533	228,647	40.79
Advertising	148,424	145,807	2,617	1.79	123,511	24,913	20.17
Total	$19,381,587	$18,473,328	$908,259	4.92	$16,333,444	$3,048,143	18.66

The following is a comparative statement of gross earnings from operation for the six years beginning July 1, 1901, and ending June 30, 1907:

Year ending June 30		Increase over previous twelve months
1902	$12,510,622	5.13 per cent
1903	13,280,321	6.15 "
1904	14,755,158	11.10 "
1905	16,333,444	10.69 "
1906	18,473,328	13.10 "
1907	19,381,587	4.92 "

RECAPITULATION—TOTAL MILEAGE OF BROOKLYN RAPID TRANSIT SYSTEM

Stock ownership	112.087	110.453	20.789	243.329	28.380	28.380	9.665	66.425	309.754
999-Year leases	114.031	107.927	32.769	254.727	.....	.....	.....	.....	254.727
Special leases	5.048	5.048	.344	10.440	1.300	1.300	1.000	3.600	14.040
Total	231.166	223.428	53.902	508.496	29.680	29.680	10.665	70.025	578.521

number of passengers carried each day per car there should be taken into account the greater seating capacity of the cars placed in operation during the fiscal year ending June 30, 1907.

CONSOLIDATED GENERAL BALANCE SHEET, JUNE 30, 1907

ASSETS

Cost of road and equipment		$114,638,829.61
Properties owned in whole or in part by B. R. T. Co.		
Advances account of construction for leased companies		9,008,126.43
The Brooklyn City Railroad Co.	$7,670,358.20	
Prospect Park & Coney Island R. R. Co.	1,337,768.23	
Construction expenditures, constituent companies		3,323,501.02
To be reimbursed by issuance of B. R. T. 1st refunding gold mortgage 4 per cent bonds, upon deposit with Central Trust Co., trustee, of certificates of Indebtedness to cover.		
Guaranty fund (securities and cash)		4,005,755.00
Underlying bonds deposited with Central Trust Co., trustee		379,000.00
Treasury bonds		5,127,500.00
B. R. T. 1st ref. gold mortgage 4 per cent.	$4,624,000.00	
Other issues	503,500.00	
Treasury stock		146,228.00
Current assets		3,002,885.99
Cash on hand	965,670.23	
Due from companies and individuals	847,066.71	
Construction materials and general supplies on hand	1,047,490.34	
Real estate mortgages	21,500.00	
Prepaid accounts	121,158.71	
Bonds and cash in escrow covering contractors' deposits		42,120.00
Accounts to be adjusted		58,068.84
		$139,732,014.89

Note.—The certificates of indebtedness issued by constituent companies, aggregating $25,677,268.29, *against which B. R. T. bonds have been issued,* do not appear separately on this consolidated balance sheet, as the property purchased appears as an asset under the head of "Cost of Road and Equipment," and "Advances Account of Construction for Leased Companies," and the liability is represented by the bonds of the Brooklyn Rapid Transit Company, issued from time to time as such certificates of indebtedness are acquired and deposited with the Central Trust Co., Trustee.

CONSOLIDATED GENERAL BALANCE SHEET, JUNE 30, 1907.

LIABILITIES

Capital stock		$45,835,908.98
Brooklyn Rapid Transit Co.	$45,000,000.00	
Outstanding capital stock of constituent companies	835,908.98	
Bonded debt and real estate mortgages		85,557,930.00
Brooklyn Rapid Transit Co.	39,702,000.00	
Bonded debt of constituent companies:		
The Brooklyn Heights R. R. Co.	250,000.00	
The Nassau Electric R. R. Co.	15,000,040.00	
Brooklyn, Queens Co. & Sub. R. R. Co.	6,624,000.00	
Sea Beach Railway Co.	650,000.00	
Brooklyn Union Elevated R. R. Co.	23,000,000.00	
Real estate mortgages	331,890.00	
Current liabilities		4,173,240.38
Audited vouchers	1,441,398.15	
Due companies and individuals	190,253.25	
Taxes accrued and not due	1,006,132.61	
Interest and rentals accrued and not due.	635,456.37	
Bills payable	900,000.00	
Contractors' deposits		42,120.00
Long Island Traction Co. Trust Fund		9,320.15
Accounts to be adjusted		66,453.79
Insurance reserve fund		51,428.27
Depreciation reserve fund		23,190.79
Contingent reserve fund		238,416.05
Surplus		3,734,006.48
		$139,732,014.89

DETROIT DIVIDEND PASSED

The passing of the quarterly dividend of the Detroit United Railways Company affected the shares of the company on the Montreal Exchange, where they are largely held, the price running off from 50 at the close of the market on Oct. 14 to 40 at the opening on the 15th. Later the shares eased off still further and reached 28½. On active trading, however, as a result of confidence the stock regained much of the lost ground and in the afternoon just before closing recovered to 37. In explanation of the passing of the dividend, President J. C. Hutchins, of the Detroit United Railways, issued this statement:

"As you know, the territory which the Detroit United Railways serves has been developing at a very rapid rate, necessitating large expenditures for equipment, improvements and additions to the property. It has always been the policy of the company to provide the public with the best possible service, the result of which is that large sums of money have been constantly expended to accomplish this end.

"The present condition of the money market is such that the company is unable to reimburse itself through the sale of its bonds, at what it deems a reasonable price, for sums properly chargeable to capital account. Notwithstanding the fact that the surplus earnings of the company are approximately equal to those of the previous fiscal year, it is deemed by the board of directors to be for the best interest of the stockholders to use such present surplus earnings in providing for the improvements to which reference has been made above."

TOLEDO RAILWAY & LIGHT EARNINGS

The statement of the Toledo Railways & Light Company for the first half of the year, ended June 30, shows up well. The figures include the earnings of the gas and lighting plants that were taken over some time ago. It is believed the company will earn more than 4 per cent on its common stock for the year. The statement, in brief, follows:

	Gross.	Net.
Railway	$782,372	$335,185
Light and power	305,698	129,647
Gas	113,971	47,153
Heat	43,278	Def. 719
Other income	.....	5,760
	$1,245,319	$517,027

The charges, including bond interest, interest on floating debt and taxes, amounted to $380,142, and the dividend was $120,000, leaving a balance of $16,885.

THE RESULTS WITH THE NEW HAVEN'S TROLLEY LINES

In his report to the stockholders of the New York, New Haven & Hartford Railroad for the year, made public recently, President Mellen, of the company, thus referred to the operation of the electric railway lines controlled by the company:

Turning to the trolley lines, it appears that they have earned $10,638,000 gross and $3,615,000 net. The policy is to take out of these trolley properties merely enough money to pay charges, and the balance goes for the improvement and development of the trolley properties themselves. Thus the report shows that $1,144,000 was expended for maintenance of way and structures of the trolley properties, which is at the rate of something like $900 per mile of road operated. That is more than the St. Paul road and other important systems spend. It is the maintenance figure of a railroad, not a mere trolley system. It indicates that in this one item a lot of money has been spent for improvements which might have been capitalized.

The operating ratio of the trolley lines was more than 66 per cent of gross receipts, showing a big increase over the previous year. From a careful study of the figures of the trolley lines and the known policy of the management, it is conservative to say that at least $600,000 was expended upon these trolley properties and the amount charged in operation. If the truth were known, the real figure might be found to be nearly twice this sum.

B. R. T. WINTER SCHEDULE

Extensive changes in the operation of the elevated and suburban lines of the Brooklyn Rapid Transit have gone into effect. The company asserts that some of the changes mean an 80 per cent increase of service on the high-speed lines in the southerly section of Kings County, comprising Bay Ridge, Borough Park, Bath Beach, and Coney Island. Radical changes have been made on the Bath Beach & West End line. Trains, which in former years stopped at Ulmer Park, will now run through to the West End terminals at Coney Island. This is accomplished by the installation of a modern lift bridge over Coney Island Creek. These through trains are run on a fifteen-minute headway outside of rush hours, and in addition a short line service has been installed between Ulmer Park and the Brooklyn Bridge. The first of the short line trains leaves Bath Beach at 8.03 A. M. daily, and the last at 7.32 P. M. A fifteen-minute headway will be maintained at night, while extra trains will be put on for the morning and evening rush hours.

The congested condition of the Brooklyn Bridge, even during the non-rush hours, makes it necessary, so the company asserts, for all additional trains to make their terminal at the Brooklyn side of the bridge. Free transfers are given at either the Bridge Street or Sands Street station for trains to and from Manhattan. On the Culver division, another short-line service was inaugurated between Sands Street and Kensington Junction. It reduces the headway from fifteen to seven and one-half minutes in rush hours. Within two or three days there will be still another short-line service on the Brighton Beach line. When it is effected three-car trains will be run to Brighton Beach and Coney Island on a fifteen-minute headway. The short-line service will be operated on a seven-and-a-half-minute headway between Brooklyn Bridge and Kings Highway.

THE CLEVELAND SITUATION

Were it not for the fact that politics enter into the matter to such a great extent, it is believed that Congressman Burton's solution of the street railway question would be accepted by the great majority of the people of the city of Cleveland as fair and equitable both to the patrons of the lines and the companies operating them. While his plan does not contemplate a fare of 3 cents, it provides for a figure to be based upon the actual value of the property, the cost of such improvements as he has demanded and the earning capacity of the lines, without consideration of the par value of stocks and bonds issued and in no event to exceed seven tickets for a quarter. The valuation of the property is to be made by experts to be named by the Mayor, and their work is to be independent of city officials and railway men alike. They will not fix the fare, but will provide information from which an equitable figure may be arrived at, whether it is three tickets for a dime, seven for a quarter or eight for a quarter. One consideration in favor of the company, however, must always be kept in sight, and that is the allowance of a margin of profit equal to 6 per cent on the actual valuation of the property and on the money that must be invested in improvements and extensions, with such depreciation charges as may be necessary.

One year is given in which to secure information and fix the rate of fare for the suceeding ten years, but during that year the Cleveland Electric is to continue to sell seven tickets for a quarter. This is to be the test upon which the permanent fare for ten years is to be based. The books of the company are to be open and there will be no possibility of deception. The low-fare companies will be treated in the same way, but they will, of course, operate at the fare they are now offering if they choose to do so. After the expiration of ten years the City Council will have the right to change the rate of fare every year if desired until the expiration of the franchise, which is for twenty years.

Two costly improvements are contemplated in Mr. Burton's plan. One is a high-level bridge across the Cuyahoga River, to be used exclusively by the railroad company for its West Side lines. The other is a large subway at the Public Square to relieve the congestion morning and evening, when the traffic is heaviest in the down-town section. With the extensions and cross-town lines that are desired and the addition of many more cars these improvements will entail the expenditure of perhaps $1,000,000 a year for the next five years. Mr. Burton desires to see the city have the best street railway service in the country and his recommendations showed that he does not wish the fare placed at so low a figure as to make this impossible. He asks the people to take everything that will be to their advantage into consideration in the settlement and allow for all expenditures in the fare rather than to have the city issue bonds and thus increase the municipal debt. This seems commendable and coincides with the desires of the old company in this respect.

While much can be said in favor of the plan from a public standpoint, it is hardly what the Cleveland Electric desires, as its contention has been for a fare of seven tickets for a quarter during the life of the franchise. With a settlement after Mr. Burton's plan, the rate of fare for the first ten years will be fixed, but for the second half of the franchise term it will be an uncertain quantity. The officers of the company have given no expression on the matter and it is not known whether the company would accept a franchise on this basis or not. It is possible, however, that a rate of fare fixed upon a report made by disinterested experts would be all they would ask, and that the officers would be satisfied to leave the matter in the hands of an administration which it deems fair and above board with everything.

Judge Lawrence has read his decision as to the legality of the curative ordinance, passed by the City Council on Aug. 3 of this year. The court holds that the Dennison and Rhodes Avenue franchises were granted to the Forest City Railway Company before the Mayor became particularly interested in the company or guaranteed any of the franchises or bills incurred by the company. All other extensions except those east of the Public Square, the court said, were rendered voidable by the interest the Mayor had taken in the new companies, from the fact that he could not act as the agent of the people and at the same time legally approve the ordinances. But he said that the Forest City Railway Company had taken up the obligations of the Mayor prior to Aug. 3 and that the ordinance passed at that time rehabilitated all the extension ordinances west of the Public Square which were not otherwise void. The Forest City Railway Company had not established its right to joint use of tracks east of the Public Square, the court held, and the extension ordinances giving the company a right to operate over Cleveland Electric tracks and to build and operate lines on Central Avenue and Quincy Street are void. The ordinance of the East Fourteenth Street, or graveyard line, is left for future consideration. It was held that the ordinances on the streets east of the Square were voided, from the fact that no arrangements for the joint use of the tracks of the Cleveland Electric had been made prior to the passage of the ordinance and no attempt had been made to arrive at an agreement and compensation for such use. The cars of the Forest City Railway Company cannot now operate east of Ontario Street, which is in the middle of the Public Square.

SECTION OF I. E. E. FOR CLEVELAND

A section of the American Institute of Electrical Engineers will shortly be organized at Cleveland, Ohio. The authorization has already been obtained from the parent body, a petition signed by a number of the most prominent engineers of that city having been submitted a short time since. A preliminary meeting was held recently and it was found that the organization would probably start with fifty or sixty members at least, with the possibility of a much larger membership a little later on. The plans of the local organization include monthly meetings, at which papers on interesting subjects will be read and discussed. The use of the lecture room and apparatus of the Case School of Applied Science has been tendered for the meetings and they will be held there. This will also be a distinct advantage to the students in the electrical and mechanical engineering courses of that school, as they will be able to listen to the discussion of problems that are met in practice and form some idea of what their work will be when they are in the field.

TRACTION LINES TO FORCE STEAM LINES TO PASSENGER AGREEMENT

Taking advantage of a recent court decision, the officials of the Winona Interurban Railway Company will start action to force the Lake Shore Railroad Company to accept the mileage used on the electric line between Warsaw and Goshen and on all the Murdock lines in Indiana and Ohio. For several months past there has been an understanding between the officials of the Big Four Railroad and the officials of the Winona Interurban Company, whereby conductors on the two roads have orders to accept either form of mileage. Should the point raised by the electric road official carry in their favor, patrons can purchase 1000-mile books from the electric road for $15, and in the event this mileage can be used on the railroads the patrons will get a rate of one and one-half cent a mile. The contract on the cover of the mileage books just issued by the Winona Interurban Railway Company and the Murdock lines contains a clause which makes it possible for one, two or more persons to ride on mileage from the book. The Winona Company officials will direct their attack to the Lake Shore Railroad, a part of the Vanderbilt system. If they ultimately win their point, purchasers of these mileage books can go to Chicago over the Grand Trunk, Lake Shore, Wabash, Baltimore & Ohio, Pennsylvania, Nickel Plate or Erie Railroads, on these mileage slips and at an uniform rate from points along the Big Four Railroad between Granger and Wabash. H. J. Heinz, of Pittsburg, president of the Winona Interurban Company, has been in consultation with the other officials and directors of the company and he urged that the effort to force the Lake Shore and other railroads to accept mileage sold on electric roads be pushed. The appearance of Mr. Heinz in Warsaw at this time gives rise to the belief that the Winona Company is contemplating extending its Warsaw and Peru line through to Valparaiso, making connection with Chicago. This plan was advocated several months ago by J. M. Studebaker, the well-known wagon manufacturer of South Bend, who donated $25,000 to the Winona Assembly to be used in extending the Winona electric railway system.

PARK MANAGERS ORGANIZE

As a result of a call to the park managers throughout the country, issued by C. H. Oberheide, vice-president and general manager of the White City, Trenton, N. J., a goodly number of amusement men representing street railway interests and independent operators met in New York recently at the Imperial Hotel and took the first steps toward a permanent organization to operate in their behalf. James R. Pratt, of the United Railways & Electric Company, of Baltimore, Md., acted as temporary chairman and Mr. Oberheide as temporary secretary. The object of the meeting, as stated by Mr. Oberheide, can best be given in his own words. He said, in part:

"For convenience I will classify the objects of this meeting. First, the most important consideration is the securing of bands, vaudeville acts and other attractions. The primary idea is that a central bureau of information be established where attractions may be booked and from which names of players and the character of their acts may be sent, by circular or by a technical magazine, to all members of the Association. It is not the plan that the Association shall control performers, but rather assist them in securing dates and in other ways prove materially helpful to employers and employed.

"Second, the consideration of the best method of advertising, whether in the newspaper press or by posters. As pursued at the present time, the highly important subject of advertising is conducted in an unscientific and consequently, costly manner, frequently failing to secure the good ends desired.

"Third, the study of the relation that an amusement park should bear toward the municipality, rural or urban, in which it is located. It must not be forgotten that a park is open about four months in a season, usually from the first of June to the last of September, while during the remainder of the year the grounds are idle. However, during the entire year the parks are under the control of the local magistrates and constabulary, and are usually within the limits of fire protection and water supply. Sanitation, particularly in the matter of surface drainage and disposal of waste, is another phase of this problem.

"Fourth, the study of proper adornment of parks, such as the selection of trees and plants best fitted to soils, is an important consideration.

"Fifth, the question of the establishment of an employment bureau, conducted upon the best continental methods suited to our American type of life, is to be highly recommended. Such a bureau would be of the greatest benefit when we all recognize how difficult it is to secure good men for a short, but highly energetic season of personal activity.

"Sixth, the matter of transportation by steam, electric and wagon roads, as well as by steamboats, is of prime importance, as are methods of landing passengers, moving crowds that congest at the gates and the collection of tickets. In this connection the use and abuse of the pass system could be well made a subject for inquiry. Attention should be paid to the subject of employment of special officers charged with constabulary powers, the right to make arrests and the effect of summary hearings before pustices of the peace and other magistrates.

"Seventh, the pressing need of giving close attention to public comfort and safety, notably in the erection in each park of a woman's building, where women and children may be cared for, and where, if necessary, a trained nurse may be provided. (The idea of a woman's building was one that materially contributed to the success of the Fenton White City, and was not only highly appreciated but proved a splendid advertisement.)

"Eighth, the dissemination of the idea that the parks must have the highest standards of respectability. The association should endeavor to eliminate vulgarity from all shows and from every act, and suppress, promptly, without fear of favor, all phases of disorder. The rowdy has no place in a park and, until he is eliminated, will prove a constant source of danger. It will be seen in the discussion of these propositions that this Association is not in any sense a trust, as the term is popularly used, and having for its object the financial control of parks, of performers, or of methods of transportation. To the contrary, this Association is one not for pecuniary profit. It is to be considered an 'Exchange' for ideas, and a means of promulgating such ideas as will benefit the management, the employed and the patrons. The need for such an organization is best proved by your hearty response to invitation and by your presence. Having outlined some of the objects of the Association, I trust that a free and full discussion will follow so that we may all be benefitted by the interchange of thought, by which means we can effect a permanent organization."

After some discussion the proposition, as outlined by Mr. Oberheide, was approved, and a permanent organization was effected to carry out the suggestions made. These officers were elected: James R. Pratt, of Balitmore, president; A. J. Pizzini, of Richmond, Va., vice-president; C. H. Oberheide, of Trenton, N. J., secretary and treasurer. Board of directors, Lew B. Sloss, Scranton, Pa.; J. J. Weaver, Covington, Ky.; A. J. Voyer, Albany, N. Y.; A. J. Pizzini, Richmond, Va.; Charles C. Ames, Providence, R. I.

After several suggestions it was decided to call the new organization the National Amusement Park Association, and F. C. Schanberger, Secretary Oberheide and A. J. Pizzini were appointed to draft a constitution and by-laws to be submitted to the members for consideration at the next meeting. An initiation fee of $50, and an annual due of $25, was determined upon, and it was resolved that only individuals, firms or corporations operating parks or amusement resorts, either as owners or lessees thereof, be eligible to membership in this Association. It was further decided that any individual person, firm or corporation controlling, by ownership or lease, an amusement place such as heretofore indicated, shall be admitted to membership, with the understanding that in the event of such individual, firm or corporation operating, by reason of ownership or lease, more than one park in any city or in the territory immediately adjacent thereto, they shall be entitled to membership in the name of said individual, firm or corporation and not be obliged to pay membership fees for more than one of the respective amusement departments which it may operate by reason of owning or leasing thereof in such city or country immediately adjacent thereto.

Lew B. Sloss, M. J. Fitzsimmons, C. H. Oberheide and J. J. Weaver were appointed as a membership committee by President Pratt.

At the conclusion of the meeting of Friday it was decided to meet again in New York, at a place to be selected by the president and secretary, on November 14.

Among those in attendance were: M. Osterman, Casino, Toledo, Ohio; C. S. Sargent, Casino, Toledo, Ohio; Fred M. Taylor, Orange Lake Park, operated by the Orange County Traction Company, Newburgh, N. Y.; J. J. Weaver, Lagoon, Cincinnati, Ohio; A. J. Pizzini, Idlewood, Richmond, Va.; Fred Lewis, Idlewood, Richmond, Va.; Lew B. Sloss, Luna Park, Scranton, Pa.; A. S. McSwigan, Kennywood Park, Pittsburg, Pa.; Geo. E. Gill, Luna, Schenectady, N. Y.; A. M. Hopkin, Luna, Schenectady, N. Y.; A. J. Voyer, Altro Park, Albany, N. Y.; Fred C. Schanberger, Electric Park, Baltimore, Md.; James R. Pratt, United Railways, Baltimore, Md.; M. J. Fitzsimmons, River View, Baltimore, Md.; John T. Benson, Park Palatino, Havana, Cuba; Lexington Park, Boston, Mass.; Director Zoological Garden, Norumbega Park, Boston, Mass.; Chas. C. Ames, Boyden Heights, Providence, R. I.; E. B. Maltby, Island Park, Easton, Pa.; George H. Thomas, Union Lake Park, Millville Traction Company, Millville, N. J.; W. J. Warner, Golden City, Carnarsie, N. Y.; D. C. McMonagle, General Manager Walkill Transit Company, Middletown, N. Y.

LAKE SHORE EARNINGS

The earnings of the Lake Shore Electric for August showed a handsome gain over the same month a year ago. Up to that time, however, the business had just about held its own, as is shown by the small amount of surplus for the first eight months of the year. The remaining months will show up well, it is believed, and the company will come out at the end of the year with a good record. The statement for August and for eight months, exclusive of local lines at Lorain, follows:

	Aug., 1907.	Aug., 1906.	Gain.
Gross earnings	$118,332.33	$102,468.55	$15,863.78
Operating and taxes	49,457.11	47,110.43	2,346.68
Net	68,875.22	55,358.12	13,517.10
Interest	25,167.82	21,040.27	4,127.55
Surplus	43,707.40	34,317.85	9,389.55

January 1 to August 31, 1907:

	1907.	1906.	Gain.
Gross earnings	$625,201.37	$575,782.18	$49,419.19
Operating and taxes	339,741.44	319,129.95	20,611.49
Net	285,459.93	256,652.23	28,807.70
Interest	193,052.39	164,605.29	28,447.10
Surplus	92,407.54	92,046.94	360.60

REPORT OF UNITED TRACTION OF ALBANY AND TROY FOR YEAR ENDED JUNE 30, 1907

The United Traction Company's report as filed at Albany for the year ended June 30, 1907, compares as follows:

	1907.	1906.
Gross receipts	$1,956,441	$1,765,223
Operating expenses	1,187,735	1,116,037
Net earnings	$768,706	$649,186
Other income	91,982	19,889
Total income	$860,688	$669,075
Fixed charges	349,921	347,071
Surplus	$510,163	$322,004
Dividends	187,485	249,980
Surplus	$323,278	$72,024
P. & L. surplus	345,185	244,361
Betterments	241,478	64,559

The company issued $7,500,000 additional stock this year for the purpose of acquiring the Hudson Valley Railway Company, making the total stock outstanding $12,500,000.

PUGET SOUND INTERNATIONAL RAILWAY

The street railway system of Everett, Wash., which was taken over Sept. 1 by Stone & Webster, has been embodied in the Puget Sound International Railway Company, a new corporation which has been organized to build ond operate a system of interurban electric railways connecting Bellingham with Seattle and Tacoma, and projected as far south as the Grays Harbor country. At a meeting of the directors of the new company an appropriation of money for the purchase of the Everett railway system was made. The system includes a suburban line connecting Everett with Snohomish. The projected connections of interurban railway systems north of Seattle will traverse many rich valleys and farming communities . At present the Everett street railway system is operated by electric power generated in a steam plant owned by the company. Ultimately the Everett system will be operated by electric power furnished by a new plant at the falls of Nooksack River in Whatcom County, which is now being installed by Stone & Webster. The Whatcom County power plant will be yoked with that of the Puget Sound Electric Railway Company at Electron, and a new plant will be built on the upper White River. Steam auxiliary plants at Seattle, Georgetown and Tacoma will be used with the main system as reserve stations.

SOUTHERN PACIFIC FERRY PLAN

The South Pacific Coast Railroad Company has filed an application in Oakland, Cal., for permission to change the motive power of its line on Webster Street to electricity. This company is under lease by the Southern Pacific Company and is really a part of its system. The franchise under which the company now operates was granted March 6, 1880 for fifty years.

The Southern Pacific ferry system on the Oakland and Alameda side of San Francisco Bay, after its proposed electrification, will be a series of loops, the "horseshoe" route from Oakland mole, along First Street, across into Alameda and down on the Alameda mole having proved a very successful method of handling trans-bay passenger traffic. The plan for loops is shown clearly in the franchise applications and right of way purchases made by the railroad. In Alameda, three applications have been made. One is for a line west on Lincoln Avenue, turning across the marsh toward the Alice Street bridge to Sixth Street. This line will tap a residence section, from which it is now a long walk to a ferry station, there being no street-car lines which materially shorten the distance. Another application is along Eighth Street connecting the "broad-gage" on Lincoln Avenue with the "narrow-gage" on Central Avenue. The third application is for a franchise on Lincoln Avenue east from Park Street, using portions of Garfield Avenue and High Street, and traversing private right of way on curves until it connects with the "narrow-gauge" near High Street bridge.

The terms of the franchises state that work shall be commenced within four months of their granting, and be completed within three years from that time. It also provides that it shall be operated as a railroad, not as a street railway, use any other motive power than steam (this permitting electricity or gasoline motors, should the Southern Pacific's experiments with this form of power prove successful). These applications, if granted, will form a double system of loops and will permit trains from either Alameda line to connect with either the Oakland or Alameda mole. Thus, by alternating boats, a close-interval service can be maintained. The applications in Alameda are but an integral part of a plan the company officials are said to be formulating for the complete electrization of the Harriman Western system. The Oakland application is for a franchise in Franklin Street from Fourteenth to Twenty-First Street. A petition has been circulated among the property-owners, and the company has acquired property for a private right of way from Franklin Street to San Pablo Avenue, between Twenty-First and Twenty-Second Streets. The steam line on Webster Street will be electrized, and in time the tracks extended from the Franklin Street station along the tracks to Twenty-First Street and San Pablo Avenue. Until that time, the Franklin Street station will be operated as a street-car line temporarily connecting with the steam cars.

ASK FOR SALE OF THE CHICAGO LINES

Three petitions looking to the foreclosure of the mortgages on the Union Traction properties and their sale have been filed in the United States Circuit Court. The defendants are primarily the Union Traction, the North Chicago and the West Chicago Companies, but joined with them are all the banks acting as trustees for the bonds and everybody else who has or claims an interest in the properties. The plaintiff is the Guaranty Trust Company, of New York, a judgment creditor against all three of the defendant companies. It was the Guaranty company which, in April, 1903, filed the creditors' bill that threw the Union Traction properties into the hands of receivers, where they have been ever since. In that bill, however, there was no prayer for a sale of the properties—only that the court take charge and conserve them. In its petitions the Guaranty company expresses the belief that, under the recent decision of the United States Court of Appeals, reversing Judge Grosscup, it will be impossible for the new Chicago Railways Company ever to get such possession of the Union Traction properties that it can accept the ordinance. The Guaranty company in its petitions asks that each company be sold separately, so that its claims against each one can be satisfied. Its unsatisfied judgments are:

Against the West Chicago Street Railway Company	$270,476
Against the North Chicago Street Railway Company	569,089
Against the Union Traction Company	318,722
Total	$1,158,287

Under the terms of the mortgage securing the various issues of bonds of the companies a default against any judgment creditor works a default of the mortgages, and this would be enough to warrant a foreclosure of the mortgages if the Guaranty company intends to carry its case to that extreme. It was hinted, however, that if the bondholders could come to an agreement the petitions might be withdrawn.

THE TRANSIT SITUATION IN NEW YORK

The Public Service Commission held three hearings on Oct. 11 and issued several orders and requests which will do much to relieve the congestion on the Brooklyn lines. At the open meeting Commissioner Bassett introduced a resolution to the effect that the board request the Bridge Commissioner to prohibit wagons and trucks from occupying the trolley tracks on the Brooklyn Bridge in the rush hours. Frequently, Mr. Bassett said, heavily laden vehicles break down on the tracks and tie up the whole trolley service. The resolution said:

"Resolved, That this board earnestly recommends to the Bridge Commissioner as a means of increasing the usefulness of the Brooklyn Bridge for the traveling public in rush hours that he put into effect two rules substantially as follows:

"First, that during rush hours from 7 to 9 a. m. and from 5 to 7 p. m., no heavily loaded wagons be allowed to cross the bridge; and

"Second, that all vehicles crossing the Brooklyn Bridge during the rush hours be required to keep off the car tracks."

Following the passage of this there was a short colloquy between the commissioners that indicated clearly that the board had in mind the adoption of some plan for keeping heavily loaded vehicles off the car tracks in Manhattan. This idea was

originally put forward by President Shonts, of the Interborough, and later by Oren Root, of the New York City Company, as about the only thing the commission could do to improve the conditions governing the operation of the surface car service in this borough.

The commission issued two orders on the Brooklyn Rapid Transit to "satisfy or answer" within ten days. One of these complaints is to the effect that transfers should be issued from the elevated to the surface at Nostrand Avenue and Fulton Street, and that the full rush-hour schedule should be maintained until 7 o'clock. In addition an order to "show cause" was issued against the Brooklyn Rapid Transit to explain why the board should not order increases in service on the Cypress Hills line, on the Van Siclen Avenue line and on the Jamaica line.

Formal announcement has been made by the Public Service Commission of the first district of New York that Bion J. Arnold, of Chicago, has been retained as consultant in relation to subway lines in the city, and that A. W. McLimont of New York, has been retained to consult in relation to the surface railway situation. Chairman Willcox, of the Commission, has explained that Mr. McLimont will study the types of car in use, the power houses, and everything relating to the equipment, for the guidance of the commission, while Mr. Arnold will do the same sort of work on the subway. He will study the problem of loading and unloading passengers at the stations where congestion is great, and will also consider the question of side entrance cars.

STREET RAILWAY PATENTS.

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED OCT. 8, 1907.

867,592. Fare Register; Wilfred I. Ohmer, Dayton, Ohio. App. filed Feb. 9, 1903. Provides a fare register adapted for use where fares of different values are to be registered—that is, where each fare payment may consist of one fare unit or a number of fare units greater than one.

867,672. Slack Adjuster; Augustus Parker-Smith, New York, N. Y. App. filed June 21, 1907. Consists in the combination with the usual cylinder, piston and foundation brake rigging of a hollow piston rod, a push rod telescoped therein and connected to one of the brake levers, a friction clutch loosely mounted on the push rod and adapted to bear against the end of the hollow piston, a second friction clutch, also loosely mounted on the push rod, a stop therefor rigidly supported with reference to the brake cylinder and a spring located between the two clutches.

867,676. Slack Adjuster; William H. Sauvage, New York, N. Y. App. filed Jan. 11, 1907. In an automatic slack adjuster for railway brakes, the combination of the wheel truck and brake system therefor, comprising a "live" lever and a "dead" lever, the car body, the brake cylinder mounted on the car body and an automatic take-up device mounted on the car body and connected to the "dead" lever on the wheel truck.

867,709. Safety Device for Point Switches; Louis Dunn, St. Paul, Minn. App. filed March 15, 1907. Provides a switch point for the side track that is movable independently of the main line point so that in setting the switch for the siding it is necessary not only to move the main line point a predetermined distance, but the side track point must be moved also and independently of the other point.

867,857. Automatic Car Replacer; James W. Walls, Morley, Colo. App. filed April 8, 1907. A car replacing frog comprising a bar highest in the center and tapering longitudinally in both directions, the portions of the bar on opposite sides of the center receding transversely in one direction, the said frog provided with smooth faces transversely inclined downwardly in opposite directions.

867,918. Electrically Operated Railway Switch; Frank J. Johns, Scranton, Pa. App. filed March 20, 1907. Relates to mechanical features of a track switch, including solenoid magnets in the roadbed beneath the switch point and circuits established by a depending shoe or tappet on the car.

PERSONAL MENTION.

MR. THOMAS GOODRICH has been appointed passenger agent for the Marion, Bluffton & Eastern Traction Company, to succeed Mr. S. L. Logan.

MR. G. A. KOHLER, who was connected for the past seven years as paymaster for the Western Ohio Railway, has been appointed in charge of the auditor's department of the Springfield, Piqua & Troy Electric Railway Company.

MR. C. C. BENSON, who has been for the past year the manager of the San Jose & Santa Clara County Railway Company, San Jose, Cal., has resigned his position. Mr. Benson leaves with the best wishes of the company and will devote himself to the interests of the Santa Cruz Beach Company.

MR. CARL J. PRINTZ, who for over seventeen years was connected with the Allis-Chalmers Company and for the last year and a half has been been superintendent with the Milwaukee Electric Railway & Light Company, has taken a position as chief engineer with the John Inglis Company, of Toronto, Ont.

MR. J. N. AKARMAN, formerly general superintendent of the South Jersey Division of the Public Service Corporation, of New Jersey, has been appointed general sales agent in New York of the National Brake Company, of Buffalo. Mr. Akarman was at the convention and received many congratulations on his appointment.

MR. H. C. BARROW, who recently resigned as superintendent of the Lehigh Valley Transit Company, of Allentown, Pa., was with the company since 1899. Previous to his connection with the Allentown company Mr. Barrow was for five years a division superintendent of the Nassau Railroad of Brooklyn and previous to that was connected with the Indianapolis Street Railway Company.

MR. CHARLES F. BAKER, for many years superintendent of motive power and machinery of the Boston Elevated Railway, and now associated with Mr. L. B. Stillwell, has recently completed his work at Baltimore for the United Railways & Electric Company. He has recently been appointed acting superintendent of construction in charge of equipping the power and substations of the Hudson Companies at Jersey City, N. J.

MR. ROBERT N. CARSON, former president of the People's Passenger Railway Company, of Philadelphia, and interested in a number of electric railways in the State, died suddenly of heart disease in the Chestnut Street Opera House, Philadelphia, Tuesday evening, Oct. 15, while attending the theater in the company of his wife and Mr. John B. Parsons, president of the Philadelphia Rapid Transit Company. Mr. Carson was one of the early figures in street railway business in Philadelphia, being a contemporary of Mr. C. F. Fox, Mr. Joseph M. Gazzam and Mr. William H. Shelmerdine.

MR. ALBERT H. STANLEY, who resigned last February as general manager of the railway department of the Public Service Corporation of New Jersey, to become general manager of the London Underground Electric Railways Company, has received further promotion in his new field. On September 26 he became general manager of the Metropolitan District Railway in addition to his other duties. He now holds this position on five London tubes companies as follows: Metropolitan District; Baker Street and Waterloo; Great Northern, Piccadilly and Brompton; Charing Cross, Euston and Hampstead, and the Underground Electric Railways.

MR. EDWARD E. POTTER, general superintendent of the Union Street Railway and the Dartmouth & Westport Street Railway companies, of Massachusetts, has been granted a leave of absence for an indefinite period, during which it is understood that he will travel on the Pacific Coast. Mr. Elton S. Wilde, treasurer, has been appointed acting superintendent of both roads, and Mr. Edward F. Nicholson, who is now in charge of the electric express department, will be assistant treasurer, while Mr. Charles T. Battey will take the position of acting manager of the electric express. Mr. Fred W. Lurs, formerly in the electric express office here, will re-enter the employ of the company to take Mr. Battey's place in Fall River.

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Proposed Association of Transportation Superintendents

An important resolution was introduced by ex-President Ely during the last hour of Friday's session, and promises to exercise an important effect upon the character of the papers to be presented at future meetings of the association. Mr. Ely's plan, which was the outcome of the executive session of the association held on Thursday afternoon, was the organization of another affiliated association which should take up lines of work pertaining to transportation, traffic and general operation, topics which are now generally considered as belonging to the field of the general manager on small and medium sized roads and also to that of the superintendent of transportation on the larger properties. If this plan should be adopted, the work of the main association would be largely that of receiving and acting upon reports from the new affiliated association, as well as from the others, and discussing broad questions of policy which are beyond the somewhat narrower field of transportation only, to which hitherto the main association has directed its attention. Logically there should be an excellent opportunity for the development of a highly efficient organization of the kind proposed. An examination of the programme of the American Street and Interurban Railway Association at Atlantic City indicates that most of the papers presented would come within the purview of the organization proposed. This applies particularly to the reports and papers presented on Thursday, with the exception of the report on heavy electric traction and the paper on the use of T-rail, and to the paper on interurban railway fares, presented by Mr. Stebbins during Friday morning's session.

One of the principal aims of the new organization would be a study of the best means of promoting traffic, which would include advertising in its various forms, such as the establishment of street railway parks and the selection of attractions there to be provided. Its scope would also embrace the consideration of means for conducting transportation outside of the engineering features, such as the type of car, the prices to be charged for transportation, the preparation of schedules and most desirable speeds. It would include the methods of collecting the receipts, other than the purely accounting phases, and the discipline of the motormen and conductors. Finally, it could take up the relations of the company and of the operating force to the patrons. Altogether the scope of an organization of this kind is so large and the problems to be considered so varied that a most valuable programme could be laid out for its consideration each year for many years to come.

There is no doubt that the activities of an association of transportation managers would intrench somewhat upon the field now occupied by the main association, but this fact need not in any way reduce the amount of effective work accomplished by the organization as a whole. Where the transportation department is conducted by the president or general manager, or where this officer is particularly interested in transportation, he will be as welcome at the meetings of the new affiliated organization as he is now at those of any one of the other organizations which are conducting independent meetings. We presume that if the association is organized, its meetings will be attended by more of such officers of the different companies than the meetings of the other affiliated organizations, because the president as a rule gives more of his time to transportation subjects

than to engineering or accounting questions or to the problems of the claim department. But the fact that such an organization is devoting its energies entirely to this subject will give, it is thought, an impetus to the work and attract the active participation of many who do not now engage to any considerable extent in the discussions of the main organization. Moreover, as in the case of the other affiliated organizations, solid work can be accomplished better than under the present plan. The idea may appear to some to be revolutionary, but it is entirely in line with the objects of the association up to the present, and such a plan, if not actually contemplated when the constitution was drawn, was a contingency for which provisions were made in that instrument.

If such a plan is carried out it will lend additional weight to the argument that the meetings of all of the affiliated associations need not and ought not to occur during the same week. This question received more consideration, though informally, at Atlantic City than ever before. More men are attending the conventions than used to be the case. In some cases the number from a single company was as high as twenty-five or thirty, and in most cases the attendance of all those who ought to go to the convention means a serious depletion of the active members of the force. On the other hand, there are arguments which appear as strong toward a continuance of the present practice of having all the meetings at the same time. The question of exhibits is one thing; the value of meeting men in other departments is another; the fact that on the smaller roads it is frequent for one man to be interested in the work of several departments is a third. All in all, the problem is a serious one. Possibly, if the meetings of the officers of the transportation and engineering departments were held at the same time the question of exhibits would be answered. The other objections to separate meetings might find some satisfactory solution. On the whole, however, we believe that the advantages of holding the meetings of all of the associations at the same place and at practically the same time outweigh the disadvantages. In an industry in which the departments are so closely interrelated as in the street railway business we cannot but believe that it is in the highest degree beneficial for the accountants to meet the representatives of the engineering department, for both of them to become acquainted with the claim agents, and for all departments to keep in touch with the broad questions of policies discussed by the managers. There is no way in which this can be done better than by the personal acquaintances made and renewed at each annual convention. An organization of the size of that which must represent the street and interurban railway interests of the country cannot expect to find its future obvious at first glance, but the association has always had the ability to attract to its support the best minds in the industry, and the problems which have arisen in the past have been more serious than those which now lie before it and have been satisfactorily answered. We do not anticipate, that with the loyalty of its members and the satisfactory record to which is can point of its achievements in the past, there is any danger that the association will take a wrong step at this time, whatever the conclusion reached upon this particular point.

Reports of the Committees

A considerable part of the work of the American Association this year, as well as that of the affiliated associations, was represented by reports of the committees. Some of these, like those on promotion of traffic and municipal ownership, partook more of the nature of papers upon the topics treated, while others, as those on compensation for carrying mail, standardization, car wiring, heavy electric traction, insurance, rules for the construction of modern car houses and public relations, were more like the usual committee report; that is, they presented a statement of the work carried on by the committee during the past year, or occurring in the industry, with recommendations for future action by the association. The report of the committee on municipal ownership, itself a comprehensive discussion of the subject, was supplemented by a paper by W. J. Clark, who has made a study of this topic and whose array of statistics should prove most instructive.

The reports on the construction of standard railway car storage and operating car houses, and on car wiring are excellent instances of the practical benefit of association work in directions which result in a direct monetary gain to the street railway industry. In their investigation of fire insurance conditions, these two committees received the hearty cooperation of the fire underwriters, who met with the committees and participated in their deliberations. The interests of the companies and the insurance organizations run very largely along parallel lines, because it is a well-known fact that the profit in underwriting fire risks is very much larger when good risks are insured at low rates than when poor risks are insured at high rates. Last year was the first time, so far as we recall, that the old line companies have been represented at any street railway convention. This year not only were a number of gentlemen from the insurance exchanges present at the meetings, but they were represented among those who contributed papers.

The Problems of the Small Road

Mr. Cooper's paper on the "Problems of the Small Electric Road" begins with a definition of the "small road," not on the basis of receipts or mileage, but as the one so situated that it is not divided into the proper number of clear-cut and non-interfering departments with a competent, technically practical man at the head of each. On such a road the manager is the expert head of all or most all departments—he is the man personally responsible for every move. However, even though this be the case, Mr. Cooper wisely advises a departmental organization to the smallest of roads, although it may seem to the outsider to be somewhat of a farce. He suggests a plan of organization that may be put into effect on the very small electric road, and follows through to roads on which the organization may be made in eight or nine separate departments. The belief is expressed that such an organization, although it may seem to be "play" at first, will soon prove to be of serious advantage in dealing with other problems outside the organization.

The second problem mentioned is that of the small road's direct and personal relations with its patrons and the community. The solution is given as perfect equity between the company and the public and the municipality. The third problem mentioned is the one relating to employes.

On the small road there is a personal relation between the management and the employe, and the reserve of trained men is not so large or available. While the public in large cities wants rapid transit in an impersonal way, the patrons of the small road require the company's employes to be human, with some courtesy and tact.

In the matter of supplies and men, the problem of the amount of reserve or stock to keep on hand is a serious one. Rush days are larger in proportion to the average day than on larger roads, and how to get and keep men for rush day supply is often a serious matter with the small road. In the matter of stock or supplies the question is also serious—a small stock means less interest on investment, less stock room space, less insurance and more rigid economy, while a large stock means better prices and better freight rates, besides better insurance against interruptions to service.

Mr. Cooper points out that all these and other problems of the small road are personal problems of its manager—and also that the questions which arise on the large road are those of the small one "condensed, intensified, made into a formula by pressure of traffic, by condensation of population, by humanity, in the gross instead of in the individual."

Maintenance and Inspection of Electrical Equipment

The report of the committee on maintenance and inspection of electrical equipment presented at the meeting of the Engineering Association on Oct. 15 was briefly considered in these columns last week, but the importance of the subject, the large amount of excellent work of which it bears the impress, and the standing of the committee warrant its further consideration. The report summarizes the present practice of a number of railway companies in a multitude of points, and some of these different methods were considered in the previous editorial. The committee does not make many definite suggestions except where current practice seems to be practically unanimous, as it was probably, and very wisely, considered by the committee that absolute recommendations, such as those expected from the standardization committee, were not desired. This need not prevent the association, however, from following up the subjects started by the committee and continuing the investigation further. For instance, the subject of car wiring is dismissed with the one recommendation that a fuse be installed in addition to circuit breakers, when metal conduits are used. The frequency of trolley apparatus inspection is considered without reference to the class of service, although the trolley which will operate 1000 miles in some classes of city service will not stand 50 miles of heavy, high speed, interurban work.

The committee finds that 18.2 per cent of commutator trouble is due to the quality of brushes, and also reports that the widest variety of opinion is expressed in describing the most satisfactory quality of brush—regarding hardness from soft to hard, regarding price from cheapest to the "very best," regarding conductivity from high to low, regarding beveling and boiling, both for and against. It is evident that all of these opinions cannot be right unless the conditions vary widely. The committee has not had the time nor opportunity to investigate these and other similar matters to the point of determining the exact answer for any one set of conditions, with modifications to suit various classes of service. The one subject of "quality of brush" alone would probably involve more experimental work than a committee of the association could well put into it. But this or similar subjects might well be taken up by the association or its committees in cooperation with the technical schools, with good results. Their experimental laboratories, working in conjunction with the practical men on the association's committees, might do good work on problems such as these, and judging by expressions made by representatives of three technical schools at Atlantic City, they would be glad so to cooperate with the association.

Gas Engines

Mr. Winsor's experience of a year with gas engines is given in a paper which was presented before the Engineering Association. Although the Boston Elevated now has two gas engine plants in operation, the paper deals with but one, the Somerville power station, which is of 700 kw rated capacity and has been operating since May, 1906, with soft coal fuel, the same as used in the company's steam stations. That the plant has proved absolutely reliable should be most gratifying to advocates of gas power. It is stated that the engine can be put into service at any time in less than five minutes, confirming the claim of quick starting. The overload capability has been found good, the 350 kw units having carried 450 kw for an hour, with swings to 495 kw. Back fires and pre-ignitions have been a rarity, and practically no interruptions have been experienced.

With regard to economy, the average coal consumption per kw-hour for seven months has been 2.034 lbs., or 1.404 lbs. per brake hp-hour. This is on a station load factor of 41.6 per cent, or an engine load factor of 83.3 per cent. The steam operated stations of the same company, for the same time, average 3.477 lbs. of coal per kw-hour, showing a saving of 41.5 per cent in favor of the gas engine plant. Mr. Winsor states in conclusion that the gas engine plant will operate at least as reliably as the steam engine plant and will use from 30 per cent to 60 per cent less fuel, depending upon the relative capacities.

Fuel economy is but one element, though a most important one, in the total cost of power production. The cost of labor per kilowatt-hour, repair and supply expenses must be known before the selection of a given equipment can be intelligently made. Given fuel economy in small sized plants, however, it is reasonably certain that all things else will follow in due course. There is no reason to expect a poorer economy in the large sized units of several thousand horse-power rating which will before long be employed in railway service, and it is certain that much will be gained in the enlargement of capacity per man which can be handled in the engine room. The disadvantage of having at first to buy water for scrubbing the gas and for cooling purposes was well emphasized by the writer of the paper, and it is significant that during the early days at the Somerville plant the water cost almost double the coal bill. A point which Mr. Winsor might have touched upon is the cleanliness and quietness of such a plant in a residential district, remote from the main tide-water stations of the company. For work in such a section these features and the high efficiency of even a small installation can be made very advantageous. The high economy secured in the fuel con-

sumption means so much less hauling of coal through streets where it might be considered an annoyance if practiced on a very large scale. The absence of a large disfiguring chimney and the freedom from annoyances by smoke are also important in such a location.

In order to secure economy and moderate maintenance expenses month after month in a small gas plant the utmost vigilance is essential on the part of the station attendants. No greater mistake could be made than to assume that a producer gas plant will give high economy automatically Mr. Winsor touched upon the value of actual operating experience in suppressing difficulties, and it is worth realizing that the problem of operating a gas engine plant is a very different one from that in a reciprocating engine or a turbine station. Fewer men are required to operate a gas plant of given capacity than would be needed in a reciprocating steam station of the same output, and it is safe to say that in a small installation like the Somerville plant, at least double the number of men would be needed if steam were the motive power. The responsibility per employe is somewhat greater in a gas engine plant, and the machinery must be operated from an entirely different viewpoint than obtains in steam stations. The supply of the proper quality of gas; the determination of the best mixtures of air; the control of lubrication within very close limits; the maintenance of good ignition; adjustment of the firing point and compression to prevent premature ignition and late ignition; and the maintenance of a steady flow of cooling water in jackets are the fundamental points to be insured in securing good performance from internal combustion engines. Leaks in the piping and general cleanliness should be handled as promptly and regularly as in steam practice, but in gas engine work the cylinder actions are the focal points. Observation of cooling water temperatures, constant watchfulness to detect unusual conditions by changes in the sound of the engines, the use of electric indicators in the sparking circuits and frequent feeling of bearings and jackets is desirable in the interests of economy, no less in the small plant than in the large installation.

The Technically Trained Man and the Electric Railway Profession

The paper by Professor Norris on "The Technically Trained Man and the Electric Railway Profession" indicates a desire for cooperation between the technical schools and electric railway companies which we hope may prove to be mutual and grow stronger as the necessities and benefits of such cooperation may become better understood. The paper points out that the present managers of railway properties have largely grown up with the business, the experience of many dating back to horse car days. These men must be succeeded by others who are now in training, and this natural succession, together with the growth and expansion of the business, calls for men with the necessary characteristics and training, which class of men the technical schools are expected to supply. As the training of the schools requires to be finished and rounded off by practical experience, Professor Norris suggests an apprenticeship course which he outlines, giving from one to three months' experience in each of various departments.

The course suggested is evidently planned in general idea from the apprenticeship courses of the large electrical manufacturing companies, which annually receive several thousand technical graduates into their shops, allowing them a few weeks or months in each of a number of departments of their factories and offices. Thus a technical graduate is given a few weeks as a helper in a coil winding section, a few weeks in a testing department, a few weeks in the designing room—not for the purpose of making him a finished expert in all of these and other lines of the business and to fit him for a general manager of the works at the end of his two years, but for entirely different purposes. One of these is to give him a general idea of the methods used in the various departments, which his education makes him particularly apt at acquiring. Another is to enable the company to determine in what particular department it can best use the apprentice; that is, to what part of the business he is best fitted by natural qualities as well as education, or whether it wishes to retain him in its employ in any capacity.

Lack of knowledge of the details of such practice by the manufacturing companies, and of the good results obtained by it, probably lay behind some of the adverse criticisms of the paper as expressed on the floor at the convention.

Such a system as suggested by Professor Norris, if adopted by a fair-sized railway property, would simply mean a substitution of technical graduates for six or eight common laborers or clerks. That there would be a rotation from month to month would in some departments be a disadvantage, but it would be more than offset by the capabilities of these men, who have had the benefit of four to six years of college training. Not one in fifty would expect to be competent to manage the smallest road at the expiration of his eighteen months' or two years' apprenticeship, but a few might be found so fitted. Nor should any expect to be advanced from one department to another unless he continued to "make good" in his work. On the other hand, the company would have under the eye of its officials a number of young men who are endeavoring to fit themselves for some branch of its business. None of the men could make himself an expert in any one department, but each will have gained a general experience in all and an opportunity to demonstrate his general capabilities and his peculiar fitness for some one department. As the apprentices "graduate" from the company's "course," some may be allowed to leave, but if the experience of the manufacturers, to quote again from other lines of the electrical industry, is to be relied upon, it will be found that places will present themselves for these men as fast as they complete their courses. Better still, as vacancies and openings in the service occur, technically trained men, with some practical experience, are already on the company's pay roll ready to fill them. This at no expense to the company, for the apprentices have earned all they have received.

The technically trained men are beginning to show themselves in the high places in electric railroading, in spite of the fact that most of them thus far have received their practical experience in a haphazard method by the rough rule of "starting at the bottom." The scheme proposed by Professor Norris is still starting at the bottom, but with a method, based on the fact that the candidate has the solid foundation of a specialized education. We should like to see the plan tried out by some of our companies. The exact time scheme as suggested may not be advisable, but could be modified by the ideas of the individual manageme..ts.

A Review of the Accountants' Convention

The eleventh annual convention of the Accountants' Association, just finished at Atlantic City, was in keeping with the high standards of previous meetings, and added to the reputation which the association already possesses as a business-like organization. The conventions of this association have been marked each year by an increasing attendance, and that at Atlantic City formed no exception to the rule. The programme, though not long in the actual number of papers and reports scheduled for presentation, was rich in topics requiring discussion and action, and of such a character as to appeal alike to urban and interurban operators. For instance, the papers upon "Depreciation," "Amusement Park Accounts" and "Mechanical Office Appliances" are equally pertinent to both urban and interurban roads, while the changes adopted in the classification of operating expense accounts were intended principally to supply the latter with a classification of operating accounts more suited to their needs than the previous standard, which was formulated before the development of the modern interurban railway. These facts are sufficient answer to the criticism, mentioned by President Tingley in his annual address, occasionally brought against the association, that it might be giving too much attention to accounting questions affecting city roads only.

Without doubt the most important topic considered by the Accountants' Association at its Atlantic City convention was the "Report on Tentative Classification of Operating Expense Accounts," presented by the committee on standard classification of accounts and form of report. It was undoubtedly knowledge that this report was to be presented at the Atlantic City convention which lead to the attendance at that convention of representatives from the Census Bureau and Interstate Commerce departments of the national government and of the Public Service Commission of New York State, to all of whom any changes in the standard classification of operating expense is of vital interest. The new classification proposed by the committee, and in some measure amended at the convention by the other members present, was intended, among other objects, to provide a certain elasticity in its application so that it could be satisfactorily used, not only by the urban and interurban electric roads of the country, but so that it would be equally well adapted to the needs of electrified steam railroads. This object has been accomplished, and the classification, in its present form, is of such universal application to all electric railway operation that it is suitable for adoption for such use by the Interstate Commerce Commission and the various State Boards of Railroad Commissioners if they should see fit. Under these circumstances a brief review of some of its most important features may not be out of place.

In the first place, the new classification departs from the old by reducing the general or administrative accounts to a minimum by spreading into maintenance and transportation some of the items which have heretofore been charged to general expenses. For instance, injuries and damages and the legal expense connected with them have been assigned under transportation or maintenance, according to the cause of the injury or damage. By this classification, the department of transportation, which causes by far the greater part of the expenses of this nature, will be charged with the expenditure applicable to its service only. This change will make possible a more exact statement of the cost of transporting the business of the company than has heretofore been available and will permit the investor or student of financial values more easily to compare the results of operation of two different classes of roads, steam and electrified steam roads for example. Stationery and printing expense has also been distributed between the departments using the material, and the cost of stables and store-rooms, after charging to the general account bearing their names, are entirely wiped out and distributed to the accounts benefited.

The classification also recognizes that all of the power manufactured at the power station is not used in transportation, and that all of the steam provided by the boilers of the power house may not be applied to the generation of electricity; that is to say, work cars and construction cars are operating over the property constantly and machinery in the shops may use part of the current manufactured. Under the new classification, construction and maintenance will be charged with the cost of producing this current. Similarly, if exhaust or live steam is being taken from the power house for the purpose of heating car houses or other contiguous buildings belonging to the company or outside interests, the power house expense will be credited with the value of the steam thus diverted.

Of course everyone recognizes that one of the principal advantages of a standard classification of accounts is the opportunity to compare the results secured on any property during different periods as time elapses. Theory would dictate, therefore, that after any form of classification which is fairly adequate to the needs of a property has been adopted, radical changes in it should be introduced only for overpowering reasons. In the opinion of the accountants assembled at Atlantic City, however, the time had arrived when such changes ought to be made in the interests of the entire industry. This conclusion was reached only after most mature thought, and is undoubtedly justified by the existing conditions. Conservatism can be carried too far, and we have no doubt that the inherent merits of the new classification of expense accounts, approved at Atlantic City, will be generally recognized and the new form adopted. We further believe that its general acceptance will follow much more quickly than was the case with the previous classification decided upon nine or ten years ago. At that time the classification, while simple and efficient, was somewhat of a revolution of operating customs. During the interim the merits of standards in this direction have become so apparent that the new classification will fall on much more fertile ground. Finally, the changes are not many, and practically no important company will find it difficult to introduce the new scheme in its accounting department. But few accounts would require to be analyzed for the year following its adoption to obtain a proper comparison of all accounts with those of the previous year. Indeed, we are told that one of the largest companies in the United States will adopt the new classification beginning Nov. 1. Coming as this classification does from accountants who have become experts in the logical allocation of the different accounts, we hope and believe that the differ-

ent State and national authorities upon whom devolves the duty of providing a classification of operating accounts for electric railways under their several jurisdictions will recognize that it is based on sound accounting principles and will adopt it accordingly.

The paper prepared by J. H. Neal, of the Boston Elevated Railway Company, upon the subject of "Where Maintenance Ends and Depreciation Begins" will bear careful study. It was unfortunate that the author considered that the subject assigned to him required his omission of a discussion on supercession, appreciation and amortisation. These three conditions belong broadly to the subject of depreciation of electric railways, and it is to be hoped that the association will at an early date consider these phases of depreciation. One important point brought out in Mr. Neal's paper is that no general percentages can be applied to all companies in all places to show the length to which maintenance can be carried or where depreciation begins. This is an exceedingly important fact and must be kept in mind because if a set of percentages used by one property is applied to another it may be either too large or is equally apt to be insufficient for the needs of the second company.

Mr. Neal's paper, which was printed in full on page 700 of our last week's issue, outlines seven methods of providing a fund for depreciation. Of these seven methods that of periodic revaluation is admittedly impracticable. Of the six methods which remain, it seems to us those dependent upon a fixed percentage of gross earnings or net earnings, and that providing for a proportion of betterments to be charged to operating expenses, are not based upon scientific and correct principles of accounting, although they may be better than nothing at all and in experience may work out to approximately accurate results. The method to be adopted should be more exact than either of these plans provides; for instance, an equal proportion of the original cost charged out annually, a fixed percentage on a gradually diminishing balance of original cost, an annuity plan, or some plan based upon the car mileage for tracks and cars, and kilowatt output of the station would be more logical from the standpoint of the real facts. There is so much to say, consider and understand in the subject of depreciation that a most careful consideration and study must be given to it before a universal plan of action can be recommended. The problem is further complicated by the comparative youth of the industry and other vital conditions. Nevertheless, the association has before it no subject of greater importance to the whole industry, and is to be congratulated that it has taken it up in the thorough manner which it has, and which is characteristic of the organization.

The paper on "Amusement Park Accounts," read by Frank J. Pryor, Jr., of the American Railways Company, will be particularly valuable to those companies operating parks for the promotion of traffic, and will serve to guide the managers of these promotors of travel to a correct understanding of the real conditions of their properties.

Another very practical effort made by the association to be useful to its members is the paper on "Mechanical Devices and Other Office Appliances," read by F. E. Smith, of the Chicago Union Traction Company. To many this paper will prove a revelation of the very wide extent to which mechanical devices have become a part of office work. One cannot read the list of appliances described in this paper without realizing that the efficiency and output of the clerical force in the accounting offices of a street railway company have been greatly increased the last few years. Many of these devices are so precise in their action as to be a positive safeguard to correct work. Machines for typewriting and others for listing and adding items or for adding only have become very common, but it is probable that the remarkable field filled by the calculating machines is not fully understood outside of a comparatively few engineering and accounting offices. Mr. Smith's paper does not aim to cover every device which can be applied to office use, but the list which he gives is so long and so varied that it can hardly help but bring new ideas into those offices where the use of such machines is not now common. Papers such as this have been read before other associations, and they appear to us to be very proper, even though the fact that the names of the manufacturers and prices of the machines are quoted might at first thought appear to be somewhat of an advertisement. But we see no reason why an association cannot discuss such matters along the line of effort for improving the conditions and lightening the work of its members. It is also evident that such discussions must aid in promptly eliminating inaccurate machinery.

A point raised by one of the members in discussing this paper should be given serious attention by manufacturers of these appliances. We refer to the noise made by the operation of the machines. One of them, when operated singly, will not be a source of serious disturbance, but to place in an office a half-dozen or more machines operated in a rapid manner will result in a noise which is often very distracting to others who have work to do other than mere routine, and who are within hearing distance. We believe that manufacturers of these appliances will some day be able to reach an approximately noiseless method of obtaining the same results, and it is surely to be hoped this time is not far distant.

The nominating committee reported an excellent ticket for officers for the ensuing year and those which now hold the reins of government of the association should add to the already high prestige of the association. All have done important work for the organization and the elevation of Mr. Henry to the presidency was an honor particularly deserved. In connection with its report the nominating committee called attention to the fact that all of the new members, who have become a part of the association through the reorganization of all the associations, had not made their presence and personality felt. The committee expressed itself as being anxious to utilize this new material by placing some of these new members upon its ticket. Owing to the conditions as they exist, however, the committee found its desire to nominate the newer men a difficult task, because (much to the credit of this association) the names placed yearly upon its tickets have always been the subject of very serious consideration, in which work for the association itself, either in committees or on the floor of the convention, has been regarded as an important factor. We have no doubt this matter will regulate itself in time,

and that the newer members will more generally take advantage of the opportunity to participate in the discussions and thus make their personality felt. The Accountants' Association has been an important agency in making more generally known the existence of accounting talent among its members, and will no doubt continue to do so. It is in these ways that the association is demonstrating its efficiency and the value of the plan of a separate organization for each of the sections of the street railway business.

The Timber Problem

Mr. Weihe's paper in our issue of Oct. 12 calls up one of the gravest questions of the present time. Each year sees the supply of suitable wood for poles and ties grow less and the price more. The general scarcity of timber for all purposes is bad enough, but in railway work particular kinds of wood have been in the past regarded as necessary, and these kinds, none of them any too common at the start, are being rapidly exhausted. In all kinds of railroading the scarcity is felt, in electric railroading rather more than elsewhere on account of special requirements for heavy poles. The costs of replacements are yearly getting more serious and it behooves one to cast about and see what can be done. The three steps which may be taken in escaping the difficulty may be roughly specified as follows: First, substitution of materials; second, replenishment of material; third, reduction of the replacement demand. With a steadily increasing call for materials of construction it is clear that if something is not soon done the railroad interests must suffer. So far as substitution of materials goes it may take two forms, the use of materials of a new kind or those akin to the old kind. Into the first category falls the rapidly increasing use of steel, into the latter the substitution of wood generally regarded as inferior for the better sorts ordinarily used.

The use of steel in railway construction is bound to give at least temporary relief in certain directions. Steel poles, either lattice or tubular, have come already into large use on electric roads. On the high tension lines now common the steel tower construction seems to have been highly successful. The chief danger feared has been from lightning, but the operating reports which we have recently published seem to show that, perhaps owing to the greatly reduced number of the points to be insulated, the total trouble from lightning has been of very moderate extent. The scarcity of large cedar and chestnut poles is therefore less to be feared than it was, say, five years ago. On the other hand, the use of steel for ties, or, in fact, of any other material than wood, has thus far been of very questionable utility. Here, therefore, if anything of material value is to be done in the way of substitution it will be in using timber hitherto passed by as of dubious quality. This leads generally to increased renewals and therefore to added cost and the further depletion of the supply. As to the possible replenishing of material, this means reforestation, which is a slow process that cannot yield immediate relief. We wish we could make every reader of the STREET RAILWAY JOURNAL an apostle of forest replacement if only on ever so modest a scale. In the present state of affairs determined action by every far-sighted man is a necessity if the country is not to come to an evil pass for lack of wood. It has ceased to be a question confronting only posterity, for the penalty of ruthless greed will fall upon the generations now living. For present help one must look elsewhere than to reforestation, not forgetting that this must be begun now to be of use a quarter of a century hence.

Mr. Weihe's paper deals especially with the questions pertaining to the use of cheap woods and to such employment of them as may tend to keep down replacements. It is a striking conception to think of timber-rot as an organism to be starved or poisoned, but it is nevertheless in strict accordance with facts. Given means to prevent rotting and one can get good service from woods which are not at all satisfactory in their natural state. A list of such woods Mr. Weihe gives, and though some of them are scarce and others are bad from a mechanical standpoint, there is hope in the very length of the list. Considering the well known good effects of preservatives, it is altogether remarkable that they are not more extensively used. The added length of service gained is important not only in delaying the time of replacement, but in lessening the care required prior to that time. The open tank treatment with coal tar creosote is so simple and relatively cheap that it would seem particularly adapted to railway work. It may very likely, however, turn out when a large number of varieties of wood are considered that the preserving process may have to be somewhat specialized. In treating cross arms and pins, for example, there is much to be said in favor of the vacuum process, since the insulating compounds used penetrate the wood less readily than does creosote. It is quite likely, too, that with rather soft woods a special kind of preservative with more "body" than usual would be desirable. However this may be there is not any doubt that careful treatment with preservatives will practically double the life of wood exposed to the weather, and that it pays, especially if one takes into account the increasing cost of replacements.

Acquainting Shopmen and Foremen with Costs of Materials

As a general rule shopmen and even foremen have very little idea of the costs of materials and of the cost of doing work in the shop. From this lack of knowledge an increased cost of doing work cannot help but result through the use of expensive materials where cheaper ones would answer just as well. In many cases also workmen in general would be more economical in the use of materials if they had definite ideas of their costs. An electrical repair man, for example, in taping a joint for a temporary connection will frequently use as much tape as if the joint were to be permanent. Again through not realizing the money value of the waste, he is likely to use tape for a variety of purposes when cord or wire or some other much cheaper material would serve this purpose equally well. Oil is another article which it is economical to employ freely to reduce bearing friction, but with which careless use constitutes a source of considerable loss. Of course in the employment of all supplies there is apt to be some waste, but no reasonable employee will object to instructions which tend to keep it at a minimum. The trouble is that many employees have a hazy idea regarding the cost of many of the supplies which they use, but this can often be corrected by frequent personal reminds, or by the posting of proper notices.

REHABILITATING THE TRACKS OF THE CHICAGO CITY RAILWAY

An ordinance passed by the City Council of Chicago early in this year requires the interests controlling the street railways of that city to rehabilitate practically their entire systems within three years from the time this ordinance became effective. This immediate rehabilitation includes the complete reconstruction of the tracks of a large percentage of the total mileage in the city, the provision of an adequate number of modern cars to handle traffic properly and the installation of sufficient additional electrical generating equipment so power to operate the various lines satisfactorily can be furnished. After the expiration of the first three years the remaining lines are to be similarly rehabilitated until the street railways in the whole city have been placed in a satisfactory operating condition. The same ordinance also covers a number of features concerning the franchises under which the street railways are to be operated and other relations between the street railway interests and the city.

The ordinance has been accepted by the Chicago City Railway, which owns and operates the lines on the south side of the city, and this company has already carried on a large amount of work according to requirements set forth. The Chicago Union Traction Company, which operates the systems on the north and west sides, will doubtless also accept the ordinance as soon as the interests controlling that company can adjust their finances satisfactorily.

This rehabilitation of the three systems which embrace all the lines in the city is being done by and at the expense of the street railway interests, under the direction of a board of supervising engineers consisting of Bion J. Arnold, chairman; Charles V. Weston, representing the city; Harvey B. Fleming, representing the Chicago City Railway Company, and John Z. Murphy, acting for the Chicago Union Traction Company. Mr. Arnold is chief engineer and George Weston is assistant chief engineer of this board.

The Chicago City Railway Company had built about six miles of track on Oct. 1, and had over ten miles of track reconstruction under way at that time. An average of about one-third of a mile of single track is being laid each day by this company, and with favorable weather one-third of the total mileage to be reconstructed in the first three years will be finished in 1907, although the work was not started until late this season. The Chicago Union Traction Company is also carrying on a large amount of track reconstruction according to the standards specified by the board of supervising engineers, in order that this work will be properly done in case the interests of this company are adjusted so the ordinances can be accepted by it.

Three types of track construction have been adopted by the board of supervising engineers for use under different conditions. Although these have been practically standardized, a few minor changes are to be made in them, so the board has decided not to make public the details of the different types. At the some time, the general features of the latter have been supplied to this journal. A standard girder rail, the cross-section of which is shown on page 844, is used in all three types. In one type the rails are laid on steel cross-ties, imbedded in concrete, and in the other two on wooden cross-ties, also imbedded in concrete; the difference between the two types in which wooden cross-ties are used appears largely in the construction of the sub-base on which the track is laid.

The steel ties are of the standard 4½-in. Carnegie girder section. They are placed on a heavy sub-base of concrete and are imbedded in a layer of concrete, which is continued 2½ ins. above the base of the rails. In some of the work that has been done these ties were spaced 5 ft. apart on centers, but in most cases they are 4 ft. apart on centers, and it is probable that the shorter spacing will be adopted as the standard. Sawed wooden ties, 6 ins. x 8 ins. in cross section and 7 ft. or 8 ft. long, are used. They are also imbedded in a layer of concrete, which for one type of track is laid on a sub-base of crushed stone, and for the other on a sub-base of concrete. These ties are spaced 4 ft. on centers.



CONCRETE MIXING OUTFIT USED IN PLACING TRACK SUBSTRUCTURE

The chief feature of all of the track construction is that the sub-structure is designed to be unusually permanent, and is built so the rails may be renewed with comparatively little difficulty and without disturbing the sub-structure. Tie plates are used on both the steel and the wooden cross-ties. The rails are attached to the steel ties by a clip, which can be removed and replaced readily, and which was designed for use in connection with this work. Screw spikes are used to attach the rails to the wooden ties, with the belief that the life of the latter will thus be considerably prolonged.

The standard grooved rail used in all of the track reconstruction was designed specially for the conditions existing in Chicago. This rail weighs 129 lbs. per yard and is rolled by the Lorain Steel Company. Although the section of the rail is generally the same as that of several grooved girder rails which have been used in various cities in this country, it differs essentially in several important features. After making a long series of studies of the effect of wear on previous rails of this type, considerable metal was added to the outside of the head just above the top of the web, as these studies indicated that an increase in section at that point would add materially to the serviceable life of the rail. The thickness of the metal directly under the groove has also been increased for the same reason. The outer edge of the rail is beveled and the pavement is finished ¼ in. below the top of the rail on that side. The head of the rail can thus be worn down until the flange of the car wheels ride on the groove before the treads of the car wheels reach the pavement. The slope on the outside edge of the head of the rail thus increases the permissible wear to a maximum, with a wheel tread not exceeding 2⅞ ins. The groove has been designed for cars with wheels having ⅝-in. flanges, with a possibility of an increase to ¾ in. While flanges of this width are scarcely suited for high-speed interurban cars, and some criticism has been offered against the adopted type of groove, the latter was designed strictly for traffic conditions in Chicago, where few, if any, high-speed interurban cars enter the city.



A STRETCH OF TRACK WITH STEEL TIES READY FOR SUBSTRUCTURE

Two other conditions also had to be met in designing the grooved portion of the head of the rail, first, a groove which would prevent the wheels of vehicles entering it, and second, a groove which would be self-cleaning was desired. As both of these conditions cannot be perfectly fulfilled by the same groove, a compromise has been made between them in this case. The rail is rolled so the extreme outer lip of the groove is ¼ in. below the top of the head of rail. The granite paving blocks used between the rails are laid so their tops are ⅛ in. higher than the outer lip of the groove, with the result that the paving will hardly wear below this lip. The wheels of vehicles can therefore readily enter and leave the tracks, while the shape of the groove is such that it will be nearly free from dirt.

TRACK CONSTRUCTION METHODS

The methods followed in the reconstruction of the two tracks of the line on Cottage Grove Avenue are more or less typical of the manner in which work has to be handled on the heavy traffic lines. This line is one of the most important in the system of the Chicago City Railway, extending southeast from the downtown business district for about nine miles to a connection with a line leading to South Chicago. Throughout practically its entire length it passes through a densely built-up residence district and connects with numerous important cross-town lines. It was completed prior to 1890 and was operated as a cable road until last year, when an overhead trolley was installed. As is common with a very large percentage of the total mileage in the city, the old rails on this line had not been renewed for years and scarcely any repairs, other than those which were absolutely essential, had been made during the long period that the city held the settlement of the various street railway franchises in abeyance. These conditions, combined with the use of the long, heavy cars which were installed last year after the line was electrified, had put the tracks in very bad shape, so the track and the upper part of the sub-structure are being removed and replaced by the type of track having steel cross-ties that has been recommended by the board of supervising engineers.

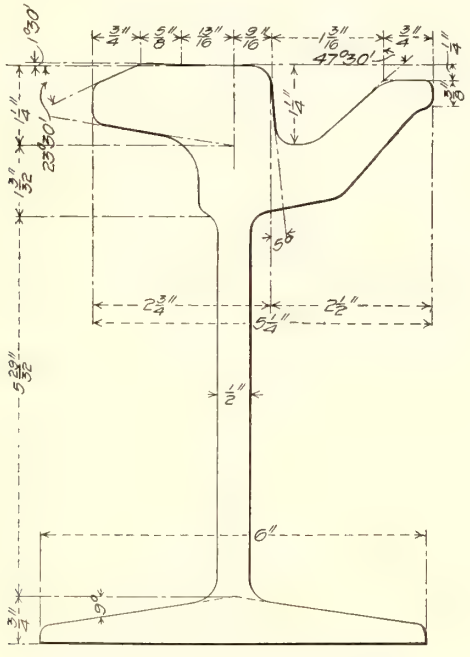
The reconstruction work is handled in sections, a single track of each section being rebuilt at a time. On this particular line the traffic is so heavy that it is impracticable to divert it all over one track, even for short distances, so a third temporary track, laid on the pavement at one side, is used to carry the cars of the regular track that is out of service. On some other lines traffic from one track has been diverted over a parallel line, but on Cottage Grove Avenue several conditions combine to make that arrangement also impracticable, so the temporary third-track is essentially necessary.

The cable formerly used to haul the cars over this line operated in a concrete conduit under the center line of each track. The rails were carried by chairs on iron brackets, or yokes, cantilevered out on each side of the heavy concrete conduit. The rails, chairs and part of the yokes have to be removed and a considerable part of the conduit has to be cut away before the new track can be built. This preliminary work is handled with considerable difficulty, particularly the cutting out of the concrete, which has been done thus far by hand with cold chisels, picks and so forth. Arrangements have been made, however, to install a num-

ber of Little Jap pneumatic hammers for cutting the concrete, the power for these hammers to be supplied by portable compressor outfits.

The excavation for a track is made and the sub-grade is prepared for considerable distances, depending in length on local conditions, before any concrete work is done. The ties are then laid in the excavation and are blocked up to their regular positions, after which the rails are attached to them. The layer of concrete on which the ties rest and in which they are imbedded is then laid up to 2½ ins. above the top of the ties, except at the joints, where it is stopped level with the top of the ties in order to permit the rails to be welded later without disturbing the concrete.

The concrete is produced by a mixer outfit mounted on a frame carried by two four-wheel car trucks. This outfit was built specially for use in this work by the Drake Standard Machine Works, of Chicago, and is operated over the rails as they are blocked up in place before the concrete is laid. The frame of the outfit is 48 ft. long and is built of structural steel. A standard Drake concrete mixer is mounted under one end of the frame where it can discharge



STANDARD GROOVED RAIL SECTION

the concrete directly into place under and around the ties and rails. Concrete materials are supplied to the mixer by a flight chain conveyor which runs the full length of the frame, the materials being shoveled into the conveyor from storage piles on the pavement on the roadway side of the track.

The concrete is made in the proportions of 1 part cement, 3 parts sand and 6 parts broken stone. These materials are piled along the track in such manner that as they are shoveled into the conveyor they are in the proper proportions for the concrete. This is accomplished by first placing a layer of sand of a predetermined depth and width on the pavement, and over that a layer of broken stone and then a layer of cement. The sand and stone are delivered in wagons, from which they are dumped directly in place on the pavement, the layer of sand being kept considerably in advance of the stone. The required width and depth of the sand and stone is measured by templates, while the number of bags of cement to be used is determined by computation. By following this method the materials are readily placed in the piles in the proper proportions, with a minimum amount of rehandling after they have been delivered.

The materials are shoveled from the measured piles into the conveyor by from ten to fifteen men, depending on conditions. The frame of the mixing outfit was placed 51 ins. above the top of the rail, in order to permit the men shoveling materials into the conveyor to straighten up each time they lift a shovelful, with the result that they can work at a higher rate of speed with less fatigue than though the frame was lower so they could not stand straight each time. A row of sheet metal deflectors, placed along the opposite side of the conveyor from the shovelers directs the materials into a trough in which the chain travels. These deflectors are arranged so they may be placed on either side of the conveyor, depending on the position of the shovelers.

The conveyor is a wide-link chain, which on its lower run travels in a cast-iron trough, carried by two Z-bars, attached to the main frame, and on the return run is carried above this trough on three loose spools. The conveyor delivers the materials directly into the hopper of the mixer and has operated with excellent results.

The mixer, which is of the pug-mill, continuous-feed type, is placed on the longitudinal center line of the frame. The concrete is discharged from it on an apron, which extends the width of the track just above the rails. It is distributed and tamped in place by six to eight men, who are required to work very rapidly to keep pace with the machine. The blocks on which the ties and rails are held up in position until the concrete is placed are removed under the alternate ties just before the concrete reaches them; the deal load of the track being carried by the remaining blocks gives the concrete an opportunity to set, as cars are not turned over the track for several days after the concrete has been laid.

The mixer is gear-driven by a 30-hp motor, which also drives the conveyor. While running 8 hp to 10 hp is fully sufficient for these purposes, but on starting considerably more power is required for a short period. The car is propelled by two 75-hp street railway motors placed on the rear truck, as a low-front truck, taken from an old trailer car had to be used under the front end to provide room between the axle of the truck and the frame of the car for the mixer. Power for all three motors is obtained from the trolley.

The amount of concrete track sub-structure laid in a day by the machine depends largely on the rapidity with which the excavation and the sub-grade can be prepared. Under average conditions, however, 750 ft. of sub-structure will be finished in a ten-hour day, requiring about 250 cu. yd. of concrete. When the machine is delivering that amount of concrete ten shovelers can supply it with materials. The machine has been in almost continuous service since the latter part of August and has produced such good results that the Chicago City Railway Company has purchased three more of the machines for work of the same kind.

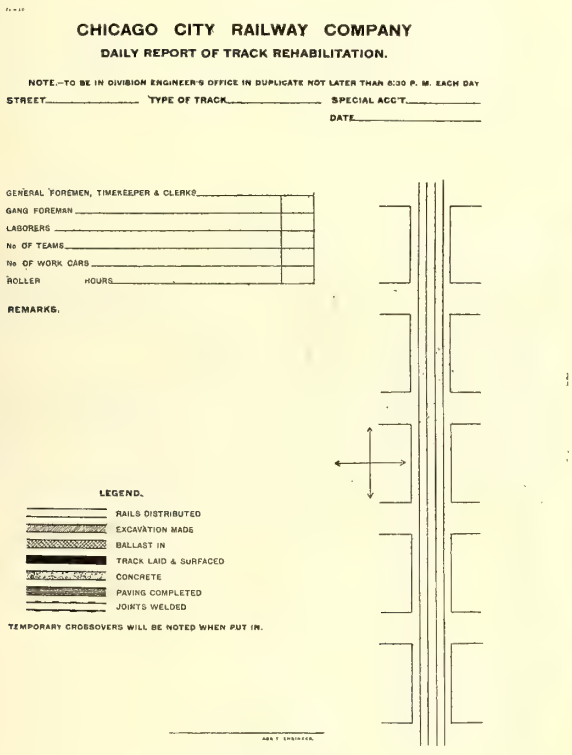
The work that has been done on the other lines of this company is all handled in a manner similar to the methods which have been described, although on most lines traffic is diverted from the track under reconstruction to another street, or on lines with light travel the traffic is all turned over one track for short distances. The track reconstruction is carried on by separate gangs of men, about 2500 men being employed in this work by the company. Each gang is under the immediate direction of a general foreman, thoroughly experienced in street railway track construction, and an assistant engineer has general supervision of the

gang. These assistant engineers are all under W. F. Graves, who is division engineer in charge of track reconstruction for the Chicago City Railway.

Each assistant engineer reports daily to the division engineer the general features of his work. One of the blanks used for these reports is shown in accompanying illustration, from which the method of recording the location of the construction gang on any street for any day and of indicating the amount and kind of work done each day is evident.

The organization of the board of supervising engineers is separated into several divisions, R. F. Kelker, Jr., being division engineer, and C. E. Thomas assistant division engineer of track and roadway. Under this division is a corps of engineer inspectors, who follow closely the construction and report daily to the division engineer the progress and other features of the work.

Although the track reconstruction, as well as all the other rehabilitation work, is carried on at the expense of the street railway company, the cost of this work is to be added


CHICAGO CITY RAILWAY COMPANY
DAILY REPORT OF TRACK REHABILITATION.
NOTE.—TO BE IN DIVISION ENGINEER'S OFFICE IN DUPLICATE NOT LATER THAN 6:30 P. M. EACH DAY
STREET_____ TYPE OF TRACK_____ SPECIAL ACC'T._____
DATE_____
GENERAL FOREMEN, TIMEKEEPER & CLERKS_____
GANG FOREMAN_____
LABORERS_____
No OF TEAMS_____
No OF WORK CARS_____
ROLLER HOURS_____
REMARKS.
LEGEND.
RAILS DISTRIBUTED
EXCAVATION MADE
BALLAST IN
TRACK LAID & SURFACED
CONCRETE
PAVING COMPLETED
JOINTS WELDED
TEMPORARY CROSSOVERS WILL BE NOTED WHEN PUT IN.
DAILY REPORT BLANK

to a previously agreed valuation of the whole street railway system, and the city will have to pay this total value if it eventually acquires the systems, as maintenance, depreciation, repairs and renewals are provided for in the meantime by special funds supplied from the gross earnings. The detailed cost of the reconstruction is therefore very carefully kept independently by the company and by the board of supervising engineers. A large amount of cost data is thus obtained, which, aside from its value as a means of arriving at the total outlay, furnishes an excellent basis for estimating the expense of future work and for checking operations from day to day.

The Trolley Express Company, of New Haven, is trying out a delivery vehicle which is a combination of a delivery wagon and motor car. It is adapted to use power from the line when on the rails and has a storage battery equipment enabling it to make 10-mile runs on trackless streets.

THE NEW YORK CARS OF THE PAY-AS-YOU-ENTER TYPE

The New York City Railway Company has just announced that it proposes to begin on Dec. 1, on the Madison Avenue line, a service in which the new pay-as-you-enter car will be used exclusively, with the idea in mind of acquainting the public with its working and of learning what modifications, if any, are necessary before equipping other lines with the new rolling stock. In its effort thus to better conditions on its lines the company has the support of the Public Service Commission of the First District of New York, and expects to receive the cooperation of the city authorities to the extent of regulating street traffic by supervising vehicle traffic so as to assist the company in the free movement of cars.

In all 155 of the new cars have been ordered, and they will all go into service at the same time. In their essen-



VIEW OF PLATFORM, SHOWING THE DIVIDING RAIL

tials they do not differ materially from the pay-as-you-enter cars in use in Montreal except that the cars are double enders, and the platform is 1½ ft. shorter than the rear platform of the Montreal car.

The interior of the car conforms to present New York City Company standards, in that longitudinal seats are used. The length of the cars has been increased, however, for the new ones will be 48 ft. over all, or nearly 11 ft. longer than the present standard equipment, while the body will be 40 ft. 6 ins. long, or 4 ft. longer than at present.

The old cars carried 4-ft. platforms having two outside wooden knees and two center knees of wood. The new cars have 7-ft. 6-in. platforms, the outside knees of which are composed of 8-in. Z-bars with a 2½-in. wooden filler

and also reinforced with 7 in. x ⅝ in. plate, which Z-bars run under the side sill back to the body bolster. The two center knees are reinforced by 4-in. x 5-in. angle irons, which extend back beyond the body bolster. Supporting the platform are also two 2¾-in. pull knees of wood.

The cars as noted are not single enders, but have the large platforms at both ends. As in the Montreal and Chicago types, the platforms will be divided by a railing to separate the incoming from the outgoing passengers, but the arrangement of the doors will be such that entrance will be restricted to the rear platform. There will be a swinging door for entrance and a sliding door for egress. The conductor will stand between the doors and behind a railing which extends to the edge of the running board and separates the passengers who are getting on from those who are getting off.

Passengers boarding the car will give the conductor their fare and pass into the car, where they can ride in comfort, free from the annoyance of the conductor forcing his way through continually to collect fares. The platform will hold more than twenty people, but no one will be permitted to stand on the platform all the time, the idea being to keep it free from obstructions and ready to receive passengers at every stop.

Beside each window, on both sides of the car, will be a push button, by means of which a passenger who desires to alight can signal both the conductor and motorman as the car approaches his destination. Passengers may leave the car through the sliding door at the rear or through the swinging and sliding doors at the front end.

The conductor will never leave his station on the rear platform and will be at all times in full command of his car. He will not give the starting signal until the running board at both ends, which he will be in a position plainly to see, is clear, and danger of a premature starting signal being given by some impatient passenger, as now frequently happens, will practically be entirely eliminated.

Plate glass will be placed on both doors and in the stationary part of the end of the car between the doors, so there will be a clear view forward and backward along the



ONE OF THE PAY-AS-YOU-ENTER CARS, DESIGNED FOR NEW YORK CITY SERVICE



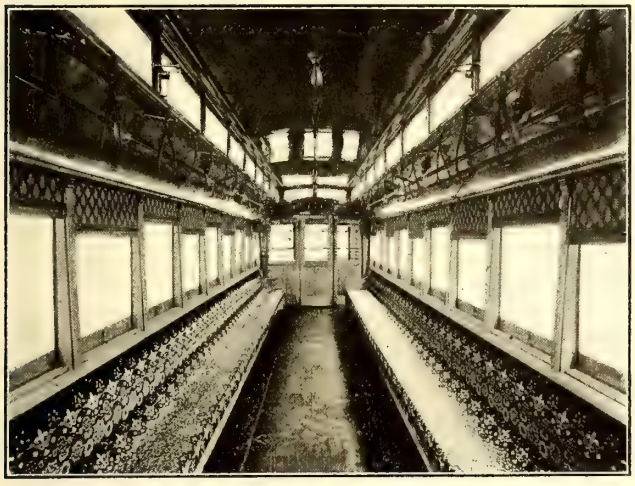
VIEW OF UNOBSTRUCTED EXIT OF MOTORMAN'S PLATFORM WITH ENTRANCE DOOR CLOSED



PLATFORM VIEW, SHOWING WHERE THE CONDUCTOR STANDS TO COLLECT FARES AND OPERATE THE DOORS

street. Illumination will be furnished by three rows of incandescent lights in the ceiling, one row in the center and one on each side. For the greater convenience of the public an experiment will be made with a signal of colored lights displayed on the front of the car, which will indicate its destination.

The new cars will seat thirty-six people and it is proposed, if the city will cooperate in the effort to make them a success, to limit their carrying capacity to sixty-five people. This will prevent overcrowding during the rush hours, and during the non-rush hours it is intended to run enough cars so that there will be no crowding. If the city will give the street railroad company the reasonable use of its tracks, along lines which have been suggested, the company will run enough cars to handle the people promptly and rapidly. When a car has reached its capacity it will make no stops until some of its passengers have alighted.



INTERIOR, SHOWING THE LONGITUDINAL SEATING

The principal dimensions of the new type of car are: Length over end panels, 32 ft.; length over crown pieces, 47 ft.; width over sills, including sheathing, 7 ft. 4 ins.; width over posts at belt, 8 ft.; sweep of posts, 4½ ins.; center of posts, 2 ft. 9 9/32 ins.; height from floor to ceiling, 8 ft. ⅝ in.; height from track to under side of sills, 2 ft. 7½ ins.; height from under side of sills over roof boards, 8 ft. 9½ ins.; height from track to platform step, 1 ft. 4⅝ ins.; size of side sills, 4 ins. x 6⅞ ins.; size of center sills, 3½ ins. x 4¾ ins.; size of end sills, 5¼ ins. x 6⅞ ins.; size of inside sill plates, 15½ ins. x ⅜ in.; thickness of corner posts, 3⅝ ins.; thickness of side posts, 2¼ ins. The wheel base of the trucks is 4 ft. and the diameter of the wheels 31 ins. There will be 4 G. E. 80 motors to a car. The inside finish is in ash, with the ceiling in bird's-eye maple. The cars were built by the J. G. Brill Company.

THE SOUTHERNERS GET TOGETHER

The representatives of southern railways at the convention last week met at the Marlborough-Blenheim on Thursday evening at the invitation of F. L. Markham of The J. G. Brill Company, J. L. Thurston of the Hildreth Varnish Company, Frank Gregg of the Adams & Westlake Company, Frank Archibald of the National Lock Washer Company, W. M. Bisel of the National Brake & Electric Company, J. E. Slimp of the Ohio Brass Company, J. L. Stayman of the Gold Car Heating Company, and N. B. Trist of the Schoen Steel Wheel Company, who are members of the Manufacturers' Association, and enjoyed an informal dinner and social evening, the object of which was to promote good fellowship among operating officials south of the Mason and Dixon line, who knew each other at present only by reputation, so to speak. The representatives of the companies named appointed themselves an entertainment committee and saw to it that each guest was introduced to all the others present. T. H. Tutweiler, president of the Memphis Street Railway Company, accepted the post of toastmaster and called on a number of the guests for talks on different subjects. The meeting was a great success and it was therefore planned to meet again next year. A committee was appointed to attend to the arrangements.

The following is a list of the guests invited to the dinner: J. H. Wilson, president Mobile Light & R. R. Company, Mobile; S. W. Huff, general manager Virginia Passenger & Power Company, Richmond; H. N. Hurt, general superintendent Georgia Railway & Electric Company, Atlanta; A. M. Moore, master mechanic Georgia Railway & Electric Company, Atlanta; T. B. Ogle, superintendent Norfolk & Southern Railway, Norfolk; R. D. Apperson, president Lynchburg Traction Company, Lynchburg, Va.; A. B. Skelding, general manager Consolidated Railway Light & Power Company, Wilmington, N. C.; E. D. Latta, Jr., general manager Charlotte Electric Railway Company, Charlotte, N. C.; W. C. De Vane, master mechanic, Savannah Electric Company, Savannah, Ga.; Percy Warner, president Nashville Railway & Light Company; W. A. McWhorter, master mechanic Birmingham Railway & Light Company, Birmingham; Theo. Passalaigue, superintendent Charleston Consolidated Electric Railway & Light Company; D. J. Duncan, manager Chattanooga Electric Railway Company; John R. McGiveny, purchasing agent New Orleans Railway & Light Company; R. W. King, manager Lookout Mountain Railway Company, Chattanooga; E. A. Longmire, master mechanic Norfolk & Portsmouth Traction Company; F. J. Duffy, manager Beaumont Traction Company, Beaumont, Tex.; T. H. Tutweiler, president Memphis Street Railway Company; E. C. Hathaway, general superintendent Norfolk & Portsmouth Traction Company, Norfolk; J. W. Leadley, manager Pensacola Electric Company; Chas. Doerr, purchasing agent Birmingham Railway Light & Power Company; D. C. Frost, general superintendent, Lynchbury Traction Company; S. M. Coffin, master mechanic Mobile Light & Railroad Company; Wm. Glenn, Georgia Railway & Electric Company, Atlanta; A. D. McWhorter, master mechanic Memphis Street Railway Company; D. A. Hegarty, general manager Little Rock Railway & Electric Company, Little Rock, Ark.

RAILWAY STATISTICS FROM HOLLAND

The Railroad Commission of the Netherlands Government has just issued its manual of statistics of the steam and street railways in Holland for the year ending Dec. 31, 1905. The report shows that the total length of steam and street railways in operation at that time was 1979.291-km (1237.05 miles). Of these twenty-six, with a total length of 273.772-km (117.10 miles), were operated by horses; thirty-five, with a total length of 953.556-km (583.47 miles), were operated by steam; seven, with a total length of 644.475-km (402.8 miles), had a combined service of horse and steam; one, with a length of 61.6-km (48.5 miles), a combined service of horse, steam and electricity; one, with a length of 44.59-km (27.87 miles), by horses and electricity, and three, with a length of 37.315-km (233.22 miles), were operated entirely by electricity. The companies had a total of 1789.588-km (1118.49 miles) of single track and 189.708-km (118.57 miles) of double track. There were 411 locomotives, 1010 horses, 1926 passenger cars and 1642 freight cars. The number of passengers carried was 90,745,793; the receipts were 8,026,696 gulden from passengers and 1.107,670 gulden from freight.

FIFTEEN CYCLE, SEVENTY-TWO TON ELECTRIC LOCOMOTIVE AT ATLANTIC CITY.

One of the most interesting exhibits at the Atlantic City convention of the American Street and Interurban Railway Association was the 15-cycle, single-phase electric locomotive built by the Westinghouse Electric & Manufacturing Company and shown on the switch on Virginia Avenue, near the Board Walk. This locomotive was built for demonstration purposes under an agreement with the Pennsylvania Railroad, as described on page 92 of the Street Railway Journal for July 20, 1907, and is No. 10,003, the other two locomotives built under the agreement having been of the direct-current type.

The locomotive is of the articulated type and consists of two separate halves, each of which, however, is complete in itself and each half has a maximum draw-bar pull of 20,000 lbs. Only one of these halves has been built and that one formed the exhibit at Atlantic City and is illustrated in the accompanying engraving.



A.C. LOCOMOTIVE SHOWN AT ATLANTIC CITY

The underframing of the locomotive is of the Atlantic type, of cast-steel with cast-steel end sills and gross girders, and provides for two driving axles with wheels 72 ins. in diameter and a pilot truck with wheels 36 ins in diameter. The total wheel base of the half-locomotive illustrated is 20 ft. 7 ins.; the rigid wheel base is 7 ft. 6 ins. and the wheel base of the pony truck is 6 ft. 2 ins. The motors are mounted on the driving axles with the same sort of suspension as employed in the New Haven locomotives, but are more powerful, having a capacity on one-hour rating of 500 hp with a maximum of 800 hp and a continuous capacity rating of 375 hp. This gives a tractive effort for the total locomotive, maximum, 40,000 lbs., or on the one-hour rating of 14,700 lbs., or a continuous capacity of 9200 lbs.

An inspection of the interior of the locomotive shows great simplicity as compared with the New Haven locomotive, owing principally to the fact that no provision had to be made for d. c. operation. Moreover, the main transformer, the most bulky of all the auxiliaries, is carried under the floor on the bolster over the pony truck, where it is entirely out of the way. The rest of the auxiliaries are mounted on a raised platform extending down the center of the car with passage ways on each side, and at this height are capable of easy inspection. The end of this raised platform nearest the motorman's position is given up to the unit switches, fifteen in number, for the transformer taps, and directly in the rear of these switches are the three compensating coils used in passing from one tap to another. These are followed by the electric blower with air ducts leading to the transformer and motor casings. Directly in the rear of the blower are the air reservoir and reverser, the latter provided with four pneumatic switches. These switches are of the standard pneumatic type but larger than those used in ordinary car control. The rest of the apparatus on the platform consists of the air sanders, the compressor motor, and the 20-volt storage battery with small-motor generator for charging. Space is left for a flash boiler for heating, if desired.

All control wiring is overhead and the interior walls of the upper part of the locomotive are lined with ground cork and white lead to prevent sweating and to act as a heat insulator.

The center of gravity of the locomotive is about 55 ins. above the heads of the rails.

The following are some general data of the complete locomotive:

Total weight, tons	140
Weight on each driver, pounds	50,000
Weight on each of the two pony trucks, pounds	40,000
Weight of each motor, pounds	19,500
Length over-all (half-locomotive)	31 ft.
Height of locomotive	13 ft. 4 ins.
Width of locomotive	10 ft.

The locomotive is designed to operate with a voltage of 11,000 on the trolley wire and 275 on each motor.

A sign mounted on the locomotive shown at Atlantic City stated that during the past two and a half years 630 Westinghouse single-phase locomotives had been shipped to eighteen railway companies in America and Europe. These motors range from 40 to 250 nominal hp each, and make a total of 79,380 nominal hp. There are now on order 310 Westinghouse single-phase railway motors for shipment to 11 different railway companies, totaling 34,135 nominal hp. This makes a grand total of 940 Westinghouse single-phase motors delivered to or on order for 25 different railway companies, and aggregating 113,515 nominal hp.

CORRECTION ON CURTIS TURBINE TEST.

On page 452 of the Sept. 28 issue an article was published on the results of tests on several Curtis turbines. Through an unfortunate transposition of figures in printing, however, a 2000-kw turbine was stated to have carried 5915 kw; the actual rating of the turbine was 5000 kw and the load carried in the test 5195 kw.

In connection with the subject of college men for railroad work, it is interesting to note that Vice-president Thornwell Fay, of the Harriman lines in Texas, has written to the Texas Agricultural and Mechanical College asking for the names of graduates or students who want to learn railroading from the ground up. These students will be placed in every department necessary to give them a thorough education in railroading.

PROCEEDINGS OF THE AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION, OCTOBER 17 AND 18, 1907

An account was published last week of the meeting on Wednesday, Oct. 16, of the American Street & Interurban Railway Association. Other meetings were held Oct. 17 and Oct. 18.

THURSDAY'S SESSION

President Beggs called the meeting to order at 10:10 o'clock and said that the first order of business was the appointment of a nominating committee. He announced his intention of appointing as members of this committee as many of the past presidents of the association as were present at the convention. He then named Hon. W. Caryl Ely as chairman of the committee. Mr. Beggs explained that his purpose in appointing the past presidents as the members of the nominating committee was partly because they had no aspiration for office and they cannot consequently be charged with promoting their own interests, possibly, by being put on the committee; and also because they know what the requirements of the association are, and the responsibilities which devolve upon the officers of the association. Mr. Beggs said that he made this explanation in deference to the great number of very active members of the Association who were present. He then called for the report of the committee on rules for the government of motormen and conductors, of which committee E. G. Connette, of Worcester, was chairman.

Mr. Connette presented the following report:

REPORT OF COMMITTEE ON RULES

Worcester, Mass., Oct. 14, 1907.

Gentlemen: Your committee on Standard Code of Rules respectfully reports that data sheet No. 18 was sent out to the various members of the association, as well as to companies which are not members, asking for the following information:

1. Company.
2. City.
3. State.
4. Urban or interurban system.
5. Have you read the report of the Standard Rules Committee which was submitted to the convention at Columbus, Ohio, October, 1906?
6. If so, have you adopted these rules as standard on your lines?
7. If you have not adopted these rules as standard, would you kindly give the committee your reason for not doing so?
8. If you have not read the report of the committee, will you please send for a copy of the report to the secretary of the association?
9. Have you any suggestions for the consideration of the committee relative to the report submitted at Columbus?
10. Remarks.

A large number of these data sheets were filled out and returned, and your committee is pleased to report that a large number of the members of this association have adopted the standard rules, with such additions as local conditions required. A few companies have used the standard rules as a basis, but have not followed the recommendations of the committee in regard to preserving the integrity of the number, as recommended in the report submitted at the Columbus convention. Three of the larger companies report that they have not adopted the standard rules. One of them does not give any reason. Another gives as a reason that it has its own book of rules. Another says that it has a supply of rule books on hand and considers that its rules are suitable to local conditions, but favors the standard rules as far as practical. Another company reports that it has not adopted the rules, because they do not provide for a joint use of tracks by steam and electric trains. This, of course, is an unusual condition, which the committee has not yet considered.

Very few suggestions have been submitted for consideration. The committee, therefore, can only report progress as to further recommendations and that the matters now under consideration be taken up by the committee for the ensuing year.

Continuing, Mr. Connette said that there is one street railway company which controls a large number of properties which has its own book of rules, and that book of rules has been adopted on all its properties. There is another holding company which controls perhaps six or eight different properties. They are members of this association, but they have adopted their own book of rules, and do not seem inclined to change. The Central Electric Railway Association has taken the national book of standard rules practically as a basis for its rules, and has used them to a considerable extent, but the association has also gotten up a book of its own, claiming that there are a great many conditions on their systems which the national book of rules does not cover. The New York State Street Railway Association has practically adopted the national standard rules, and they are in effect in nearly all the cities in the State of New York. It seemed to the speaker, therefore, that the work of this committee for the ensuing year should be to make an effort to have a conference with representatives of the two companies mentioned, and also with representatives from the Central Electric Railway Association, and see if there is some way by which one book of rules which could be used by all of these different companies could be adopted.

President Beggs said he would like to supplement what the chairman of the committee had said. While Mr. Connette did not refer to the companies represented by the president of the association, he might have had them in mind. Mr. Beggs said his own companies, while urgently desiring a set of standard rules, had not adopted the national rules, nor had they had any new rules printed for the last two or three years, anticipating just such a result as Mr. Connette had mentioned. It is a very serious matter, if a company puts into effect a printed code of rules to change them within a short time, perhaps radically. Therefore, he had felt for the companies for which he was responsible in St. Louis and Milwaukee and in a number of smaller cities, that these rules were not in such condition that they could be adopted in their entirety. He had been waiting until the rules might possibly have become more thoroughly digested, and until the time that these other organizations to which Mr. Connette had referred might agree on something which they would all adopt as standard. When that conference is held, he would be glad to have his companies represented at that conference. It should be promotive of great good.

As there were no further remarks the report of the committee was accepted with the thanks of the association and ordered to be published in the proccedings.

HANDLING OF FREIGHT ON ELECTRIC LINES

Mr. Beggs then called for the paper entitled "Light Freight Handling by Electric Lines," by P. P. Crafts, general manager Iowa & Illinois Railway Company, Clinton, Ia., and general manager Joplin & Pittsburg Railway Company, Pittsburg, Kan. Mr. Crafts presented the paper which is published on page 872 of this issue.

After reading the paper Mr. Crafts said that of his company's receipts from freight, 71 per cent were from local

traffic and 29 per cent from transfer, and that percentage practically corresponds to the tonnage carried. He then exhibited various forms used in carrying on the business, and explained their purpose.

H. H. Polk, president of the Inter-Urban Railway Company of Des Moines then read his paper entitled, "Freight Service on Electric Railways." This paper appears on page 877.

Vice-President Brady, who occupied the chair, called upon C. Loomis Allen, of Utica, for some remarks.

Mr. Allen said that his observations had been the opposite of the views presented in the two papers. On his roads the handling of express or freight had been confined to what is known as package or light freight; in fact, this term had not been applied to the business, it was called "electric express." He thought that the majority of the roads in New York State which are transacting an electric express or freight business are doing so at the expense of their regular passenger business. Not only that, he believed that for every dollar they are putting in they are taking out only 90 cents. That was a pretty broad statement to make, but he believed when the accounts were analyzed and the proper charges made to the cost of conducting this department, these results have been produced in the past. At a meeting of the New York State Railway Association, held last month at Kingston, a committee was appointed to collect from the roads in New York State complete data as to the class of consignments, which are transported, and the cost of conducting the business. The New York Association hopes to have before another year passes some results that will be tabulated and will be valuable information to those located in that territory. He knew of but two roads in Central New York that are handling the freight business in carload lots. With one of these properties he is familiar and knows that for every dollar which comes in as receipts on this class of business the company is spending one dollar and a half to get the business.

C. D. Emmons, general manager of the Fort Wayne & Wabash Valley Traction Company of Ft. Wayne, Ind., said that the experience of that road in the freight handling business has not been as disastrous as that described by Mr. Allen. All must realize in starting a business of this kind that it must be developed. His company had been in the business for the past two years, and had had to increase its facilities largely. It started with earnings of from $5 to $10 a day for running a car a short time, until at present the receipts of the company's freight cars are averaging between $75 and $100 a day for ten hours' service. Last year's expense account, in which the investment, proportion of track labor, and all other items are included, according to the mileage of the cars, shows expenses about 60 per cent of the gross receipts from the business. The company has recently been obliged to attach a trailer car to its motor freight cars, and it expects by the development of the trailer business to reduce the percentage of operating expenses. In the speaker's territory the companies feel that the freight business is a large factor in the development of their properties, especially along the lines presented in the paper. The farmers along the line are already beginning to ask for sidings, to get coal in, to ship cattle and for other purposes.

E. F. Peck said that the Schenectady Railway Company is operating a freight and express business under a separate corporation, and thinks it is making money. All items of expense in connection with the freight business are charged independently, and are not mixed with the company's passenger expenses. In its operation of the express and freight business last year the company showed 20 per cent profit, and it certainly intends to continue that line of business.

J. H. Pardee, of J. G. White & Company, New York, believed the question of the desirability of an express and freight service to depend largely upon the locality. If the electric railway company is in competition with good service on a steam road, it is at a great disadvantage in competing for heavy and carload freight. The steam railroad hauls freight in comparatively inexpensive cars, while the electric railway attempts to compete with cars costing at least seven or eight times as much. The interest and depreciation from these costly cars should not be lost sight of in estimating expenses. The profit in the express business depends very largely upon the classification. The speaker thought for this reason that the classifications of the steam roads and of the old line express companies should not be followed, but that each road or each class of road operating under similar conditions must decide upon its own classification. If this was properly done the business would be profitable. The reason that a great many people ship by electric express instead of steam express is that the electric railway company delivers the goods more quickly and in better condition and that the service is more satisfactory. An electric railway with an express business and quick delivery can therefore get the business at a higher price. At one time the speaker thought it was necessary to go below the steam railroad rate. He does not now think it is necessary to do so. The business can now be got at a rate on which there will be a profit.

Mr. Allen said that his original remarks might be misunderstood without an explanation. The papers under discussion referred to the carrying of freight, which did not seem to be profitable under many conditions. There is little doubt, however, but that an electric express proposition can be made successful. The Detroit companies were the pioneers in that business and he would like to hear their experience.

George W. Parker, of the Detroit United Railway Company, said that company had been in the electric express business since 1891. At first it adopted tariffs corresponding to those of the steam railroads, but as the company's experience in the handling of freight and express broadened, changes have been made in the tariffs. On some of the company's properties the business has been profitable, on others it has not been so profitable. On at least one line it will have to be abandoned. He doubted whether an attempt to do car load business in electric cars was a good thing if it required the supply of high class equipment for low class traffic.

Mr. Polk explained that his paper was on carload freight and that the freight is handled in box cars without any motor equipment whatever and pulled by an electric locomotive. He claimed there was a profit when $15 to $25 or $35 could be earned per car and eight or ten cars were hauled in a train. The freight department of his company is kept entirely separate from the passenger department, and his line is built entirely on a private right of way. The company is not bothered by any franchise restrictions and is permitted to conduct its business with any kind of equipment. The company is charging the Iowa distance tariff.

G. B. Hippee, of Des Moines, also bore testimony to the profit of the freight business. He said no investment is

required in the rolling stock to haul the freight. The cars are furnished by the steam railroad companies, to whom they are afterwards delivered. He thought the freight business more desirable than the passenger business, if for no other reason than the question of hazard.

W. S. Dimmock, of Seattle and Tacoma, believed his company did a larger freight business than any other company which had been mentioned. His company has in service between 300 and 400 freight cars and is operating some twelve to fourteen freight trains per day. Some of those trains haul as high as 700 and 800 tons per train at a speed of fifteen to eighteen miles per hour. The freight service on other lines is operated by single cars, or with cars that are equipped with motors and are not run as a train. The amount of business handled has increased so fast that the company wishes it had about 200 more cars to take care of it. In fact, the State Commissioners now consider the company is on a par with steam railroads as to the business carried and the importance of it, and has placed the company under its control, as has also the Interstate Commerce Commission. It might be interesting to mention the different classes of freight handled. The company is carrying daily between Seattle and Tacoma some 2000 to 3000 gallons of milk which are picked up through the valley and taken into Seattle each morning on a special train. It has two or three trains per day of ten or twelve cars of coal—60,000 lbs. capacity cars—pulled with a locomotive or an ordinary box car, each car equipped with four type G-66 motors. The company also has a refrigerator line. It was fortunate in having some packing houses located in Seattle and some in Tacoma. Each one of them desires to ship its product to the other city, so the company gets the freight going and coming. The cars operated on those trains are built on purpose for the hauling of beef, which is hung in the cars by halves; in other words, the beef is not quartered after it is killed. The cars are about 14 ft. high and operate around 8-deg. curves and at high speed. The beef is killed in the afternoon at 3 o'clock and at 5:30 it is hung in the refrigerator cars. At 6 o'clock the cars pull out of Tacoma or Seattle, as the case may be, for the opposite city, are gotten in there in the course of a couple of hours and are unloaded. While the train is being unloaded the same motor car is at the local freight stations picking up other freight, and the cars are hauled back and ready for service the next day. This business is conducted on the interurban line between Seattle and Tacoma. In addition the company operates two local freight trains out of each city per day, and has all the business, both in carload lots and local freight, that it can possibly handle. The expense of conducting this freight business, including the depreciation of the cars, averages 45 to 52 per cent of the gross receipts. Very desirable flat cars can be purchased for from $450 to $550, delivered on the coast. The company also has some 12 miles of sidings on its suburban lines, where it is hauling lumber in trains of five and six cars, in many places over 5 and 6 per cent grade. This service brings in a very handsome revenue. The company does perhaps $20,000 freight business, gross, per annum. These 12 miles of sidings mentioned extend into the private property of people owning timber and woodlands. The siding is generally built at the expense of the man owning the ground or the timber, the rails being leased by the railway company for that purpose. In addition to the wood business the company has found that its small package freight business is increasing very rapidly. For instance, upon one line about 7 miles long, on which no business had ever been done, the company's traffic manager thought such traffic could be made profitable. During the first two or three months the business was practically nothing. Now, at the end of one year, the company has one freight car running constantly and is thinking of putting on a second one, and the local package freight is so heavy that it is impossible to take care of it without additional equipment. All this was upon a line where it was impossible to see any business a year ago. The company also loads heavy standard steam cars with lumber, shipping it into the Middle West over such lines as the Northern Pacific and the Great Northern; these roads furnish the cars. A number of mills are located upon the electric lines and the shipper has the steam road freight cars turned over to the electric line at the transfer point.

In answer to questions Mr. Dimmock said his line had steam road competition. There are two steam lines paralleling the electric line between Seattle and Tacoma. There is also a heavy competition by boats. The freight traffic is not allowed to interfere in any manner with the passenger traffic. Trains are dispatched under the standard rules of the steam roads, with telegraph operators and station agents. The total operating expense of handling this freight service, which does not in any way interfere with the passenger traffic, will be somewhere between 45 and 50 per cent. Speaking of the passenger traffic Mr. Dimmock said that the company has passenger trains operating between Seattle and Tacoma every hour, both ways, and at a speed of sixty-five miles per hour. Most of the freight business is done at night. Motormen are paid at the rate of 33 1/3 cents per hour, conductors at 30 cents per hour and brakemen at from 22 to 23 cents per hour.

Mr. Crafts added some more details in connection with the freight business done by his company and which he said was small in comparison to that mentioned by Mr. Dimmock and Mr. Polk. It is not strictly package freight. The company started in to call it "express," but decided later upon the term "freight." The rates charged are those given in the standard classification distance tariff permitted by the Iowa Railway Commission. The company averaged last year each week approximately 550 individual shipments, of which 60 per cent, or 333, were local shipments. Of the local shipments 50 per cent are minimum shipments for which 25 cents each are paid. This freight is carried in a $10,000 38-ton car, which is filled day in and day out. As to the expenses: The company charges in to its freight operating expenses the salary of a solicitor, a portion of whose time is devoted to developing passenger traffic, but a very small portion. The company maintains an extra clerk at each end of the line. It also charges to its freight business the rent, light and telephones that are required outside of the passenger business, all books, stationery, etc. It also charges off 3 per cent of the gross receipts for damages and claims, etc. It charges to the car the same power cost per car mile that is charged to the passenger coaches, and the same proportion of expense of maintenance for the roadway and car. Motormen and conductors are paid 22 cents per hour for all platform time. The company has found that the service develops traffic. For instance, a storekeeper is enabled to carry a very much smaller stock of goods because he is certain that he can get a supply at almost any moment within two or three hours of the time he notifies the railway agent to send in an order. His carrying cost is reduced and the railway receipts per ton are increased. The company has steam road competition and for some time had boat competition also.

Mr. Hegarty, of Little Rock, moved that the Accountants' Association be requested to take up the question of a classification of freight accounts to comply with the requirements of the Interstate Commerce Commission. The motion was seconded and unanimously carried.

OTHER PAPERS

The following papers were then read: "A Department of Publicity," by J. Harvey White, publicity manager, Boston Elevated Railway Company, Boston, Mass.; "Advertising from the Standpoint of the Street Railway Company," by E. W. Warnock, general passenger agent, Twin City Railway Company, Minneapolis and St. Paul; "The Problems of the Small Electric Road," by H. S. Cooper, manager, Galveston Electric Company, Galveston, Texas. These papers and reports are printed in this issue.

The meeting then adjourned until Friday morning at 9:30 o'clock.

FRIDAY'S SESSION

President Beggs called the meeting to order at 10 a. m. and read several acknowledgments of the invitation to attend the convention sent out from the secretary's office. They included letters from Henry M. Watson, of Buffalo, past president of this association; Randall Morgan, of the United Gas Improvement Company of Philadelphia; William M. Carroll, a member of the Public Service Commission for the First District of New York; Governor Hughes, of New York, and others. The president then appointed as a committee on resolutions C. D. Wyman of Seattle, H. G. Davies of Cleveland, and C. S. Sergeant. He then called upon H. G. Davies, of the Cleveland Railway Company, chairman of the insurance committee, to present the report of that committee. This report is published on page 890 in this issue.

FIRE INSURANCE

President Beggs said he desired to emphasize what Mr. Davies has said as to the importance to most companies of the insurance question. It is usually left with some subordinate, or the head of some department, usually the accounting department, and goes along from year to year as a matter of form, without much attention being given to it. In President Beggs' own companies it is one of the matters which has always received the personal attention of the president. That may be due to the fact that a long time ago he was engaged in the fire insurance business for some years. He attaches so much importance to this matter of fire insurance that the Milwaukee Company has in its fire insurance reserve fund $450,000 of high-grade 5 per cent bonds; in other words, for ten or eleven years it has been getting in condition each year to secure what it was entitled to receive from an insurance standpoint, for a company that took care to keep its properties in such condition as to reduce the fire hazard to a minimum. The company is looking forward to the time when it may carry its own insurance and save a very large proportion of this 55 per cent. The delegates should not think from this that the fire insurance companies make 55 per cent profit. That is not the case. Under no circumstances can over 50 per cent of the amount paid by the insuring public in any line of business—except in the case of some great catastrophe—be returned to the insured. The first draft on every insurance premium paid is probably 25 per cent, which goes to the state agent as the commission. That can never come back. Then the tax on fire insurance premiums in the State of Wisconsin is about 7 per cent of the entire amount of premiums paid. Then there is all the expense of the advertising which must be paid for out of the premiums, and in every case the advertising runs into a very considerable amount of money. The history of the companies some years ago was that there had not gone back to the insured in this country quite 50 per cent. The balance is that which the insured, if they were in position to do it, could save. If a company can carry its own insurance it can save the expense of maintaining the organization and the taxes which must be paid. Therefore, a company which will put itself in position to carry its own insurance is performing a service to the entire insuring community, because the employes, knowing that fact, are unconsciously just a little more careful around the car house and other properties. The speaker said he was most rigid in inspecting fire insurance matters. He would go through the shops and into every out-of-the-way corner, around the belt drive and lockers and cupboards, and under the benches where the men throw old overalls, greasy rags and things of that kind. A great mass of people who pay for insurance know nothing about the great hazard which arises from these conditions, and in very many cases there is no proper inspection by the company of these things. He also inspects very carefully the matter of car wiring. He has been able, therefore, possibly because of dealing with the insurance matter in this way for the past ten years, to get a lower rate on insurance than many others do, at least during part of the time. The Fire Underwriters now have a wholesome respect for the $450,000 of 5 per cent bonds mentioned, because he is in a position to say unless he gets what is a reasonable rate of insurance he will not carry the insurance with any company which will not give a reasonable rate. In the city of St. Louis the railway company is doing the same thing. It has 1000 shares of the company's preferred stock, par value $100, as an insurance reserve fund. The interest goes into the general fund. In that case the speaker pursued the policy of carrying a fixed percentage of the company's gross receipts to its fire insurance reserve fund, and from that pay every expense incident to carrying the insurance. He believes that a railroad company having its car houses in the outskirts of the city to a very great extent, and spreading over a large area, can afford to carry its own insurance, if it has accumulated enough reserve fund to pay for one large fire, but to do this requires years of preparation.

H. N. Staats said that about three years ago he received an invitation from Mr. Davies, of the Cleveland Electric Company, to attend the convention of the American Street Railway Association, to bring to the attention of the executive committee of the association the advisability of appointing an insurance committee. That was the first step taken. Great encouragement was received from Mr. Ely, then president of the association. They returned to Cleveland, and at once took steps to organize what is known as the American Railway Insurance Company, the Electric Mutual Insurance Company, and the Traction Mutual Insurance Company, with the end in view of interesting the members of this association in carrying their own insurance at actual cost. Insurance is a fixed charge—no one can get away from it. The idea is to make that fixed charge as low as may be practicable, and the speaker claimed that can be done better through a mutual organization than through an organization of companies whose only interest is to make the largest amount of money out of the capital invested. When a company deals with the old-line companies it is dealing with companies who put up their money for a specific object. The old-line companies have a very necessary place in the community and are needed, but through co-operation on the part of this association

with other associations, the companies can carry their insurance at actual cost, and that cost will be less than that at which the old-line or stock-insurance companies can carry it.

Bruce E. Loomis, speaking for the insurance companies, said that the latter would always be pleased to take up any insurance questions with the railway companies and meet all requests so far as they could. Mr. Sweetland spoke along the same lines. Mr. Beggs referred to the important assistance which the underwriters had given to the committees of the association during the previous year. He then asked for the report of the committee on the construction of modern car houses. This report was presented by E. J. Cook, of Rochester, and appears on page 880.

MUNICIPAL OWNERSHIP

The next report was that of the committee on municipal ownership, which is printed on page 893. C. D. Wyman, the chairman of the committee, presented the report.

A. E. Lang, of Toledo, called attention to the reference in the report to the attitude of the labor unions on the subject of municipal ownership, which he thought should be modified. While some labor organizations do favor municipal ownership, there are a great many men who are reluctant members of such bodies. The recent vote on this subject in Chicago made it clear to his mind that when the subject is properly presented to a labor union, the more intelligent of them will act wisely. While he was ready to vote to approve the report and spread it upon the records in full, he thought that sentence might wisely be modified.

Gen. G. H. Harries agreed with Mr. Lang. He said that there are in a few places labor leaders who are strongly socialistic, and who thoughtlessly—because all the leaders are not necessarily thoughtful men—have favored municipal ownership; but the big strong men of the labor movement realize that municipal ownership, if it ever should be an accomplished fact, will mean death to unionism, and they oppose it. In the inner workings of the strong labor organizations, there is opposition to municipal ownership, because if it should be carried out there would not be any unions of trainmen, as there are no unions of policemen, firemen or of any other municipal organization. That seems to be the only thing in the report that ought not to be universally endorsed.

Mr. Wyman thought that had not been the position of the labor unions in Seattle, Chicago and elsewhere where contests had arisen. He was glad to know that the labor unions are coming around to a right view of the situation.

President Beggs said that in Milwaukee there had been a referendum three times upon the question of installing a municipal electric lighting plant for the city. Since the passage of the law placing all public utilities under a State Commission, every civic body in the city of Milwaukee, some five of them, the Chamber of Commerce, the Merchants & Manufacturers' Association, the Business Men's League, and every commercial organization, had by special resolution memorialized the Common Council to drop the question of a municipally-installed plant, upon the ground that now having a public commission they are assured of fair rates and that there is no necessity for the city spending a million and a half dollars to put in a municipal electric lighting plant with the abuses possible and which they recognize. But the labor unions had taken directly the opposite course by specific resolutions, and if it were not for them the matter would be dropped, notwithstanding that certain politicians are still attempting to foist themselves upon the public as the champions of a municipal plant.

Upon vote the wording of the sentence referred to was left to the committee.

ATLANTIC CITY AS A PERMANENT MEETING PLACE

President Beggs then introduced A. T. Bell, president of the Atlantic City Hotel Men's Association, who discussed the proposition to select Atlantic City as the place of meeting of the association for a period of five years. The proposition of the Hotel Men's Association in this connection was printed on page 811 of the Street Railway Journal for last week. Mr. Bell, in setting forth the merits of this plan said that since the organization of the Hotel Men's Association, which is now in its third year, special effort had been made to provide such facilities as would induce such gatherings as those of the association to go to Atlantic City. It was found that first, the transportation facilities were good from all the large centers of population; second, the hotels were there with private bath rooms and plenty of first-class accommodations, but there was lacking what might be called an ideal place for exhibits. As a makeshift, however, the exhibits had been placed on Steel Pier, and with the kind assistance of the United States Weather Department, it had been a success. Mr. Bell admitted, however, that in the event of a storm the pier would not have been an ideal place. Drop curtains had been provided which would all have been spread out at an angle and the passageways would have been protected as well as possible. Nevertheless, it would not have been comfortable, and everyone must realize that fact. To overcome that, and provide some other facilities that are necessary, the Hotel Men's Association has taken the subject up with the owners of the next large pier below, known as Young's Ocean Pier. Those gentlemen have at the solicitation of the hotel men made the proposition contained in the circular. Their proposition involves the building of what would be an ideal permanent exhibit hall. The proposed building is a long, narrow one, with two aisles, spaces on each side of the aisles and double spaces in the center, a building which would be in all perhaps two-thirds of a mile long. At the end of this would be meeting rooms for the association and its affiliated and allied associations. It would have a place for the storage of crates, boxes and the paraphernalia that come with the exhibit. In addition to those more permanent facilities there would also be live steam at suitable pressures, electric feeder wires at all the different commercial voltages, and in a general way everything else that is usually so expensive and troublesome to get. It is proposed to connect the pier with the steam railroads so trains of exhibits could be brought on and the cars run through these aisles on the tracks, which would be depressed and could be covered after the exhibits were in place. A large traveling crane passing over the center would take the heaviest exhibit right out of a car and put it in position. In fact, so far as the handling of exhibits and large machinery is concerned, it would be a large first-class machine shop. On each side of the building would be a long porch, about 20 ft. wide, on which there would be a set of tracks 3000 ft. long. The track exhibits could be placed on those tracks to have not only the manufacturing exhibit, but also the track exhibit together. In addition to that, on this ocean pier, they would not be hampered by what is known in Atlantic City as the restrictions of easement deed. In reference to the latter he said that to have the ocean side of the boardwalk clear, all the property owners had signed covenants granting to the city the right to restrict the placing of buildings outside of the pier,

the sale of commodities outside of the pier, and against other things, among which is this—they are not permitted to restrict the public from coming in. On the Ocean Pier, however, which was built before the signing of these deeds and the forming of these covenants, these restrictions do not lie, which fact has been determined by carrying the matter through the highest courts. It would therefore be possible, if it were so desired, to exclude the public entirely from this exhibit structure during the time of the convention, which is a matter that some of the exhibitors think very important. The idea, further, is to manage this exhibit hall on something like what is called the American plan of a hotel. If one goes to any of our large hotels and engages a room, he is shown to the room and finds not only the room there, but a carpet, beds, mattresses, bureau, a piece of soap and everything else needed, and when going to the dining-room, the meals are found. In the case of an exhibitor bringing his exhibit to the Steel Pier, so far as he knew, as soon as he engages his space he has to go out and buy everything essential. Their idea is to provide all these essentials and include them in one cost. It is not intended, however, to restrict individual exhibitors from using their own taste in some individual decoration, and of course they must provide their own exhibits and make them as attractive as they can.

This corporation has in mind the expenditure for this purpose of about $1,500,000. Should it be found later on that the sum necessary would be $2,000,000, that sum will be forthcoming provided the financial plan, which would have to be considered more in detail by the individual exhibitors, is agreeable to them. The question that comes up to the association was whether in a broad general way it would be advisable for the association to determine upon Atlantic City as a meeting place for five years, which is the term the pier people feel they should be assured as a starter for the enterprise. There are, of course, some large questions which the association must answer for itself. He would, however, say that the consideration of this proposition must be taken up from three points of view: First, whether the erection of such a building is of sufficient advantage to determine its use for five years; second, the Manufacturers' Association must determine in a general way that these proposed facilities are satisfactory; and then the individual exhibitor must be asked whether he sees in it a good business proposition. The financial interests connected with this pier are determined to make an improvement. They must make it in the immediate future. If favorable action were taken at once they would go ahead along these lines, and if the action taken is unfavorable, or postponed, they felt they must go ahead along other lines. Therefore, some action either on the part of the association favoring the plan or placing the authority in the hands of a committee with full power to take definite action later, would be entirely acceptable.

President Beggs said without attempting to determine what the association will do or should do, it would be his judgment that the association was not prepared to take definite action immediately whether it would be justified in committing the American Street and Interurban Railway Association and its affiliates to locating its conventions for a period of five years. It seemed to him it would be better to refer the entire matter to the incoming officers and executive committee, giving them full power to go ahead in the premises, so if it was found to be desirable they could act upon the suggestions made by Mr. Bell without postponing it for another twelve months. The officers and executive committee members of necessity act in entire harmony with the Manufacturers' Association. At the same time, not forgetting that, if the association chose to determine to meet at any one particular point for five years, he knew the loyalty of the Manufacturers' Association is [illegible] they would cheerfully acquiesce. Yet, because of that disposition, he felt strongly that whatever is done should be in concert and after full consultation with the officers and executive committee of the Manufacturers' Association. Mr. Beggs pointed out that between 3000 and 4000 members of the various associations and their guests are present at the meetings. Nearly all of them wish a room with a bath, but there are very few cities in the United States that would give that. The Jamestown Exposition, for example, would have been favorably considered, as satisfactory accommodations could have been made in temporary structures for the exhibits, but the executive committee knew Norfolk could not accommodate the representatives properly. If the Jamestown Exposition had been chosen, instead of the officers of the affiliated associations being the objects of congratulations on every hand by those who came to Atlantic City for the admirable accommodations and the arrangements made for their entertainment, they would have been subject to denunciation. Although at Columbus, the best elements of the society of that city turned out en masse to receive the association and their entertainment had been most hospitable, the hotel accommodations had not been anywhere near so ample as at Atlantic City; yet Columbus compared favorably in hotel accommodations with other cities of the same size anywhere. He would be perfectly satisfied always to come to Atlantic City with the conventions, but that question must be decided for the best interests of the association. Mr. Shaw then took the chair, as Mr. Beggs was obliged to leave for another engagement.

A. H. Classen, of Oklahoma City, said he came some 3000 miles from Atlantic City and would like to have the conventions further toward the center of the United States. It ought to be St. Louis, Cleveland, or some other point of that kind, but he thought the executive committee and the manufacturers' committee were eminently fitted to decide the matter. He therefore moved that the matter be referred to the executive committee. The motion was carried.

HEAVY ELECTRIC TRACTION AND CARRYING MAIL

The next business was the report of the committee on "Heavy Electric Traction," presented by Calvert Townley, of New Haven, as chairman. The report, which will be found on page 889 of this issue, was approved. It was followed by the report of the committee on compensation for carrying mail. In the absence of G. Tracy Rogers, of Binghamton, N. Y., chairman of the committee, the report was presented by Gen. G. H. Harries, of Washington, D. C.

Mr. Harries said he had no formal report and had not consulted with Chairman Rogers, who might want to submit the material on hand in a more definite manner. An effort was made by the chairman of the committee and Secretary Swenson to interest the Postoffice Department and the House Committee on Postoffices and Post Roads in the matter of increased compensation for carrying the mails on electric cars. The committee had already succeeded in securing legislation to increase the maximum compensation for carrying pouch mail from 3 cents to 4 cents. At the same time, Congress has placed a very serious restriction in the law, by providing that on electric railways, outside of cities exceeding a length of 20 miles, the compensation received by such roads should not exceed the rates paid to the steam railroads. This was an unfair discrimination,

causing many railway managements more or less distress because the price paid must necessarily be less than the actual cost of rendering the service. It was agreed some time ago to the then Second Assistant Postmaster-General, Mr. Shallenberger, that the service on the electric cars was very good and the compensation very small, much less than it ought to be. Since that time he had spoken with the new Second Assistant Postmaster-General, James T. McCleary, and with the Postmaster General himself, incidentally bringing this out. While no organized campaign is yet in progress, still the new committee should be instructed to make an effort to secure the maximum of 6 cents for the pouch service, and not less than 25 cents a car-mile on the postal car service at the next session. The 20-mile limitation should be extended to 50 miles. The Department is friendly, and in spite of the fact that there has been a desire on the part of Congress to decrease the compensation for carrying the mail, that desire will not extend to the electric suburban and interurban service.

He believed if the committee will go to work at once upon the Postoffice Department it will not have to do very much to secure favorable recommendation for a proper increase and the removal of the serious disability caused by the 20-mile limit. With the Department's recommendation, and in view of the report of the Postmaster General now being written for presentation to Congress, the committee on Postoffices and post roads will be likely to give the association's committee a hearing, at least. They might get some concessions, if not everything. He therefore moved that the committee be instructed to proceed immediately before the Postoffice Department, so the report of the Second Assistant Postmaster-General and the report of the Postmaster-General himself may each contain recommendations satisfactory to the association. Mr. Harries said in conclusion that the committee would present a more formal report later.

T-RAIL CONSTRUCTION

The paper on "The Use of the T-rail in Cities" was then read by C. Gordon Reel, vice-president Kingston Consolidated Railway Company, Kingston, N. Y. This paper is printed on page 883 of this issue.

P. P. Crafts asked Mr. Reel what was the particular object in using the 90-lb. rail, over, say, 70-lb. rail.

Mr. Reel said his idea was that he would be putting in something very much more substantial. The standard 90-lb. T-rail is sold up at $28 a gross ton, and the 70-lb. T-rail on the basis of $36 a ton. As four times 9 is 36 and four times 7 is 28, he received 20 lbs. of good steel as a present.

Mr. Crafts replied he referred to the standard A. S. C. E. section, but Mr. Reel said there would hardly be room enough, as he thought the 70-lb. T-rail is only 5 ins. high.

Mr. Crafts said it was 4¾ ins. high.

Referring to an illustration in his paper, Mr. Reel pointed out the difficulty of getting the paving bricks over the heads of the spikes with the 70-lb. rail. There would be no room for a sand cushion. The 100-lb. section looked ideal for eastern railroads to use.

Mr. Crafts said his company has just taken over a road with 2 miles of double track equipped with 70-lb. standard section, and that the matter of height is the trouble anticipated. They are going to operate seven-ton cars over the track, and find there seems to be little space for the sand cushion.

Mr. Reel said that a ½-in. sand cushion would be sufficient.

Mr. Crafts asked if any one had any experience with the 70-lb. section. Mr. Reel replied that Mr. Peck, of Schenectady, had made some 80-lb. rails which he believed have been entirely satisfactory.

F. W. Coen said the experience which the Lake Shore Electric Railway Company has had with 70-lb. T-rail in paved streets is unsatisfactory. The brick will not stay. It has abandoned that construction entirely, except on some streets where there is little service or very light cars. With heavy cars the rail is absolutely unsatisfactory. If a brick is used with the nose under the rail the other end of the brick will turn out.

Mr. Crafts thought that to be the trouble. His company purchased cars with wheel flanges of the standard M C B dimensions, 1¼ ins. each way, and anticipating something of the kind has been obliged to reduce the height of the flange.

P. E. Mitchell said that on the Knoxville Railway 2 miles of double track was paved with 70-lb. T-rail, but the company uses a special brick with the corner hollowed off, the same fitting under the rail. This brick comes in half and whole lengths, placed alternately. The brick is manufactured by the Southern Brick Company. About every seven or eight feet an extension joint of pitch is put in and the balance cemented. The brick is tapered as it goes under the ball of the rail, leaving a groove small enongh for the cars.

Mr. Crafts feared that to get a sand cushion he would have to taper the brick where they go under the rail.

Mr. Mitchell said he got a ½-in. or ¾-in. sand cushion. There is no turning up, because it is one solid mass across the pavement.

Theodore Stebbins then presented his paper on "Interurban Railway Fares," printed on page 866 in this number.

This was followed by the paper on "Municipal Ownership in Great Britain and in the United States," by William J. Clark. Mr. Clark's paper will be found on page 885 of this issue.

MUNICIPAL OWNERSHIP AND PUBLIC RELATIONS

Mr. Clark said he would not read his paper because it was composed principally of statistics which convey more meaning in print than if spoken. However, he would take the opportunity of making a few off-hand remarks as regards the attitude of the labor leaders in this country and abroad on this great question. Dealing more directly with the labor leaders in this country, in the work of the Civic Federation, of which he has been a member for the last two years, he said no class of men work more thoroughly and earnestly on the investigation than the labor leaders. He believed the most valuable contribution to the literature on this great subject is that which will soon appear by Prof. John R. Common and J. W. Sullivan, both eminent labor leaders. (Mr. Clark then read two or three pages at the termination of his report.)

Vice-President Shaw then called for the report of the committee on public relations, of which W. Caryl Ely is chairman.

Mr. Ely said the report of the committee had been read and considered the day before at the executive session. Mr. Wyman's committee had covered considerable ground covered by the report of the public relations committee and the members had heard several papers along the same lines. Therefore the reading could be dispensed with. The burden of the report deals with the important movement all over this country in the way of regulation and control through Public Service Commissions, and is suggestive of possible desirable action on the part of the association. This report is printed on page 891 of this issue.

Mr. Ely added that a short time ago while considering

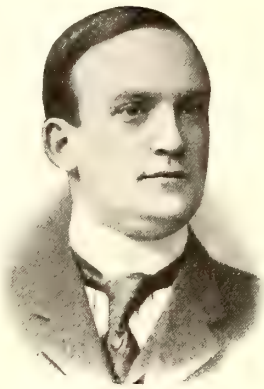
this subject and the kindred subject of municipal ownership, it occurred to the committee that a paper upon municipal ownership by W. J. Clark would be a very desirable thing. Mr. Clark was communicated with only a short time ago, but with the proverbial willingness to undertake labor in the general good so characteristic of him, he had prepared the paper already mentioned. Under the circumstances it seemed to Mr. Ely that a special vote of thanks should be extended to Mr. Clark for his kindness in preparing the paper. This motion was carried.

NOMINATIONS

W. Caryl Ely as chairman of the nominating committee presented an entirely unanimous report and suggested the following gentlemen for election to the respective offices in the association: President, Calvin G. Goodrich, of Minneapolis; first vice-president, James F. Shaw, of Boston; second vice-president, Arthur W. Brady, of Anderson, Ind.; third vice-president, Thomas N. McCarter, president The



CALVIN G. GOODRICH,
PRESIDENT,
American Association.



JAMES F. SHAW,
FIRST VICE-PRESIDENT,
American Association.



ARTHUR W. BRADY,
SECOND VICE-PRESIDENT,
American Association.



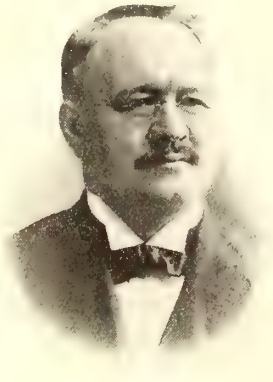
THOMAS N. McCARTER,
THIRD VICE-PRESIDENT,
American Association.



FRED G. SIMMONS,
PRESIDENT,
Engineering Association.



F. R. HENRY,
PRESIDENT,
Accountants' Association.



H. R. GOSHORN,
PRESIDENT,
Claim Agents' Association.



BERNARD V. SWENSON,
SECRETARY,
American Association.

OFFICERS AND EXECUTIVE COMMITTEE, AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION

Public Service Corporation, Newark, N. J. Members of the executive committee: the president, vice-presidents, Frank R. Henry, of St. Louis, president of the Accountants' Association; Frederick G. Simmons, of Milwaukee, president of the Engineering Association; H. R. Goshorn, of Philadelphia, president of the Claim Agents' Association.

On motion of Mr. Harries the report was adopted.

The report of the committee on resolutions, of which C. D. Wyman was chairman, was presented by H. J. Davies as follows:

REPORT OF COMMITTEE ON RESOLUTIONS

I. *Whereas,* The American Street & Interurban Railway Manufacturers' Association has assembled and placed for examination a very complete, excellent and interesting exhibit of railway appliances for the inspection of the members of this association; and

Whereas, The arrangement of the exhibits with respect to artistic effects as well as with regard to convenience and facility for examining them gives evidence of the most careful and painstaking thought; and

Whereas, The social and entertainment features provided by the American Street & Interurban Railway Manufacturers' Association have been most carefully planned and carried out.

Now, therefore, Be it resolved that the American Street & Interurban Railway Association place on record its appreciation and thanks to the American Street & Interurban Railway Manufacturers' Association, its officers, executive committee and its members collectively and individually, for their energetic and tireless efforts in producing these most successful results.

II. *Whereas,* The members and guests of the American Street & Interurban Railway Association are under very great obligations to the Mayor of Atlantic City, the Atlantic City Business Men's Association, the Atlantic City Hotel Men's Association, the Atlantic City Bureau of Publicity, the telephone and telegraph companies and the technical and local press, for numberless courtesies and attentions, including facilities for exhibiting street railway materials and appliances and other privileges and attentions.

Now, therefore, Be it resolved that the thankful acknowledgments of this association be tendered therefor.

III. Resolved also, That the association is indebted to its officers for their faithful work during the year to the authors of the papers that have been read and to the standing

and special committees of the association for their carefully prepared and valuable reports.

C. D. Wyman,
C. S. Sergeant,
H. J. Davies,
Committee.

The report of the committee on resolutions was adopted.

W. Caryl Ely offered the following resolution as the outcome of the discussion at the executive session the preceding day:

Whereas, Experience has demonstrated the desirability and usefulness of our existing affiliated organizations; and

Whereas, It has appeared from discussion that another organization of similar character should be organized, to which should be committed lines of work pertaining to transportation, traffic and general operation.

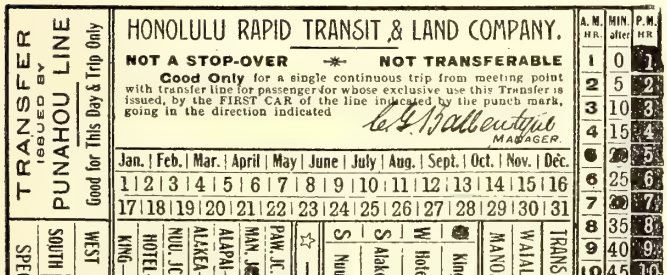
Now, therefore, Be it resolved, that the executive committee be and hereby is requested to take such steps as it may deem desirable to encourage the formation of such an organization.

Mr. Ely stated that this resolution had received the unanimous approval of the executive committee. The resolution was unanimously adopted.

MISCELLANEOUS BUSINESS

Ralph Sweetland, as the representative of the National Fire Protection Association, wished to thank the association for inviting it to be present and extending it the privilege of the floor.

L. T. Peck, of the Honolulu Street Railway Company, gave some interesting information regarding the correction of the abuse of transfer privileges. In Honolulu under his company's franchise there was a provision that for one fare a passenger could go from any point on the system to any other point on the system. Under the franchise he was



HONOLULU TRANSFER DESIGNED TO PREVENT CIRCLE RIDING

not compelled to take the shortest route, neither could the company select the route for the passenger. The result of this law was that the transfer privilege was abused. The company has a number of parallel lines and several cross lines intersecting them, and soon found that by the use of the ordinary transfer system there was a great deal of around-the-circle riding. After standing several lawsuits, being worsted every time and losing a good deal of money for suits for the ejectment of apparent circle riders, the company adopted a through transfer—that is, when the passenger pays his fare he is given a transfer which he keeps to the end of the journey. It not only identifies the line on which his journey originated but the zone of the line on which he started. On line No. 1, if a passenger gets on between zone A and zone B, it is punched on the ticket to show that he got on line No. 1 between zone A and B. The passenger holds this ticket and can go in a certain direction, but if he attempts to get back to his starting point when he presents his original transfer ticket to the conductor of the original line, the conductor sees not only a transfer ticket punched for his own line but a transfer ticket in which the zone on the line is marked, showing the beginning of the passenger's journey. If he comes back to some point on that zone, he cannot go through as the courts have held that to go over the same rails in either direction a second time constitutes an attempted fraud on the corporation. This system has been used successfully for two years.

Mr. Beggs, who returned to the meeting at the conclusion of Mr. Peck's remarks, made a farewell talk in which he heartily thanked the entire membership of all the associations for their uniform courtesy and consideration during his term as president. He could not bespeak for the new officers and executive committee greater consideration, or give them greater assurance of the continued successful administration of the affairs of the association than to be able to assure them of continued and united support from the affiliated associations. He would always look back to his administration as president of this association as one of the greatest honors he had received in the street railway business. Without reservation or qualification he pledged to the incoming officers and executive committee of the annexed and affiliated associations as earnest work as he had given in the past. Mr. Beggs was heartily applauded, after which the meeting adjourned.

FOREST HILLS STATION PLANS FILED

Plans for a temporary terminal station at Forest Hills have been filed by the Boston Elevated Railway Company with the Massachusetts Railroad Commission for approval. The new drawings cover the elevated structure over Washington Street from the vicinity of Burnett Street to the New Haven crossing over Washington Street. A new type of structure is shown where the line is to cross the Arborway, consisting of seven steel and concrete arches, four of which are over roadways and three over bridle paths. These will require a single line of columns at this point, with masonry coping above. The whole structure will harmonize in appearance with the masonry arches which carry the steam railroad tracks across the parkway.

The station will consist of two platforms, with a line of double track between them for elevated trains, and a similar arrangement in the street for surface cars. The whole structure roofed in will be about 360 ft. long. On the steam railroad side will be a platform 20 ft. wide with four exit stairways in two groups. The loading platform for elevated trains will be 45 ft. wide, and in addition to two stairways is to have two escalators connecting the surface-car platforms and the elevated level. An office, waiting room and toilet rooms will be located at the north end of the elevated loading platform.

For reversing the elevated trains a double cross-over is provided beyond the station. A spur track is also provided, on the south side, leading into the company's land and available as a connection to car houses or shops. Surface cars are to be run beneath the elevated platforms, where cross-overs are provided for reversing them if desired. The layout also allows the movement of surface cars through the station. The entire station location is held to be on a temporary basis, pending developments in proposed interurban connections, which may make necessary a large terminal station on private land.

RECENT IMPROVEMENTS IN CATENARY LINE CONSTRUCTION AND METHODS OF INSTALLATION

The important developments now going on in both the single-phase and high-voltage direct-current railway fields lend considerable interest to the following details which the General Electric Company has just made available of its latest work in catenary construction. This information includes not only a description of the latest designs but also of the methods of installation.

DIFFERENCES BETWEEN THE OLD AND NEW OVERHEAD SYSTEMS IN POLE SPACING, FLEXIBILITY, ETC.

In the older types of line construction in which the trolley wire is supported directly from a bracket or cross span, the limit for pole spacing with reasonable sag in the trolley wire is approximately 100 ft. The minimum deflection attainable with this spacing necessitates heavy upward tension on the trolley to maintain contact with the wire. In the catenary construction, however, the spacing of the poles is only a matter of weight of span which each pole can carry, and of sag permissible in the messenger cable. It has been found that, without unduly increasing the height and the weight of the poles, the spacing may be 150 ft. on tangents.

The catenary system which is equally applicable to bracket or cross-span construction, consists essentially of an arrangement of a slack messenger cable and suitable hangers so distributed as to maintain the trolley wire practically without sag between suspension points, or to limit the sag as may be necessary for various conditions of operation. The blow of a collector passing suspension points at high speed is thus greatly reduced. The shorter distance between hangers necessitates less stress in the trolley wire and reduces danger of break in the line.

The catenary system, therefore, offers the mechanical advantages of a longer pole spacing and a flatter trolley wire; flexibility in the line to obviate the hammer blow of the collector at suspension points; and reduction of danger of mechanical breakage.

The insulation surfaces practicable with the molded insulating devices used in the older type of construction, while ample for 500-volt direct-current work, are inadequate for the higher potentials of alternating-current distribution, and an entirely new system of insulation has been adopted. In bracket construction, the messenger is carried by porcelain petticoat insulators on the bracket arms, and in cross-span construction the messenger is insulated either by strain insulators introduced in the span wire or by an insulated messenger hanger or support. The strain insulators for this purpose and for all pull-offs and anchorages for voltages up to and including 3300 volts are of specially treated wood, while those for higher voltages are of porcelain under compression. The entire insulating system is designed for three times the normal working voltage under the severest weather conditions.

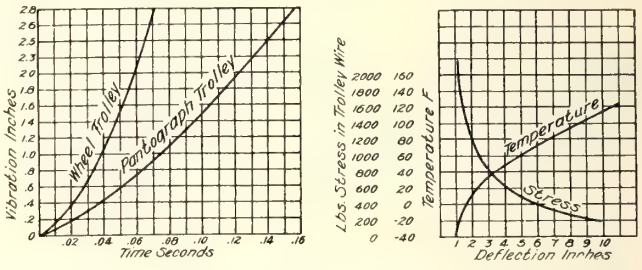
The three-point suspension in which, with 150 ft. pole spacing, the hangers are 50 ft. apart has been found ample to maintain a sufficiently level trolley wire for operation with wheel collector at speeds up to sixty-five miles per hour. A new element, however, is introduced by the sliding pantograph or bow trolley which, on account of its great inertia, requires a closer spacing of the trolley support.

Fig. 1 shows comparative curves of time required for vertical vibration of wheel and pantograph trolley respectively. It has been found that an eleven-point suspension renders the trolley wire sufficiently level for the relatively sluggish action of the pantograph collector. This brings the hangers 13.6 ft. apart, and for all operative conditions with sliding collectors the eleven-point suspension is recommended. Fig. 2 shows the effect of temperature variation on sag and stress in trolley wire with the three-point construction.

The standard hangers for supporting the trolley wire from the messenger consist of screw clamp ears adapted for grooved trolley wire, and interchangeable on Nos. 00, 000 and 0000 wires. These hangers have sister hooks or clamps for engagement with the messenger wire. The ear and sister hook grip are slotted to receive the flat steel connecting strip or stem to which they are riveted.

In span construction, and also generally in bracket construction where the pole line is on the outside of the curve, the alignment of the trolley wire with respect to the center line of the track is maintained by bridle pull-offs acting upon both trolley wire and messenger. In bracket construction the alignment of the trolley wire may be maintained either by the use of pull-off guys between poles in conjunction with bridle pull-offs or by the closer spacing of poles and the use of steady braces.

In double track, center pole, bracket construction, the setting of special pull-off poles may in some cases be



FIGS. 1 AND 2, TIME CURVES OF VERTICAL VIBRATION AND TEMPERATURE VARIATION OF THREE-POINT CONSTRUCTION

avoided by the use of spreaders which maintain the distance between the two trolley wires. The pull-offs are lead from the inner end of the spreader to a bridle between the poles. The steady brace is also employed for "staggering" the trolley wire on tangents, where a sliding collector is used, to avoid wearing grooves in the contact surface of the collector.

With catenary construction a special method of anchoring has been adopted, differing somewhat from that used with ordinary direct-current trolley construction, to avoid the possibility of a sliding collector catching on the anchor cables. Both the trolley and the messenger wires are anchored to the point of support of the messenger by a bridle pull-off and strain insulator located directly over the trolley wire. The point of suspension which may be either bracket or cross span, is in turn anchored to adjacent poles.

All pull-off and anchorage devices allow ample clearance for the bow trolley when tipped out of normal horizontal position by super-elevation of the track or uneven loading of the car.

MATERIALS

The angle iron bracket, by reason of its horizontal stiffness, greatly facilitates initial adjustment of the messenger during installation and insures maintaining uniform sag in messenger span throughout the length of the tangent.

The angle bracket consists of two 2-in. x 1½-in. x ¼-in. angle irons joined at the extreme end by a space block and rivet, and by a second space block approximately 2 ft. nearer the pole. The guy rod which supports the bracket from the pole top is attached to this second space block, and the slot

formed between the angles by the space blocks through which the insulator pin bolt passes provides means for transverse adjustment of the messenger with respect to the track. The inner ends of the angles are sprung apart to span the pole to which they are lagged or bolted.

For double track pole construction a bracket arm having two guy rods and two sets of fittings may be used. These double brackets are riveted at one end and bolted at the other to allow for spanning the pole in installation, these are 16 ft. over all and suitable for 14-ft. track centers.

The T iron bracket arm has all of the advantages of the angle iron bracket, excepting its stiffness in the horizontal plane, which is regarded as fully warranting its higher cost. The guy rod is attached to the arm approximately 2 ft. from the end and the extension beyond the guy rod attachment provides for transverse adjustment of the messenger.

The insulator pin for the angle iron bracket arm is of malleable iron and engages the slot in the end of the bracket, and is clamped by a bolt passing upward through this slot. The insulator pin for the T iron bracket arm is of malleable iron with a hook bolt.

The insulators for messenger insulation are for voltages up to and including 3300, and for voltages above 3300 up to and including 11,000 volts, respectively. The upper shell of the 11,000-volt insulator is grooved to limit fractures from missiles and leave sufficient porcelain for insulation against normal stress even after the edges have been broken off. This grooving of the petticoat affords considerable insurance against grounding of the line.

The strain insulator for potentials up to and including 11,000 volts was first described in the Street Railway Journal of Jan. 19, 1907, on page 115. In this insulator, the material under mechanical stress is entirely in compression and the crushing strength of the material is considerably above the maximum stress to which it can be subjected in service. The ultimate strength of this insulator exceeds 7500 lbs.

For voltages not exceeding 3300, specially treated wood strain insulators are used on account of their lower cost. These insulators are of hickory split into sticks before being turned to insure straight grain, and treated to exclude moisture.

Steady braces or strains are used for maintaining transverse alignment of a trolley wire on bracket line construction and for staggering the line on tangents where sliding collectors are used. Transverse adjustment of the trolley wire is obtained by adjusting the clamp on the bracket arm.

Spreaders are used for transverse pull-off for double track, center pole, bracket construction, where special pull-off poles on the outside of the curve are not available. A bridle is run between the line poles, and the end of the spreader on the inner side of the curve is pulled off to this bridle, the thrust of the spreader pushing the line on the outer side of curve into proper alignment.

The Form CA hanger, for supporting the trolley wire from the messenger cable, is attached to the messenger cable by a malleable iron sister hook, and to the trolley wire by a device similar to the screw-clamp grooved wire ear. The ear and sister hook are connected by a stem of flat steel strip riveted to both sister hook and ear. The flat steel stem has the advantage of lightness, which is important for the avoidance of hammer blow from the trolley. It also presents minimum resistance to wind stresses, and if bent by accident, as in breakage of the line, may be readily straightened.

The company's standard hangers are non-adjustable, so proper installation of the line may be insured. The messenger wire supporting the trolley wire must have a uniform tension throughout its length to prevent unbalancing of the pull in the cable which would result in distortion of the spans and require an unreasonable amount of maintenance to keep a line up properly.

The standard span and conditions for tangent track, are as follows: For sliding collectors—Pole spacing, 150; number of hangers per span, 11; sag of messenger wire, 16 ins.; and distance from point of support of messenger to trolley, 20 ins. Conditions are the same for a wheel collector excepting that there are three hangers per span. Special hangers are made to accommodate conditions.

To provide clearance for sliding collectors and to avoid "pockets" or angles between trolley wire and pull-off wire, in which the collector may catch, the anchorage devices are designed to raise the anchor guys above the plane of the trolley wire. In the Form CA anchor hanger, the strip connecting stem of the Form CA intermediate hanger is replaced by a solid rod, and the sister hook by a clamp which holds the messenger against longitudinal movement. Both ear and clamp are provided with rings for attachment of the span wires. The anchor eyes are devices fastened to the bracket arms to which the main anchor guys and the bridles from the anchor hangers are attached. The anchor clamp is inserted in the span wire in cross span construction in place of the regular span wire messenger hanger. The anchor turnbuckles are for the adjustment of the strain wires between the anchor hangers and the eyes for clamps.

The span wire messenger hanger is for the attachment of the messenger to the cross span, and is used throughout tangents and curves in cross span construction, excepting where replaced at anchorages by the span wire anchor clamp. The feeder ears are of bronze with tinned lips for soldering to the trolley wire. The short distance between supports prevents any danger of the ear turning over and obstructing the passage of the collector.

The splicing sleeves are made in hard drawn brass, hard drawn copper and also in a special bronze which is particularly recommended for conditions of congested traffic. In installing them it is important that the grooved wire be held upright and not allowed to tip over on one side. The ends of the wires to be joined should be brought out through the milled slot in the top of the sleeve and hammered down to form hooks engaging with the ends of the slots. The joint should be carefully soldered and the ends of the wire cut off flush with the surface of the sleeve.

The section insulators are for use with both wheel and sliding collectors on potentials of 3300 volts or over. The insulation of the trolley is effected by two porcelain strain insulators, and the trolley wire is held in its normal horizontal position by petticoat insulators and clamps. These clamps form the approaches for the wheel collector in its transition from the trolley wire to the runway. The runway consists of wooden cross pieces with metal grooves on the lower side which are separated by small air gaps and bolted to the frame. The lower surface of the frame forms the runway for the sliding collector. The strain is taken by a cable made up in an eye on the approach clamps and with a threaded eye bolt passing through a casting on the upper center cross bolt of the frame. A nut on this eye bolt allows adjustment for the maintenance of the horizontal position of the approaches. For lower potentials, the section insulators are similar to standard section insulators with the addition of strain insulators in the messenger.

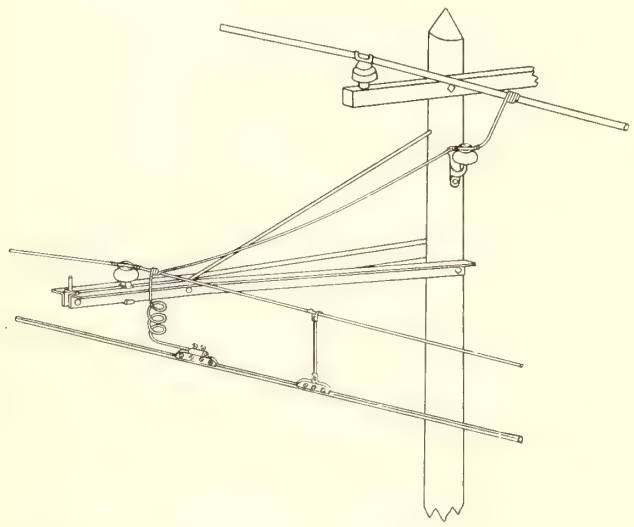
Frogs for use with both wheel and sliding collectors are similar to the company's Form G trolley frogs, excepting the addition of runways for the sliding collector. For use with wheel collectors only, crossings are the standard Form G.

The crossings for use with sliding and wheel collectors are composed of light structural steel sections having a dip at the center point to provide clearance for the passage of the sliding collector.

Deflectors are for use with sliding collectors and are designed to depress the collector when a car is turning from a siding to the main line, or crossing from one track to another. They will not interfere with the operation of wheel collectors.

For ordinary conditions the messenger cable should be of 7/16-in. extra galvanized Siemens-Martin steel. For pull-offs ¼-in. cable is satisfactory, and for general guying purposes ⅜-in. extra galvanized Siemens-Martin strand is generally recommended. Special conditions may call for "high strength" cable but as this cable requires mechanical fastenings on account of its stiffness, it should be used only where absolutely necessary.

For curve work, either steady brace or pull-off construction may be adopted. The steady braces are recommended for all curves not sharper than 4 degs., or 1433 ft. radius. It will generally be found that curves sharper than 10 degs.,



ARRANGEMENT OF FEEDER TAP IN BRACKET CONSTRUCTION

or 574 ft. radius, can be more cheaply installed by the use of pull-offs on account of the greater pole spacing allowable with this class of construction.

The pole spacings are planned to keep the trolley wire within from 4 to 6 ins. of the track center, as it is believed that a greater variation than this will give excessive strains for wooden poles.

Where a sliding collector is to be used, the tangent line should be staggered by steady braces in bracket construction, or pull-offs, in span construction, to avoid wearing grooves in the collector contact surface. For this purpose the trolley wire should be displaced approximately 8 ins. on each side of the center line of the track every 1000 ft., i. e., there should be one complete wave from the extreme position on one side across the track and back to the extreme position on the same side in each 2000 ft. of line.

As there are in this construction two wires to be provided for instead of one, it is necessary to make suitable provisions for two wires in special work, pull-offs and anchors.

BRACKET CONSTRUCTION

In bracket construction after the poles are installed, the brackets should be located at a height of 16 ins. more than the required distance between the top of the rail and the trolley wire. This allows for 2 ins. sag of the bracket, due to the yielding of the pole when loaded, in single track construction. For double construction this distance should be 14 ins. greater than the desired height of trolley above the top of rail. Generally no back guys are required for this construction on tangent track, but all poles on curves should be properly guyed.

When brackets and insulators are in place the line is ready for the trolley and messenger wires. The foreman doing the construction work can soon determine what method of running out the trolley and messenger wires is best suited to the conditions under which he has to work. The following method of installation is suggested and is known from experience to be efficient and practicable.

The trolley and messenger wire may both be run out at once and hung over the brackets, except at curves where the trolley wire should be supported below the bracket arms. The trolley wire should then be pulled up tight and temporarily anchored while resting on the bracket arm.

In ordinary construction it is generally inconvenient to measure the tension on the trolley wire. For this reason it is recommended to obtain the desired tension of about 1000 lbs. for No. 0000 trolley wire, that the pull be made with a pair of three-sheave blocks, and a "luff" or purchase with a pair of two-sheave blocks. Three men can pull a trolley to about the right tension with this combination.

The messenger wire should next be adjusted for tension to give a sag between supports of about 9 ins. at 30 degs. F., 10 ins. at 60 degs. F., and 11 ins. at 85 degs. F., after which it may be lifted in position on the insulators and tied in. The trolley wire should then be dropped and temporarily supported by hooks from the brackets and from the messenger wire at the center of the span. The line will then be ready for the hangers. Both messenger and trolley wires should be anchored every ½ mile on tangent track, and at the ends of tangent track approaching a curve. Sufficent slack should be left in the curves to allow the trolley and messenger wires to be pulled over to the center of the track. Where bridles for pull-offs and anchors are used, care should be taken to see that no wires are allowed within a space 6 ins. above the plane of the trolley wire at a distance of 3 ft. from the trolley wire. This clearance is necessary to avoid interference with sliding contacts. The same clearance should also be maintained where steady braces are installed.

SPAN CONSTRUCTION

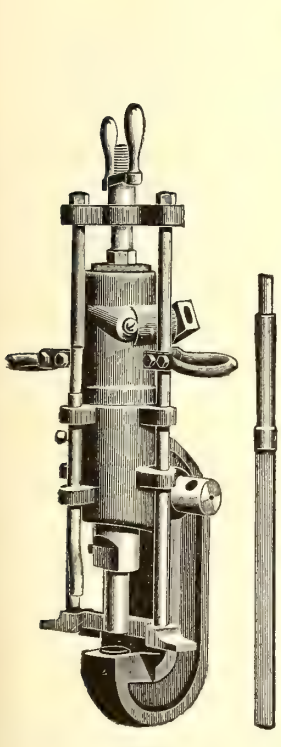
In span construction the span wire should be installed so that, when the weight of the messenger and trolley is put on it, there will be a sag of at least three or four feet between a straight line drawn through the points of support of the span wire and the point on the span wire where the messenger hanger is attached. When unusually long distances are necessary between the poles the sag should be greater. The back guys should be insulated for full-line potential.

After the poles are guyed and the spans in place the messenger and trolley wires are run out and hung temporarily from the span wires by hooks. The tension on the trolley and messenger wires and the installation of hangers may then proceed as in bracket construction.

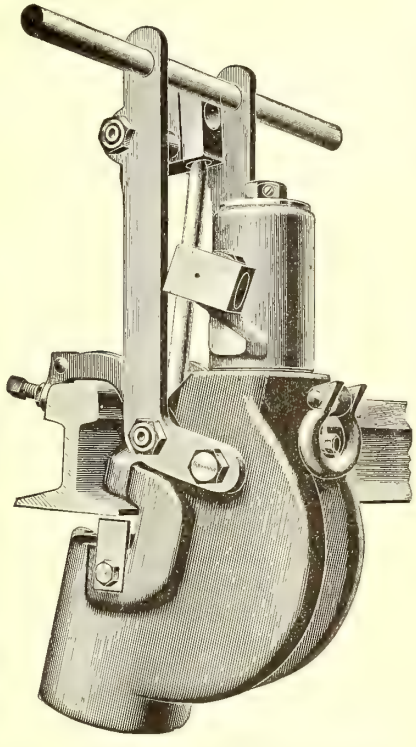
HYDRAULIC RAIL BONDING

In the construction of high-speed interurban roads requiring extra heavy rails, the joint plates frequently used rarely leave enough room under them to place bonds of sufficient capacity, and to meet the requirements of this situation the Electric Service Supplies Company, of Philadelphia and Chicago, has perfected a full line of hydraulic tools with which to install rail bonds underneath and through the base of the rail. In applying the bonds by the hydraulic method a tapered hole is punched in the base of the rail by the hydraulic punch illustrated herewith, which has an indicated power of 100 tons, the axis of the hole being at right angle to the top surface of the rail base, while the small end of the hole is underneath. The hole is clean, with bright, clear walls, and a crew of one mechanic and one helper can punch 200 holes per day sufficient for 100 bonds, assuming there is no material interference from traffic.

The form of bond used is the company's well-known "Protected" type L-3, with three crimps or tucks in the body portion to provide flexibility. The company estimates that this bond, when straight, should be made 1½ ins. longer than the final set length to provide the proper flexibility. The terminal heads of the bond are beveled to compensate for the tapered shape of the rail base and to give the compressing tool firm hold on the copper and a bearing underneath equivalent to a right angle with the axis of the compressing ram.



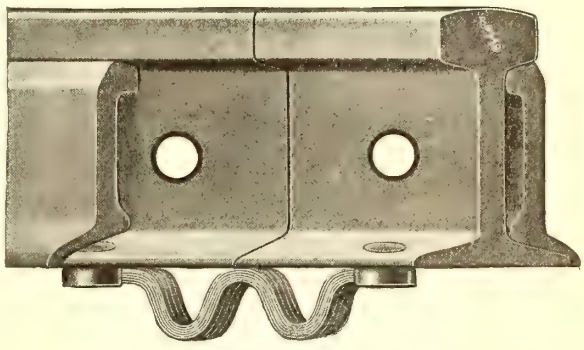
THE COMPRESSOR USED TO ATTACH THE BOND



HYDRAULIC PUNCH FOR PREPARING HOLES IN RAIL

An hydraulic compressor is used in attaching the bond. It has an indicated power of 35 tons, and is self aligning on the rail, so as to permit the compressing ram to operate in a line parallel with the axis of the bond terminal. The beveled shape of the bond head gives the tool a flat and solid grip on the terminal. The hole for the terminal being punched tapered with the small aperature underneath, the compressing ram forces the copper down against the taper until flush with the rail, producing a dry contact in the first instance, and absolutely sealing the connection so that it is moisture proof. This operation so densifies and kneads the copper into close relation with the sides of the hole that the union cannot be ruptured by any action in service. With this compressing tool, a crew of two men can apply 300 terminals, or 150 bonds per day, if there is no interference from traffic.

The company says that with this method of bonding, the union between rail and copper is so perfect, both when first made and after years of service, as to test practically nil in resistance. While this method of bonding was originally designed for extra heavy work, where space under the joint plate did not permit sufficient capacity, the company is now supplying these bonds in lighter capacities, and recommends the method as one of the most perfect for 4/0 bonding. If the bonds are painted black, as they should be, they are not conspicuous, and do not attract the copper thief, nor is



THE BOND APPLIED

there enough material in them to make removal worth while. The bond is sufficiently exposed to permit of easy inspection, and being made to lie close against the rail, ballasting material will not interfere with it. Nearly 1,000,000 bonds are in service that were installed by this method.

A LIGHT, TAPERED STEEL POLE

An extremely light and durable steel trolley pole, known as the Pittsburg standard trolley pole, is being manufactured by the Pittsburg Pole & Forge Company, of Verona, Pa., which manufactures steel poles and forgings of every description. The pole is tapered under a special process, and it is said not to be possible to break it at the acknowledged weak places in the ordinary pole. The Pittsburg pole is made of specially rolled tubing and will stand a test of from 75 to 125 lbs. The poles are made in half-foot sizes from 10 ft. to 16 ft., with outside diameter at the base of 1½ ins. and tip diameter of 1 in. The inside diameter at the tip in each instance is 49/64 in. The weights of the plain poles are as follows: 10 ft., 16 lbs.; 10 ft. 6 ins., 16¾ lbs.; 11 ft., 17½ lbs.; 11 ft. 6 ins., 18¼ lbs.; 12 ft., 19 lbs.; 12 ft. 6 ins., 19¾ lbs.; 13 ft., 20½ lbs.; 13 ft. 6 ins., 21¼ lbs.; 14 ft., 22 lbs.; 14 ft. 6 ins., 22¾ lbs. The weights of the reinforced poles are as follows: 10 ft., 18 lbs.; 10 ft. 6 ins., 18¾ lbs.; 11 ft. 19½ lbs.; 11 ft. 6 ins., 20¼ lbs.; 12 ft., 21 lbs.; 12 ft. 6 ins., 21¾ lbs.; 13 ft., 22½ lbs.; 13 ft. 6 ins., 23¼ lbs.; 14 ft., 24 lbs.; 14 ft. 6 ins., 24¾ lbs.

The right of way for the electric railway to be built between Temple and Waco by Dr. T. M. Barnes of Fort Worth and associates has been obtained, and the construction of the line is said to be assured. The road will run from Temple east to Marlin, a distance of about twenty-five miles, and from Marlin it will run northwest to Waco, a distance of about twenty miles.

AN AUTOMATIC CUT-OFF VALVE

An excess flow safety valve for boiler service which not only acts as a "non-return" valve, but also shuts off the boilers with surety and protection if the main should be broken, acting automatically as a cut-off valve and, by the turning of a hand-wheel as an ordinary stop-valve, is being placed on the market by the Lagonda Manufacturing Company, of Springfield, Ohio.

This valve works instantly either way and does not depend upon differences in pressure for its action, but upon the actual flow of steam through the valve. If a tube in one of the boilers should give way it shuts down that boiler only, and allows all the other boilers in the battery to go on supplying steam as usual. If, on the other hand, a steam header bursts, or a joint breaks or a cylinder head blows off the engine, the cut-off valves on all the boilers close immediately before the room has been filled with steam, and repairs can proceed at once.

The valve is installed so that the lower valve disc is toward the boiler and the hand-wheel on top. Normally, when the boiler is not working the upper valve rests upon the seat and prevents steam from the main from entering the boiler. When the steam pressure in the boiler is raised slightly to exceed that in the main, the valve lifts and steam flows from the boiler into the main. The valve is very nearly counterbalanced by a weight on an external arm. The leverage of this weight may be adjusted to different rates of steam flow and boiler output. The valve is operated not by pressure, but by the actual flow of steam through it. The normal flow of steam into the main raises the discs to mid-position. The valve remains in that position as long as steam is being drawn from the boiler at the normal rate, but in case of a break on the line side of the valve the excessive rush of steam would carry the lower valve up against the seat, shutting off the boiler. Of course, when the flow reverses the upper valve drops instantly to its seat and shuts off the steam. The rate of flow at which the boiler would be shut off is determined by the weight above mentioned and by the distance between the two valve faces. This is adjusted to correspond to the greatest overload at which it is desired to operate the boiler, say, a rate over twice the normal rated capacity or when the water begins to raise in the gage glass.

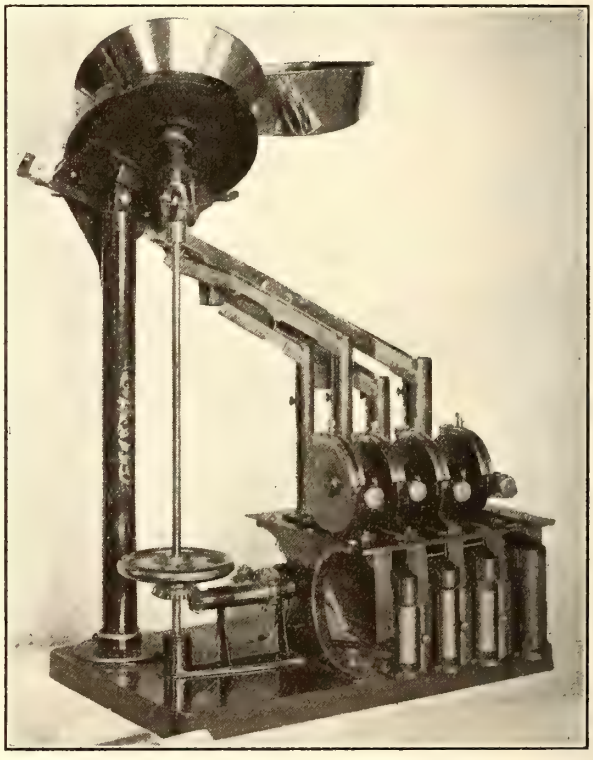
A fork-and-link arrangement connects the valve discs and balancing lever positively, so that the position and condition of the valve may be determined by a glance at the balancing lever, which is provided with light springs which prevent the chattering or closing of the valve under ordinary conditions. The springs are not strong enough to prevent closing in case of accident, but will prevent closing in case of a momentary rush of steam. These springs can be adjusted to meet different quantities of flow of steam.

PROPOSED LINE OUT OF PHILADELPHIA

It is reported in Philadelphia that control has been secured of the Philadelphia, Delaware & Montgomery Railway Company by new interests, and that a third-rail electric railway will be built from Lafayette Station on the Schuylkill Valley division of the Pennsylvania Railroad to the Delaware River in Tinicum Township, and thence under the river to connect with the Pennsylvania Company's electric line to Woodbridge, and that a separate line will be built to Atlantic City. A survey has been completed for the proposed line from Lafayette Station southward past the Philadelphia Rapid Transit Company's terminal at Sixty-Ninth Street to the Delaware River. Estimates made of the cost of constructing a two-track tunnel under the Delaware place the figures at $2,000,000.

A NEW COIN COUNTER

Street railway companies generally will be interested in a new coin counting device just perfected and placed on the market by the Dolt Coin Handling Machine Company, of Portland, Me., which it is said possesses several advantages not now found in the ordinary coin counting machine. Briefly, the new coin counter, of which a picture is presented, sorts, counts and delivers in regulation bank package amounts, nickels, dimes, quarters and half dollars with accuracy, and in one-fifth to one-tenth the time necessary to do the same work by hand, so it is said. The counting, sorting and wrapping, by the way, are carried on simultaneously. The machine is made in many different models, and in extreme cases will be built to suit individual requirements. The regulation machines, however, are built along liberal lines with the end in view of making them readily available for different classes of service and so are adjustable as to the number of coins delivered. In this way the package amounts may be varied from time to time. Another feature of the device is that the operator can keep in touch with each and every coin from the time it enters



COIN COUNTER FOR HANDLING NICKELS, DIMES, QUARTERS AND HALF DOLLARS

the machine until it is delivered and counted. It is said for the coin counter that it automatically eliminates Canadian nickels, 20-cent pieces and quarters and rejects badly mutilated coins. The machine is complete in itself, no extra parts being needed for the manufacture of wrappers, or for any other portion of the work. The output of the machine can be considerably increased by operating it with a motor.

PAPERS AND REPORTS PRESENTED AT THE ATLANTIC CITY CONVENTION OF THE AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION, OCTOBER 17 AND 18, 1907

REPORT OF COMMITTEE ON PROMOTION OF TRAFFIC

BY W. E. HARRINGTON (Chairman), H. J. CROWLEY, H. E. REYNOLDS, H. F. GRANT, G. W. PARKER.

The committee on "Promotion of Traffic" respectfully submits this, its second report. The committee feels that the subject matter in its first report, submitted at the last annual convention at Columbus, Ohio, in 1906 is so full and complete that little is left to enlarge upon. There are a few subjects of interest which the committee herewith submits:

PARK AND AMUSEMENT FEATURES

Just so long as street railway companies own, control or have an interest in parks along their lines, the much mooted question as to their desirability from a purely financial point of view will continue to be debated. Last year this committee in the course of a minute investigation into the general subject of "Promotion of Traffic" went into the park proposition thoroughly. Among the questions asked the street railway managers of the country was this: "If you had it to do over again, would you equip and operate a park?" Seventy-four per cent of the replies were in the affirmative.

While the preponderance of sentiment is thus shown to be in favor of the operation of the parks, it does not by any means necessarily mean that this 74 per cent of street railway park managers have found that the parks themselves, of themselves, and in themselves, have shown a balance on the right side of the ledger. As nearly as can be ascertained a very small percentage of the parks actually pay in their receipts from various sources the cost of operation. What profit exists must be due to the increased traffic on the company's lines in consequence of the exploitation of the park, and the exact difference between the additional receipts from this source and the additional cost of the extra transportation facilities that must be provided is still a matter for individual computation.

As to the actual, practical lay-out, construction and operation of a street railway park, much, almost all, depends upon the local conditions existing in the community in which the park is to be operated. The class of people, their average wage, their hours of labor, their predilections for certain forms of amusement, all must be reckoned with. Therefore no matter how much may be learned from the experience of others, the final test as to the success of a park must lie in the shrewdness of the park manager in adapting his offerings to the wants of his patrons.

As to the question of whether a park should be owned and operated directly by the street railway company management, or should be leased outright, there seems to be a prevalence of opinion that, conditions being favorable, it is more satisfactory in the long run to lease the park outright on a flat rental basis. Where conditions make it unwise to do this the next most satisfactory method seems to be to let as many concessions in the park on a flat rental or percentage basis as is wise.

In some sections of this country it is claimed by some park managers that a park cannot be successfully operated unless liquor is allowed to be sold on the grounds. This is not, however, the experience of the majority, who find that the moment a license of this kind is granted in a park, the general class of patrons and the general tone of the place is lowered. In a short time the better class of people keep away entirely and the park, no matter how well its grounds and attractions are kept up, literally runs down.

The distance that a park should be located from the center of a community, in order to draw the greatest number from that community, has been the subject of much discussion and varying opinions. The majority of managers, however, are of the opinion, and results seems to indicate, that from 2.5 to 6 miles, or a half-hour ride at a 5-cent fare is about the most advisable. Of course, in some sections it is possible to draw people from a greater distance, but they are few in comparison.

As to just what form of amusement enterprises should be included as attractions in the parks, experience has shown quite an unanimity. First of all, it is a strong asset to a park to have it located on the banks of an attractive river, lake or small pond where the public may enjoy boating and such features. There must be a good up-to-date carousel, a dancing pavilion and some sort of an athletic field. There must be the usual candy, cigar and other booths with a good restaurant, where the inner man may be appeased at a small cost. Swings are universally popular, and it must not be forgotten that while the older folks and the male population may crowd the park in the evening, there are some good long hours during the day when business might be done to advantage. For this reason as many features as possible to make it comfortable for the ladies and pleasant for the children should be installed. If you can get the children interested you can get their mothers and sisters and aunts. They all make riding during a portion of the day when they can be handled very nicely. There should also be some sort of accommodations for picnic parties. The ideal accommodations of this character would include a covered pavilion with tables and chairs where lunches might be comfortably eaten, whatever the weather, and some means of warming up coffee, cocoa or other auxiliaries to a lunch would be well received, although regarding this, fire dangers must be considered and perhaps a watchful attendant might be necessary.

As many different sorts of concessions are advisable as the patronage and tastes of the patrons seem to justify. This is another thing that local conditions will have to govern.

Theaters have been found to be about the best of the what might be called special attractions. The majority of the parks have open theaters, as far as the seating space is concerned, but it would undoubtedly be better if a theater combining the airy coolness of the open theater and the safety in case of rain of a covered or closed theater could be used. It would be more expensive, but in the long run would probably justify itself.

The character of the shows presented in these theaters depends upon the community, what they like and what they are most in the habit of seeing during the winter months. It is advisable, if possible, to give them something different from their regular theatrical entertainment. In the majority of parks it has been found that the strong popular preference is for vaudeville shows of five or six good acts. The price of admission varies in these theaters, but it is generally considered that reserved seats should not be over 25 cents, and the majority considerably less.

Bands are essential to the full enjoyment of people of this country when seeking out-of-door amusement, and they should be made use of as often as the conditions will permit, Sundays and holidays, or certain days during the week, or every day if the patronage would make it possible to stand the expense. It is also wise to introduce during the season a number of unusual special features free and in addition to those that the regular park attractions afford. Of these the most popular seems to be balloon ascensions, but there are baby shows, animal hunts, driving horses and a wide diversity of thrillers that draw crowds at these times and keep people in the habit of looking to the park for their pleasure.

Whatever the attractions and whatever the location and general make-up of the park may be there is one thing that must not be forgotten and cannot be expressed and emphasized too strongly and that is, that the best of order should be maintained at the park, whether by the regular city or town police or by special park officers sworn in as deputies. Nothing gives a park a knock-out blow so quickly as disorder, and the management should go to any length to see that it is quelled in its incipiency.

The general management of a park when operated by a street railway company itself should be vested in one of the company's operating staff, although he may have an assistant manager directly in charge. The final decision, however, should be his.

There is another point which cannot be too strongly considered in the operation of an amusement park by street railway companies or any one else, and that is the advertising of the

park. A first-class, well-kept park, nicely located and with an abundance of good attractions will, of itself, attract some people, but only by the most strenuous kind of publicity will it attract enough people to make the venture possible.

How to advertise is the question. How to spend the least money and get the most results. The most expensive advertising is not always the most profitable. Many a business concern has spent millions in advertising and then gone into the hands of its creditors. The advertising which counts is of the character that is seen by the people who are most likely to be attracted by it. That may sound like a self-evident fact, but it is not so self-evident but that it is often disregarded.

Of all forms of advertising in these modern days it is universally conceded that newspaper advertising stands at the head. This applies to parks as well as to everything else. It must be sharp and to the point, not too niggardly, and must be supplemented with attractive reading notices in the regular news columns. Whether all this matter is paid for and how much of it is used depends, of course, on the attitude of the newspapers toward the park management and the cleverness of the advertising man. It must not be forgotten in this matter, as in all others, that newspaper men are a bright, intelligent, self-respecting lot of workers, very sensitive about being used fairly and squarely, as one gentleman should use another, and they will do more in return for courteous, fair-minded treatment than money can ever procure.

Next to the newspapers and standing almost beside them in importance in park advertising are the cars of the park operating company. The first people to be reached are the people who are in the habit of riding on the trolleys, and nowhere may they be better reached than in the cars upon which they ride. These cars also traverse the entire district tributary to the park. It must be found profitable advertising to hang dasher signs upon these cars, signs that have very little reading matter, but which bring out the main attractive features plainly so that all may read.

Another splendid way in which to make use of the company's own facilities is to fix up an old car with billboards on each side, and cover them with big stands of advertising paper advertising the park, with a proper arrangement of lights so that they may be used at night and then run them continuously over the lines. Advertising cards are also valuable when tacked in the ends of the cars or suspended in frames, where it is possible to do this without infringing on the contract of any advertising concerns. Billboard advertising is valuable in some sections, but it is doubtful if it is as strong as any of the other methods suggested, and, as a rule, should be used merely in a supplementary way.

In this matter of advertising on and in the cars, it may be well to lay special stress on the fact that if this advertising matter is printed it should be religiously used—not on one car, but on all. There is a habit among operating men, who feel that their first and almost only duty is to see that the cars are run according to schedule as nearly as possible, of letting a lot of this paper lie around loose in car barns, instead of plastering the cars over with it. It is needless, perhaps, to speak of this, but only the most constant and eagle-eyed attention to this matter is sure to bring the results. It must be followed up assiduously or the expenditure will be for naught.

On the whole, investigation seems to show that, given a good park in a good location, in a community capable, if sufficiently interested, to support a park of this size and character, with good attractions, good order and proper advertising, there should be no reason why the incentive it gives to travel should not make it a profitable venture for a street railway company to promote.

Many small railway properties are not financially able to make large expenditures for parks upon the lines practiced by the larger railway properties, and it has been the experience of not only some small, but some large, railways to lease desirable, nicely wooded sites, favorably located, and to build some open-air fire-places, at a cost, say, from $10 to $15, and to provide neatly constructed rustic pavilions, and by this means make an attractive spot for picnics and outing parties.

BASEBALL

The matter of professional baseball as a promoter of traffic is a subject which the committee believes to be worthy of serious consideration. The interest taken by the general public in the national game during the past few years has been growing, as is evidenced by the large number of associations formed in cities varying in population of from 200,000 to 15,000 in the Eastern, Southern and Middle West States. The information bearing upon this paper is gathered largely from the territory above named.

The large majority of electric railways either operate pleasure parks in connection with their system, or their lines extend to or pass parks of a similar nature, operated by parties interested outside of the railroad. Where the above conditions exist, and the parks are suitably located, it is found advantageous to locate the ball park either in or adjacent to the park grounds, the ball park being either owned or controlled by the railway company. There seems to be no uniform system of leasing the baseball parks, each company apparently handling the matter in the way which would seem advantageous to the road.

Assuming the railroad company controls the baseball park, one of the methods which has worked out satisfactorily is the leasing of the grounds without consideration for a period of years to a local baseball association, the railroad company maintaining it, depending entirely upon the revenue from transportation as its return.

Another method of handling this business which has proved satisfactory in some of the smaller cities is for the railroad company to form an association of parties whose interest is friendly to the railroad. The grounds are leased to the association for a nominal sum, the association to put the grounds and buildings in condition and furnish uniforms for the ball team. They in return guarantee to keep the grounds in repair, police them and play a stipulated number of games each week during the ball season, which is usually twelve weeks.

The association may be formed from all classes who care to be interested. One of their members is elected as business manager, who in turn appoints some college player as manager of the team, which team is largely made up of college students.

During the past few years a number of railroads operating in cities with a population as hereinbefore stated have taken up this subject. They provide suitable and attractive grounds and grandstand, and the financial results derived from the income, after deducting interest and depreciation, have been very gratifying. In several instances where the ball parks are located adjacent to the railroad's pleasure grounds, the income from this sport compares favorably with the best amusements operated.

The committee has given this subject careful study, and the conclusions reached are that street railways operating in a territory where the density of population will support a first-class baseball club, will find it will add considerably to their revenue if the matter is intelligently handled.

As an illustration of the method pursued by the Pottsville Union Traction Company, of Pottsville, Pa., herewith is appended the form of contract between the railway company and the representative of the Atlantic League; it is interesting to comment that the earnings from the baseball park exceeded the expectations.

Articles of Agreement, made and concluded this eighteenth day of December A. D. one thousand nine hundred and six, by and between The Tumbling Run Park Association, party of the first part, and Ernest C. Landgraf, of the city of New York, State of New York, party of the second part, witnesseth that said party of the first part hereby stipulates and agrees to rent to the party of the second part a certain baseball park located near the premises of the party of the first part in the township of North Manheim, County of Schuylkill and State of Pennsylvania, which park shall be properly fenced and shall contain a grandstand with a seating capacity for five hundred persons and bleachers with seating capacity for six hundred persons. To have and to hold the said baseball park for and during the baseball seasons of 1907 and 1908, together with an option on the part of the party of the second part to renew the lease for longer season upon such terms as the parties hereto may agree upon.

In consideration of the premises, the party of the second part covenants, stipulates and agrees to pay to the party of the first part an annual rental of four hundred and fifty ($450) dollars to be paid in manner following; that is to say, one hundred and fifty dollars on the first day of May, one hundred and fifty dollars on the fifteenth day of June, and one hundred and fifty dollars on the 15th day of July, in each of said two years. The party of the second part also covenants and agrees, as soon as the gross receipts of said park amount to ninety-five hundred dollars, to pay to the party of the first part, as an additional rent, one-half of the excess of the gross receipts over and above ninety-five hundred dollars, after deducting from said excess 10 per cent of the gate receipts for the Atlantic League treasury, and also deducting to pay each visiting club either the sum of fifty dollars or fifty per cent of the gate receipts, as each visiting club may elect. Such excess of rent shall be paid by the party of the second part to the party of the first part daily after any game or series of games shall have been played.

It is mutually understood and agreed that the baseball park shall be in the form of a rectangle, whose size shall be not less than three hundred and sixty feet by three hundred and eighty feet.

In testimony whereof, the parties hereto have set their hands and seals the day and year first above written.

TUMBLING RUN PARK ASSOCIATION,
W. E. Harrington,
President. (Seal.)

Signed, sealed and delivered in the presence of us:
Ernest C. Landgraf. (Seal.)
(Signed) R. H. Koch,
(Signed) F. A. Hewett.

Approved by Counsel, R. H. Koch, 12/18/06.

ICE SKATING

The subject of ice skating as a promoter of traffic is one that has been given some consideration by a large number of roads in certain localities. Where rivers and lakes are within easy reach of the street railway lines, due to local conditions, ice skating has been very popular. Where facilities for skaters are located remote from highways of public travel and it is necessary to extend the lines to transport the skaters, the financial results to the road are problematical, and in such cases should be given careful thought before the investment is made. Usually places are found on some parts of the existing lines where skating can be had and, if situated in the suburbs, a sufficient number of arc lamps may be erected and operated from the trolley circuit to furnish light for evening skaters.

The cost of keeping the ice in good condition for skaters, and the result of snow, is a subject for serious consideration. In some cases where the income derived from this class of patrons has been very satisfactory, the expenses have been so great as to leave little or no profit. The committee is of the belief that a railway company is not warranted or justified in making any large investment to care for this source of travel, as the results from this traffic largely depend on weather conditions.

SPECIAL CARS, EXCURSION RATES, SPECIAL RATES

The committee is at a loss to know how to contribute anything new regarding these subjects in addition to that which was included in the report of the committee last year. It is the sense of the committee, however, for railways having heavy regular service, not to originate excursions, but to cater to special car service and excursion business planned by others.

FREIGHT AND EXPRESS

The committee has to report that the development of the trolley freight and express business is becoming quite an important factor in the earnings in railway properties in various parts of the United States.

The value of statistics is unquestionable, and in view of the large number of railways now actually carrying on this character of business, we respectfully suggest and recommend the appointment of a committee to report upon "Freight and Express" at the next annual convention; the report to treat upon, particularly, the most desirable methods to be pursued, charges to be made, methods of collection, and, above all, to collate statistics bearing upon the revenue to be obtained from such business and the operating expenses, and finally upon the character of equipment, stations, sidings and terminals.

CONCLUSION

The committee has obtained through the courtesy of the STREET RAILWAY JOURNAL and the *Electric Railway Review* most valuable indexes of articles bearing upon the various questions affecting the subject matter of your committee's work. The indexes are appended hereto.

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VOLUME XXVIII

Burlington, Vt., 975.
Columbus, Ohio, 595.
Concrete Subway at Rochester, 104.
Kingston Point Park. 1080.
Lake Minnetonka, near Minneapolis, 368.
Meyers Lake, near Canton, Ohio, 428.
Pittsburg Company Disposes of Park, 1167.
Report of Committee on Promotion of Traffic, 802.
Riverside Park at Sioux City, 183.
Rock Springs, Chester, W. Va., 404.
Steubenville, Stanton Park, 340.
Winter Sports on the Hartford & Springfield Railway, 1072.

VOLUME XXIX

Amusements for, 331, 506, 513.
  Comments on, 486.
  Handling of, by the Operating Companies (Garner), 696.
  Discussion on, 738.
Bay Shore Park, near Baltimore, 312.
Booking Shows for Summer Theaters, 703.
  Comments on, 309.
Dellwood Park, Joliet, Ill., 321.
Electric Park, Newark, N. J., 506.
Laying out an Ideal Inland Resort (Hulse), 317.
  Comments on, 309.
Madison Park, Seattle Electric Company, 508.
Management of, 512.
Of Minneapolis and St. Paul (Warnock), 325.
Olympia Park, Connellsville, Pa., 324.
Park Entrance at Oklahoma City, 689.
Park Luna, City of Mexico, Opening of, 35.
Problem of, 486.
Spring Lake Park, Trenton, N. J., 324, 511.
Winter Sports, Boston & Northern Street Railway, 330.

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Volume XVI—1906

Cars— PAGE
Special for the Interurban Railway, Des Moines.... 160
For Detroit United Railway.... 326
Electric Car Equipment, Long Island Railroad.... 468
Private Car, Detroit United Railway.... 552
Pay-as-you-enter Car, Montreal Street Railway.... 693
Observation Car for Toledo.... 945

Volume XVII—1907

Interurban Rolling Stock Exhibited at Indianapolis.... 120
Model Car for Long Travel (W. H. Evans).... 129
A Modern Interurban Limited Car.... 160
Side-Entrance for Hudson & Manhattan Ry., McAdoo Tunnel.. 167
Motor Cars, Metropolitan West Side Elevated Railway.... 180
Work and Wrecking Car, Cincinnati Tractiond Company.... 191
New Type, United Traction Company.... 223
Special for Tacoma Railway & Power Company.... 234
Dining Car, Montreux-Bernese Oberland Electric Railway.... 255
Plow Car for Denver.... 263
Sand Supply Car at Knoxville.... 292
Special Cabs for Chicago & Milwaukee Electric Railroad.... 328
Buffet Cars, Ft. Wayne & Wabash Valley Traction Company.... 393
Light-Weight Cars in Denver.... 447
14-Ton Motor Cars in Denver.... 452

Volume XVIII—1907

Cars for City Service (T. J. Nicholl).... 44
Pay-as-you-enter Car in New York.... 62
Pacific Electric Railway Rolling Stock.... 65
Self-propelled Motor Cars for Interurban Service.... 89
Freight and Miscellaneous Equipment, Pacific Electric Railway.. 94
Los Angeles Railway Emergency Car.... 103
Los Angeles Railway Shop Car.... 104
London Crane Car.... 184
Side Door Cars in New York Subway.... 196
Flat Trailer for Handling Automobiles.... 197
Trail Cars in Paducah, Ky.... 221
Sleeping Car from Springfield to St. Louis.... 262
Union Pacific Motor Car.... 263

Volume XVI—1906

Freight— PAGE
Interchange with Steam Roads.... 449, 450, 517
Freight Handling on the Toledo & Western Railway.... 553
Electric Freight Classification.... 581
Handling Freight on the Dayton & Troy Electric Railway.... 601
Trolley Freight on the Groton & Stonington Street Railroad.... 646
Milk Traffic on the Aurora, Elgin & Chicago Electric Railway... 647
Committee's Report on "Promotion of Traffic," Columbus Convention.... 791
Interurban Freight Service.... 813
Discussion on Freight and Express Service, Columbus Convention.... 819
Interurban Freight and Express (E. C. Spring).... 830
Spokane Pend d'Oreille Rapid Transit Co.... 1021

Volume XVII—1907

Interline Accounts.... 532
Exchange of Freight with Steam Roads.... 212, 669, 687
Freight Handling—
Birmingham Railway, Light & Power Company.... 648
By Electric Lines.... 518
New Bedford, Mass.... 523
Pennsylvania.... 544
Toledo & Western Railroad.... 592
Freight Service—
Boston & Worcester.... 94
Terre Haute Traction & Light Company.... 270

Volume XVI—1906

Express—
Express Contract, Iowa & Illinois Railway.... 646
Express Service in Pittsburg.... 1008
Express Service, Aurora, Elgin & Chicago Electric Railway.... 1008

Volume XVII—1907

Companies' Contracts with Electric Lines...502, 759, 769, 802, 830, 876
Express Service—
New York Subway.... 1
Columbus, Delaware & Marion Railway.... 23
Indiana Union Traction Company.... 23
Massachusetts.... 301
Boston & Worcester Street Railway.... 334
Consolidated Railway of New Haven.... 330
Boston.... 414
Boston to Springfield.... 831

Volume XVII—1907

Laconia Street Railway.... 42
United States Express Company, Operated on Indiana Lines.... 175

Volume XVI—1906

Rates—
Rate Sheet, Toledo, Fostoria & Findlay Railway.... 141
Hepburn Railway Rate Bill.... 255
Interstate Fares Reduced on Account of Ohio Two-Cent Law.... 568
Baggage Question with Electric Roads.... 647
Tickets and Rates (F. W. Coen).... 825

Volume XVII—1907

Steam Road Switching, Discrimination.... 23
Tariffs, Joint Electric and Steam (Chas. E. Flagg).... 36
Suit to Compel Joint Rates.... 167
Joint Rates with Steam Roads.... 57, 355, 535
Minnesota Commodity Reductions.... 57, 159, 220, 255
Decision of Ohio Commission on Rate Discrimination.... 591

Volume. XVIII—1907

Laconia Street Railway.... 42
Proposed Interchangeable Mileage Agreement in Iowa.... 79
Long Ride for One Fare in New York.... 93
Cost of Street Car Fares.... 104
United States Court Restrains Passage of Three-Cent Fare Law (Detroit).... 108
Portland (Oregon) Railway.... 108
Hearing in Lincoln (Neb.) Fare Case.... 108
Ohio Commission Reversed in Hocking Valley-Scioto Valley Case. 135
Two-Cent Interurban Rate Law in Indiana.... 140
Rates for Children Over Five Years.... 171
Complaint against New York Central Subway Rate of Fare.... 202
Passenger Rates on Atlantic Shore Railway.... 219
Law Fare Rate Case Argued in Minneapolis.... 231
Joint Rates in Oregon.... 232
Low Fare Decision in Minneapolis.... 242
Minneapolis Council Cannot Regulate Fares.... 262
New York Commission Investigation of Mileage Ticket Rates... 262

Volume XVI—1907

Parks— PAGE
Philadelphia & Western.... 945

Volume XVII—1907

Pittsburg Railways Abandon Parks.... 23
Green Bay Traction Company.... 94
Twin City Rapid Transit Company.... 94
Toledo Railways & Light Company.... 166
International Railway, Olcott Beach, Buffalo.... 202
North Alabama Traction Company.... 202
Chicago & Joliet Electric Railway, Dellwood Park.... 224
Philadelphia Rapid Transit Company, Willow Grove.... 335
Amusements: How this Feature Should be Handled by Operating Companies (H. W. Garner).... 516
Muskogee Electric Traction Company.... 787

INTERURBAN FARES

BY THEODORE STEBBINS

The subject of interurban fares is one of immediate interest because matters connected with the transportation of persons and property by railroads have been the subject of very active and even violent popular discussion. The state legislatures have been taking blind actions and state executives have been advocating and adopting arbitrary measures with the railroads. Twenty state legislatures have passed restrictive legislation on passenger rates, and fourteen states now limit passenger rates to two cents a mile. In this situation, it is important to understand the position of the interurban railway.

All interurbans are anxious to serve the public and to earn reasonable dividends for stockholders. It is not so clear, however, how rates shall be adjusted to satisfy these ends. It is customary to measure the service and its cost on the basis of cents per passenger-mile. The charges range from three cents per mile in unsettled sections down to half a cent per mile for commuters in thickly settled districts, who use the cars twice each working day, or where excursions are handled in bulk. The ordinary range of fare, however, is between two cents and one cent per mile. We find the two cents per mile charge prevailing in the Middle West, and the one-cent rate common in thickly settled districts, mostly in the East. Tables have been published showing the charges made by various roads. For example, the convention issue of the Street Railway Journal for October, 1906, on page 672, gives the rates for various classes of tickets charged in Ohio and adjoining states, and shows that the average single trip fare in this

locality is upward of two cents per mile. It will also be observed, however, that other and lower rates are made on such roads for regular daily passengers down to about one cent per mile. These western roads sell forms of tickets and make rates corresponding in a variety of forms and variation of rates with the steam roads. At the other extreme we find certain interurban roads charging one cent per mile, and the majority of such roads make this a uniform charge to all adults, and their character of travel approaches that of the ordinary street railway company.

Tables can be prepared, giving the rates charged by the various companies, but these are meaningless without knowing at the same time the conditions under which such roads are operating, and so we will seek to indicate the justification for these variations in fares.

The cost per car-mile of operation does not afford a direct measure of the rates that should be charged to passengers. The density of travel has a far greater influence on rates. The road must be built and furnish a service to suit the distribution and density of population and the fares that can be collected follow as a consequence of this environment. The cost per car-mile may not vary much between properties quite different in character, but it is the commercial and social habits of the people which determine the quantity and times of traveling as well as the percentage of the car-load (that is, passenger-miles divided by seat-miles) and thus the passenger rates are determined.

COST OF SERVICE

The seat-mile cost can be figured as shown for illustration in the following table which indicates also the effect on such cost of more frequent service:

Annual cost per mile of track	*A*	*B*	*C*
Headway (minutes)	60	30	15
Car-miles (plus extras)	15,000	30,000	60,000
Cost of operation	$1,800	$3,600	$7,200
Interest and depreciation	2,700	3,600	4,500
	$4,500	$7,200	$11,700
Cost per car-mile (cents)	30	24	20
Car seating capacity	40	40	40
Car seat-mile cost (cents)	75	6	5

The actual passenger rate per mile must be more than the car-seat cost as a minimum in proportion as the passenger-miles are less than the car-seat miles. If the passenger-load averages 40 per cent. of the seating capacity, then, on a sixty-minute headway, the average cost would be 100/40 times 0.75 cents, or 1⅞ cents per mile. This indicates how much rates might be decreased if full loads were constantly carried and why some roads can afford to make mileage rates less than other roads.

The distribution and occupations of the population along the line are the powerful elements affecting the percentage of load. Assume two roads, each fifteen miles long; the first joining two cities of large size with little intermediate population, and the second leaving a city and traversing a succession of villages growing smaller and terminating in a hamlet. The first road may prosper on one cent per mile and the second starve on two cents even though operating the same number of cars with the same number of passengers to and from the principal terminal. In the first, the loads are carried through; in the second case, two-thirds of the load may be dropped within the first four miles. Assume a third case where a succession of towns of equal importance are traversed. The cars may load and unload several times in the course of the trip and this makes for an intermediate policy on rates.

DENSITY OF TRAVEL

To give some idea of the variation in density of travel on electric railways, the following figures are given:

Territory.	Passenger per mile.	Average fare.	Receipts per mile.
United Kingdom	939,658	2.26 cents	$21,240
United States	333,862	3.76 "	12,553
Indiana	133,000	5.6 "	7,500

The above figures for the United States and Indiana include all electric railways; that is, both city and interurban. The density of travel on the Ohio interurbans is indicated in the following table, grouping them together according to principal terminal:

Principal Terminal.	Its population.	Receipts per mile.
Cleveland	500,000	$5,045
Columbus	200,000	3,829
Toledo	225,000	3,257
Dayton	90,000	3,137
Miscellaneous	.....	3,542

Twenty-eight interurbans in this same section are classified in annual receipts as follows:

0	$2,000	4		
2,000	2,500	4	8	19
2,500	3,000	7	11	
3,000	3,500	4		
3,500	4,000	1	4	9
4,000	4,500	3		
4,500	5,000	1	5	
5,000	up	4		
		28		

Most of these roads furnish hourly service so that by making some additions for limited and excursion cars, the receipts per car-mile can be calculated and assuming the average rate to be 1.5 cents per mile, the number of passenger-miles and its relation to the car-seat mile capacity can be determined.

As indicating the variation in car-miles per mile of road, it may be stated that the elevated roads in New York operate 1,635,000 miles per mile of road, as against 15,000 or less for the ordinary interurban road in the Middle West, while the expenses per car-mile on the elevated are nine cents per mile, as compared with about fourteen cents for the Middle West interurban.

The expenses per car-mile and per seat-mile for a known service are capable of calculation with mathematical precision, but the density of the traffic can only be learned by experience and this experience indicates how much the rates charged must be increased beyond the basic seat-mile cost.

WESTERN INTERURBANS

For the average conditions prevailing throughout the Middle West and other sections of medium density of population, a large amount of testimony is available to show that the basic single-trip rate should be upwards of two cents per mile. If less is charged, not enough additional travel is secured to increase the gross receipts. If more is charged, travel is curtailed and the gross is reduced. In stating this it must be understood that mileage, commuter and other lower rates are granted and maintained at proper relation to the single trip rate.

The widest consensus of opinion on the subject is found in a resolution passed by the Ohio Interurban Railway Association on May 25, 1905. This association represented about two thousand miles of interurban roads and the matter was given earnest consideration in private discussion between the members and in the open meeting. The resolution reads as follows:

"Whereas, A demand for improved service on interurban roads has very largely increased the operating expenses of such roads, and many roads have met this demand; and, Whereas, in order to obtain their share of the business many other roads contemplate improving their service in like manner; and, Whereas, the prevailing low rate of fare on most interurban roads will not permit of such improvement in service, therefore, be it Resolved, that the Ohio Interurban Railway Association recommend a uniform base rate of two cents per mile, and a minimum charge of 10 cents."

A. H. Royce, secretary and treasurer of the Canadian Street Railway Association, writes:

"Since the reduction to two cents a mile (by legislative act) the companies have done away with all commutation tickets and charge a flat rate of two cents a mile. We find that it is

impossible to operate a road properly and keep up the rolling stock and equipment even at less rate. In the other provinces of Canada, the rates of fare are regulated by agreements with the municipalities through which they operate. There is no legislation affecting these rates, and as a rule the charge is three cents a mile."

J. McM. Smith, general manager of the Southern Michigan Railway Company, writes:

"We started out a year or two ago on the rate basis of one and one-half and one and three-quarters cents per mile, but we found this to be entirely too low, and accordingly we made a uniform raise. It is my belief, based on long years of experience in this business, that a road must be exceptionally well located if it can be made profitable on a rate less than two cents per mile."

S. Hendrie, general manager of the Grand Rapids, Holland & Chicago Railway, writes:

"I am inclined to think that all our interurban passenger fares in Michigan are too low in view of the increase in the wages and in the cost of all materials which enter into the construction and operation of electric roads to-day. In 1894-96 I took franchises for a road on the average of one cent per passenger mile, but new steel then cost $16 per ton, copper 13 cents per pound, number one standard ties, 35 cents each, common labor $1.50 per day, etc. At that time, conductors and motormen were paid 17.5 cents per hour, and other labor in proportion. The same road could not be built to-day for twice its cost, and although the fixed charges are low, the present owners are not satisfied with its net earnings."

H. H. Polk, president of the Inter-Urban Railway Company of Des Moines, Ia., writes:

"The rates generally charged are as follows: 2 cents a mile for single trip tickets; 1.5 cents for round trip tickets, good for one day; and 1.25 cents for mileage. (These mileage books are for any three people, and good until used.) However, I am of the opinion that our round trip and mileage rates are too low, and we are seriously considering the raising of these rates. With the universal two-cent fare now forced on the steam railroads by state legislatures, I am of the opinion that it will be rather up-hill work for interurbans to exist at the present rates."

C. N. Wilcoxen, general manager of the Cleveland & Southwestern Traction Company, writes:

"There are but very few roads in this state operating at less than two cents per mile, with the usual reduction for commuters' tickets, etc. The average rate obtained by the Ohio roads is approximately 1.65 cents per mile. To attempt to operate on a 1.25 cents per mile basis would mean bankruptcy to the interurban roads of this state."

H. A. Nicholl, of the Indiana Union Traction Company, writes:

"Our single trip tickets are 1.5 cents per mile. This is as low a rate as I believe any electric road can carry passengers with a reasonable profit."

EASTERN INTERURBANS

From the average conditions prevailing in Massachusetts, New Jersey, some parts of Pennsylvania and other sections with considerable density of population, a large amount of testimony is available to show that the heavier travel, the more frequent trips, the shorter rides, and repeated loading and unloading in a trip, make profitable and advisable no variety of tickets but only a single adult rate.

M. C. Brush, vice-president of the Newton Street Railway Company, and associated companies writes:

"I find upon careful investigation that on about 50 per cent of our lines our fares vary from 1 cent per mile to 1.5 cents per mile. On the remaining 50 per cent it varies from 0.4 to 0.9 of a cent per mile. The average New England street railway manager does not believe that under present operating conditions it is possible to carry a patron more than five or six miles for 5 cents. That is, I think you will find that the average New England manager believes that one cent per mile is a fair charge in this territory."

Note.—The Massachusetts law requires half rate for school tickets.

F. L. Fuller, vice-president and general manager of the New York & Queens County Railway Company, writes:

"The rates on Long Island are one cent per mile collected in five cent zones."

F. W. Bacon, general manager of the New Jersey & Hudson River Railway & Ferry Company, writes:

"I do not think the rates in New Jersey on interurban roads are in excess of 1.25 cents per mile and our average rate is 1.15 cents per mile, but we do not issue commutation tickets or other forms at any cheaper rates and make only 25 per cent reduction on school tickets."

CALIFORNIA INTERURBANS

The extremes on rates seem to exist in California. Mr. Schindler, of Chico, Calif., makes most interesting statements. His line, in the Sacramento Valley, has steam railroad conditions, and charges three cents per mile, and his patrons are well satisfied. In the southern part of the state, business is done mostly on round trip tickets at 0.6 of a cent per mile. He states:

"It is a curious fact that in the southern territory where existing rates are already extremely low, there is a strong movement toward a further reduction of rates; while here where the highest rates exist, the public is generally well satisfied."

The above quotations are taken from letters on the subject of "Rates" addressed to our secretary, Professor Swenson, to whom I am much indebted for this and some statistical information.

Examination shows a clear distinction in conditions and practice between the two and one cent rates per mile. The one cent rate applies to conditions approaching those of the city railway, five cent zones, no tickets, a succession of towns, with contiguous population limits. The two cent rate applies to cities and towns considerably separated, where passengers may travel, 25, 50, 100 or 200 miles, and this rate applies to occasional travelers on single trip or interline tickets. Tickets are also sold and gradations of adult rates for commuter and school travel are made down to one cent per mile. For interurbans of this character, we will describe the kind of tickets sold.

KIND OF TICKETS

1. The single trip ticket (good between specified points for an adult) is the basis of maximum charge on each interurban line. Occasionally, a higher rate is charged for fare paid on the cars, but this practice is diminishing, because it entails a greater variety of fares and discriminates against the farm community boarding the cars where ticket offices cannot be maintained, and this farm community is often the most important class of customers for the road. To increase the sale of tickets in order that cash may be taken at the offices and not by conductors, it has been proposed to charge higher cash fares on the cars and give receipts with a redeemable value to any ticket office the same as some steam railroads do, but this is impracticable for interurban conditions and in one case only to my knowledge has been adopted.

2. The round trip ticket good for an adult, is the most common form of ticket, in fact is sold by some roads where single trip tickets are not sold, and is ordinarily sold at a 10 per cent reduction over double the single trip rate. In a few cases the reduction is 20 per cent.

3. Interline tickets are those sold by one road for transportation over its own line and one or more connecting lines, usually not more than three. Such a ticket, when sold for a round trip may be nearly a yard long and practically correspond in form and appearance to the familiar steam railroad ticket. The interurbans of the Central West sell large numbers of these tickets and they are essential in competition with the steam railroads.

4. Mileage books, so-called, are sold at 16 2/3 per cent to 33 1/3 per cent reduction from the base rate. If such books are good for a specified number of miles, 500 or 1000, then the conductor must carry a sheet of mileage distances between points and detach coupons accordingly. The reservation is commonly made that no less than five coupons shall be detached. Since the rates per mile charged on different roads and often on various sections of the same road vary for franchise or other reasons, it has therefore been found expedient to issue "Mileage Books" not for a specified number of miles but containing a certain number of five cent coupons. This avoids the necessity of conductors carrying mileage cards, permits detaching coupons of a face value equal to the single trip ticket; reduces the complexity of accounting and in general is practical where mileage coupons are impracticable. Properly these are

called coupon ticket books and if good on one road "Local;" if good on a group or roads, "Interchangeable;" but we continue to speak of them in common parlance, as "Mileage Books." Such interchangeable books issued by certain members of the Central Electric Railway Association contains 240 five-cent coupons, face value $12, sold at a net price of $10. These books are good for use over some thirty-seven railways and their underlying companies all operating several thousand miles of track. This book is good for one person only, usable within one year and not less than two five-cent coupons are detached for any ride, no matter how short. Each individual company is free to issue, also, mileage books good over its own line under such conditions as it may see fit. In some cases these are good for use without restriction as to name and number of persons and at a slightly lower rate.

5. Commuter books are also sold, good commonly only for either thirty days or a calendar month, and containing forty, fifty or sixty rides, each book limited to one name. Such books are not in as common use now as the writer believes they will be in the future, as they form a means of building up a steady suburban travel, the same as steam roads operate so profitably out of our large cities and without interfering with higher charges for occasional travelers.

6. Book tickets are sold for ten, twenty, thirty, forty, fifty, or one hundred rides with or without limitation as to name or family, or length of use and on some roads serve the same purpose as commuter books.

7. Excursion tickets are sold by almost all roads for special occasions, usually limited to one day and issued for summer riding to parks, church picnics, political meetings, city shopping, and a great variety of purposes.

8. Half rate tickets are sold for single and round trips of children from five to twelve years of age.

9. Party tickets are sold for a specified number of persons traveling together between specified points within a time limit.

10. Special car-load rates are made for excursions at the lowest rates. The car is permitted to carry a full seated load and usually a limited additional number of standing persons.

Twenty-six interurbans in Ohio, Indiana and Michigan are reported by the Street Railway Journal to sell these kinds:

Tickets.	No. of Companies.
Single trip	24
Round trip	24
Commutation (individual)	13
Commutation (family)	11
School tickets	14
Mileage books	10
Interchangeable coupons	15
Sunday	7
Week-end	4
Not selling tickets	2

All the above and many more forms of paid transportation are used in the development of the interurban business. The writer, on undertaking the management of an interurban system, found in use tickets of as many as 400 kinds; that is, differing in form and points between which they were usable.

GRADATION OF RATES

The gradation of price between these various forms of tickets must follow a consistent sequence in order that each ticket may find its proper use. To illustrate: If the mileage book price is less than the commuter rate there would be no sale for commuter books. The gradation is commonly something like this: Assume the base rate for a single trip ticket is two cents per mile, round trip ticket will be 10 per cent off, or 1 8/10 cents; the interline single trip ticket will be the sum of the single trip rates of the connecting roads and the interline round trip ticket will likewise be the sum of the round trip rates of the connecting roads, or less if there is a competitive route; the mileage book will be 16 2/3 per cent off or 1 2/3 cents per mile net; the commuter book ticket rates will be about 1.25 cents; the school rate will be one cent and the excursion rate and party rate will vary from 0.5 cent to 1.5 cents, according to distance, size of excursion and other conditions. This gives a general idea of the consistent relationship between these various rates, but, of course, there are considerable departures from this practice in individual cases.

The average gradation of rates in cents per mile, in three western states is shown in figures from the Street Railway Journal, May 5, 1905, as follows:

	Ohio		Michigan		Indiana	
	Issued by.		Issued by.		Issued by.	
Cash fare	1.84	23	1.58	5	1.68	8
Single trips	1.77	17	1.48	4	1.68	6
Round trip	1.63	20	1.34	4	1.45	6
Commuters (family)	1.45	12	1.10	2	1.23	3
Commuters (individual)	1.09	17	1.00	2	1.20	5
Mileage	1.37	6	1.25	1	1.22	2
Interline coupons	1.48	10	1.30	1	1.67	1
School	1.03	12	0.87	2	0.94	4

THE ESTABLISHMENT OF RATES

C. L. S. Tingley, vice-president of the American Railways Company of Philadelphia, speaking of Pennsylvania conditions states:

"The whole thing is a matter of ordinance regulation and not a question of scientific rate making."

This is true for many roads elsewhere. For the short interurban, with the dense traffic, five cent zones and no tickets are clearly indicated. For the long interurban, experience has clearly indicated the expediency of a mileage basis of charge with tickets and a graduation of rates for different classes of travel. The western interurban connection with other interurbans and having steam or electric competitors will need (a) cash receipts for use on the car; (b) single and round trip tickets; (c) interline single and round trip tickets; (d) interchangeable coupon books; (e) commuter or book tickets; (f) school tickets; (g) excursion tickets. A consistent relation in rates for each kind of ticket has been specified in the preceding sections.

The interline tickets and interchangeable coupon books are required for steam competitors. The commuter tickets are required to build up a travel of wage earners working in one place and living in another Excursion tickets are required for those who might not otherwise ride, and school tickets are ordinarily an unprofitable concession to education.

The profit from traffic should not be estimated too narrowly on a cents per passenger-mile basis. If a car receives all its load at the terminal and does not pick up passengers along the way, the space taken by the passenger is worth as much whether he rides all or part of the trip; or to make specific application, commuter rates should be determined more by what the passenger can afford from his daily wage and by seat-trip cost than by mileage rates.

Excursion rates and car-load rates are subject to the greatest variation and the cost of such business may be figured progressively lower as one in turn omits interest, depreciation, general expense, track maintenance and other items that are not affected sensibly by the operation of an additional car over the road. If platform wages, power and car repairs are figured as the only cost of the additional service very low mileage rates may be made. Such reduction of excursion rates is justified within limits to the extent upon which the largest annual receipts may be secured.

A company may make money on excursions at half a cent a mile where it is losing on regular travel at two cents a mile. For the same reason, commuter travel at a cent may be a desirable addition to the business where general travel will hardly yield a profit at a cent and a half. By commuters we mean those persons traveling back and forth between work and home every working day. The lower rate enables certain people to take employment in the city when they could not afford to pay fares at full rates out of their daily wage, and enables workmen in the city to move to the country when otherwise they would locate along some city line reached by a five cent fare.

Roads differ greatly in regard to the possibilities of commuter travel. On some a large feature can be made of this business; on others, it is not worth while even to put the books on sale. In conclusion, we may state the rate which may be profitable for one road may be unprofitable for another and, in each case, the distribution of the population along the road and the character of the travel must be studied carefully to determine the rates charged. The heavier the travel and the more miscellaneous its character, the greater reason for making a uniform and low rate for all classes of travel. On the other hand, the less the density of the population, the greater reason for making an initial single trip high rate for the occasional

traveler and creating in addition, a large regular travel by other forms of lower rate tickets

In conclusion we may state, that before attempting to fix rates, the first thing is to study the density of the population along the line, and its location, to estimate how much will be through travel, how much short ride travel out of the terminals, how much loading and reloading of passengers will occur in the course of the trip, what pleasure resorts exist, or may be built up, what commuter travel will be created, that is, working people in the city drawn into the country to live, and country people secure employment in the city, and all of these and other elements are more vital in determining the rates of fare than the car-mile cost, trip-seat cost, or the seat-mile cost. In fact, the character of the travel, should determine the kind of road built, and the choice of rolling stock. After a study of all the conditions a determination must be made of various kinds of tickets to be sold and the gradation of rates between them.

Ticket offices should be established wherever ticket sales will justify it, and in the Middle West, about 60 per cent of receipts are collected through such offices. Reasonable care will insure that such receipts reach the treasury of the company. Tickets have the advantage of keeping money out of the conductors' hands, but, as a considerable amount will be collected by the conductors, it is of vast importance to secure a proper account of it.

Large sums remain to be collected by the conductors on the cars from passengers boarding them where ticket offices cannot be maintained, and from passengers failing to buy tickets where they are sold. Every safeguard should be provided for such collections in order to check fully the work of the conductors.

The cash fare receipts issued on the cars should show at least from what point to what point fare is paid and the auditor's stub must give corresponding information. The tickets and stubs turned in by the conductor will then show how many passengers should be in the car at each point along its trip. An actual count of passengers at one or more points thus affords an exact check on the conductor's returns.

ADVERTISING FROM THE STANDPOINT OF THE STREET RAILWAY COMPANY

BY A. W. WARNOCK,
General Passenger Agent, Twin City Rapid Transit Company, Minneapolis, Minn.

This is the age of advertising! No one who wishes his business to grow and develop neglects the important feature of publicity.

One of the last industries to adopt this modern business force was the street railway, but these carriers are appreciating that printer's ink, judiciously used is the power to encourage trolley travel and assist in the delightful work of paying dividends. It is such an axiomatic and proverbial saying, "Advertising Pays." I will not take any time to discuss that question. I shall try to suggest some practical means for advertising street railways that may prove interesting.

When I say that advertising pays, of course I mean—it depends. Depends on what you have to offer and how you offer it. But granted you apply the same reasonable business rules to the problem that you would to any other feature of operation, there is no question but that returns will be satisfactory.

I take it what one company thinks and what one company has done will be a far more interesting story to hear than a long line of glittering generalities. So with that end in view, I want to tell you what the Twin City Rapid Transit Company, or the "Twin City Lines," as we are now calling our system, has recently done in the line of publicity.

Two years ago the "Twin City Lines," completed and opened for travel the famous "Great White Way" electric line of eighteen miles from Minneapolis to Lake Minnetonka. This line is now one of the really celebrated electric lines in the United States and has been the means of revolutionizing cottage and picnic life at Lake Minnetonka, "The Lake Beautiful" of the Northwest. With the opening of this line, the company found a great many opportunities for expansion. The fleet of four large steamboats already operated on Lake Minnetonka was purchased and rebuilt. The company also built in its own shops six fast express boats, each 70 ft. long and capable of a speed of fifteen miles an hour. The idea of this fleet was to encircle the shores of the lake and build up a summer cottage business for the electric line, as well as to offer transient tourists and excursion parties an opportunity to cruise the lake.

To supply the demand of picnic parties, sixty-five acres on beautiful Big Island were purchased and converted into a most attractive picnic and amusement resort. This island is two miles from the terminus of the electric line, and three large ferry boats which the company built, with a carrying capacity each of a thousand passengers, were put on to perform a shuttle service between the electric line and the park. One of the steam roads which had furnished service between Minneapolis and the lake was leased and electrified, giving the "Twin City Lines" two first-class routes between Minneapolis and the lake. In view of such broad development there was urgent need for the widest publicity to secure business, and the general passenger department was formally launched. This department had for its function the development of business for the two lines to Lake Minnetonka, for the fleet of a dozen steamboats, and for Big Island Park, as well as for many other parks and resorts, such as Minnehaha Falls and Lake Harriet in Minneapolis; Phalen and Como Parks and Indian Mounds in St. Paul; Wildwood, on White Bear Lake.

Having outlined our necessity and appreciating that our lines offered unique and magnificent opportunities for exploitation such as are possessed by few electric transportation companies, we undertook a vigorous compaign with the central idea of letting the public know what we had for sale. Our advertising has been along four general lines: Newspapers, folders and pamphlets, car window cards, special advertising, and I will briefly relate our experience with each of these methods of advertising.

NEWSPAPERS

There has always been a good sentiment existing between the "Twin City Lines" and the local newspapers. The time will probably never come when street railways or any other public service corporation will be immune from criticism on the part of the press, and this is a good healthy sign, both for the press and for the roads. I am making a temperate remark when I say that, through and through, by and large, our newspapers, as well as our public, entertain a fine feeling of regard for our company. I think this is due in large part to the high personnel of our management which is broad, progressive and always disposed to do the fair thing. Our company has anticipated what the public wants instead of being urged by them to fulfill their wants, and I think as you travel the country over, you will find no street car patrons more loyal or more prone to express superlative praise for their home system than the people of the cities of Minneapolis, St. Paul and Stillwater. I emphasize strongly the feeling between the press and the road because I think it a strong asset that every road should have. The good-will of the newspapers is of incalculable value and a road should utilize every fair means to secure the support of its newspapers. I mean by this that the relation of the company to the public should be of such a character that in all fairness the newspapers will have a friendly feeling for the company. Criticisms, of course, will be made on the best of service, but the general trend of sentiment should be favorable. There is nothing that appeals to newspapers so strongly as the practice on the part of a public service corporation of taking the public into its confidence, and we have always taken our public into our confidence.

Our newspapers do not accept tickets or transportation of any kind from us, and all the advertising we receive from them is paid for by us in cash at full standard rates. We make contracts with all the papers at the beginning of each year for a good round sum, sufficient to tell the public all about our attractions, as well as sufficient to impress the newspapers that we are eager to give practical expression of our friendship for them by buying liberally of their product. It depends largely on what we have to say as to the amount of space we use. We have used as much as a page in each of the papers to tell of some new feature of our service, and we have taken as small a space as four inches. Our advertising campaign is on practically from May to October, and during those five months we plan to use our entire yearly contract with each paper. Before we systematically undertook advertising, our company would spasmodically give a page advertisement possibly in the middle of the winter to the various papers for their special edition, which, of course, had no advertising value as far as our company was concerned. Since we have adopted a business basis for advertising, we absolutely eschew the special edition and the newspapers are eminently satisfied with the basis we have established.

It is a difficult thing to measure the returns for a transportation company from newspaper advertising. The department

store which offers a list of articles in its advertisements one day, can the next day, by actual sales, tell very closely the net result of the advertisement, but in advertising any transportation feaure, it is difficult to check up exactly by the general volume of business that is developing. I am quite convinced, however, that our newspaper advertisements have not only educated people as to what we have to offer, but by exploiting what we are doing and are trying to do, a warm confidence in us and our intention to serve them has developed.

The good-will of reporters, paragraphers, editorial writers and jokesters on a paper, it seems to me, is of inestimable value to a street railway, and if they poke good natured fun at your company it is good advertising. I would sooner have our announcements printed in the columns of good, clean newspapers and carried into the homes of our patrons, than any other means of educating the people direct. Such advertising can scarcely be properly estimated or appreciated. Beyond question, the more intelligent newspaper advertising you do, the better will be your business. I am making these statements on the assumption that the service you are advertising is as good and possibly better than what you say it is. Personally I feel that our company offers such good service under all conditions that superlative language is warranted and still be absolutely within the realm of actual truth. If you do not have a good proposition to offer, then make it a good proposition or do not advertise it. The same rules apply to advertising a street railway as to advertising a theater, a department store or any other enerprise. A good article can stand unlimited advertising, a poor one cannot win out in the long run, no matter how much or how good the advertising may be.

FOLDERS AND PAMPHLETS

Our company had never issued a folder of its own until we decided to issue the Twin City Trolley Trips folder. We planned to produce the best electric folder that had then been issued. We adopted the regular standard railroad folder as to shape, nine by four inches, and it was to comprise forty-eight pages. The best paper was selected and the best printing company was given the work. We went to a great deal of pains to have an attractive birds'-eye view map of our system engraved for four colors. We devoted the entire folder to outlining suggestive trips on our lines, and we neglected no opportunity of indicating to the reader where he might go and what he might see by traveling on our cars. Small charts indicating exactly where to get on cars and where to get off, and a wealth of pictures with reading matter boiled down as much as possible, was the material we put into this publication and enclosed in a most attractive cover, we launched our first edition of fifty thousand copies on a breathlessly waiting public. This year we issued the second edition of fifty thousand copies. Our folder has been the model for at least ten other electric folders. Speaking purely from a mechanical standpoint, it was said to be the finest trolley folder ever issued, and we have something like a bushel of letters from prominent officials of steam and electric companies in the United States endorsing this judgment. Wonder was expressed that we issued such a good folder, but there is no wonder about the matter. We have a wonderful proposition of splendid car and boat lines and glorious places to tell about, and the story should be told in the best possible way. Had we not used as good paper or employed as good mechanical means to turn out a folder that would be appreciated and kept by the recipient, I think we would have fallen short of doing something first-class as it should be done.

We instituted a practical campaign of distribution. By advertising to send the folder to any address on receipt of four cents in stamps, we started an avalanche of mail and inquiries that has been coming upon us ever since. I think we have received requests for our folders from prospective visitors living in nearly every state in the Union, as well as a number of foreign countries. We have the folders on distribution at our ticket offices where copies may be had for the asking. Prospective visitors to the Twin Cities are always eager to secure copies and our large department stores are more than pleased to distribute them from their information bureaus to visitors who have just come to the cities. We have enjoyed the cooperation of not less than fourteen of the largest and best department and stationery stores in the Twin Cities in this matter, and the support and good-will of these stores is a good advertisement for us as they really constitute themselves agencies in our favor.

The returns from folders can be checked pretty closely. That is to say, you can tell more or less accurately whether the folder is a good advertisement or not. On the cars day after day I see patrons perusing the pages of these folders and following up special trips which are outlined. Day after day people come into our office to ask advice as to certain desirable trips marked out which they wish to make, and as some of these trips run as high as sixty cents per passenger, it can readily be seen that it is profitable to have instilled in the home body or stranger's mind the desire to make these journeys.

A trolley folder should be absolutely devoid of advertising matter, except for the company itself. It should be a story of the cities in which it operates told in such a broad way as really to be a text-book for the cities. It should accurately picture and portray the many beauty spots around the cities whether reached by the cars of the company or not, and altogether, it should breathe a spirit of boosting for the cities it represents in such a way as to command the admiration of the public and civic clubs which appreciate publicity of this character. The first cost of maps and plates may seem to the uninitiated as severe, but I do not think any money could be better spent in the publication of a folder than for the best paper, ink and engravings. It should be a tourist handbook that reflects, in a strong, clever way, the company it advertises and the cities it describes.

We have also issued an "Airship View of Big Island Park," a twenty-page folder exclusively for Big Island Park. This contains, on one side, a bird's-eye view of Lake Minnetonka and Big Island Park, and is used to create a distinct travel to Lake Minnetonka. The method of distribution is practically the same as for our trolley folder, and we also use it as a means of circularizing all prospective parties to Big Island Park.

A third folder of six pages we issue describes our "Sightseer" car service which we have successfully operated for the past two seasons. This "Sightseer" offers a belt trip of 40 miles around the Twin Cities in three and one-half hours for fifty cents, and has been the means of educating strangers and showing them the beauties of two cities, which they could not possibly see on their own account in so short a time and in so comfortable a manner. To each passenger on the "Sightseer" we give a small twenty-four page pamphlet containing the lecture as given by the conductor on the car. This pamphlet serves in a manner to bring to pleasant memory the trip and lecture the passenger has enjoyed.

We issue a complete sixteen-page time table for all our interurban lines, with steamboat schedules and information which strangers need to guide them over our interburban lines. While we issue these time tables in an attractive way typographically, they are printed on inexpensive paper to permit the widest distribution.

In addition to having prominent stores in the Twin Cities hand out our printed matter, we have our publication on distribution in the folder racks of all the railroad ticket offices and hotels. These racks are controlled by an association of ticket agents of both cities. The ticket agents of all the roads entering the Twin Cities have a most friendly feeling towards our company and are always glad to suggest trips and plan little journeys over our lines for strangers who come to their offices with the inevitable inquiry: "How can I spend a few hours before my train leaves?" I have had so many direct evidences of this attention on the part of our railroad ticket friends as to feel that feature of trolley travel development worthy of special endeavor.

In the Twin Cities, the telephone companies and Union stations maintain information bureaus, and these also distribute our literature and take an active interest in telling strangers what we have to offer. With such a kindly sentiment toward us on the part of so many different agencies with which the traveling public comes in contact, it can readily be seen that we possess a good-will in a line of publicity that is of immeasurable value.

CAR WINDOW CARDS

An attractive feature of our publicity is the use of large cards for the windows of our cars. We use eight windows of each of our standard cars, four on each side. These cards are 13 ins. x 24 ins. in size and are fastened on the inside of the upper sash. They are printed in large type on both sides so that they can be read from the inside of the car as well as from the outside, and on these cards we sing the praises of all the lakes, parks and resorts on our lines. One of these cards is devoted to the telling of the adventures of Hi Jinks, the Picnic Person.

Mr. Jinks has had a really remarkable career. We tell each week with a funny cartoon and a verse, the adventures of Mr.

Jinks at Big Island Park, and the series of twelve Hi Jinks cards for the season of 1907 has made such a hit as to really be worth passing mention. The first week we had Mr. Jinks making his bow. The second he was hugging himself with delight at the idea that Big Island Park was soon to open. The third week he was packing his picnic basket to go to Big Island Park, etc. Each week he does something new.

We held a competitive contest in which artists prepared this character from the suggestion we outlined of a genial, old bachelor who was out for a good time, and who could appreciate the good things we had to offer at Lake Minnetonka. After the character was finally selected we employed the best lithographers to develop the pictures. The verses were really funny and of such easy rhyme as to be remembered. To illustrate how the Hi Jinks cards have taken with the public I may say that we have had a wealth of poems submitted by patrons from everywhere. Presidents of banks, lumber companies and other large enterprises, as well as clerks, bookkeepers, school teachers and a vast army of other trolley riders suggested verses about Mr. Jinks. Mr. Jinks has become as good an advertisement for the "Twin City Lines" as any vaudeville joke that has made a soap, or breakfast food famous. The compliment has been paid us that Mr. Jinks has Mr. Sunny Jim and Miss Phoebe Snow completely wiped off the map. This, perhaps, is fulsome praise. People have actually been on the lookout for these cards as they appeared every Saturday morning in our cars. We have kept Mr. Jinks entirely in our own cars and he has come to be recognized as one of the distinct officials of our company. Only rarely has he made his appearance in newspaper columns, although the jokesters and the rhymsters on all the daily papers have used him as a mark at which to fire many good-natured shots. The career of Mr. Jinks has quite convinced me that people like good-natured advertising with a touch of humor in it. When you get your advertising so serious and so matter of fact that it reads like a complaint in a lawsuit, I should say you were on the wrong track, but when advertising develops a good-natured and kindly feeling on the part of patrons towards you, I believe it is a sure sign that people are paying attention to what you are saying. Next year we have in mind using a sequel for Mr. Jinks, and we expect to make this character lead even a more successful life than he did this year.

While speaking about our car window cards, I should say that most companies have it in their power to use their equipment for advertising in the cheapest and most effective way possible. Street car advertising admits of much display and the use of colors, and appeals to the trolley rider. It always strikes his eye when he is in a receptive mood and this advantage is very great. Street car advertising admits of all the inventive genius one can summon to one's aid and offers an apportunity for the exploitation of new parks, lakes, resorts, opening of new lines and other trolley information which should be given to the public attractively and persistently.

Last year our company adopted an effective trade-mark. It is designed after a Spanish Mission window and is original, attractive and unique. We are using this symbol very generally on all our advertising matter, letter heads, etc. Every road ought to have a distinctive trade-mark. Right in line with our publicity we have named our famous fleet of boats after cities, towns and resorts on our lines—Como, Excelsior, Harriet, Hopkins, Minneapolis, Minnehaha, Minnetonka, Plymouth, Puritan, Saint Paul, Stillwater and White Bear. Each boat is thus a good advertisement for the place whose name it bears.

SPECIAL ADVERTISING

In special advertising, our company has followed two or three lines that have been effective. We had the best landscape photographers photograph our lines from one end to the other, and the most attractive scenes of cars, boats, parks, double-track, wooded grove, shining lake, beautiful meadows and woods have been reproduced by their cameras. These photographs are 9 ins. x 12 ins. in size and form a collection distinctly in a class by itself. In each of these photographs can be seen a bit of track or one of our cars or boats somewhere in its make-up, and this gives us an advertisement that it is impossible to miss. These photographs are so good that persons publishing books about the Twin Cities invariably come to us for the loan of them, and as all the photographs are copyrighted, we grant the loans on condition that a line of advertising for our company be printed with the picture, and this is readily done. The photographs are so good that one company issued thirty souvenir post cards in colors, absolutely without expense to us, and they report it is the best selling series that they have in their large stock. Furthermore, each card bears a line of advertising for us which was written and put there by us. So much for the great benefit of a fine collection of photographs to any electric transportation company. These photographs have also been used for souvenir stamp books, and the publishers have reported that the sales have been large.

The two maps published by us, one being the bird's-eye view of our entire system, and the other the bird's-eye view of Lake Minnetonka and Big Island Park, are so attractive and they tell such a good story, that every hotel in the Twin Cities, as well as some of the larger business houses, have had them framed and given the best places possible in their rotundas and offices where strangers may see them.

I do not know of any business to-day that offers such strong possibilities for intelligent exploitation as street railways, or "Electric Railroads," if you prefer the term. The people generally feel a sense of proprietorship in the street railway when they see its cars running along the street, and take a pride in them that they would not think of entertaining for the commercial railroad with which they come in contact only when they go to the station to meet friends or take a trip. With this sense of proprietorship on the part of the public, it is easy to appeal effectively to your patrons. For ourselves, the "Twin City Lines," offer so many attractions in the way of parks, lakes, falls and other points of interest, that it is really a pleasure to educate the public as to where we can take them and how well we can take them there. With good feeling existing between the company and the press, with the manifold advantages we possess, and with the desire to do the fair thing on all occasions, our company offers a magnificent field for the most intelligent exploitation. We aim to make our lines the best advertised in all America.

In conclusion let me say from a close personal observation, that these statements apply with equal force to almost every electric transportation company in the country. The ground for this line of endeavor still lies fallow in many communities. That business can be developed and a fine public spirit engendered by printer's ink, properly, intelligently and enthusiastically applied, is my profound conviction.

LIGHT FREIGHT HANDLING BY ELECTRIC LINES

BY P. P. CRAFTS,

General Manager Iowa & Illinois Railway Co., Clinton, Ia.; General Manager Joplin & Pittsburg Railway Co., Pittsburg, Kan.

This subject has been discussed pro and con for a number of years; in fact, ever since the interurban railway became a reality, that is, after it branched from the confines of the so-called urban railway. Although some of the older and slower roads began to conduct a so-called express business several years ago, the freight carrying field was not entered with spirit until the modern high-speed road, built on private right-of-way with heavy construction, was developed. It was then discovered that the interurban not only could compete with the steam roads and express companies, but that, due to its frequent and reliable service, it could also develop a freight business that could not have been developed by them. To be sure, a number of the earlier roads have charters which do not admit of their carrying freight or express, but, on the other hand, the managers of many roads, although unhampered by such restrictions, have not given the subject the attention which it deserves.

As a result of the errors made by the earlier roads, coupled with their faith in the final outcome of a concentrated and careful campaign, some of the newer high-speed roads in the Middle West made a start. To-day it is a common thing to read of interurban railways financed and constructed with a view of handling freight as well as passenger traffic, as it is now becoming an important factor in the earnings.

Where parallel steam competition exists, interurban managers should not be discouraged, for shippers will favor the road which gives them good passenger service, provided, of course, rates are equalized and proper attention given to that branch of the business.

Generally speaking, it is a mistake to assume the position that freight will be carried only as an accommodation to your patrons, and then charge an exorbitant rate or neglect to ship promptly, or to take proper care of the shipment after arrival at its destination. On the other hand, many managers, in their anxiety to build up a profitable business, have overloaded their

roads with expensive handling facilities, such as costly freight depots, intricate accounting systems, free team deliveries, etc., which have eaten the profits that might otherwise have been realized.

For that reason, it is sometimes a mistake to charge a higher tariff on passenger cars than is charged on freight trains; rather say to the shipper that you will handle his small rush shipments, on passenger cars when possible, at the regular rate, as an accommodation, so long as he confines himself to the freight trains as far as possible. It is very gratifying to the average shipper to know that the road upon which he depends will accommodate him when he gets caught short of some commodity, or that his profits will be increased by being able to obtain quick shipments of perishable goods. This also induces him to carry a smaller stock of staple articles, the result being that the road gets the benefit of a larger number of shipments at the minimum rate, which is, in fact, the most profitable part of the freight business, except in car-load lots.

Whether or not a freight business will be profitable depends somewhat upon the following conditions: The population served outside of the main terminal and its dependence upon that terminal as a trading center; the proximity of other trading centers to the population served outside of the main terminal, and the railway facilities tending to attract business away from the main terminal; steam trunk line connections leading to the main arteries of commerce and the ability of interurban roads to establish joint rates with them.

A full exposition of the third condition cannot be given without consuming too much time. In general, however, an interurban road with proper freight handling and terminal facilities, which offers quick and efficient service, together with joint rates with some trunk line, in competition with other trunk lines operating between competitive points, may reasonably expect a fair division, or a greater portion, of the freight traffic. As stated earlier in this paper, shippers desire the best service with lowest rates, but, assuming rates to be even, shippers are generally favorable to the roads which provide good passenger accommodations; consequently, the interurban roads reap the reward of frequent passenger service.

Owing to the antagonistic attitude of the steam roads, however, it is generally difficult to establish joint rates except where competition does not exist between them, unless connection may be made with some competing road which disregards the pooling or territorial agreements. Let us trust that the day is rapidly approaching when the national and state commissions will take such action as will induce our larger and more powerful brothers to recognize the despised interurban. The progressive and aggressive attitude of the interurban managers, if continued, will exert more influence in that direction than anything else that can be done.

Interurban freight traffic may be properly divided into the following classes:

1. Strictly light packages, transported only in baggage rooms of passenger coaches, at express rates or at a fixed charge per package or per hundred pounds, regardless of class, and generally termed express business.
2. Less than car-load freight transported on fast baggage cars at regular freight or special tariffs under regular or special classifications, generally the former.
3. A combination of class two and the haulage of a few local car-load shipments daily at regular tariffs and classification.
4. Regular car-load tariff hauled by steam or heavy electric freight locomotives at regular tariffs and classifications. Or any combination of the above mentioned classes.

Depending upon local conditions the freight traffic of a road may be confined to any one of these classes or it may be started in the first class and grow to the fourth class. As the fourth class will be discussed in another paper, I will treat only the first three classes, particularly the second class.

A freight business of class one may be conducted at small expense and is of material assistance in the earnings of a road. The freight carried consists generally of packages easily transported in baggage compartments of passenger cars, which are usually empty except for a few trips per day. Usually no extra office force is required, the only expense being for stationery, books and possibly a small storage space at the main terminal. In some cases, when the charges are a certain rate per package, regardless of weight within reasonable limitations, a proper system of tickets dispenses with way-bills, expense bills, etc.

Inasmuch as the majority of freight-handling interurban road come under the head of class two, that part of the paper will probably be of interest to the greater number of managers, so I shall enter into greater detail in handling the subject.

Interurban roads which conduct their freight business under the head of class two more nearly approach operating conditions parallel to the time-freight business of steam railways. The ability of the interurban roads to make fast time and to deliver at highways, farm crossings and warehouse or store doors is an inducement to either the shipper or the receiver, which assists in obtaining the business. Being usually restricted, however, to a narrow car similar in appearance to a passenger car, due to operating over city streets, an interurban road has limitations of its freight-earning capacity.

The profits of such a business depend largely upon the opportunity of the management to secure combined freight and passenger depots at the terminals and in the larger local towns, so that extra labor in billing and handling at stations may be avoided, upon the charges of terminal city railways for the right to haul freight over their tracks, and upon the hour of day when freight may be delivered to receivers.

Generally speaking, the margin of profit in this class is close and only careful management will produce a profit, particularly during the first few months after the business is started. Expenses must be carefully watched and attractive freight houses and convenient hauling facilities at terminals sacrificed for something which costs less to maintain.

Damage claims must be carefully handled, and to that end it is advisable to adopt some system of billing and accounting which permits a shipment to be easily traced from its starting point to the final destination. Some interurban roads have adopted simple billing systems, requiring only one writing to make the receipt, way-bill, expense bill and office copy. Such a system, however, does not permit of proper checking, particularly if merchandise is transported over more than one road.

After an interurban road enters class two, a good local commercial agent is a necessity. The business, consisting of a great number of small shipments, requires constant development and care, particularly if competition exists. A live commercial agent, who is a good street man, and not a desk man, earns his salary many times over, particularly if he understands how to deal with shippers. The business obtained depends considerably on the personality of the commercial agent.

I fear that many managers, in charging expenses to the freight business, do not give proper consideration to such items as additional clerks, printing and stationery, insurance on goods in freight houses, a proper percentage of the receipts to cover loss and damage, power for freight cars, proportion of track and line maintenance, telephone service, interest on the freight handling investment, etc. Neglect of these items deceives the manager as well as his stockholders, and unless receipts grow beyond the safe point the awakening will be painful and embarrassing.

Perhaps a brief description of the freight business conducted by the Iowa & Illinois Railway Company may be of interest as illustrating the point brought in the foregoing paragraph. We went into the freight business in a very tentative manner. In fact, it took considerable time for us to decide whether or not there was sufficient business in less than car-load lots to warrant the purchase of a freight car and the expense of operating a freight business.

The next grave question was that of rates, and, after considering for some time a reduction of the rate below that permitted by the Iowa state law for class "A" roads, we finally concluded to adopt the maximum tariff and to consider the business as freight and not express.

At first our old passenger depot in Davenport served also as a freight depot, but within a very few months, we outgrew the capacity of the space allowed to freight and were forced to take our passenger business to a new location. In Clinton, we still have sufficient space to handle the business, but within a very few months we will be compelled to seek additional storage room.

Immediately upon starting the business, we engaged a commercial agent, and the quick growth of the receipts to the point where we are paying expenses showed our wisdom in so doing. Within one year, with one freight car engaged in the business and the use of passenger coaches to carry some freight, the business grew to a gross exceeding $10,000 a year. During the

summer and fall of 1906, we were compelled to operate our freight car two round trips per day for nearly 75 per cent of the time, and after the contract with the American Express Company was put into effect, we purchased and placed in service a trailer freight car, having the same capacity as the motor. The improved facilities which we have been able to offer shippers since purchasing the second car have increased the business at a very rapid rate.

We make a specialty, on less than car-load business, of beating the time of the steam railroads twenty-four hours between Davenport and points on the Chicago & Northwestern Railway in the western part of the state. For this reason, we obtain considerable business which is transferred to that road. Besides this, rush shipments in small quantities of perishable goods, such as milk, cream, butter, eggs, fruit, etc., from certain stations are handled in the baggage rooms of the passenger coaches.

We find that a trailer freight car is much cheaper to operate than a motor, but of course, it can handle only through business. It does not seriously delay the passenger coach to which it is coupled.

When the freight business was started, we adopted what we considered to be a very simple set of forms for billing and accounting, but we soon ascertained that the tracing of damaged and stray shipments was very difficult, and after carefully looking over the field we finally adopted the forms used by the Chicago & Northwestern Railway. These appeared at first to be very complicated, but a short acquaintance indicated their simplicity and the ease of tracing damaged and stray shipments.

We make a specialty of rush orders by telephone via our private line. Often a merchant in Clinton who finds himself short of some particular article telephones to us, and through our Davenport office via the private line we transmit the order to the shipper in Davenport. Shipments so ordered are frequently in Clinton within two hours from the time we were called up at the Clinton office. Wherever possible, we deliver from the cars to the store doors, which saves drayage and naturally brings business to us. A number of small platforms, at which we stop the local express cars, have been built by the shippers between towns.

We constantly endeavor to please our shippers and to show a spirit of co-operation, which has a great influence on the growth of the business.

We endeavor to be conservative in charging off expenses against the freight business and work into it anything which rightfully belongs there. We go so far as to charge off monthly three per cent of the gross receipts. This is piling up a tidy fund, but we propose to allow the account to grow, for at any time we may have to meet heavy freight damages due to fire, water or wreckage.

At the present time, the earnings from this business amount to 15 per cent. of the total gross and we hope to see it reach 20 per cent. on the same basis, *i. e.,* while our freight business comes under the head of class two.

Our transfer business has been developed under heavy steam road competition at lower rates, for in obeying the state laws we have been compelled to charge two local rates which are higher than the rate for the same mileage in a continuous haul on one road. The saving of time mentioned above has accomplished that result. A recent ruling by the Iowa Railway Commission reduces the tariff on two locals 20 per cent., and although our receipts per shipment will be naturally reduced, the increase in volume of business will be gratifying.

This exposition of the freight business as conducted by the Iowa & Illinois Railway is not made so much to indicate what is being done by that road, but is rather intended to illustrate the methods generally pursued by interurbans of like character.

An investigation made of a number of roads has brought out the fact that the average interurban conducting a freight business pursues practically the same methods described in this paper. There are, of course, a number of roads which pursue other methods and successfully too, but in such cases, local conditions govern to a great extent.

The percentage which earnings from freight traffic bear to the total gross earnings of course depends largely on local conditions, but of these roads which have favored me with statistics, I have ascertained that these earnings vary from 5 to approximately 40 per cent. of the total gross. Interurbans which handle car-load business, in addition to the traffic of which this paper treats, in some cases enjoy gross earnings from freight exceeding those derived from passenger traffic.

I believe the experience of interurban railways to this date is that such satisfactory results are now being obtained, I am safe in predicting that any average interurban railway, the existence of which is warranted by prospective passenger traffic, can be assured of a profitable freight business, which within a few years, if not immediately, will become an important factor in its earnings.

A DEPARTMENT OF PUBLICITY

BY J. HARVEY WHITE,
Publicity Manager, Boston Elevated Railway Company

The organization of publicity departments by public service corporations is a comparatively recent innovation. For many years certain corporations have maintained, carefully organized and systematically conducted advertising departments, but it has been only within the past few years that a few of the larger companies have established departments for supplying the public with general information relative to their affairs, plans, policies and acts.

Publicity has been heralded as a positive and permanent cure for all corporate ills. A loud and increasingly clamorous cry for corporation publicity is being raised by the public, press and political leaders who commonly represent that corporations are monsters of iniquity, plundering the poor defenseless public. So persistently have they been portrayed as institutions of dishonor, greed and oppression, that the public is disposed to believe any accusation against a corporation unless overwhelming evidence to the contrary is produced.

The problems involved in the public relations of large corporations to-day are quite as important as, and in many cases much more complicated than, those involved in operation. It is in the general field of public relations that a department of publicity finds its principal usefulness and performs its most valuable service. Its function is to enable the public to know the corporation as it really is.

Annual reports disclose the vital statistics relating to operation and finance. These compilations are not only seldom read, but are almost meaningless to the general public. They do not and cannot meet the popular demand for publicity. The public wishes to know and is being educated to the belief that it has an absolute right to know practically everything that relates to public service corporations. A refusal to answer in full every question that may be proposed to a corporation is commonly regarded as *prima facie* evidence that it is afraid to have the truth known and conclusive evidence that it is arrogant, insolent and despotic.

Public opinion is a practically irresistible power. The company that stands discredited in public opinion is hampered and harassed at every turn. It does not receive fair treatment. Its merits are not recognized and every shortcoming will be magnified. On the other hand, if the public believes that a company is trying to give an efficient service and a "square deal," its excellencies will receive some recognition and its unavoidable defects will be tolerated with reasonable good nature by a large portion of the community.

No one who participates in the larger responsibilities of street railway management needs evidence outside of his experience as to the power of public opinion, or as to the importance of securing and holding, the public good will. It is undoubtedly a fact that the service rendered by most street railways merits a larger measure of public confidence and esteem than is accorded. The reason that the public so often fails to give full credit where credit is due is not because the public is constitutionally unfair but because it is uninformed or misinformed. To overcome this defect, to eliminate unfairness and hostility based on ignorance or misinformation is the function of a department of publicity, and the extent to which this is accomplished is a fair measure of the department's efficiency. Responsibility for criticism and opposition based upon real facts must be borne by the general management, but responsibility for hostility and unfairness based upon public ignorance must be borne by the department of publicity if it is authorized to make the real facts known.

The most efficient, available and practical agency for developing a fair and even friendly public sentiment is the local press. If the local newspapers constantly condemn the service and policy of a corporation, even though the criticism be unfair and unfounded, the public is certain to become antagonistic. If,

on the other hand, the facts presented by the newspapers to their readers show that the company is alive to its obligations and is giving a reasonably good service and that its shortcomings are not due to indifference, inefficiency or willful disregard of public rights, public unfriendliness will be reduced to a minimum.

The first step toward securing fair treatment of a company by newspapers is fair treatment of newspapers by the company. This means the reversal of the old and rapidly disappearing policy of giving no information that can be withheld and establishing a policy of entire frankness and withholding nothing that can properly be supplied for publication. If those whose duty it is to gather news learn from experience that all reasonable information is truthfully and promptly supplied to them and that it is only in rare cases that their requests are denied, they will learn to depend upon the company, as they ought to be able, for their news, and the stories that get into print will be more accurate and more satisfactory both to the publisher and the corporation.

The first essential for a department of publicity is ability to secure information quickly and accurately. The person in charge should have facilities for reaching every department and branch of the organization. The range of inquiries touch every phase of railway activity and interest. The head of the department will be called upon to give information concerning operation, construction, equipment, discipline, law, legislation, accounting, finance, plans, policies, accidents, undertakings and occurrences of every description. It is not necessary for the head of a department of publicity to have a very profound knowledge of any particular branch of the business, but he should know a little something about nearly everything that pertains to, or affects the company.

Next in importance to ability to get information quickly and accurately is to make the department accessible to the newspapers at all hours of the day and night. From midnight until about ten in the morning, there is seldom need of being prepared to furnish information about anything except accidents or other unusual occurrences, but from ten o'clock in the morning up to midnight all sorts of inquiries are received and the department should be prepared to answer them.

The equipment of a department for publicity work need not be elaborate. One man with a telephone connected with all of the departments and stations, a desk and a few chairs for the use of reporters can accomplish considerable valuable work. A large company will require a somewhat more extensive outfit. The writer of this paper is provided with two offices; a private office for himself, and a general office for a stenographer and clerk. Each office has a telephone. There is a small library, a collection of maps and plans, files for clippings, documents, memoranda and correspondence. These offices are open from nine to five on business days. During the other hours of the day and night and on holidays and Sundays a clerk, to whom all accident reports are made as soon as possible after their occurrence, is on duty and gives information to the newspapers.

The company's effort to cooperate with the newspapers in securing accuracy in stories relating to the company is generally appreciated in the newspaper offices. Inaccurate news accounts are still printed and the company is misrepresented in reports, but there are decidedly less of these objectionable and unwarranted statements than formerly appeared. Uniform accuracy in newspaper reporting is as impossible of accomplishment as the entire elimination of accidents in railway operation. All that can be accomplished in either case is to reduce the unfortunate occurrences to a minimum.

The Boston Elevated Railway Company does comparatively little advertising. The exhibit which has been prepared for the convention is, therefore, not very extensive. It consists of a bird's-eye view of the system on a large poster, a map of the central portion of the system, showing connections and pictures of places of interest reached by it and a few display newspaper advertisements of trolley trips.

What has been said in this paper relates to publicity from the company's standpoint. An appropriate conclusion to the discussion is a presentation of the same subject from a newspaper standpoint, and this is to be found in the remarks of Thomas F. Anderson, one of the best-known representatives of the press of Boston, made at a meeting of the Massachusetts Street Railway Association last winter.

Mr. Anderson said: "This is an age of publicity, and it is a great mistake for any transportation company or other public service corporation to try to ignore this fact and keep the newspapers and the public in the dark concerning its doings. In the nearly twenty-five years that I have been actively engaged in journalistic work a vast change has taken place, not only in the physical make-up and the management of street railways, but in their general relations to the press.

"In the old days, it was sometimes next to impossible for a newspaper man to obtain from the head officials of these companies any authentic information about the company's affairs, no matter of how legitimate public interest it might be, and one of the most dreaded of my 'assignments' in the earlier days of my newspaper work was that of interviewing the taciturn and unapproachable president of one of the larger of these roads.

"How different are the conditions to-day! Twenty or twenty-five years ago the reporters often had extreme difficulty in getging a satisfactory report of the annual meeting of one of these companies, but see what happened here in Boston within a week, in connection with the annual meeting of the Boston Elevated Railway Company.

"Not only was a carefully prepared summary of the company's report and financial statement sent around in advance to all the Boston newspapers, but the company, through its publicity department, even made itself responsible for officially reporting the election of directors and all the other essential details of the meeting. The newspaper reporters and editors didn't even have to do any thinking and the best thing about it all was that the published reports were in exact accordance with the facts. Under such conditions there was, of course, no excuse for inaccuracy.

"Twenty years ago the reporter sent by his city editor to interview a street railway president—frowningly 'grouchy' or smilingly uncommunicative, as the case might be—always went forth on his errand with fear in his heart, and usually was obliged to cool his heels in an outer office awaiting the great man's pleasure.

"To-day he sets forth with lightness of spirit, for he is morally certain that the twentieth century railway magnate will give him the 'glad hand' and perhaps a good cigar; and if he cannot give him the information he seeks he will at least send the newspaper man away feeling almost as pleased as if he had secured the desired news.

"Not only have the managements of our street railways adopted a radically different policy with respect to their personal dealings with representatives of the press, but they have gone even a step farther, in some instances, and established official 'publicity bureaus,' after the manner of the modern steam railroad company.

"Through the medium of these departments, the press is kept in constant and almost instantaneous touch with the affairs of the company, and the president, vice-presidents and general manager of the corporation are each and all relieved of the burden of attending to the wants of a battalion of newsgatherers.

"When I speak of publicity bureaus in this connection I do not mean the departments established by some roads for the special purpose of advertising the facilities and attractions of the road, but those that have been created primarily for the purpose of serving as an official medium of news and news-suggestion between the public and the newspapers.

"The first American street railway company to establish a publicity bureau of this sort was the Boston Elevated Company, and to Col. William A. Gaston, who was president of the company at that time, is due credit for this exceedingly happy concession to a legitimate public demand for authentic information.

"The Elevated Company's publicity department was established in 1897, and it grew out of President Gaston's conviction that the public, which furnished the patronage and the dividends of the company, really had some rights in addition to that of riding a certain distance for 5 cents.

"Another important consideration was that the time of the president was too valuable to be infringed upon very extensively even by newspaper men; and this was probably the determining reason for establishing the bureau.

"J. Harvey White was selected as the head of the department. At first he devoted only a part of his time to this work, but with the growth of the system, and the increasing popularity of the bureau itself with the newspapers, he was soon obliged to give all his time to the duties. Just now that comes pretty nearly meaning twenty-four hours a day, for he is practically 'on call' at all hours.

"Mr. White has an office of his own in the Elevated Company's building, and has a stenographer and an assistant. His

mission in life is not to advertise the company, except as that may come in incidentally to his regular work, but to save the time of President Bancroft—one of the busiest men in New England—and to aid the newspapers in getting authentic news reports about the company, be it changes in policy, accidents, appointments of officials, additions of new rolling stock, or what not.

"His time is given up largely to receiving and talking with reporters who come with every conceivable sort of inquiry, all of which Mr. White is supposed to be in a position to answer off-hand; and when he is not doing this he is preparing special matter to be sent out by himself in the shape of news items or 'special articles.'

"When I called on him the other day he was preparing for the Boston papers an article about the life history of the latest employee to be added to the Elevated Company's pension list; and not only had he obtained and prepared the necessary data, but had sent the company's official photographer to make some photographs of the subject—all of which will later make a readable article that will be appreciated by both the newspapers and the public.

"It is the policy of the Elevated Company—in contrast to the secretive methods of many of the old-time street railways—to give out everything of a news nature that can possibly be construed as legitimate public property; and in the case of accidents everything except the names of those who are injured or claim to be injured. The latter reservation is made for the protection of the company, and to circumvent the enterprising 'ambulance attorneys' who are always around in times of such trouble, and some of whom do not scruple to engineer legal conspiracies against the company. The Elevated Company, like most others, also has a rule forbidding its employees to give to reporters or others any information as to accidents."

PROBLEMS OF THE SMALL ELECTRIC ROAD*

BY H. S. COOPER,
Manager, Galveston Electric Company, Galveston, Texas.

What is a "small" electric road? What is the measure of its "smallness"? The gentlemen asking for this paper indicated that their measure was gross earnings, by the fact that they spoke of "companies with less than $500,000 revenue per annum." That is one way of looking at it, but the writer believes that gross earnings is not a true measure of a "small" electric road; if $500,000 gross earnings means a "small" road, does $500,001 mean a medium-sized one? And if not, where does the medium-sized one begin and end and the big one commence? Also, at the dividing line of $500,000—or any other amount larger or smaller—do the "problems" change suddenly—or even to any extent?

And, if a mere arbitrary sum of gross earnings is not a proper division line between the "small" road and the one above it, what is the proper measure? Is it active track-mileage, or number of cars on regular schedule or population served? It is not any one or two or all of these for, if it were, many roads would be in the "small" class which are not considered in it and several so-called "small" ones would jump out of it quickly.

For the purposes of this paper, therefore, an entirely different basis of comparison will be taken, not only because it differentiates the roads in line with the question of "problems" but also gives what the writer believes is a truer division between a "small" road and the class just above it than any arbitrary measurement, financial, numerical or statistical.

The "small" road is one whose condition is such that it will not allow of full departmental organization. That is to say, it is one that, although it might rank out of the "small" class in one or two of the items of gross earnings, track-mileage, rolling stock or population served, yet it is so situated that it is considered that it cannot afford to be, cannot be made to be, or is not divided into the proper number of clear-cut and non-interfering departments with a competent, technically practical man at the head of each. It is in such a "small" road that the manager has to be, ex-officio, foreman or superintendent of every department or of most departments; or at any rate, he has to be the expert head of departments. It is in such a road that the detail which, in one fully organized into departments, is settled by the head of that department, comes to the manager's desk or calls him away for a visual inspection and a decision. In such a road he must have "a finger in every pie" instead of merely examining or tasting the finished product. With such a road the duties of the manager are not merely managerial; they are not only a combination of the executive, legislative, judicial and administrative, but also are paternal and pedagogic. Personally, the sins of every department are directly visited on him, for is he not IT? To him personally come bond and stock holders, the public, the municipality and the employees. He cannot hide behind any department, for he may be, or must be, the decisive head of that department. He cannot take refuge behind the impersonality of an office nor a corporation title, for his personal responsibility is too well known. Even if he blames matters on a "wicked partner" such as the "board of directors" or the "home office," every one knows that it is a subterfuge and, anyway, both of these wicked partners will quickly repudiate the blame and the "last state of that manager shall be worse than the first." This is the real mark of the "small" road as it is also its first problem, a problem that begins and ends at home and is a very vital one.

The importance of organization is not fully appreciated by the "small' or "near-small" road. To many owners and managers, organization into departments seems a useless and non-productive process, entailing no revenue and much unnecessary expense, time and labor. To the very small road where the manager is everything, from engineer to bookkeeper, where the difference between bond interest and deficit is but a hairbreadth, in such a road, departmental organization seems—and probably may be—somewhat of a farce. But it must be a very small road where this really applies. Simple organization is capable of beginning much lower down in the scale of roads than is commonly practiced among owners and managers, and even a pretty full and complete organization can be started—and will prove remunerative—a great deal sooner than is generally believed.

The simplest organization will have not less than four departments—counting the manager as one of them. These would be:

1. Accounting { Bookkeeping, Car accounting, Purchasing, Correspondence, } Manager and Clerk.
   Claim department. Accidents, etc. Manager and local counsel.
2. Generating. Power station. Chief engineer. Assistants.
3. Transportation.—Operating of cars. Inspector, or starter and trainmen.
4. Maintenance { Rolling stock, Buildings, Track, Line. } Superintendent { Barnmen, Trackmen, Linemen. }

This simplest plan of organization is possible to any road; of course in a very small road the manager may have to be the chief engineer and the superintendent of maintenance and of transportation in addition to his other duties, but in any road having full business for six to ten regular cars on an urban line or three or four regular cars on an interurban line, the above plan of organization is none too complex.

As we go up in the scale of the smaller roads, or as a road grows in size, these departments can easily and profitably be amplified until it is—for a small road—fully organized into departments, which means into about eight, as follows:

1. Accounting and auditing.
2. Claims and legal.
3. Purchasing and stock-room.
4. Power station:
5. Shops.
6. Track.
7. Line.
8. Transportation.

And, if there is a "pleasure park" attachment.

9. Advertising and attractions.

That organization—those departments—will answer for a wide scope of sizes of roads. It may be that in the smaller roads the manager will again have to be the virtual head of each department; that the departments will overlap and interfere to some extent, but these are drawbacks only to be amended by increase in size, in earnings or in profits and, if properly carcied out, that very organization will aid to that end.

It may seem foolish, when your trackman and lineman are one and the same person, when your winder also repairs trucks, when your carpenter repairs cars and buildings and does pipe-

*Abstract.

fitting, to ask them to bisect themselves into heads of departments while you show them how you want the work done, and, perhaps, how to do it; but, unless you expect your road to be forever stationary as to size, you can afford the foolishness. In the first place it is good training for both men and manager; it leads to and teaches the proper forms and the proper use of them; it tends to exactitude in work, in authority, in responsibility and in these ways makes far better discipline and more efficient and economical operation. That is the first problem of the small road—so to organize itself that, without waste of time or energy or the unnecessary unreeling of red tape, it will have the advantage of known authority and responsibility from the track greaser up to the manager. If the road thinks it is too small for any real departmental organization, let it "play at it" with a few simple departments and forms and in a short time that play will develop into earnest.

The second and next most important problem of the small road is its direct and personal relation with its patrons, the municipality and—to an extent—the employes. Nothing can be done impersonally. In every move it makes there is a personal motive imputed and a personal feeling engendered. This is compelled to be the case where most of the patrons and all the municipality know the manager and other officials and many of the employes. It is especially the case if there is a local board of directors and it is a wise board, and a blessing in disguise to the manager, if it puts everything "up to him."

This personal relation of the small road is not really a hard problem and if it is rightly worked out it can be made an advantage that is well worth the trouble to obtain it. In a comparatively small city, up to 50,000 or 75,000 inhabitants, the city will always regard its street railway as one of its possessions; not merely an adjunct or attribute as in the cosmogony of the big city, but as an object of personal interest or value and in the same category as its other civic improvements. If, therefore, the road can be made in any way a credit to the city, something that it can boast of in some particular, it is a distinct advantage gained for the road.

To obtain such a condition—that most valuable asset of a public service corporation—a pleased and satisfied public—is the next problem of the small road, but to do so needs individual care and tact in a much greater degree than with the larger road, where the public is larger and the inertia, therefore, greater; where the electric road is one of many public utilities and, as a whole, less an object of personal solitude to the citizen; where its total physical and financial condition, its rights and its franchises are not facts known to every taxpayer. In the small roads these are all matters of personal interest to the citizen, are discussed in all companies and, as this condition is handled by the road, so will they become aids or hindrances, weapons of offense or defense for the company.

And the simple solution of the matter is: perfect equity between the company, its patrons, the public and the municipality. The personal equation must "cut no ice" in matters general or matters of policy—that policy must be a straight business one requiring only the facts that—as a "public utility corporation" it has only one master, the public; only one client, the majority of its patrons, and that its only duty is to serve and keep faith with the one honestly and squarely and impartially to give the other the best service that its patronage allows.

To listen courteously and interestedly to the complaints, "kicks," hints and crude suggestions of the patrons and nonpatrons of the road, to sift the wheat from the chaff and give due thanks for the few poor grains found, and to pass by the bushels of husks without offense; to meet graft—open or implied—without open recognition of it and with an honesty of company policy, purpose and dealings that inoffensively disarms it; to refuse gracefully an improper or impossible request, favor or privilege asked and leave no resentment for the refusal; to explain, excuse, expound, exonerate; to do so as to leave a satisfied or convinced person; to do so as to leave no sting; to do so in a manner to satisfy the company's motives and acts—this is the second problem that the small road puts up to its managerial head.

The third problem is a material one—one that may be divided into two heads: employes and materials. With the first, the relations of the head of the road are not only those of a—or the—superior official. They are, as I have said, pedagogic and parental. He is seldom, if ever, "The Manager" or "Mr. So-and-So"—he is "The Boss," or "The Old Man," personally known and having a personal influence and example with them. Therefore, much is expected or exacted from him and through him from the company that is not expected from the larger road where the only "boss" is "Rules and Regulations," or an impersonal official in a swing chair before a flat-top mahogany desk; where the employe is not an individual but a unit and, in consequence, is treated by a formula with a very small variable in it. The head of the small road has the direct personal equation to meet in his discipline and in his employment. He can not be as independent of his "help" as can his brother of the larger road, for his reserve supply of trained or valuable men is not as large or as available, the small road has to be, or should be, stricter as to certain requirements than the large ones, especially among its conductors. In the large cities with their steady traffic of strangers, to the company and its employes, the requisites for competent trainmen are, in certain directions, less and less exacting, than for those of the smaller road where a certain courteous attention to and a familiarity on the part of the trainmen with the patrons and their ways is an asset of the transportation department and the company. The public in the larger cities simply desires transportation—rapid transit by preference. It doubtless appreciates convenience, comfort and courtesy, but it will sacrifice them all to spend less time in transit and be content with the change.

In the same category comes the question of supplies, and repairs and renewal parts. Whether to keep these at an absolute minimum for ordinary conditions and again to trust in Providence, or to carry a reserve or emergency surplus—those are the questions, and they are not as simple as they look. The first means small interest on investment, less stock-room space, less handling, less insurance, less depreciation, and a more rigid sconomy of use—the latter because everything must be made to last to the final minute and under such a strain that the employes are more careful and economical in their use. On the other hand, such a course means small-quantity purchases at small-quantity high prices and also small-quantity high freight or express rates; it also means a shortage of cars or an uneconomical "patch-up" of cars, line or track when the emergency does come.

To carry an emergency surplus means again a case of "insurance of continuity of service" and, as its proper handling will allow the buying of certain things in larger quantities, it means an economy in purchasing. On the other hand, it means an increase in investment, in depreciation and deterioration of certain supplies, and a more lavish use—at any rate a less economical use—unless life and mileages are accurately kept and applied. That means considerable additional clerical work for some one. The decision of these questions is also a local one, influenced by local traffic and geographical and climatic conditions, by the distance to large commercial centers where such supplies are always in stock and—firstly and lastly—by the financial condition of the road, by its policy and by the balanced judgment of the manager.

FREIGHT SERVICE ON ELECTRIC RAILWAYS

BY H. H. POLK,

President, Inter-Urban Railway Company, Des Moines, Iowa.

The first electric railways built were nothing more or less than street railways extended into the country, the track being laid upon the public highways, constructed of light rails and ties, and in most instances operated by street railway men who had had no experience in steam railroading. They therefore did not realize the great possibilities of freight as a source of earnings. Had they, however, given serious thought to the freight question it would have been immediately dismissed owing to the character of construction and the equipment then in vogue.

These conditions have changed, and the modern electric railway is following very closely standard steam railroad construction, which means low grades, minimum curvature, heavy rails and bridges and also the private right of way which permits of high speed and the handling of any kind of traffic. In every territory occupied by an electric railway there will be found freight to be shipped in and out. The electric railways will have steam railroad competition or they will not. If they have no competition they should get all of the freight to be moved, both car loads and less than car loads. If they have competition and make the proper effort, they should get prac-

tically all of the local or less than car-load shipments owing to the frequent and rapid service which can be given.

If an electric railway is fortunate enough to have traffic arrangements with connecting steam railroads it should secure a large portion of the through car-load foreign shipments to competitive points. It seems to me that steam railroads that refuse to recognize electric railways because they are such are very short-sighted. They cannot by this policy stop the building of electric railways and the electric railways can be made good feeders for steam railroads, if afforded proper treatment by them, such as publishing joint tariffs and granting a division of the through rate, thus securing for the steam railroads much freight which originates on the line of the electric railway. There are also many instances where the electric railway taps a new territory, one to which the steam railroad has heretofore never had direct access. To do a successful car-load freight business it is absolutely necessary to have a traffic agreement with at least one connecting line of steam railroad, for if this cannot be accomplished, then the rate from a point on the electric railway to a point on the steam railroad would be the sum of the two locals, and therefore prohibitive in most cases.

The question of interstate through routes and joint rates and facilities for the interchange of traffic is fully covered in the Hepburn Act and the Interstate Commerce Act. It is provided in section 15 of the Hepburn Act that "The Commission may, after a hearing on complaint, establish through routes and joint rates as the maximum to be charged, and prescribe the division of such through rates as hereinbefore provided, and the terms and conditions under which such through routes shall be operated when that may be necessary to give effect to any provision of this act and the carriers complained of have refused or neglected to voluntarily establish such through routes and joint rates, provided no reasonable or satisfactory through route exists, and this provision shall apply when one of the connecting carriers is a water line." We are awaiting with deep interest the decision of the Interstate Commerce Commission on the complaint made by the Cedar Rapids & Iowa City Railway Company against the Chicago & Northwestern Railroad Company, charging them with refusing to establish such through routes and joint rates.

A. B. Stickney, president of the Chicago Great Western Railway Company, and one of the ablest railway men of to-day says that he does not care how freight is brought to his road, whether in a wheelbarrow, stage coach, horse car or by an electric car, he will take it and be willing to pay something to get it. This is the broad view to be taken of this question. I think it is generally conceded that the electric railway is more popular with the farmer than the steam railroad. Accorded the proper treatment, the majority of the farmers living along an electric line will take great pride in it and soon come to think that it is their railway. It is more profitable for them to ship over the electric line than over the steam road, as the former gives them more rapid, frequent and fully as reliable service, enabling them to receive and ship freight, mail and express at almost any hour of the day. The farmers, merchants and manufacturers will generally ship their products over the electric railway if they are given the opportunity, for in a great many ways it is much more convenient than shipping via the steam railroads and hauling long distances in a wagon.

With the electric railway doing a general railway business, such as the hauling of passengers, freight, mail and express, running through the farms or near them, it is of course a simple matter to market the produce of the farm, including fruits, poultry and dairy products. This farm produce can be marketed regardless of the condition of the roads at any time of the year. It should be the policy of electric railways to put in side tracks, stock yards, loading chutes, etc., whenever it is shown that they will be used. Stock can then be loaded on the farm without driving it seven, eight or ten miles to some railroad station. The estimated shrinkage for driving cattle twelve miles is forty-seven pounds per head, while the shrinkage in transit is but twenty-seven pounds per head, when shipped 300 to 400 miles. By using the electric railway the shipper will save the resulting shrinkage from driving and has his choice of the steam railroads of larger cities, enabling him to obtain the lowest rate and the shortest route.

The electric railway having joint rates with connecting steam railroads gives to the farmer the advantage of such through line. He has merely to notify the electric railway of his intention to ship over a certain road and he will be supplied with a car from that road. He can also ship in tile, coal, machinery, cattle, hogs, etc., having cars set upon sidings on or near the farm, eliminating the long haul from the railroad station.

Much the same thing is true of the smaller cities and towns through which the electric railway runs. A merchant can easily order by telephone from the wholesale houses, and within an hour or two goods so ordered are in his store. Is it not true then that these advantages will give to the electric railways all of the business it can handle?

Steam railroads are the main arteries of commerce of the world; electric railways are the capillaries that bring life and activity to the various communities. This being true, the prosperity of the community depends largely upon these smaller avenues of trade, and the electric railway built through unoccupied territory (I mean a territory lacking in steam railroad facilities) with the proper facilities offered in the way of freight depots, loading platforms, stock yards, elevators and reasonably good service, can obtain a great deal of freight both car loads and less than car loads.

The bulk of the business of steam railroads is made up of car-load freight. Lyman E. Cooley, the noted engineer of Chicago, is authority for the statement that over two-thirds of the freight moved in the United States consists of fuel ore and building materials. All of these are handled by rail in car-load lots. Now add to this the total of other commodities and livestock known to move regularly in car loads and it seems to be a reasonable assumption that the amount of car-load freight in the United States is not less than 85 per cent of the total freight handled. Without access to the records of the steam railroads it is of course impossible to say just what proportion the car-load traffic bears to the whole freight traffic handled.

In a recent hearing in Minnesota this subject of car-load freight was dealt with very exhaustively, and the railroads asserted and attempted to prove that the less than car-load freight was very expensive, and did not yield its fair share of the net total revenue, on account of the cost of handling. This seems to be the prevailing opinion among steam railroad traffic men. They solicit the car-load freight more strenuously than they do the less than car load, and will gladly take it at much lower rates per hundred pounds, than the less than car-load or package freight.

Some of the reasons given in support of this opinion are:

1st. That car-load freight is loaded by the shipper and unloaded by the consignee, thereby relieving the railway company of the responsibility of loading and unloading, and the cost of handling.

2d. That a very large percentage of it is handled on private terminals.

3d. That for the two reasons given above, the risk from loss and damage is very much less.

4th. That less bookkeeping and accounting is necessary on car loads.

5th. That is costs much less per ton to move ordinary commodities, such as move in car loads, than to move a car of merchandise or package freight.

Accurate data on the cost of handling freight on electric lines is very difficult to obtain. I addressed letters to the general managers of thirty electric railways, asking for certain information relative to the cost of handling freight. I received replies from the majority stating that they did not keep their records of handling freight and passengers separate and therefore could not give the desired information. I am therefore compelled to resort to our own experience.

Some comparison of statistics of freight traffic on steam railroads and electric railways may be interesting here.

During the year 1904 steam railroads of the United States handled 1,306,628,858 tons of freight, at an average revenue of four-fifths of one cent per ton-mile.

The Baltimore & Ohio earned five and eighty-two hundredths mills (0.582 cents) per ton-mile. The Inter-Urban Railway earned 5.928 cents per ton-mile. The great difference in the cost of handling and the amount earned is caused by the difference in the average distances hauled. The Baltimore & Ohio's average haul being 192.84 miles, while the Inter-Urban Railway's average haul was only 10.5 miles.

In the following table I have taken the earnings of steam railroads from all sources, with the per cent that each item is of the total as published in the annual statistical report of the Interstate Commerce Commission for the year ending June 30, 1901, and the earnings of strictly electric railways from all sources with the per cent. that each item is of the total, as pub-

lished in the latest reports of street railroads and electric railways, compiled by the Department of Commerce and Labor, Bureau of the Census, for the year ending June 30, 1902.

1901.	Steam.	%		Electric.	%
Passenger	351,356,265	22.12		233,821,549	94.4
Mail	38,453,602	2.42		432,080	0.2
Express	31,121,613	1.96		401,672	0.2
Other Car Pass.	8,202,982	.52		303,608	0.1
Freight	1,122,608,471	70.67		1,038,097	0.4
Other earnings	36,729,104	2.31	Sale of Electric Current.	7,703,574	3.1
Miscellaneous	54,000	.01		3,853,420	1.6
		Less			

On steam railroads it will be noted the receipts from freight traffic is about 70 per cent. of the gross earnings, while on the electric railways the average receipts from freight is only 0.4. However there are a few electric railways that receive for freight between 20 and 35 per cent. From the above it is evident that freight traffic on electric railways has not yet received the attention which we believe its future development will justify.

E. E. Kimball of the Railway Engineering Department of the General Electric Company has very kindly given me some data on power consumption and cost of maintenance of electric locomotives and passenger cars.

ENERGY CONSUMPTION.

Freight Trains.

Gross Weight in Tons.	Schedule speed of trains.	Watt-hours per ton-mile at locomotive.
100	15 m.p.h.	28
200	15 m.p.h.	23
300	15 m.p.h.	20
400	15 m.p.h.	19
500	15 m.p.h.	19

Interurban Cars.

Gross Weight in Tons.	Maximum speed.	Stops per mile.	Watt-hrs. per-ton-mile.
20	45 m.p.h.	½	80
		¾	87
		1.00	92
40	45 m.p.h.	½	70
		¾	76
		1.00	81
50	45 m.p.h.	½	67
		¾	73
		1.00	78

The cost of repairs and maintenance of a 40-ton locomotive equipped with 100-hp d. c. motors when hauling a 200-ton train about 100 miles per day will average about 1.5 cents per locomotive-mile. This includes repairs to motors and control, and care of locomotive.

An electric railway, in order to do a general railway business must be equipped to properly and promptly handle any business given to it.

1st. The freight department should be in charge of a general freight agent, who should be held responsible for all matters pertaining to his department. He should also pay strict attention to freight claims, giving them a thorough investigation and adjusting them promptly. There is no excuse for delay in settling claims promptly, as the mileage of the majority of electric railways is short, and the stations few as compared with steam railroads, it is therefore much easier to locate damages, shortages and delays.

2d. In the large cities a good solicitor should constantly be at work, keeping in touch with the freight situation, making regular calls upon the merchants, manufacturers, dairy concerns, wholesale houses, etc., as well as soliciting business from the farms through which the road runs and from as far away as it is possible to draw it. The amount of business obtained by a solicitor five or six miles away, on either side of the road is astonishing.

Besides soliciting, he should find a market for the products of the farm, such as dairy products, poultry, fruit, vegetables, etc. Encourage all of these lines and the freight business will rapidly grow.

3d. The accounting is a matter of so much detail that it will be impossible for me to cover it in the limited space allotted to me. I will say, however, that transportation of freight on electric railways is so nearly identical with that of steam railroads that it is very essential that the general form of steam railroad accounting be adopted.

4th. There should be a commodious freight house, centrally located, and convenient to wholesale houses. This is of primary importance in the larger terminal cities. The freight house should be built on the most approved design in order to economically handle freight. There should be doors on one side convenient for the use of teams. Opposite these doors should be located the doors for loading and unloading of cars, so that the truckers may truck from the wagons directly to the cars or vice versa.

This house should be in charge of the agent, and under him should be a foreman, and as many men as are needed to properly handle the business. There should also be in the larger terminal cities and smaller cities, freight-yards, with sufficient switch tracks and team tracks.

5th. Each of the stations along the line should have a freight-room, in charge, of course, of the station agent. The duties of

	Number of tons carried.	Per cent. of tons carried.	Average rate received per ton.	Freight revenue.	Car loads handled exclusive of switching.	Car loads switched.	Number of tons carried one mile.	Number of tons carried one mile per mile of road.	Average receipts per ton mile, cents.	Operating expenses per ton mile, cents.	Operating expenses per cent. of freight earnings.	Freight earnings per cent. of gross earnings.
Local freight car loads	65,052	78.94	$0.406	$26,421 11	.....	.....	694,828	9.677	3.802	.....	.....	.....
Local freight less car loads	8,116	9.85	$2.27	$18,423 32	.....	.....	85.920	1,197	21.443	.....	.....	.....
Foreign freight car loads	9,195	11.16	$0.84	$7,723 80	.....	.....	107,335	1,494	7,724	.....	.....	.....
Foreign freight less car loads	40	0.05	$2.67	$106.80	.....	.....	443	7	24.131	.....	.....	.....
Total	82,403	100.00	.....	$52,675 03	3,627	1,484	888,526	12,375	.....	.....	0.37	0.23
Average	.....	.....	$0.639	.....	.....	.....	.....	.....	5.928	2.194	.....	.....

The cost of repairs and maintenance of interurban cars will average about 1.5 cents per car-mile. This figure includes cost of repairs to motors and control, and cost of cleaning the car bodies.

Of course these figures will vary considerably on different roads in different sections of the country, owing to the service conditions of the road. It will be noted from the above data, that as the weight of the train increases, the power consumption decreases per ton-mile, this of course is due to wind pressure per ton. This is also true of power consumption on passenger cars, but the passenger cars will use more power per ton-mile on account of them making more frequent stops.

The report of the Inter-Urban Railway Company for the year ending June 30, 1907, gives the following statistics on freight:

the agent are many outside of the freight service. He receives and issues train orders, sells tickets, and solicits passengers as well as freight business.

6th. At all stations or side tracks, shippers should be encouraged by the company. In addition to the stock-yards, and loading chutes for the convenience of stock shippers, it is also of great importance to have depot grounds of sufficient size to permit the leasing of a part of them for a nominal rental to persons desiring to put in grain elevators and other industries that will ship their products.

In my opinion, grain is one of the best paying commodities to handle, and effort should be made to obtain shipment of this commodity.

7th. The rolling stock should be modern, the electric loco-

motives equipped with motors of sufficient capacity to handle trains of at least one to fifteen cars at a speed of at least twenty miles an hour or better, in order not to interfere with passenger service. The company should own enough box and flat cars to properly handle the business.

The service must be of the best; its frequency depending upon demand and incidentally upon competition.

8th. The small or less than car-load shipment should be handled in express cars, equipped with motors of at least the same capacity as the passenger cars.

The less than car-load shipments on the Colfax division of the Inter-Urban Railway are handled in express cars, at freight rates. Car-load shipments on this division are handled by an electric locomotive when necessary. While on the Beaver Valley division we have a way freight leaving Des Moines at 4 o'clock in the morning. This train is composed of an electric locomot ive,merchandise cars, car-loads, and a caboose. It picks up all car loads and does all the switching at the various stations, out and back, setting loads and empties at the various elevators, stock-yards, coal mines, etc.

RATES

Until 1887 nearly every large railroad had a classification of its own, but now most business is handled by one of three classifications. These are the official, which is used in the East, the Southern and the Western. In several states, Illinois, Iowa, Georgia, and some others, there are classifications prescribed by the State Board of Railroad Commissioners applying to freight carried entirely within the State. The electric railways should use the classifications and rates which are used by the steam roads in their territory.

It may be interesting to know how the freight rates of the United States compare with those of some of the European countries. In England the average amount paid by the shippers for moving a ton of freight one hundred miles is $2.35; in France, $2.10; in Austria, $1.90; in Germany, where most of the railways are owned and operated by the Government, $1.84; in Russia, $1.70; while in the United States the average cost to the shipper is only 73 cents or less than 40 per cent of average cost in Europe.

A report of the Department of Commerce and Labor for the year 1902, in a general discussion of the characteristics and significance of electric railway service, says: "It is difficult to avoid entrance into the domain of prophecy. Some of the electric railways have already made such progress in methods that certain prophets look forward to the complete superseding of steam traction by electric traction. However this may be, it is evident that, even if the electric railways confine themselves to the methods already widely prevalent, they are bound to become a social and economic factor of enormous importance. Remarkable benefits have already been realized from the existing electric lines, and the extension of such railways to a large proportion of our more prosperous communities seems but a matter of a short time."

REPORT OF THE COMMITTEE ON CONSTRUCTION OF STANDARD RAILWAY CAR STORAGE AND OPERATING HOUSES

Your committee appointed to consider the subject of the "Construction of Standard Railway Car Storage and Operating Houses" held two meetings in conjunction with a similar committee appointed by the National Fire Protection Association.

One of these meetings was held in New York on May 21, 1907, at the association's headquarters. All the members of your committee were present at that time and received a report from the committee of the National Fire Protection Association, covering rules for the construction of buildings of this character.

After a thorough consideration of the rules submitted, your committee made a number of changes and suggestions which were then submitted to the committee of the National Fire Protection Association. These suggestions and corrections were, in turn, submitted by this last named committee to their association at meetings held in New York on May 22, 23 and 24, 1907, and the suggestions made by your committee were practically agreed to.

The second meeting was held in Baltimore on Sept. 19, at which Messrs. Porter, Pumfrey, Parker and Adams were present, representing the American Street and Interurban Railway Association, and Messrs. Patton and Townsend, representing the National Fire Protection Association.

At this meeting the rules and regulations, for the construction of car houses, which follow, were finally agreed upon. These rules have received the approval of the National Fire Protection Association, and they are respectfully submitted by this committee to the association for consideration.

H. H. Adams, Chairman.
A. V. Porter,
E. J. Cook,
E. L. Parker,
Chas. F. Ferrin,
Thos. Pumfrey.

REQUIREMENTS FOR THE CONSTRUCTION OF STANDARD RAILWAY CAR STORAGE AND OPERATING HOUSES

A standard railway car storage house should be so constructed and protected that it may not contribute in any manner toward the spread of fire therein, and contribute only, in case of fire, not to exceed sectional losses of the structure. One single division should not exceed dimensions to expose to any one fire a greater number of cars therein than would represent a valuation of $200,000 of combustible rolling stock or a total interior trackage of not more than 1800 ft.

(*Note.*—The following are recommendations from the standpoint of fire protection only and are in no way intended as a detailed guide to architects or mill engineers with reference to the actual strength which any building may require due to size or occupancy.)

SECTION 1, WALLS

Walls to be of good hard burned brick, laid in best of lime and cement mortar. (Concrete construction is not covered under this specification.)

(*a*) *Outside Walls.*—To be not less than 12 ins. thick, and when walls are over 60 ft. in length, to be strengthened by piers or pilasters not less than 20 ins. x 20 ins., spaced not over 20 ft., center to center, the walls between piers being not less than 12 ins. thick. When without piers to be not less than 16 ins. thick.

Where exposed, to be carried full thickness of wall, at least 5 ft. above roof, and to be provided with a durable and non-combustible coping. Where roof is of fire-resistive construction, walls to extend to roof. If exposed, walls to be solid or any openings therein to be protected in a standard manner.

(*b*) *Cut-Off of Division Walls of Fire Sections.*—To be not less than 12 ins. thick, and when walls are over 60 ft. in length, to be strengthened by piers or pilasters not less than 20 ins. x 20 ins., spaced not over 20 ft., center to center, the walls between piers to be not less than 12 ins. thick. When without piers to be not less than 16 ins. thick.

To be not less than 5 ft. parapet, carried full thickness, projecting through and beyond cornice 8 ins., with a durable and non-combustible coping. Where roof is of fire-resistive construction parapet may be modified.

To be no openings in division walls separating car storage sections, except that for every 100 ft. of length there may be one opening in the wall of an area not exceeding 28 sq. ft., the same to be protected with a standard automatic sliding fire door on each side of wall. End walls to have no openings within 5 ft. of division walls.

SECTION 2, HEIGHT

One story, without basement or space below, except at pits. Height of walls not to exceed 20 ft. at eaves line or 25 ft. at peak of roof above the floor level, the slope being from ½ in. to 1 in. per ft.

Note.—Where it is necessary to exceed 25 ft. in height, this may be increased by permission of inspection departments having jurisdiction, but in no case should this height exceed 30 ft.

SECTION 3, AREA

Sections between standard cut-off or division walls to contain not over 20,000 sq. ft. of floor area. Distance between centers of adjacent tracks to be not more than 12 ft. or less than 10 ft.

SECTION 4, ROOF AND ROOF SUPPORTS

(*a*)*Post or Column Covering* (*when of fire-resistive type*).—All vertical metal supports to be insulated by not less than 4 ins. of concrete or of terra-cotta, or of such other approved insulating material as is recommended in the Building Code of the National Board of Fire Underwriters, independent of any

air space next to the metal. Well laid brick is strongly preferred for column covering.

(*b*)*Girder and Beam Covering* (*when of fire-resistive type*).—All metal girders and beams to be insulated on the sides by not less than 4 ins., and on the top and bottom by not less than 2 ins. of concrete, or terra-cotta, or of such other approved insulating material as is recommended in the Building Code of the National Board of Fire Underwriters.

Note 1.—No plaster of paris or lime mortar shall be used for the purpose of insulating material, nor shall any plaster, whether or not on metal lathing, be considered a part of the covering required.

No single block or unit of insulating material used for column covering shall have a greater vertical dimension than 12 ins. when placed in position, nor shall the shells and web of hollow tile or terra-cotta blocks be less than 1 in. in thickness, and these blocks shall be well laid up with Portland cement mortar and the said blocks be suitably tied or anchored together.

Note 2.—The quality, design and weight of all metal structural parts and supports, the necessary tie rods, bearing plates, wall templates and the riveting, bolting, connecting and anchoring of structural parts, to be in accordance with requirements as recommended in the Building Code of the National Board of Fire Underwriters.

(*c*)*Roof* (*when of fire-resistive type*).—To be of an approved system of brick, concrete or terra-cotta, or other non-combustible material, with approved insulation of special supports or tie rods, as recommended in the Building Code of the National Board of Fire Underwriters for such purpose. Roof covering to be tar and gravel or approved composition.

(*d*) *Roof and Roof Supports* (*when of slow-burning type*).—Roof planking to be not less than 3-in. spliced timber. To have timbers (preferably single stick) not less than 6 ins. x 12 ins., spaced not less than 6 ft., nor more than 10 ft. on centers, supported by wooden posts, not less than 10 ins. x 10 ins., and without trusses. Where roof timbers enter walls at opposite side they should be self-releasing and have at least 8 ins. of brick work between ends of beams. To be without monitors. Roof covering to be of tar and gravel or approved composition.

SECTION 5, SKYLIGHTS AND VENTILATORS

Skylights to be of flat type, wired glass and metal frames, constructed in accordance with the rules and requirements of the National Board of Fire Underwriters covering their installation. Ventilators, if any, to be of metal.

Note.—It is advisable to provide skylights with fuse-releasing attachments that in case of fire the skylights may open and carry off heat and smoke. A metal ventilator set in each skylight is also advisable.

SECTION 6, CORNICE

Cornice, if any, to be of non-combustible material and plain finish.

SECTION 7, FINISH

Finish (interior trim), if any, to be non-combustible and without concealed space.

SECTION 8, FLOORS

To be of brick, concrete, stone, cinders or earth.

SECTION 9, PITS

To have brick, stone or concrete retaining walls or piers; brick or concrete floors; steps of stone, concrete or iron; the rails to be supported on brick, stone, concrete or wood stringers exposed on one side only, and to have not more than four track sections communicating.

SECTION 10, TRACKS

To run clear from building, without break or transfer table. To be terminated by suitable bumpers, so that there will be a clear space of not less than 3 ft. between bumpers and wall of building. Special track work in front of building to be provided with guard rails where necessary.

SECTION 11, TRACK DOORS

Track doors to be in pairs, to be arranged so that whether open or closed any door of one pair will not interfere with the operation of any other pair. When within 10 ft. of cut-off walls, to be constructed and hung as for a standard swinging fire door. Approved metal roller doors may also be used.

SECTION 12, HAZARDS

All electrical, heating, power and occupancy hazards to be installed and maintained, and where necessary to be cut off, to be in accordance with the rules and requirements of the National Board of Fire Underwriters, as published in specific pamphlets by the National Fire Protection Association.

SECTION 13, EXPOSURES

Buildings should be so located that there may be but a minimum exposure only from other property.

SECTION 14, REINFORCED CONCRETE OR CONCRETE-STEEL CONSTRUCTED BUILDINGS

Reinforced concrete construction may be accepted in instances where tests and inspections of the material and structural supports are properly made under provisions as set forth in Section 110, pages 153 to 159 of the Building Code of the National Board of Fire Underwriters, prescribed as follows, viz.:

SECTION 110, REINFORCED CONCRETE OR CONCRETE-STEEL CONSTRUCTED BUILDINGS

The term "reinforced concrete" or "concrete-steel" in this section shall be understood to mean an approved concrete mixture reinforced by steel of any shape, so combined that the steel will take up the tensional stresses and assist in the resistance to shear.

Reinforced concrete construction may be accepted for fireproof buildings if designed as herinafter prescribed; provided, that the aggregate for such concrete shall be hard-burned broken bricks or terra-cotta, clean furnace clinkers, entirely free of combustible matter, clean broken stone or furnace slag or clean gravel, together with clean siliceous sand, if sand is required to produce a close and dense mixture; and provided, further, that the minimum thickness of concrete surrounding and reinforcing members, ¼ in. or less in diameter, shall be 1 in.; and for members heavier than ¼ in. the minimum thickness of protecting concrete shall be four diameters, taking that diameter, in the event of bars of other than circular cross-section, which lies in the direction in which the thickness of the concrete is measured; but no protecting concrete need be more than 4 ins. thick for bars of any size; and provided, further, that all columns and girders of reinforced concrete shall have at least 1 in. of material on all exposed surfaces over and above that required for structural purposes; and all beams and floor slabs shall have at least ¾ in. of such surplus material for fire-resisting purposes; but this shall not be construed as increasing the total thickness of protecting concrete as herein specified.

All the requirements herein specified for protection of steel and for fire-resisting purposes shall apply to reinforced concrete filling between rolled-steel beams, as well as to reinforced concrete beams and to entire structures in reinforced concrete. Any concrete structure or the floor filling in same reinforced or otherwise, which may be erected on a permanent centering of sheet metal, of metal lathing and curved bars or a metal centering of any other form, must be strong enough to carry its loads without assistance from the centering, unless the concrete is so applied as to protect the centering as herein specified for metal reinforcement.

Exposed metal centering or exposed metal of any kind will not be considered a factor in the strength of any part of any concrete structure, and a plaster finish applied over the metal shall not be deemed sufficient protection.

All concrete for reinforced concrete construction whenever used in such buildings must be mixed in a machine which mixes one complete batch at a time and entirely discharges it before another is introduced. At least twenty-five complete revolutions must be made at such a rate as to turn the concrete over at least once in each revolution for each batch.

Before permission to erect any concrete-steel structure is issued, complete drawings and specifications shall be filed with the commissioner of buildings, showing all details of the construction, the size and position of all reinforcing rods, stirrups, etc., and giving the composition of the concrete.

The execution of work shall be performed by workmen under the direct supervision of a competent foreman or superintendent.

All forms and centering for concrete shall be built plumb and in a substantial manner with inside surfaces smooth and made tight so that no part of the concrete mixture shall leak out through joints, clacks or holes, and after completion shall be thoroughly cleaned out, removing shavings, chips, pieces of wood and other material, which should not be permitted in forms.

The reinforcing steel shall be accurately located in the forms and secured against displacement while the concrete is being placed and tamped.

Concrete shall be placed in forms as soon as practicable after mixing, and in all cases immediately after the addition of water.

Whenever fresh concrete joins concrete that is set, or par-

tially set, the surface of the old concrete shall be roughened, cleaned and thoroughly slushed with a grout of neat cement and water.

Concrete shall not be installed in freezing weather; such weather shall be taken to mean a temperature of 32 degs. F. or lower; concrete shall not be allowed to freeze after being put in place, and, if frozen, shall be removed.

The time at which forms and centering may safely be removed will vary from twenty-four hours to sixty days, depending upon temperature and other atmospheric conditions of the weather; the time for such removal to be determined by the commissioner of buildings.

The concrete shall be mixed in the proportions of one of cement, two of sand and four of other aggregates as before provided; or the proportions may be such that the resistance of the concrete to crushing shall not be less than 2000 lbs. per sq. in. after hardening for twenty-eight days, but for reinforced or plain concrete columns the mixture shall not be leaner than one part of cement, two of sand and five of the coarser aggregate in any case. The tests to determine this value must be made under the direction of the commissioner of buildings. The concrete used in concrete-steel construction must be what is usually known as a "wet" mixture.

Only high-grade Portland cement shall be permitted in reinforced concrete or concrete-steel constructed buildings. Such cements, when tested neat, shall, after one day in air, develop a tensile strength of at least 300 lbs. per sq. in.; and after one day in air and six days in water shall develop a tensile strength of at least 500 lbs. per sq. inch; and after one day in air and twenty-seven days in water shall develop a tensile strength of at last 600 lbs. per sq. inch. Other tests, as to fineness, constancy or volume, etc., made in accordance with the standard methods prescribed by the American Society of Civil Engineers, may, from time to time, be prescribed by the commissioner of buildings.

The sand to be used must be clean, sharp grit sand, free from loam or dirt and shall not be finer than the standard sample kept in the Department of Buildings.

The stone used in the concrete shall be a clean, broken stone, of a size that will pass through a ¾-in. ring, or good gravel may be used in the same proportion as broken stone, broken hard bricks, terra-cotta, furnace slag, or hard clean clinkers may be used.

The steel shall meet the requirements of Section 21 of this code.

SECTION 21, STRUCTURAL MATERIAL

Wrought Iron.—All wrought iron shall be uniform in character, fibrous, tough and ductile. It shall have an ultimate tensile resistance of not less than 48,000 lbs. per sq. in., an elastic limit of not less than 24,000 lbs. per sq. in. and an elongation of 20 per cent in 8 ins. when tested in small specimens.

Steel.—All structural steel shall have an ultimate tensile strength of from 54,000 to 64,000 lbs. per sq. in. Its elastic limit shall be not less than 32,000 lbs. per sq. in., and test specimens, ruptured in tension, must show a minimum elongation of not less than 20 per cent in 8 ins. Rivet steel shall have an ultimate strength of from 50,000 to 58,000 lbs. per sq. in.

Cast Steel.—Shall be made of open-hearth steel containing ¼ per cent to ½ per cent of carbon, not over 8/100 of 1 per cent of phosphorus, and shall be practically free from blow holes.

Cast Iron.—Shall be of good foundry mixture producing a clean, tough, gray iron. Sample bars 5 ft. long, 1 in. square, cast in sand molds, placed on supports 4 ft. 6 ins. apart, shall bear a central load of 450 lbs. before breaking. Castings shall be free of serious blow holes, cinder spots and cold shuts. Ultimate tensile strength shall be not less than 16,000 lbs. per sq. in. when tested in small specimens.

Concrete-steel shall be designed in accordance with the following assumptions and requirements:

(1) The adhesion between the concrete and the steel is sufficient to make the two materials act together; the unit value of the adhesion is at least equal to the unit shearing strength of concrete.

(2) The design shall be based on the assumption of a load four times as great as the total working load (ordinary dead load plus ordinary live loads) producing a stress in the steel equal to the elastic limit and a stress in the concrete equal to 2000 lbs. per sq. in.

(3) The modulus of elasticity of concrete at 2000 lbs. per sq. in. is equal to one-eighteenth of the modulus of elasticity of steel.

(4) The steel takes all the tensile stress.

(5) The stress-strain curve of concrete in compression when the stress in the extreme fiber is 2000 lbs. per sq. in. may be assumed:

(a) As a straight line.

(b) As a parabola with its axis vertical and its vertex on the neutral axis of the beam, girder or slab, or

(c) As an empirical curve with an area one-quarter greater than if it were a straight line and with its center of gravity at the same height as that of the parabolic area assumed in (b).

(6) The assumption belonging to the common theory of flexure, where not modified by any of the foregoing, will apply.

In the design of structures involving reinforced concrete girders and beams as well as slabs, the girders and beams shall be treated as T-beams, with a portion of the slab acting as flange, in each case. The portion of the slab so acting shall be determined by assuming that in any horizontal plane section of the flange the stresses are distributed as the ordinates of a parabola with its vertex in the stress-strain curve and with its axis in a longitudinal vertical plane through the center of the rib of the T.

The shearing strength of concrete corresponding to a comprehensive strength of 2000 lbs. per sq. in. shall be assumed at 200 lbs. per sq. in.

All reinforced concrete T-beams must be reinforced against the shearing stress along the plane of junction of the rib and the flange. Where reinforced concrete girders carry reinforced concrete beams the portion of the floor slab acting as flange to the girder must be reinforced with bars near the top at right angles to the girder, to enable it to transmit local loads directly to the girder and not through the beams, thus avoiding an integration of compressive stresses due to simultaneous action as floor slab and girder flange.

Concrete indirect compression shall not be stressed under the working load more than 350 lbs. per sq. in. Reinforced compression members shall be designed on the assumption that this stress in the concrete will be simultanous with one of 6000 lbs. per sq. in. in the steel. Should the use of hooped concrete be proposed, the working stresses will be a subject for special consideration by the commissioner of buildings.

In the execution of work in the field, work must be so carried on that the ribs of all girders and beams shall be monolithic with the floor slab.

In all reinforced concrete structures special care must be taken with the design of joints to provide against local stresses and secondary stresses due to the continuity of the structure.

In the determination of the bending moments, due to the external forces, beams and girders shall be considered as simply supported at the ends, no allowance being made for continuous construction over supports. Floor plates when constructed continuous and when provided with reinforcement at top of plate over the supports may be treated as continuous beams, the bending moment for uniformly distributed loads being taken at not less than $\frac{W\ L}{10}$; the bending moment may be taken at $\frac{W\ L}{20}$ in the case of square floor plates which are reinforced in both directions and supported on all sides.

When the shearing stresses developed in any part of a reinforced concrete or concrete-steel constructed building exceed under the multiplied loads the shearing strength as fixed in this section, a sufficient amount of steel shall be introduced in such a position that the deficiency in the resistance to shear is overcome.

When the safe limit of adhesion between the concrete and steel is exceeded provision must be made for transmitting the strength of the steel to the concrete.

Concrete-steel may be used for columns in which the ratio of length to least side or diameter does not exceed twelve. The reinforcing rods must be tied together at intervals of not more than the least side or diameter of the column.

The contractor must be prepared to make load tests on any portion of a reinforced concrete or concrete-steel constructed building within a reasonable time after erection as often as may be required by the commissioner of buildings. The tests must show that the construction will sustain a load with a

factor of safety for floors and structural members as required by Section 136 of this code, viz.:

SECTION 136, FACTORS OF SAFETY

Where the unit stress for any material is not prescribed in this code the relation of allowable unit stress to ultimate strength shall be:

As one to four for metals, subjected to tension or transverse stress;

As one to six for timber;

And as one to ten for natural or artificial stones and brick or stone masonry.

But wherever working stresses are prescribed in this code, varying the factors of safety herein above given, the said working stresses shall be used.

RULES AND REQUIREMENTS FOR INSTALLATION OF AUTOMATIC SPRINKLER EQUIPMENTS IN RAILWAY CAR STORAGE HOUSES.

The rules and requirements of the National Board of Fire Underwriters for sprinkler equipments, automatic and open systems, as recommended by the National Fire Protection Association in published edition of 1905 (or as may be covered by later issues), are to be observed in protecting this class of property, and in addition thereto the special features as herein recommended are to apply.

Attention is also called to the necessity of subdividing the areas of street railway property so that an excessive amount of value shall not be exposed to any one fire.

SECTION 1, CEILING CURTAINS

Permanent ceiling curtains are recommended in buildings having a height of over 25 ft. from floor to ceiling. These curtains may be constructed of non-combustible material or of not less than 1-in. tongued and grooved boards, coated on both sides with non-inflammable paint; curtains to subdivide ceiling into pocket areas not exceeding 5000 sq. ft. each and be of a depth from ceiling to trolley wire. Underwriters having jurisdiction should be consulted as regards the specific location of these curtains.

SECTION 2, AISLE SPRINKLERS

(*a*) In addition to the regular ceiling installation sprinklers to be placed on both sides of each track, in an upright position, on horizontal pipe lines parallel with tracks, and to be so located that water will spray directly into cars through side windows of car bodies; the sprinklers to be at such a height that their deflectors will be from 2 ins. to 4 ins. below the upper sash rail of car windows.

(*b*) Distance between sprinklers on aisle lines not to exceed 8 ft.

(*c*) The standard pipe schedule to govern installation of aisle lines, except that no pipe smaller than 1 in. to be used.

(*d*) When the distance between sides of cars on adjacent tracks does not exceed 4 ft. one line of sprinklers to be placed in the center of each aisle between tracks.

(*e*) When the distance between sides of cars on adjacent tracks exceeds 4 ft. two lines of sprinklers to be installed. Sprinklers to be placed not less than 6 ins. nor more than 12 ins. from the sides of cars to be protected.

Note.—When the distance between the sides of cars in adjacent tracks is less than 12 ins. or where aisle lines in accordance with this section may not be practicable as at curves, switches, transfer tables, car elevators, repair and paint shops, special instructions from underwriters having jurisdiction should be obtained as regards installing raised or altered lines.

(*f*) Sprinklers to be placed between cars and partitions, division or outer walls, not less than 6 ins. nor more than 12 ins. from the sides of cars to be protected.

(*g*) Sprinklers on all aisle lines to be staggered spaced.

Note.—It is recommended that aisle sprinklers be provided with a shield to protect them from spray of overhead sprinklers and to serve as a means of banking heat waves. Underwriters having jurisdiction should in all cases be consulted as to whether or not these shields should be provided.

SECTION 3, SUPPLY MAINS TO AISLE SPRINKLERS

(*a*) Aisle sprinklers to be supplied through independent connection from main risers taken from above and close to dry pipe valves; shut-off valves to be provided for ceiling and aisle systems so arranged that either may be controlled independently.

Note.—Ceiling and aisle systems should preferably be installed upon separate dry valves.

(*b*) Aisle lines not to be supported by nor connected to ceiling sprinkler piping. Special hangers or supports to be provided that aisle lines may be rigidly secure.

(*c*) Ceiling sprinkler lines to be protected against contact with trolley poles.

SECTION 4, PITS AND UNDER FLOOR SPACE

Where the under floor space does not communicate with the pits, is tightly inclosed and is not used for any purpose, sprinklers may be omitted in such under floor space by special consent in each instance of the underwriters having jurisdiction.

SECTION 5, ADDITIONAL HAND FIRE APPLIANCES

Auxiliary hand fire appliances are deemed essential, as fires within car bodies must not be expected to be extinguished minutely by sprinklers, and the following equipment should be provided:

(*a*) *Extinguishers.*—To be one approved and labeled 3-gal. chemical fire extinguisher for each 2500 sq. ft. of floor area; extinguishers to be uniformly distributed in permanent locations.

(*b*) *Sand Pails.*—In rooms containing pits, or where any wiping up or cleaning is done, to be six pails to each 2500 sq. ft. of floor area. Pails to be of galvanized iron, painted red, with the word "Fire" in black letters 3 ins. long. Pails to be of 3 gal. capacity and provided with scoops.

(*c*) *Small Hose.*—Fifty feet of 1½-in. approved linen hose to be provided for each 6000 sq. ft. of floor area. Hose to be provided with ⅜-in. nozzle and to be in lengths of not over 50 ft., the same to be kept folded and attached to a 2-in. standpipe, which shall have an adequate supply of water at not less than 50 lbs. pressure.

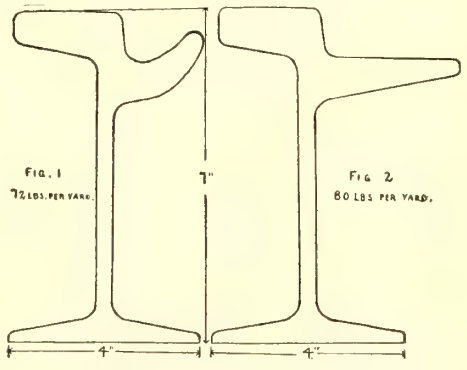
Where an approved water supply is not available and building is not over 12,000 sq. ft. of floor area, additional approved and labeled chemical extinguishers may be accepted in place of each hose connection.

Note.—Underwriters having jurisdiction should be consulted as to standpipe and hose layouts.

THE USE OF THE T-RAIL IN CITIES

BY C. GORDON REEL,
Vice-President, Kingston Consolidated Railroad Company

In the horse car days the equipment was so light and speeds so leisurely that the problem of a proper track was easy of solution. It was expected that wagon traffic of all kinds would follow along the car tracks, and so city ordinances usually required that the street railway companies make proper provision for the accommodation of vehicular traffic. With the introduction of electricity weights and speeds were increased enormously. The trend of development has been steadily to approach nearer and nearer to steam railroad standards. With the increase in weight of equipment and increase of speed the grooved and girder rail sections soon demonstrated their inability to carry the car traffic without rapid deterioration. The inefficiency of these sections was due not to the light weight so much as to their unscientific design. The vertical web of the



FIGS. 1 AND 2.—GROOVED AND GIRDER SECTIONS ORIGINALLY USED IN KINGSTON, N. Y.

rail was usually directly under the flange of the wheel so that the weight of the car would be carried on a sort of projecting shelf. This unsymmetrical unloading was more than the rails could stand. They pounded down rapidly at the joints and could not be held to gage. Our companies were unfortunate enough to build with 7-in. grooved and girder sections shown

in Figs. 1 and 2. These rails were structural wrecks at the joints long before they were worn appreciably.

In other cities similar sections have been used which overcome the inherent weakness in design by brute strength, so to speak; that is, they are rolled in weights up to 150 lbs. per

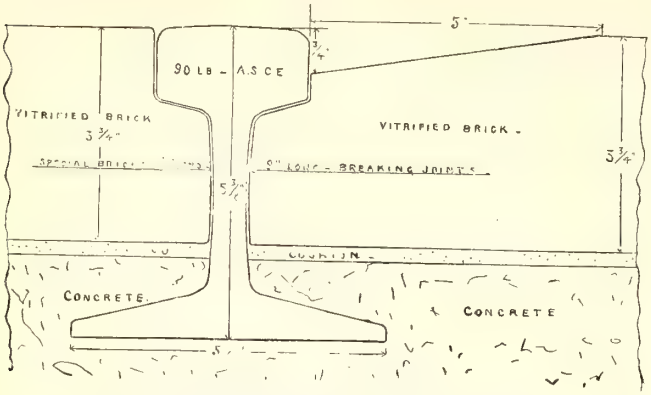


FIG. 3.—LATEST CONSTRUCTION IN KINGSTON, N. Y., SHOWING SPECIAL BRICK OUTSIDE OF RAIL.

yard, which would seem absurd to steam railroad men, especially in view of the very much heavier rolling stock used by the steam roads. It is self-evident that a proper section should not be inordinately heavy and should carry its load with no tendency to moving sideways, and furthermore that the track should stand solidly in place without having to strap the rails together every few feet. All T-rails fulfill the first two requirements, but the standard steam railroad sections would seem to serve better than the high T sections in regard to lateral stability. Just what is gained by using a high T is hard to understand, still I am willing to concede that, in view of the experience in some of the larger cities which use this rail, there is a chance for an argument between high T sections and standard T sections. Personally, I would prefer to pay more per ton for standard sections than for high T sections, although under ruling prices the high Ts cost considerably more per ton than standard T sections.

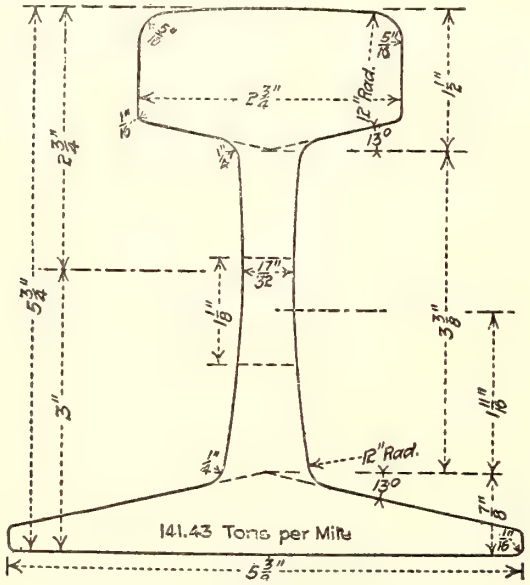


FIG. 5.—OPEN-HEARTH SECTION

When it became necessary to renew the tracks in Kingston, I looked over the experience of other companies and concluded that the T-rail was in every way more desirable than the grooved or girder rail and proceeded accordingly. To make sure, we laid an experimental piece of track, using 90-lb. A. S. C. E. standard rail. This gave such good results that we placed an order for several hundred tons in 60-ft. lengths with a view to extending the construction. After the rails were delivered a bitter opposition was engineered by interests which formerly owned one of our roads and who seem to be sore because we have been successful. It was argued that if, when they built the road, it was necessary to use an iron lip, that unless we used the iron lip, ruts would form along the track. The only difficulty about this point was that it was not necessary, in the first place, to use any iron lip, because experience proves that there is no greater tendency for a rut to form along a T-rail than along the outer edges of a grooved or girder rail. They also used letters from city engineers of New York, Brooklyn, and Albany, stating that no T-rails were used in those cities. This argument we easily answered by asking our opponents to

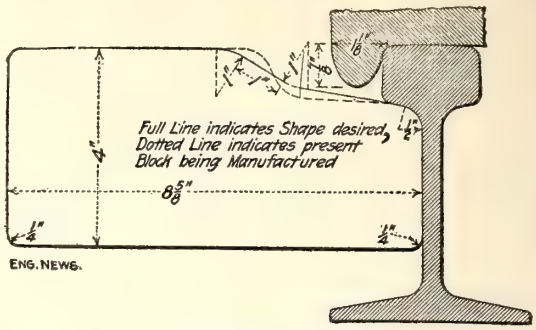


FIG. 4.—TYPE OF CONSTRUCTION, FT. WAYNE, IND.

produce letters from cities where T-rails had been used. The fact that they produced letters from places where they had not been used was certainly no evidence against their use. After a lot of misrepresentation and personal abuse in their newspaper we finally got consent from the city to lay T-rails in two rather important streets, with the stipulation that if, after the end of a year, the city authorities so desired we would remove them and substitute the old rails. As an instance of the unfairness of the opposition, this proposed trial was fought bitterly. They well knew that if the construction was tried it would make good. Another feature which had to be overcome was a bill introduced in the Legislature intended to prohibit the use of the T-rail entirely in the State of New York. Whether or not this bill had any connection with the Kingston opposition or was merely a coincidence, I am unable to say. In any event, the bill was easily defeated and was never reported from the committee.

Since the installation of this 90-lb. standard construction in the two streets referred to, we have been granted permanent permission without any restrictions to use this 90-lb. standard T-rail in Broadway, Main Street and Fair Street, which are

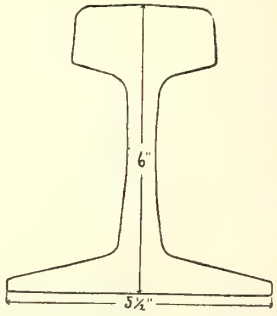


FIG. 6.—THE DUDLEY 100-LB. T-SECTION

the most important streets in the city. The opposition has simply made itself ridiculous and is now considered a joke.

The construction first proposed (published in the Street Railroad Journal of Jan. 26, 1907) has been amended as shown in Fig. 4; that is, we are using a special form of brick outside the rail as well as inside. It will be noted that on the inside we will go up on the head of the rail to such a distance as to barely give room enough for our wheel flange. In this way the obstruction in the street will be much less than though the brick projected under the head of the rail and very much less than any form of grooved or girder rail. I might say in passing, however, that it is now standard practice to use only ordinary brick. On the outside the brick is merely laid flush with the rail, and on the inside it is tucked under the head as shown in Fig. 5, which illustrates the construction now standard in the streets of Milwaukee.

The "nose" brick extensively used heretofore has not been entirely satisfactory. By referring to Fig. 4, which illustrates the type of construction adopted in Fort Wayne, it will be noted

that the designer desired a somewhat different form than the market provided. We think that the kind we are having made for Kingston, illustrated in Fig. 3, combines many desirable features. In the event of heavier flanges being used experience teaches that they will cut their own way in the brick and will not crack the pavement badly.

In regard to what standard section to use we have found the 90-lb. A. S. C. E. most desirable. It would seem though that the open-hearth section used by the Union Pacific and the Southern Pacific Railroads (Fig. 5) would be most desirable since it has somewhat more height and better proportions gener-

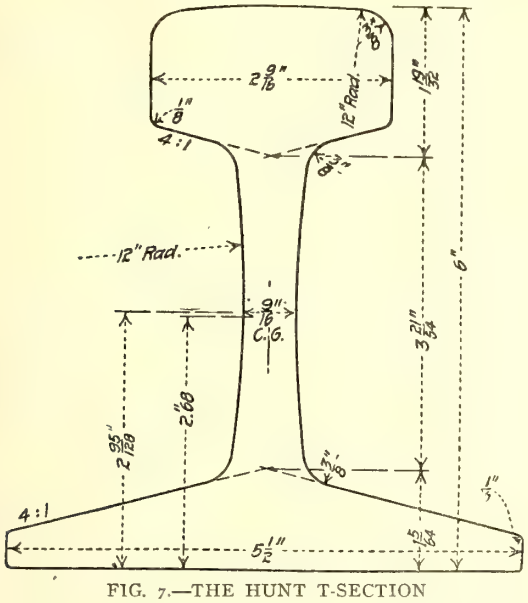


FIG. 7.—THE HUNT T-SECTION

ally. If heavier rail than the 90-lb. is used the Dudley 100-lb., section Fig. 6 would be excellent as would also the section designed by Capt. R. W. Hunt.

By referring to the following publications admirable types of construction will be found illustrated.

Tacoma, Washington.....Street Railway Journal, Sept. 7, 1907.
Kingston, N. Y.....Street Railway Journal, Jan. 26, 1907.
Indianapolis, Ind.....Electric Traction Weekly, Feb. 7, 1907.
Seattle, Wash.....Electric Railway Review, June 29, 1907.
Milwaukee, Wis.....Street Railway Journal, Sept. 7, 1907.
Montreal, Canada.....Street Railway Journal, Sept. 7, 1907.

The gist of the whole T-rail matter seems to be that street railway tracks are beginning to be built to serve the companies which build them and the patrons of these companies, rather than every Tom, Dick and Harry of a truckman who stubbornly insists on following the car tracks instead of staying out in the roadway where he belongs. If this driving along the tracks served any economic end it might be tolerated, but it does the truckman no good and interferes with the movement and comfortable transportation of countless thousands of more important people. It would seem absurd if it were not true that any one would argue in favor of having the tracks of a street railway reserved for the transportation of merchandise at the inconvenience and discomfort of human beings.

The horse car, the wagon on the track, slow speed, light equipment, grooved and girder rails bespeak the past. The electric car with the wagon in the roadway, high speed, heavy equipment on T-rails belongs to the present. If any man or body of men, either through ignorance or spite, endeavor to relegate any of you gentlemen to the past and, benightedly or spitefully, attempt to require you to continue grooved and girder rails in the face of present development, you will combat and overcome this ignorance and prejudice if you have a spark of manhood, and as "Angels of Light" will fight for and achieve T-rails, thus confounding these spirits of the Dark Ages.

NOTE: The article by Mr. Reel in the STREET RAILWAY JOURNAL of Jan. 26, 1907, includes a list of letters from city engineers throughout the country stating that they have adopted T-rails, explaining why they prefer them to the old grooved and girder types. The data on the subject were collected by Mr. Reel and presented at the January, 1907, meeting of the Street Railway Association of the State of New York.

MUNICIPAL OWNERSHIP IN GREAT BRITAIN AND IN THE UNITED STATES

BY W. J. CLARK

It is a great pleasure once more to address my old friends, the members of this association. Since we first met, some twenty years ago, you have accomplished more in producing local transportation facilities than has been done in all other countries of the world combined, thus promoting the public welfare, general progress and development of the country to an unprecedented degree. This brief statement in itself practically answers the question as to whether or not municipal ownership or private enterprise best serves public needs in that field where you have accomplished so much.

All virtues are not possessed by any particular class of mankind or are attendent upon any specific form of public policy; neither are all vices and shortcomings. Fewer serious evils exist, however, in connection with the development of public utilities by private enterprise in this country than are found connected with municipal ownership and operation either here or in its greatest stronghold, the British Kingdom. Comparison of municipal with private ownership of public utilities should naturally be made on economic grounds alone, based upon the actual results secured therefrom, for the worth of partially demonstrated theories is, of course, but speculative at best.

How impossible it is to treat thoroughly all that is covered by my text within the time allotted me here is best illustrated by stating that there will shortly appear a printed report of nearly three thousand pages upon municipal and private ownership made by a committee of which I have the honor to be a member. Yet this report, voluminous as it is, does not by any means exhaust the subject.

Contained in the report is much valuable information concerning certain municipally owned American gas, electric light and water supply plants that were investigated. It clearly demonstrates that with the exception of city water works, municipal ownership is not a success financially or otherwise, and even as regards water supply the showing made by the municipal plants was not so favorable from either a sanitary or financial standpoint as that of the company water works which were investigated. The baneful effects of political control and management appear in connection with the municipal plants investigated and are quite fully set forth in the report mentioned.

Turning to United States census bulletins of 1902 and 1903, giving statistics upon towns and cities of 8000 population or over, it is seen that the cost of their municipal water works was $508,469,415 and their estimated selling value is $499,925,742. The cost of municipal gas works is stated as $43,018,673; their selling value is estimated at $30,186,567. On municipal electric lighting plants the cost is stated as $10,670,954 and their estimated selling value is $13,614,064. No further comments on the last feature are necessary other than to say that the disinterested experts of the committee found great shrinkages in values from original costs on every municipal electric lighting plant which they investigated.

The same bulletins show that the estimated value of all municipal industrial enterprises in American towns and cities of 8000 population or over is $707,511,949. The annual revenue therefrom is stated as $60,725,802; the operating expenses as $28,352,317; earnings from operations, $31,955,581.

According to the same United States census reports the average rate of interest paid on municipal loans is 4.1 per cent, so from the earnings should be deducted $29,007,090 for interest, leaving an apparent net income of $2,948,491. If a depreciation of 5 per cent on the estimated value of the plants were allowed for, such depreciation would be $35,375,597, so that the actual deficit from operating such municipally owned plants would show as $32,427,106.

There are no municipally owned street railways in the United States, at least only one with a trifle of trackage. So on that industry in which you are most interested we must turn to the United Kingdom for information, and naturally you wish this feature treated more thoroughly than the other municipally owned public utilities. Before proceeding to do this, however, a glance should be given to the comparative development of the more important other public utilities in the United Kingdom and in this country.

In the United Kingdom there are about 1400 water supply undertakings, approximately 1100 of which are municipally owned and represent an investment of about $400,000,000. The

investment in the 300 company plants is about $250,000,000. In the United States there is a total of over 4000 water supply plants, about equally divided in ownership between municipalities and companies. The present investment of American municipalities in their water works is about $650,000,000, or the equivalent of the entire investment in water works of the United Kingdom.

There are a total of about 730 gas plants in the United Kingdom, of which 265 are municipally owned and have an investment of approximately $200,000,000. The 465 company plants have invested about $410,000,000. The total investment for gas plants in the Kingdom is, say, $610,000,000. There are about 1000 gas plants in the United States with an investment of nearly $1,000,000,000.

In the United Kingdom there are 268 municipally owned electric lighting plants with an approximate investment of $177,400,000. There are 206 company plants with an approximate investment of $110,000,000. Total investment of the Kingdom in electric lighting, $277,400,000. In the United States are about 4000 electric lighting stations representing an investment of over $1,000,000,000. The total kilowatt output of the American stations is some eight or nine times greater than that of the British stations, so it is seen at a glance that far greater practical results are secured from the American investment in the electric lighting plants than is the case in the United Kingdom.

It is obvious that the greatest advantages and benefits which the public derive from the existence of local transportation facilities are directly proportionate to the extent that these are available to it. This makes local travel possible at low rates of fare, and incident thereto, aids such important matters as public enlightenment through readier intercommunication, redistribution and scattering of congested population, improved sanitation makes the ownership of homes possible to the humblest, extends the area available for employment to the laborer and increases taxation revenues through the improvement and increased values of real estate. These are the most important economic features involved in the local transportation problem.

American progress in this respect has been accomplished by private enterprise without imposing financial burdens upon public treasuries or increasing local taxation. British development of local transportation has been hampered by the municipalities where undertaken by private enterprise or favored by every unfair means at their command when undertaken by the municipalities themselves at serious risk to and great expenditures from their treasuries have been accompanied by increased taxation.

Compare the results arising in the two countries from the widely varying policies that have been respectively followed.

In 1902, the last year when official figures thereon are available, the urban population of the United Kingdom was 29,144,726; that of the continental United States was 33,850,000 and this latter included smaller communities than in the former.

The total length of tramway track in the United Kingdom was 2336 miles or 1 mile of track for 12,476 of its urban population. At the same time there was only one car for each 3760 of the urban population. The United States then had 22,328 miles of electric railway track or 1 mile for 1516 of its urban population and 1 car for each 574 thereof. In short, the urban resident of the United States had comparatively eight and one-half times greater trackage facilities available to him for travel than had the urban resident of the United Kingdom and six and one-half times the number of cars.

From 1890 to 1902 the increase of trackage in the United Kingdom was but approximately 56 per cent. During the same period the corresponding increase in the United States was about 200 per cent.

From 1902 to 1906 the length of trackage in the United Kingdom had increased 1256 miles. In the United States during the same period the increase was approximately 12,500 miles or ten times greater than in the United Kingdom.

In 1902 there were two cities of over 100,000 population in the United Kingdom without street railways. In the United States there were none.

In the United Kingdom there were seven cities or from 50,000 to 100,000 population without street railways. In the United States there were none.

In the United Kingdom there were thirty-nine cities of from 25,000 to 50,000 population without street railways. In the United States there were none.

In the United Kingdom there were 295 communities of from 8000 to 25,000 population without street railways. In the United States there were twenty-one.

Next in importance to the creation of transportation lines is, of course, the service rendered thereon. In the United Kingdom, where the greatest of handicaps and hardships have been placed upon the local transportation companies and where the municipalities have acquired the cream of the properties with the densest traffic, the average headway between cars is at present about one-third more frequent upon the company owned lines than upon those operated by municipalities.

Contrast British conditions of service with those in America.

In 1902, the last year when full comparative figures are available, the total car miles run upon the tramways of the entire Kingdom was 145,127,423. Upon the local transportation lines of America, 1,144,430,466 car miles, or nearly eight times a greater number were run to accommodate an urban population but a trifle larger than that of the Kingdom.

A total of 1,394,452,983 passengers were carried on the tramways of the United Kingdom. On the street railways of the United States 5,521,509,521 passengers were carried. Of this last, however, 1,062,403,392 were on free transfers, a number practically equivalent to 90 per cent of the entire number carried in the United Kingdom.

On the basis of passengers carried per year the American street railway car averaged but slightly more than one-half the number carried by the tramcars of the United Kingdom. That is, the American car averaged 93,585 passengers per year, as against 182,463 passengers per year in the United Kingdom.

Now as to comparative costs of service rendered:

Making due allowance for the more favored conditions surrounding the existence and operation of British municipal properties the rates of fare upon British company systems are comparable with those of the municipalities. On this most important feature it is therefore demonstrated that despite all of the disadvantages under which they labor, British tramway companies are doing comparatively as much for the public on low fares as are the municipalities.

The average receipts per passenger on all tramways in the United Kingdom were 2.25 cents as against 3.76 cents in the United States. However, 9.65 passengers rode per car-mile in the United Kingdom as against 5.2 passengers per car-mile in the United States.

Gross receipts averaged 21.81 cents per car-mile in the United Kingdom as against 19.55 cents per car-mile in the United States.

The British passengers paid about 60 per cent. of the rate of fare paid by the American passenger, but as above stated, the facilities for travel available to him were only from 12 per cent. to 15 per cent. of those enjoyed by the American urban resident.

From 1890 to 1902 the increase in length of local transportation lines in the United Kingdom was but 536 miles. Similar increase in the United States was 10,755, or nearly twenty times as great. During the same period the average fare per passenger in the United Kingdom had decreased about 33 per cent. In the United States, despite rapidly increasing cost of essentials to operation and greatly increased facilities, it had yet decreased about 26 per cent.

It should be appreciated that it costs far more to operate local transportation service in America than in the United Kingdom. Rates of wages in this particular industry are at least double in this country those paid for similar purposes abroad. As the result of fairer treatment before the courts the rate of damage per car-mile for personal injuries in the British Kingdom averages about one-third of what is paid by American companies. As nearly as can be estimated the operation of an American street railway costs about 65 per cent more than should a similarly situated property in the United Kingdom. So it is seen that considering the cost to them of service rendered by American street railway systems the rates of fare charged are comparatively as low as those prevailing in the United Kingdom, while far greater facilities are afforded the public.

From what has been stated it is apparent that the legitimate objects for creating and operating local transportation lines have been more thoroughly met by American private practice than has been accomplished through British municipal methods. But there are other phases of the situation which should be considered.

Prominent among the arguments which are always advanced in favor of municipal ownership and operation are the alleged

financial advantages which accrue to municipal treasuries therefrom. Unquestionably there are a few instances where municipally owned utilities have brought an actual return from their operation to municipal treasuries. It would be strange indeed if this were not so, but these cases are rare and I have never known an instance where, if in the statements of their capital and operating expenditures due allowance were made for assistance rendered them toward a favorable showing, from other municipal accounts and branches of the city government, the showings would not be far less favorable.

Investigation of specific municipally owned undertakings and the results derived from their operation are of little value in determining the entire question of municipal ownership, or of direct value, unless permission were given to get at the actual basis of, and details followed in, their accounting. I have never known such permission to be granted in the United Kingdom. In fact, many pages of sworn testimony exist in the reports of parliamentary hearings which show that even the government auditors do not attempt to see if expenditures of municipalities are distributed to proper accounts.

The most honest, best intentioned municipal officials of the Kingdom unconsciously, perhaps, permit their public utilities to receive most important financial benefits from other branches of the city government, whose expenses are paid for out of general public funds, or they knowingly adopt a policy of this character and carry it to the extreme, considering it moral from the standpoint of municipal practice, although these same men would condemn anything of the sort attempted in ordinary private business. For these, and kindred reasons, the best way in which to obtain some light on the net financial results derived by the municipalities from municipal ownership in the Kingdom is to inspect their financial condition before and after municipal ownership became a dominating factor therein, drawing some incidental comparisons with American conditions.

Municipal ownership in the United Kingdom has brought burdens of local debt and taxation which are hardly grasped by the average American. To appreciate fully how onerous these burdens are, a glance should be given to those other burdens of debt and taxation which the British citizen bears in connection with his national government before the other weighs down upon him.

In 1905 the national debt of the United Kingdom averaged $91.68 per capita of its population. That of the United States was $11.91 per capita. The expenses of the national government for the United Kingdom averaged $13.80 per capita. In the United States this was $6.67 per capita.

Turning now to municipal indebtedness and taxation, the present amount of the local indebtedness of the United Kingdom is probably not far from $2,800,000,000, or say approximately $98.00 per capita of the urban population. About one-half of this has been incurred for municipal trading enterprises. In 1903 the amount of such indebtedness was $2,200,000,000, or approximately $79.00 per capita of urban population. In 1902 the total amount of local indebtedness of the United States was $1,439,504,991, or $43.53 per capita of urban population.

In contrasting the local indebtedness of the respective countries, and their expenditures for local government, it should not be forgotten that America has and does expend for school property and educational purposes, enormous sums, while such expenditures in the United Kingdom are comparatively small. The value of school houses in the United States was approximately $450,000,000 in 1902. In the United Kingdom the value of similar property was about one-third that figure. It should also be remembered that in rapidly growing American cities the legitimate demands for improvements and consequent expenditures should be far greater than in old, well established British communities.

According to official estimates in 1902, the value of the realizable assets of British municipalities exceeded their indebtedness by approximately 23 per cent. The realizable assets of American municipalities exceeded their indebtedness by about 40 per cent.

The United States Census Bureau estimates that in this country for each $100 of national wealth there is public indebtedness of every name and nature amounting to only $2.85. In the United Kingdom corresponding debt averages $10.50 for each $100 of national wealth.

In 1880 the total local debt of the United Kingdom was $684,670,350, or about $19.56 per capita of the total population. In 1902 it was approximately $2,200,000,000, or about $52.64 per capita, showing a total increase in amount of $1,504,740,825, or approximately 219 per cent, an increase per capita of $33.08 or 169 per cent. In 1880 the total local indebtedness of the United States was $724,427,848, or $14.44 per capita of the total population. In 1902 it was $1,439,504,991, or $18.24 per capita, showing a total increase of $15,077,143, or 97 per cent, and an increase per capita of only $3.80 or 26⅓ per cent. British local indebtedness is now increasing at the rate of about $150,000,000 per year, or about $3.25 per capita of the entire population. The local indebtedness of the United States is increasing at the rate of about $70,000,000 per year, or less than 90 cents per capita of the entire population.

In the fiscal year of 1881-2 the total expenditures for local government in the United Kingdom, representing the amounts raised from taxation and received from the national government for local purposes, also raised by taxation, amounted to $333,327,495, or $9.45 per capita of the entire population. In the fiscal year of 1902-3 the total expenditures for local government were $760,825,000, or $18 per capita of the entire population, showing an increase in total of $427,497,505, slightly over 128 per cent and per capita of $8.55, or say 90 per cent. During the same period the rate of taxation upon assessed valuation of property had increased over 60 per cent, and the rate of assessment had been increased.

In the same period the increase in amount raised by local taxation in the United States averaged but 45 per cent per capita; and the rate upon assessed valuation had increased but 12 per cent, while rates of assessment had decreased.

These figures conclusively demonstrate the fallacy of the theory that British municipal ownership has relieved local taxation and improved the financial condition of municipalities. The proof is all to the contrary.

No statistics exist which fully cover all the public utility undertakings of local authorities throughout the Kingdom, but the parliamentary return of 1902, "Municipal Corporations Reproductive Undertakings of England and Wales," shows for that part of the Kingdom alone the following:

The total investment in such undertakings was		£121,172,372
Amount of loans repaid	£16,246,579	
Amount of sinking funds	4,644,835	20,891,414
Amount unpaid for which provision has not been made		£100,280,958
Total annual receipts from operation		£ 13,040,711
Operating expenses	£ 8,228,706	
Interest paid	2,975,906	
Set apart for depreciation	193,274	£ 11,397,886
Official statement of earnings from operation or about 1.36% on the total capital invested and 1.64% on that not paid or provided for		£ 1,642,825
Loans were repaid to the amount of		£ 1,264,544
Or 1.04% on the total capital investment.		
Showing a net profit of only		£ 378,281

It should be noted that small as the showing of profitable return upon an enormous investment thus is, less than one-fifth of one per cent has been allowed for depreciation in making that showing. If an allowance of five per cent had been made for depreciation, a figure more nearly correct, the amount which should have been deducted for this important item would be £6,058,618, instead of £193,274, as shown by the parliamentary return. Consequently instead of there having been earnings from operation there was properly a deficit of £4,222,519, or about 3.45 per cent on the entire capital investment of 4.22 per cent on the remaining investment. It should be observed in this connection also that the actual deficit would be about three and one-half times as great as the sums annually set aside for repayment of loans. These actual conditions, despite all complicated and misleading systems of accounting, must ultimately show in the general financial condition of the municipalities.

A favorite financial argument of the municipal ownership advocates is that owing to the superior credit of municipalities they can more readily secure capital for the creation of public utilities than can be done by companies, and upon a more favorable basis, with less risk to the investors in securities. This should seemingly be so, but let us note what the present selling values of British municipal securities are, bearing in mind that none were issued below par. The London stock exchange daily official list for Oct. 1, 1907, contains quotations upon 151 municipal securities. Of these nine were quoted at par or above; 22 from 95 to 99; 9 from 90 to 94; 60 from 85 to 89; 38 from 80 to 84; 8 from 75 to 79; 4 from 70 to 74; 1 below 60.

Among these are some remarkable quotations.

Certain London securities at	72 to 74
Certain Glasgow securities at	77 to 79
Certain Liverpool securities at	74 to 76
Certain Manchester securities at	86 to 88

It is thus seen that British investors have suffered enormous losses from the shrinkage in values of municipal securities, and that the credit of the municipalities consequently has been impaired.

There is an important feature of municipal finance involved in this connection which is generally overlooked. In all cases where Parliament has authorized municipalities to make loans for public utility purposes, it is provided that a sinking fund must be set aside to pay off ultimately the indebtedness. Rarely, however, is any provision made concerning the manner in which such sinking funds are to be invested and municipal authorities consequently handle them in accordance with their own unrestricted ideas. It should be said also that parliament in fixing the amounts to be contributed to sinking funds, and the time for their completion, rarely considers that a good share of the physical property of any public utility must be replaced one or more times before the original debt has been offset through the workings of the sinking fund.

Almost invariably these sinking funds are invested in municipal securities, and these frequently some issue of the same municipality for other public utility purposes. Consequently shrinkage in the value of municipal securities has seriously reduced the actual amount of these existing sinking funds, yet so far as I have been able to ascertain in all official statements thereon, this fact has not been stated. As regards municipalities investing sinking funds in their own securities, it is needless to remark that this is not in accordance with sound financial practice. It is clearly to be seen that the insufficience of sinking funds to care for the original cost of properties, plus the additions required for renewal of certain portions thereof which have not been provided for, will ultimately create a financial condition thereon far different from that originally expected.

Once more dealing more directly with that particular public utility in which you are most interested at the latest period when official data is available thereon.

The last parliamentary report on the tramways and light railways of the United Kingdom, covering the fiscal year ending Mar. 31, 1906, so far as municipal properties are concerned, and that ending Dec. 31, 1905, for the tramway companies, shows that the municipalities had only 2,499 miles of track. On a basis of $5.00 to the British sovereign, the existing capital obligations of the British municipal tramways are shown as $177,199,735, averaging say $70,840 per mile of track.

As is well known, in nearly all of the larger British cities the municipal authorities have acquired previously existing tramway systems owned by companies. This under a form of legalized confiscation authorized by the "Scrap Iron" Clause, so called, in the Tramway Act of 1870. As a result, only $14,896,745 of the total capital expenditures made by the municipal tramways is shown as being paid for all the pioneer work done and properties created by the tramway companies, that have since been acquired by the municipalities. Had British municipalities been obliged to pay for what had preceded them in tramway work and investment, proportionately to what has been done in this country, their total capital investment in tramways would now be at least $250,000,000.

In connection with the development of British tramways it has been necessary to do much street widening, which should properly be charged to tramway capital accounts. Tramway companies there have been obliged to pay for such expenditures. But it is rare where municipal tramways have had to assume much of such expense. The total charge to the capital accounts of the municipal tramways for this item is only $3,750,000 for the entire Kingdom. It is an established fact, however, that in London alone about $20,000,000 was expended for street widening on account of the tramways, which has never appeared in the tramway capital account. At Liverpool the same condition exists to the extent of about $5,000,000.

If all the British municipally-owned tramways bore a pro rata charge for street widenings to that imposed on the London United Tramways Company, Ltd., there should be added to the total of their capital account about $70,000,000, which has been assumed as ordinary local indebtedness, or partially paid for out of general local funds raised by taxation. To put the situation more clearly, British municipalities have apparently confiscated about $70,000,000 to $80,000,000 in tramway values, and in stating the capital investment in their municipal tramways have omitted to say that $70,000,000, which should have been included thereon, has gone into general public improvement or similar accounts. Consequently, had British municipalities proceeded to acquire their present 2499 miles of tramway properties on the same basis as British and American companies have been obliged to follow, their total capitalization would easily reach $330,000,000, or say $132,000 per mile of track. The average per mile of track in the United States of stocks and bonds issued against street and elevated railways is less than $107,000 per mile of track.

The results from operation of British municipal tramways during the fiscal year ending 1906 were, according to official statements:

Gross receipts		$34,267,430
Operating expenses		21,618,670
Net receipts		$12,648,760
Rental of leased lines, etc.		510,410
Income from operation		$12,138,350
Interest charges	$4,201,125	
Reserve for renewal and depreciation	3,118,085	7,319,210
Net income		$4,819,140

which was applied as follows:

To repayment of debt and sinking funds	$3,316,680
Relief of taxation	1,029,905
Other matters and balance carried forward	482,935

Under the whole theory of British municipal ownership finance, ample allowance for depreciation must be made and full contributions to sinking funds maintained, or the theory absolutely fails in practice.

Inspection of the above figures reveals the fact that only 1.8 per cent on the capital investment has been allowed for depreciation and renewal. If an allowance for this of 5 per cent had been made, an addition to the renewal and depreciation fund of $5,667,840 is necessary, thus changing the net income as stated to a deficit of over $800,000, preventing the making of legitimate contributions to sinking funds or for other purposes.

If we take into account, as we should, that $70,000,000, which should have been charged to tramway capital account, has gone to general municipal accounts, and estimate the interest on this capital at 3 per cent, it is seen that at least $2,100,000 should be added to the deficit resulting from the operation of tramways as shown above. It is thus apparent that British municipal tramways, taken as a whole, are operated at a serious actual loss, and that excepting in a few specific cases, payments to sinking funds or to relieve taxation have not been actually earned.

Based upon the official figures, which have been shown to be entirely unreliable, all the financial returns received by the municipalities of the United Kingdom from the operation of both company and municipal tramways, including local taxation thereon, repayment of debt or contributions to sinking fund, reserve, depreciation and renewal funds, and relief to local taxation, etc., average but approximately $925 per mile of track annually. From the closest approximation which can be made in the United States, the average financial benefits which its municipalities receive from the taxation of and other contributions from street railways, and from taxation of their securities, the average is approximately $1,295 per mile of track annually, or $370 per mile of track greater than that shown as similarly received by the municipalities of Britain.

The last remaining important economic advantage claimed for municipal ownership is improvement in the conditions of the laboring man, and with this is always coupled the statement that there are no politics in connection with British municipal affairs, and no political dangers involved by greatly increasing the number of municipal employes. Rates of wages have increased and hours of labor have greatly decreased in connection with the operation of public utilities during recent years, both in this country and in the British Kingdom. It is questionable if these net benefits to labor since the introduction of electricity have been greater on British municipal tramways than upon American street railways. There is no question, however, but that British municipal ownership has unfairly created a class of privileged municipal employes at public expense, and to the detriment of their fellow laborers not employed by municipalities. At least this has been so stated to me by prominent American and British labor leaders.

As to whether or not a grave public danger exists in connection with the creation of such a class, is best illustrated by reading extracts from one of the circulars of the Municipal Em-

ployes Association, advancing arguments for increasing its membership:

Because unity is strength.
Because the officers of this Association have worked for years for a municipal body, and therefore know the way to approach and deal with local authorities for you better than others who have never worked for a public body.
Because it is estimated that there are nearly 2,000,000 municipal employes in the United Kingdom. What could they not do for themselves, if all together?
Because concessions, estimated to cost the municipal authorities upwards of £2,000,000 per annum, have been obtained by us.
Because we have never been defeated by a municipal body yet. If they decline a request to-day we are up and at them again to-morrow.
Because there is no need for strikes with us. We can get what we want without them, if we are united, by returning to the Council men who are in favor of fair conditions of employment.
Because we get concessions; not shout and rave about them.

A still greater political and public danger rests in the Association of Municipal Corporations and Town Clerks, and kindred organizations, which are more powerful in their influence on parliamentary legislation than any American party or political ring has ever been in national or state legislation. The votes of the 2,000,000 municipal employes mentioned above are practically controlled by them. The town clerks and other prominent salaried officials of the municipalities dominate the policy of their association. These men also generally dominate the parliamentary politics in their respective localities, and members of parliament rarely reside in the localities from which they are elected. As a result of this condition, the political future of the great majority of parliamentary members is principally dependent upon the attitude towards them of these associations. In addition to this, cash, legal, engineering and other talent are contributed by the members of the association for the services of some specific member in promoting or opposing legislation, affecting only the particular locality of that member.

Time does not permit me to go into details of how these influences have placed upon private utility companies the unfairest of burdens in securing franchise rights or in conducting their business when these have been secured. Nor how these influences have obstructed progress to the great detriment of the public at large. The unwise investment of enormous public funds with the attendant evils brought about by these influences has already been stated.

The American visitor who has been royally entertained by high-class, non-salaried elective municipal officials, and who has not gone deeply into the entire system of British municipal government, may doubt the existence of the situation described; but thorough investigation will reveal it in even more serious form than is here stated.

The real motives which have animated the great power behind the British municipal ownership movement, have emanated from those who expected personal benefit therefrom, and they are as intensely selfish as those which have ever led to the organization of a private company or have dictated the action of professional politicians in this country.

REPORT OF COMMITTEE ON HEAVY ELECTRIC TRACTION

BY CALVERT TOWNLEY (Chairman), E. B. KATTE, L. B. STILLWELL

The scope of your committee's work, as suggested in the committee's own report of last year, included mainly the consideration of such questions pertaining to heavy electric traction as might from time to time be referred to it by the association. Fortunately, such references have not seemed necessary to your officers during the past year, and therefore your committee is not called upon to report its consequent findings.

The progress of electrification has been considerable, and the service required from electrified lines widely varied. Owing to this latter fact, and to the rapidly developing state of the art, it is as yet rather early to attempt to establish new standards, and your committee is not prepared to recommend such.

The more important electric railroad projects begun or materially advanced during the past year have all been bulletined, and many of them described in the technical press. A review of same would be out of place here, but it may be of interest to summarize these in a brief list, which is therefore below appended.

CONTINUOUS CURRENT 500 TO 600 VOLT INSTALLATIONS

New York Central & Hudson River Railroad, New York City.—This noteworthy installation, which has been in progress for some years, and which comprises 35 100-ton locomotives, and 131 multiple unit cars, has been practically completed and is in successful operation.

Detroit River Tunnel Company, Detroit, Mich.—Six 100-ton locomotives.

United Railways, Portland, Ore.—One 35-ton locomotive.

Boston Elevated Railway Company, Boston, Mass.—This company, which has operated heavy elevated service for a number of years, has under construction 308 160-hp motors for use as double equipments.

Metropolitan West Side Railway Co., Chicago, Ill.—Two hundred and twenty-eight 160-hp power motors have been added to the previous equipment of this company's motor power for use with multiple unit control as double equipments.

Philadelphia & Western Railroad, Philadelphia, Pa.—One hundred cars, each equipped with four 125-hp power motors.

Brooklyn Rapid Transit Co., Brooklyn, N. Y.—This company has added to its rolling stock 100 elevated cars, each equipped with two 200-hp motors with multiple unit control.

West Jersey & Seashore Railroad (Pennsylvania Road), Camden, N. J.—Eighty cars, each equipped with two 200-hp motors.

Philadelphia Rapid Transit Co., Philadelphia, Pa.—This company has added to its equipment 170 125-hp motors for use in two-motor equipments.

The Hudson Companies, New York, N. Y.—Fifty cars, each equipped with two 170-hp power motors.

Buffalo, Lockport & Rochester Railway, Rochester, N. Y.—Nineteen cars, equipped with four 75-hp motors each.

Texas Traction Company.—Fifteen cars, each equipped with four 75-hp motors.

West Shore Railroad Company (Oneida Railway Company), Utica, N. Y.—Fifteen cars, each equipped with four 75-hp motors.

Pittsburg, Harmony, Butler & Newcastle Railway Company.—Twelve cars, each equipped with four 75-hp motors. This equipment is noteworthy as contemplating the use of 1200 volts on the trolley, two 600-volt motors being connected in series.

Buffalo & Lake Erie Traction Co., Buffalo, N. Y.—Eight cars, each equipped with four 100-hp motors.

SINGLE-PHASE ALTERNATING CURRENT INSTALLATIONS

New York, New Haven & Hartford Railway Company, New York City.—This installation, which has been in progress for the past two years, has been practically completed and is in successful operation. It comprises 35 90-ton locomotives operating both from 11,000-volt, single-phase trolley and a 650-volt continuous current supplied from the third rail.

Spokane & Inland Railway, Spokane, Wash.—This installation comprises 14 locomotives, six equipped each with four 100-hp motors and eight equipped each with four 75-hp motors; also 21 passenger cars, each equipped with four 100-hp motors. This road is operating partly from 6600-volt trolley and partly from a continuous current. Length of track, 146 miles.

Sarnia Tunnel.—Five 62-ton locomotives; trolley voltage, 3300 volts.

Illinois Traction System, Springfield, Ill.—One 50-ton locomotive and eleven cars, each equipped with four 75-hp motors; trolley voltage, 3300.

Erie Railroad, Northern New York.—Six cars, each equipped with our 100 hp motors; trolley voltage, 11,000. Length of track, 34 miles.

Washington, Baltimore & Annapolis Railway Company, Baltimore, Md.—This equipment comprises 21 cars, each equipped with four 125-hp motors; also four cars each equipped with two 125-hp motors; trolley voltage, 6600.

Richmond & Chesapeake Bay Railway Company, Richmond, Va.—Four cars, each equipped with four 125-hp motors; trolley voltage, 6600.

POLYPHASE INSTALLATIONS

Great Northern Railroad, Cascade Tunnel, Washington.—This equipment will comprise four locomotives, each of 100 tons, to be operated on a 3000-volt, three-phase alternating current. This installation will doubtless be watched with great interest and will give an opportunity of demonstrating the fact regarding the advantages for and objections to polyphase currents for heavy railroad use.

CONTINUED CURRENT 1200-VOLT INSTALLATIONS

Southern Pacific Company, Oakland, Cal.—This equipment will comprise 44 cars, each to be equipped with 125-hp motors

to be operated continuously two in series on 1200 volts. There will also be forty trail car equipments.

Indianapolis & Louisville Railway.—Ten cars, each to be equipped with four 75-hp motors connected two in series for 1200-volt operation.

Much interest has been attracted to the investigations of the Pennsylvania Railroad, who are preparing to equip their new New York City Terminal and the tunnels connecting Manhattan Island with New Jersey and with Long Island by electricity. For the purposes of demonstrating the various possibilities open to them they have arranged to test both large continuous current and large alternating current locomotives, that comprising the greatest novelty being a 140-ton 15-cycle, single-phase alternating current locomotive for operation from 11,000-volt trolley.

REPORT OF THE COMMITTEE ON INSURANCE

BY H. J. DAVIES (Chairman), G. L. ESTERBROOK, A. H. FORD, CHAS. O. KRUGER, R. B. STEARNS

Your Insurance Committee has held three meetings since its appointment a year ago, has sent one circular-letter (with data-sheet No. 17) to every member of the association, and to other street railway companies, and has analyzed the data received in response thereto. The filling out of the data-sheet involved considerable work, and for this reason, as well as because the subject of insurance still receives less attention from street railway companies than any other part of their business, the number of blanks returned was much smaller than the committee had hoped to receive.

The seventy odd reports received show insurance premiums amounting to more than $3,000,000, losses of $1,482,600, and payments by the insurance companies of $1,360,000 in adjustment of the losses, or 45 per cent of the premiums paid, indicating that, while rates on many large properties have been reduced, there is still considerable profit in the business.

A large part of the cost of conducting insurance business consists of commissions paid to agents, brokers and solicitors. It is evident from these figures that if this item of expense could be eliminated, either by co-operation among traction companies mutually to insure their own properties, or by arrangement with existing insurance companies to do the business directly with the traction companies without the intervention of middlemen, a substantial additional saving in premiums might be obtained.

Of course, if full reports had been received from all the members of the association, the ratio of loss to premiums might have been greater. On the other hand, it might have been smaller. Some of the companies that reported gave figures for only a part of the period called for by the blank. If even these companies had made full report for each of the seven years the result indicated might have been changed. It may be that all the losses suffered by these companies are not included in their reports, but the large losses suffered by the Baltimore, Cleveland and St. Louis companies within that period are included and these three losses alone amounted to more than $800,000.

Some of the companies reporting are setting aside from their earnings an insurance reserve or fund in lieu of insurance or in addition to insurance. The amounts so set aside are not included in the premiums on which the foregoing calculations are based. If they were included the percentage of loss would be smaller. Members that did not fill out data sheet No. 17 are urged to do so and to mail it to Secretary Swenson as soon as possible, so that the association may have the information on file for the benefit of its members. The committee recommends that the secretary of the association send out a blank soon after the close of each calendar year, asking the members to give him the data called for by questions 5, 6 and 7 of this year's data sheet and that he tabulate the information received, so that the association may know at all times the gross cost of insurance, the losses and the causes of fires. It was very difficult for members to get together all the data asked for by the data sheet; it will be comparatively easy for them to make a report for a single year at a time.

Your committee received in response to its circular letter more than fifty insurance forms or descriptions of property. A sub-committee was appointed to make examination and study of these and to prepare a general form that would aid the members of the association in negotiating for insurance. This work has not yet been completed.

The reports show that the causes of fires have been various—some from lightning, some from defective wiring, some from short-circuits in cars, some from electric heaters, one from the upsetting of a car stove caused by the derailment of a car, one from placing wet horse blankets in an armature oven to dry, and some from other causes. Most of the fires started in cars and a large proportion of the car fires occurred in cars in service on the road. Several of the fires reported occurred in theaters or other park properties, and one was in a storage warehouse owned, but not occupied, by the street railway company that reported the fire. The losses from these fires are included in our statement of losses, although the properties destroyed or damaged were not, strictly speaking, street railway properties.

After the adjournment of the Columbus convention President Beggs appointed a committee on car house construction to consider and make recommendations upon the subject of the building of car houses, with especial reference to the prevention of fires, so as to carry out more effectually the suggestions of the insurance committee in its report of last year in regard to the importance of the adoption of methods of protecting the buildings and rolling stock of street railway companies from destruction or damage by fire. That committee has done most excellent work in collaboration with a similar committee of the National Fire Protection Association.

Responding to suggestions made to the association by representatives of the old-line insurance companies at the Columbus convention your committee invited the Eastern and Western associations of those companies to meet with it in New York at the office of this association on Sept. 23. The meeting was attended by H. A. Smith, vice-president of the National Fire Insurance Company, Hartford, Conn.; C. G. Smith, secretary of the German-American Insurance Company, New York; C. H. Holaman, assistant manager of the Commercial Union Insurance Company, Hartford, Conn.; E. H. A. Correa, vice-president of the Home Insurance Company, New York; Fred. S. James, Western manager of the National Fire Insurance Company, Chicago; Ed. Milligan, vice-president of the Phœnix Insurance Company, Hartford, Conn.; J. W. G. Coffran, Western manager of the Hartford Insurance Company, Chicago; Wm. Hare, assistant manager of the Norwich Union Fire Insurance Society, New York; J. H. Stoddard, general agent of the New York Underwriters, New York; Bruce E. Loomis, manager of the Fire Underwriters' Electrical Bureau, of New York, and three members of your committee.

The insurance committee of this association has from the start urged that the prevention of fires was more important and more economical financially than the collection of losses. While the work of your committee has brought about reductions in rates and a more intelligent and careful consideration by traction managers of the subjects of insurance against fire losses and the prevention of such losses, the effect of the work, it is believed, has been greater upon the insurance companies than upon the traction companies. This was made manifest at the meeting of your committee last month. The old-line insurance companies have lately been giving much attention to traction properties. They are coming to look upon them as less hazardous than they had supposed them to be. They have recommended improvements in the construction and protection of many street railway plants. They are treating our properties in a class by themselves. They have done a great deal to educate street railway companies to guard their properties against damage by fire and a great deal more to educate themselves on this subject and on the subject of the cost of insuring such properties as a class. They admit that mistakes have been made in the insurance business, as in all businesses; that the business has been too much localized; that it has been difficult to break away from century-old customs and to adopt more modern methods.

The old-line insurance companies propose a more intelligent and expert inspection of traction properties. The representatives of the companies present at the September meeting of your committee stated that they were ready and able to quote rates which were fair and which they could convince us were fair; that they were ready to offer inspection and supervision that could not be excelled; that they had substantially completed a new schedule for rating street railway properties which would make like rates upon like properties throughout the country

that could not be seriously criticized; that they had made arrangements for an efficient inspection service; that they were devoting more money, more thought and more time to inspection than in former years and that they much preferred a low rate with a sure though small margin of profit to a high rate with big margins in certain years and big losses in other years; that they proposed to keep regularly employed a bureau of experts under the direction of Bruce E. Loomis to advise street railway companies in regard to construction of buildings and in regard to devices and means for preventing fires and minimizing losses; that the rates made would include the services of this expert bureau, which would take the place of the numerous inspectors heretofore sent out by insurance companies, so that there should not be variations in recommendations and so that rates on like properties would be uniform.

Your committee is convinced that these insurance companies are sincere in their statements of willingness to co-operate with the traction companies in improving their risks and to write insurance at rates that will give them a comparatively small margin of profit. In return for the high-class inspection and supervision and this reduction in rates they hope to obtain substantially all the insurance of traction companies and they think that, with their new machinery and organization, they will be able to furnish good service at a cost lower than the street railway companies can obtain by any other instrumentality.

Your committee is of the opinion that while this association should acknowledge obligation to the stock insurance companies for their present lively interest in the traction insurance business and for the efforts they are making to so improve street railway properties as to enable them to reduce rates, the street railway companies of the country should so construct, equip and protect their properties as to invite competition in insurance and should be prepared to carry all of their own insurance whenever rates are too high and prepared at once and at all times to carry at least enough of their own insurance to make the rates. To this end we recommend most earnestly your support of the insurance companies that have been organized by about thirty of the traction companies. This association ought to have the means of knowing, through its own bureau or through a bureau maintained by an insurance company or insurance companies organized and conducted in the interest solely of street railway companies, and not for profit, the exact cost of insurance and the best methods of construction and protection, so as to be able to give intelligent consideration to the rates charged or asked by the old-line companies or by other companies, and, if they appear exorbitant, to be able to present reasons why they should be lower.

The action of the stock companies since you began the consideration of the subject of insurance three years ago in reducing rates, especially to the companies that have been most active in forming organizations for mutual insurance at cost, indicates, first, the effectiveness of the work of your committee, and, secondly, a determination on the part of the old-line companies to retain the business of the traction companies, even if they have to do some of it at a loss. This is emphasized by their statement to your committee that rates ridiculously low—so low as to show no possibility of profit—have been made to certain street railway companies. Their purpose in making these low rates was to prevent those companies from carrying their own insurance or from uniting with other companies for mutual insurance at cost. As your committee pointed out last year, rates lower than cost are unwise for both insurer and insured.

The old-line companies express a willingness, even an anxiety, to co-operate with the traction companies to bring about or secure better protection and lower rates of insurance, being actuated, they say, by a desire to benefit the traction companies. The real fact is that they realize that such co-operation and such intelligent treatment of the subject are necessary in order to enable them to retain the business they have, to say nothing of enlarging their lines of insurance. Some of their representatives intimated to your committee that they would be willing to do business with the traction companies at a net profit of 10 per cent. of the premium, or even a smaller percentage; but they declined to consider a proposition to return to the policyholder any net earnings in excess of that profit, and they are unable to eliminate from their expenses the commissions of agents and brokers.

The tendency of the times toward self-insurance is shown by the practice of the United States Steel Corporation, the Pennsylvania, the New York Central and other large steam railroad companies, which carry their own insurance.

The mutual insurance plan recommended by your insurance committee has been favorably considered by the Central Electric Railway Association, the National Electric Light Association and the Association of Edison Illuminating Companies, each of which has appointed an insurance committee with duties similar to those devolving upon this committee.

A great many properties are under-insured. In case of loss on such properties a part of the loss would have to be sustained by the insured. A lower rate of insurance, to which the figures complied by your committee indicate that the railway companies as a whole are entitled, and which any company that will make the improvements now recommended by most of the insurance companies ought certainly to receive, will enable companies to carry large amounts of insurance for the same amount of premium that they now pay. On the other hand, full valuation of properties, especially of well-protected properties, ought, and is likely, to bring reduced rates. We recommend to the members, therefore, a more careful valuation of their properties for insurance purposes and that a fund or reserve be established to cover losses in excess of valuations—the difference, for illustration, between the 80 per cent usually carried on certain classes of property and the full value of such property.

The number and value of cars subject to destruction at any one fire are oftentimes too great. If it is essential to the operation of the road that rolling stock of a very great aggregate value be stored in one locality the storage house or yard should be divided by fire walls or otherwise, so that a total destruction of the property in any one location or unit will not tie up the road or seriously cripple it. The fewer cars there are in each unit the less will be the likelihood of a disastrous fire and the lower should be the rate of insurance.

We trust that our work and this report will receive your entire approval.

REPORT OF THE AMERICAN ASSOCIATION COMMITTEE ON PUBLIC RELATIONS

BY W. CARYL ELY (Chairman), JOHN B. PARSONS, JERE C. HUTCHINS, CHARLES W. WETMORE, HENRY A. ROBINSON, E. C. FOSTER

It has been considered by your committee that the subjects naturally within its scope are those indicated by its title, namely, our relations with the public as distinguished from those matters pertaining to our internal business operations. These external or public relations in the minds of your committee naturally subdivide themselves as follows:

1. Our relations with that portion of the public served by our several lines of transportation; in other words, our patrons.
2. Our relations with governmental bodies, Federal, State and Municipal.

Under the first heading are embraced such questions as service, rates of fare, transfers, rules and regulations governing the service in so far as they apply to or directly affect our patrons, and in general our methods and ways of transacting our business as affecting our patrons and those persons who are residents of our several transportation districts.

Under the second heading are naturally grouped such subjects as franchises, taxation, including all public burdens and impositions, capitalization, service, rates of fare, public regulation and control. The events of the past year have caused the last mentioned subject to occupy a position of all absorbing interest and importance.

The contention for the enlargement of the powers of the Interstate Commerce Commission is familiar to you all and need not be further adverted to here. In addition to this a series of events relating to the management, operation and control of corporate enterprises has directed the attention of all people throughout this country to the subject. The legislatures of more than a dozen states during the past year have enacted laws which in some way or other directly provide to some extent for the supervision and control of corporations engaged in the business of transportation. In some states this legislation has embraced nearly, if not quite all, of the so-called public utility corporations. It may be and undoubtedly is a fact that this riveting of public attention upon this particular subject has in a large measure been brought about by a better understanding on the part of the American public of the facts and conditions concerning municipal ownership and its inapplica-

bility in this country and under the conditions prevailing here to this particular species of property. Public regulation and control and municipal ownership are intimately related. Indeed, it would seem that the one is the alternative of the other. We believe, in fact, that it is so now generally conceded and this seemingly almost universal turning away in this country from attempts at municipal ownership towards practical regulation and control affords evidence of the highest quality of a growing, if not an already established, belief that municipal ownership is impracticable and undesirable in this country.

It is not the purpose of your committee to discuss at length any of the matters herein referred to, but we would briefly call your attention to the statutes of the three states of Massachusetts, New York and Wisconsin as affording the most pertinent examples of this class of legislation.

Massachusetts in 1864 was the first of all the states to establish a State Board of Railroad Commissioners, and in 1885 was again the first to provide a Board of Gas and Electric Light Commissioners. New York in 1882 established a Board of Railroad Commissioners and a few years since again followed the lead of Massachusetts by establishing a Gas and Electricity Commission. During the past legislative session New York enacted a law to regulate public utilities and placed under State commissions nearly all public utilities, the telegraph and telephone companies being almost the sole exceptions. The New York commissions act of 1907 differed from the previous legislations in that state and also from Massachusetts by committing the regulation and control of the railroads as well as the other public utilities to the same commission, and divided the state into two commission districts, but made the subjects of commission jurisdiction the same in both districts. The New York law at the time of its passage was by far the most comprehensive piece of legislation of the kind that had been enacted up to that time. It conferred upon the Public Utilities Commissioners all the powers that had heretofore been invested in the Board of Railroad Commissioners and the Gas & Electricity Commission, and in addition thereto vested in the Commissioners the power to fix the capitalization of such corporations both in stock and bonds, and also the power to make rates and specify and regulate service. It prohibits the capitalization of franchises except in such amounts as had actually been paid by any corporation to the public for any particular franchise possessed by it.

Later in the year the Legislature of Wisconsin passed a Public Utilities law regulating heat, light, water, power and telephone companies, and another law bringing telegraph companies and street railways under the same provisions as steam railways and interurban electric lines, and bringing all these public utilities under the jurisdiction and control of the State Board of Railroad Commissioners. The Wisconsin law goes further than either the Massachusetts or New York laws in that it provides for the physical valuation of the properties of such corporations, and provides for a complete system of uniform accounting with special requirements as to depreciation and construction accounts. It also provides for the so-called sliding scale by authorizing the Commission to investigate and sanction such devices; confers the power to regulate rates, fares and charges and establishes what it terms the indeterminate permit, which it defines to be "the right to continue in business until such time as the municipality exercises its option to purchase the property at a just compensation to be determined by the State Commission." This is a most important provision and one far in advance of anything heretofore attempted in any legislation in this country. Under the indeterminate permit feature corporations operating under existing franchises are permitted to surrender them and to receive in place and in lieu thereof by operation of law an indeterminate permit, agreeing thereby to sell to the municipality in the manner therein provided and "to waive the right to insist on the fulfillment of any contracts regarding rates or services which might be set up as a defense against the orders of the State Commission." In return the corporations obtain protection against unnecessary competition on the part of other corporations or municipal plants, the question of necessity to be decided by the Commission. This indeterminate permit provision does not apply to telegraph or telephone companies. In fixing rates the Wisconsin Commission is empowered to act absolutely instead of fixing merely maximum rates as provided by the New York law. An exhaustive statement concerning this Wisconsin legislation, the method of its enactment and the objects sought to be achieved by the legislation is contained in an article upon the subject appearing in the *American Review of Reviews* for August, 1907, by Professor John R. Commons, Professor of Political Economy in the University of Wisconsin.

A Public Utilities Commissions bill is, at present writing, pending in the Legislature of New Jersey, and there are well-authenticated statements concerning the preparation of bills upon the same subject to be introduced at the coming sessions of the Legislatures in other states.

Under these circumstances it is not the purpose of your committee at this time to discuss the questions academically. It is a condition and not a theory that confronts us. The powers sought to be conferred upon commissions by legislation of the character above referred to are so far-reaching as to overshadow at the moment any and all of the subjects within the purview of your committee; indeed, nearly all of them are in part or in whole embraced within the scope of such legislation.

In view of the importance of the subject, its delicacy and its far-reaching effects upon street railway properties it would seem to be wise for your Association at this time to consider the adoption of some coherent and well-defined policy with reference to the matter.

During the past year the Committee on Public Policy of the National Electric Light Association has devoted a great deal of attention to this subject, and the reports of that committee and its sub-committes on Municipal Ownership and on Public Regulation and Control are respectfully recommended to your attention.

The conclusions of the sub-committee on Public Regulation and Control were stated to be:

First.—That the National Electric Light Association should favor properly constituted general supervision and regulation of the electric light industry.

Second.—That if state commissions be constituted they should be appointed in that manner which will give them the greatest freedom from local and political influences, to the end that their rulings shall be without bias.

Third.—That state commissions should be clothed with ample powers to control the granting of franchises, to protect users of service against unreasonable charges or improper discriminations, to enforce a uniform system of accounting and to provide for publicity. If the state provides for publicity on the one hand, on the other hand it should safeguard investments. Regulation and publicity would be a grievous wrong unless accompanied by protection.

The report of the full committee was written before the passage of the Public Utilities bill by the Legislature of New York, and while the full committee does not in terms make recommendations embodying the sub-committee's conclusions as stated above, nevertheless its general tenor is in the line of acquiescence in the general public policy involved in the legislation of regulation and control.

Mr. Everett W. Burdett, of Boston, is the Chairman of the Public Policy Committee of the National Electric Light Association, and partly because of his great experience and ability which peculiarly fit him to be a wise counsellor at this juncture, and particularly because of the excellence of the report in question, your committee has considered it wise to reproduce it here as well as the reports of two of the sub-committees.*

Your committee does not feel that it would now be justified in recommending any line of action to be pursued by this Association or its members when and as it and they shall be called upon to define a line of action as legislative emergencies of this character shall arise in different parts of the country, but we respectfully urge upon you the desirability of formulating such a policy, and to that end beg leave to suggest that at this session of the Convention a meeting be held of such of the administrative officers of electric railways as may be in attendance at this Convention.

In conclusion the committee apologizes for its inadequate treatment of this subject, but ventures to express the hope that it may still be of assistance in your further deliberations, if any, upon the subject which has formed the burden of this report.

*The committee includes these reports in an appendix.

REPORT OF THE COMMITTEE ON MUNICIPAL OWNERSHIP

BY C. D. WYMAN (Chairman), J. A. BEELER, H. M. SLOAN AND J. J. STANLEY

In August last your committee in a circular letter to the members of the association asked as to the status of the municipal ownership movement in their respective localities. Among other questions to which replies were solicited were the following:

"What, if any, agitation or movement has arisen or been in progress during the past year for the extension of municipal public utilities?

"Has there been any movement looking toward the municipalization of your company's business or any part thereof?

"If any such agitation has arisen, please state its cause or causes.

"What seems to be the present status of public opinion in your vicinity touching municipal ownership of public utilities, such as street railroads and lighting companies?"

To our inquiries 132 replies were received, of which 55 represented city lines alone, 15 represented interurban lines alone, 62 represented both city and interurban lines.

The number of states represented by replies was 37 states and territories and four Canadian provinces. The number of cities covered by these replies of over 50,000 population was 73, and of those under 50,000 population 332. The number of municipally-owned utilities in cities represented by the replies was as follows:

1. Street railway systems, 2, one of which was in Canada.
2. Electric lighting plants, 29.
3. Gas plants, 4.
4. Water works, 69.

The answer to the question as to whether there had been any agitation regarding the municipal ownership of street railway lines in the field covered by our membership during the past year elicits an almost universal negative. We quote a few of the answers returned:

The manager of a line operating in one of the largest cities represented in our membership states:

"In answer to No. 7 as to the present status of public opinion I may say that the public mind of * * * on the question of municipal ownership has had a very serious set-back, as was demonstrated pretty conclusively by the mayoralty election last spring when the question of municipal ownership was the dominant issue. It should be stated in this connection that the result came principally from the non-partisan effort of a large number of the better class of citizens to educate the public, and their very thorough efforts were effectual in disabusing their minds of the many glittering fallacies that demagogues, yellow journals and mistaken zealots had built up in their fancy. It occurs to me that the average voter is thoroughly convinced of the rottenness of municipal politics, in this country especially, and it is easy to convert him to the fact that graft and perpetuity in office would be the result of municipal ownership."

The president of a large company in a Southern state says:

"Much less said now in regard to it than there was a year or two since. The public seems to have lost interest in the subject."

Still another manager reports:

"Less favorable to lighting than a year ago, and not considering railroads at all."

From central New York the word is sent that the business men of that locality are adverse to the experiment, and from a growing city in the far North a manager of a combined company writes:

"Decidedly against municipal ownership. Three newspapers adverse to it and also the best business people."

A company in Ohio reports:

"Authorities are not inclined to municipal ownership, they had a sad experience with the gas plant."

Another company in the same state replies:

"The public do not want it."

From the far South word is sent that public sentiment is against municipal ownership, and a Virginia company reports that the scheme is not looked upon with favor by the more intelligent citizens of the city. Two companies report that there has been some talk about it, and give as reasons therefor the desire for political preferment on the part of some politicians, but qualify the statement by saying that the taxpayers are taking no active steps in support of the movement. One company admits that by reason of poor service which they have been obliged to give there has been some newspaper talk about the city taking over the railroad lines, and another one speaks of the municipal ownership scheme being used as a threat to obtain certain reductions in fare.

The condition as revealed in the answers with reference to lighting, gas and water works is not quite so favorable, although even with reference to such public utilities, a number of the replies are to the effect that with existing municipal plants in their cities the people are becoming disgusted with the operation and the service they afford, and to that extent are being turned against further extension of the municipal ownership scheme.

From a careful reading of these replies, which have been placed by the committee on file with the secretary of the association, we feel safe in making the assertion that municipal socialism as affecting street or interurban railway properties, in the sense of the taking over by municipalities of the ownership and operation of such properties, has as a social doctrine and as a political text quite considerably decreased in force during the past year. This decadence of the municipal ownership idea may be ascribed to several causes. A year ago the propaganda seemed to be the tide of a great movement which, on account of its utility as a political doctrine and its popularity with the masses because of its premises of reduced cost of service and an extension of opportunities for labor, was sweeping on largely unopposed, to the ultimate confiscation of our properties. The glories of its conquests abroad had been for some years rehearsed, and the blessings which it would introduce here in this country proclaimed from political platforms and through socialistic publications. But during the last 12 months the people at home and abroad have given to the subject a careful and critical examination of its principles and an analytic study of the facts as developed here and abroad through the trial of the scheme, with the consequence that the weaknesses and the fallacies of the proposition as a social economic theory, and especially the dangers of attempting to introduce to any great extent the practice it advocates in municipalities with the political complexion of American cities, have been shown, and what might be termed at least the radical and bald theory of municipal ownership and operation by the people of a municipality of such utilities, as those of transportation and to some extent of light, has been marked doubtful and is no longer in a general way being urged.

We believe that the campaign of education which has been in progress during the past year against the theory and principles of municipal ownership, a campaign to which doubtless the members of this association have contributed in public and in private, has shorn the idea of much of its strength and to that extent has weakened its force both as a political and a social enemy. This change of sentiment finds its illustration in the result of the elections in London last March, and Chicago in April of this year, both of which contests turned on the questions of municipal trading and municipal ownership, and which as precedent to the vote, involved a very complete collation of statistics touching the practical result of municipally owned utilities, and as well a great deal of illuminating academic discussion as to the principles and effects of the doctrine. At the London election out of 118 candidates 84 were unconditionally opposed to municipal trading, and the candidates in general in their addresses absolutely condemned competion with private enterprises. In Chicago also the issue was practically the same, the line of separation being clearly drawn between those who believed and those who did not believe in the wisdom of placing in the hands of the municipality the transportation business of that city. Thus we think we are safe in the conclusion that municipalization, involving the ownership of a public utility property and its operation by a municipality, has during the last year received a very considerable set-back, and it is pleasing to feel that in the long run the pendulum of justice and fairness, which may at times of frenzied reform swing to the extreme point of danger, will after a while return to a normal and safe position.

It must not be concluded, however, that the dangers to our corporate life are at present so greatly lessened as to be unworthy of our constant care and effort. In the stead of the socialistic theory of municipal ownership there has of late arisen the doctrine of public regulation, which has sprung into such popularity as to have become the favorite measure of legislation in almost every state in the union during the past 12 months. Perhaps we are trespassing upon the preserves of our committee—that of Public Relations—in adverting to this

matter, but as it is so intimately related and apparently is, to a large extent, the outgrowth of the movement for municipal or state ownership of public utilities, we may be forgiven for devoting some space to its consideration.

The past year bears many resemblances to the period of the Granger agitation. Railroad legislation in the states has been, however, far more widespread. Not only in the central and far West, but in the supposedly more conservative Atlantic seaboard states, a large part of legislative effort has been devoted to passing railroad laws. To be sure, these have referred to the steam companies, but the agitation which has given rise to them has also borne fruit in the passage of certain legislative bills which have included public utility corporations such as trolley, gas, electric light and telephone companies. It has been calculated that the number of such laws affecting railroads passed within the last year is about 300. Ten State Legislatures alone at their recent session passed 177 different laws with reference to the control of steam railroad corporations and dealing with almost every department and innumerable details of railroad operation and management, from the reduction of passenger fares to dusting of passenger cars, from establishing railroad commissions more powerful than any ever before created to requiring railroads to run only eight-wheel cabooses.

Public utility corporations, therefore, are just now passing through a crisis in their history, the result of which is difficult to predict. The socialistic and political organization through which perhaps more than from any other source the municipalization of street railway companies was preached and to some extent promoted a year ago has, it is true, during the past year shown less strength and declined to a marked degree, but on the other hand, as we have mentioned above, socialistic legislation instigated and promoted by both political parties, has been prevalent both in Congress and in State Legislatures to a degree exceeding that of any other period in the country's history. When corporate interests were obliged to face what seemed to be an un-American doctrine, radical in its tendencies and quite opposed to the character of our institutions, the socialism which, unaffiliated with other political organizations, demanded that all public utilities of every name and nature be turned over to the general government and the state or municipality, the fight was largely in the open and to that extent lacked some of the elements of danger which are present in the more covert and at the same time more generally popular movement which has of late been instituted by both democratic and republican organizations for the publicly proclaimed purpose of controlling the corporations for the people, but which it seems to us in many instances, if the provisions embodied in various bills are to be literally carried out, would mean, practically, confiscation. The socialists in this country find their work being done for them, and the rather anomalous spectacle is presented of the decline of a party whose avowed doctrines and policies are at the same time being supported. The condition is one which represents a drift that may become mischievous and dangerous unless we are fully alive to the forces which animate and vitalize it and are willing to meet it fairly and patriotically. Unless we are greatly mistaken, invective and stubborn opposition to the principle of regulation by commission or in some other way will not turn the tide which is setting in favor of that sort of control. That corporate offences have been committed in the haste for extension and for the occupancy of alluring fields which this country has presented, is a fact not to be controverted, and we respectfully submit that it is possible that some proper form of regulation, which shall on the one hand prevent ruinous competition to what are natural monopolies and on the other assure to investors the proper handling of their funds, would be helpful to all our interests. We must not deceive ourselves into believing that the spirit of socialism in this country has suffered such a decided reverse that it is entirely relegated to the rear. It is true its army is clad in a somewhat different uniform than formerly and marches under banners with new devices, but unless it is met with the same sort of intelligent study and a willingness to fairly discuss the questions, such as has characterized our municipal ownership campaign during the past year, we shall fall short, we fear, of properly safeguarding our interests.

In an excellent report upon this subject, made to the National Electric Light Association on municipal lighting, it was stated: "It would be a serious error to assume that the present movement of public sentiment toward public regulation signifies that municipal ownership is now or is soon going to be consigned to the limbo of discredited theories along with such past crazes as free coinage of silver at a ratio of sixteen to one. If public regulation shall fail to establish a good understanding between the corporations operating public utilities and the customers of those corporations, we shall inevitably have a revival of the cry for municipal or State ownership."

At the risk of repetition, your committee wish to emphasize their feeling that while municipal ownership as a socialistic scheme has been greatly weakened, it reappears in many of its essential features in some of the schemes which have been legislated upon for what is properly known as "Public Regulation," and it is our business to meet it on the open platform of discussion with the idea of accepting that which it presents which is fair and just, and to the elimination from it of such elements as are unjust and confiscatory.

ANNUAL MEETING OF THE ALLIS-CHALMERS CO.

At the annual meeting of the Allis-Chalmers Company, held at Jersey City Oct. 24, President Whiteside said that the past year had been marked by a very considerable increase in the sale of the products of the electrical and steam turbine departments. Probably the most important work which has been brought to a commercial consummation has been in the development of the company's steam turbine units. Sizes ranging from 500 to 7500 kw have been completed and their success thoroughly established. The company's sales of steam turbines have already reached nearly 100,000 kw normal capacity, and compared with the previous year show in orders booked an increase of $800,000. The gas engine department has also shown substantial progress. Orders to Aug. 1, 1907, for the horizontal, twin-tandem and double-acting type of gas engines, ranging in capacity from 500 to 5000 hp, aggregate 189,350 hp. One of the company's notable contracts covers the electrification of a steel plant requiring gas engine electrical units of an aggregate capacity approximating 60,000 hp. Another for traction purposes comprises three horizontal, twin-tandem gas engines of 1500 hp each, direct-connected to 1000-kw, 3-phase, 25-cycle alternators of our manufacture and includes all substation apparatus. During the year the company installed and placed in operation ten complete hydro-electric plants, having a combined output of 105,000 hp. The air brake department was organized about July 1, 1906, to exploit the sale of air brake equipments under the Christensen patents. A reasonable degree of success has already rewarded the company's efforts in this line of business. The company has now completed the development and manufacture of a considerable number of large alternating current and direct current generators, rotary converters, induction and direct current motors in all sizes and capacities, transformers for both power and lighting service, street railway motor equipments and electric hoists, all of which are in successful operation. It is worthy of note that notwithstanding the large inroads made by the steam turbine and gas engine, the company's Corliss engine business continues in steady volume, particularly for the medium and smaller sizes. The financial report of the company for the year ending June 30, 1907, shows a profit on operations of the last fiscal year after deducting expenses of manufacturing and selling, interest, dividends on preferred stock of The Bullock Electric Manufacturing Company, and provision for doubtful accounts of $1,226,242. From this amount the following deductions are made: Charges for maintenance, repairs and renewals on buildings, machinery, plant, tools, etc., $854,503.32; depreciation on buildings, machinery, plant, tools, etc., $253,987.42; interest on bonds, loans and notes payable, $505,049.40. This leaves an operating deficit for the year of $387,298.14. For the quarter ended June 30, 1907, the company shows a net profit after deducting selling expenses, interest on bonds, etc., of $200,358; for the quarter ended Sept. 30, 1907, the net profit was $288,910.

The annual report also shows that the finance and executive committees have been abolished. This places the management of the company in the hands of Elbert H. Gary and W. H. Whiteside. The following new directors were elected: Elbert H. Gary, Edmund C. Converse, Charles MacVeagh, general solicitor of the United States Steel Corporation, and Alexander F. Banks, president of the Joliet Eastern Railroad (a railroad operated by the United States Steel Corporation). All of these are United States Steel Corporation officials. This materially strengthens the board and places the financial affairs of the company in excellent hands. The company has ample funds now to operate efficiently.

CONVENTION NOTES

In addition to the companies whose exhibits were described last week the following companies were represented at the Atlantic City convention:

J. P. SJOBERG & COMPANY, of New York, made an exhibit in connection with Semon Bache & Company. As is well known, Sjoberg & Company do an extensive business in woodwork for cars, and have recently been making a specialty of car vestibules, of which they have furnished a large number for the New York City Railway and other lines. Mr. Sjoberg himself was present.

W. R. GARTON COMPANY, of Chicago, were present in the persons of W. R. Garton and Ray P. Lee.

R. W. MARSHALL & COMPANY, of New York, were represented by R. W. Marshall, Geo. S. Thompson and Herman S. Crossman.

RUSSELL CAR & SNOW-PLOW COMPANY, of Ridgway, Pa., exhibited in connection with Messrs. Wendell & MacDuffie, their Eastern sales agents. The Russell snow-plows are adapted for both city and interurban service. The company also makes a specialty of a combination car and snow-plow which may be used for carrying express or freight in addition to cleaning the tracks.

SCRANTON ELECTRIC CONSTRUCTION COMPANY, of Scranton, Pa., made the acquaintance of many of the delegates through their purchasing agent, Joseph B. Noros, who was present at the convention.

BARBOUR-STOCKWELL COMPANY, of Cambridgeport, Mass., manufacturers of special track work for electric railways, were represented by F. F. Stockwell and W. W. Field.

BURDON TROLLEY CONTROLLER COMPANY, of Louisville, Ky., exhibited the Burdon trolley catcher, a device shown for the first time at the convention. Although the company is just preparing to take active steps to put the catcher on the market, it has already been tried out in actual service. In addition to exhibiting the device the company distributed circulars containing testimonial letters from the Louisville Railway Company and the Louisville & Southern Indiana Traction Co., expressing satisfaction with the workings of the trolley catcher in service. A distinctive feature of this new device is that it is operated by a gravity weight, and does not depend upon springs. The company was represented by C. H. Jenkins, general manager.

MILLOY ELECTRIC COMPANY, of Bucyrus, Ohio, was represented by P. D. Milloy. While making no exhibit on the Steel Pier, Mr. Milloy had samples of the Milloy trolley base at his hotel, where they could be inspected by the delegates.

AMERICAN CARBON & BATTERY COMPANY, of East St. Louis, Ill., was represented at Atlantic City by P. V. D. Brokaw, manager, and Harold J. Wrape. American carbon brushes are becoming very well known in the electric railway field, and the company has recently increased its manufacturing facilities so as to give special attention to brushes for this service.

WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, was represented by E. W. Goldschmidt, of its New York office, and John Mustard, of Philadelphia.

THE WILDER SNOW-PLOW & MFG. COMPANY, of Worcester, Mass., was represented by W. E. Wilder, president. The company made no exhibit, but Mr. Wilder explained to many of the delegates the distinctive features of the Wilder Radial Snow-Plow.

H. B. IVES COMPANY, of New Haven, Conn., was represented by Jerry M. Hayes. This company is making a specialty of the "New Haven" trolley wheels and bushings, and also manufactures register fittings and other car trimmings.

INTERNATIONAL TIMBER PRESERVING COMPANY, of Chicago, was ably represented by H. De Steese, its eastern sales manager. Mr. De Steese had a sample can of "Neosote," and explained to many of the convention delegates the advantages of this compound as a preservation for poles, ties, bridge timbers, etc.

SAMSON CORDAGE WORKS, of Boston, Mass., had expected to make an exhibit at Atlantic City, but reported that 10 cases of goods which had been shipped from Boston had been lost or held up on the railroad. The company is looking forward to the days when electricity will replace steam for all railroad traffic, so that delays of this kind will become impossible.

DAYTON MANUFACTURING COMPANY, of Dayton, Ohio, had a quartet of representatives in the persons of John Kirby, Jr., Jos. Leidinger, Peter Leidinger, and Nelson Emmons, Jr. As is well known, the Dayton Manufacturing Company makes an extensive line of car trimmings and supplies, including headlights, sand-boxes, brake handles, basket racks and other specialties.

J. P. DEVINE COMPANY, of Buffalo, N. Y., whose specialty is the Passburg System of vacuum drying apparatus, was represented by J. P. Warfel.

BONNEY VEHSLAGE TOOL COMPANY, of New York, was represented at the convention. This company is now putting on the market an extensive line of ticket punches, for which many points of superiority are claimed.

STANDARD AUTOMATIC TROLLEY RETRIEVERS COMPANY, of Greensboro, N. C., was one of the new companies exhibiting at the convention. The company was represented by Chas. L. Van Noppen, secretary and treasurer, who explained to delegates the workings of the "Standard" automatic trolley retriever.

THE SAFETY INSULATED WIRE & CABLE COMPANY, of New York, was represented at the convention by its sales agent, Richard C. Smith.

ATLAS ANCHOR COMPANY, of Cleveland, Ohio, made an interesting and instructive exhibit of the Atlas anchors, which are especially adapted for heavy construction work. The company claims not only that the Atlas Anchor costs less installed than other similar devices, but that when set in any good ground the anchor will hold more than the connecting rod. To set the anchors, the company has a unique device which works on a thrust ball-bearing cone, by means of which one man can exert a strain twice as great as that required to set the anchor. Thus the anchor is set to its full load position, independent of the pole, and will not creep afterward. The company offers to send a digger and setter with a half dozen anchors to any electric railway company on 60 days' trial.

THE RUBBERSET BRUSH COMPANY, of Newark, N. J., made an interesting exhibit of brushes for various purposes. These included brushes for painting and varnishing cars, iron work, and other requirements of electric railway companies. A. L. Holtzman, who represented the company at Atlantic City, distributed as a souvenir of the convention a shaving brush, which was very much appreciated by the electric railway men who received it.

UNIVERSAL POLE & POST PRESERVING COMPANY, of Circleville, Ohio, was represented by H. P. Folsom. The literature distributed by Mr. Folsom included an interesting pamphlet entitled "The Decay of Poles," and some other circular matter illustrating the method adopted by the Universal Pole & Post Preserving Company for preventing decay.

THE BUCKEYE ELECTRIC COMPANY, of Cleveland, was represented by M. H. Hartman, of the Cleveland office, and J. M. Smith, Philadelphia sales manager. This company manufactures special incandescent lamps for railway and park service.

G. C. REITER, Canton, Ohio, was represented by Mr. E. Rutter. This company manufactures a full line of gongs for railway service, and an exhibit of various styles, sizes and finishes was made in the booth of the Wallace Supply Company.

H. D. MILES and O. S. SLEEPER, of the Buffalo Foundry & Machine Company, were at the convention. This company manufactures vacuum drying and impregnating apparatus and devotes especial attention to railway and electrical work.

MR. A. R. DITTRICK, of the Dittrick & Jordan Electric Co., Cleveland, Ohio, was very much in evidence throughout the convention. While no formal exhibit was made, everybody knows Mr. Dittrick, and he was kept busy distributing the handsome pocketbook and letter opener souvenir which had been prepared for the occasion.

MR. WILLIAM A. ARMSTRONG, JR., of the Electric Service Supply Company, and J. M. Smith, of the Buckeye Electric Company, with their wives, Mr. and Mrs. F. B. Musser and Mr. and Mrs. H. R. Fehr and Miss Flynn made up a party at Haddon Hall during convention week.

THE MAGANN AIR BRAKE COMPANY had a booth on the pier, but did not exhibit any apparatus. E. C. Rutherford, sales manager, was the only representative of the company attending the convention, but he was very much in evidence. As stage manager of the vaudeville show on Thursday, he did excellent work. The programme of the performance was not definitely laid out until Thursday. Still the performance passed off without any of the hitches or delays that are customary at amateur performances. This was certainly pretty good stage management.

THE HOWE STEAM SAND DRYER attracted considerable attention. This sand dryer, which has been described in the Street Railway Journal, is so constructed that the air after being heated by steam coils and absorbing moisture from the sand is drawn out of the sand by means of ventilating ducts in which a partial vacuum is created by a steam jet. The moist air so drawn out is, of course, replaced by dry air which is then heated. The construction increases greatly the capacity of a dryer of given size. The dryer of 10 tons per day capacity shown at the convention was 6 ft. 9 ins. high, 5 ft. long and 4 ft. 1 in. wide. Among sales made at the convention was a dryer to the Springfield Traction Company, Springfield, Mo. A. D. Blackinton, president of the Howe Manufacturing Company, of Scranton, Pa., the manufacturers of the heater, and C. F. Towne, exclusive sales agent, were in attendance at the convention.

THE PEACOCK BRAKE, exhibited in a tastefully decorated booth, was examined by many visitors who had not previously had an opportunity to have its features explained to them. Several styles of brakes were represented by aluminum models, one being the first model of the brake exhibited at a convention. Visitors generally admired the large stuffed peacock, which, perched on one of the columns in the rear of the booth, added considerably to the appearance of the booth. Visitors were received by G. S. Ackley, president of the National Brake Company, and several of his representatives.

THE NATIONAL FIBER & INSULATION COMPANY, of Yorklyn, Del., showed its Peerless insulation, a strong, tough insulating paper made by a special chemical process and furnished in sheets or in rolls and from .005 in. to ¼ in. in thickness.

THE TROLLEY SUPPLY COMPANY, of Canton, Ohio, showed the Kuntson trolley retriever.

THE AMERICAN RAILWAY SUPPLY COMPANY, of New York, represented by Charles Lounsbury and Walter Chur, showed a full line of metal cap and coat badges for electric railway employes.

THE AMERICAN SEWER PIPE COMPANY, of Pittsburg, had on show vitrified clay conduits in single and multiple ducts for underground work. F. N. Kondolf, A. S. McCome and W. R. Adams represented the company.

THE COLUMBIA NUT & BOLT COMPANY, INC., of Bridgeport, Conn., was represented by Fred Atwater. A complete line of block nuts was on show.

THE CURTAIN SUPPLY COMPANY, of Chicago, Ill., showed complete curtains and curtain material of all kinds, also the Forsyth N 86 roller tip fixture, No. 88 ring fixture, Keeler eccentric fixture, Acme and Climax open car ring fixture. W. H. Forsyth, A. L. Whipple and Ross F. Hayes represented the company. Mr. Whipple also acted as chairman of the entertainment committee of the American Street & Interurban Railway Manufacturers' Association, in which capacity he did excellent work and added greatly to the social success of the convention.

S. F. HAYWARD & COMPANY, of New York, showed their well-known fire extinguishers.

THE NATIONAL CAR WHEEL COMPANY, of Allegheny, Pa., showed different types of car wheels.

ARCHBOLD BRADY COMPANY, of Syracuse, N. Y., was represented by W. K. Archbold, R. L. Allen and C. Loomis Allen.

THE BRADY BRASS COMPANY, of New York, manufacturers of the well-known Brady bearings for electric motors, street car journals, etc., were represented by D. M. Brady, president, and Amos J. Passino, Henry J. Lahey and H. S. Hayward, Jr.

ROSSITER, MacGOVERN & COMPANY, of New York, were represented by Frank MacGovern.

THE CINCINNATI CAR COMPANY, of Cincinnati, Ohio, had as its representatives at the convention H. C. Ebert, president; Robert Dunning, G. T. Farrell and Fred Phelps.

THE CLEVELAND FROG & CROSSING COMPANY, of Cleveland, Ohio, was, as usual, represented by G. C. Lucas, general manager, and George Stanton, sales agent.

THE FALK COMPANY, Milwaukee, Wis., exhibited in connection with Wendell & MacDuffie, its Eastern representatives. Otto H. Falk, vice-president, and W. Frank Carr, chief engineer, were present.

THE ELECTRIC RAILWAY EQUIPMENT COMPANY, of Philadelphia, Pa., dealers in second-hand cars and other electric railway supplies, had in attendance its general manager, Charles S. Ayres, and other representatives.

THE ELECTRIC RAILWAY EQUIPMENT COMPANY, of Cincinnati, Ohio, manufacturers of tubular iron poles, brackets, line material, etc., was represented by W. A. McCallum and J. G. Kipp.

THE JEWETT CAR COMPANY, of Newark, Ohio, which is building so many fine cars for interurban service, was represented by W. S. Wright and E. Besuden.

W. R. KERSCHNER, of Allentown, Pa., dealer in new and second-hand electric railway supplies, was present in person, and was also represented by J. B. Noross.

THE E. G. LONG COMPANY, of New York, manufacturers' agents and supply dealers, was much in evidence in the person of E. G. Long, president.

THE McGUIRE-CUMMINGS MANUFACTURING COMPANY, of Chicago, had ample oportunity to interest the electric railway officials in its cars, trucks, sweepers, sprinklers, etc., through its quartette of representatives, John G. Cummings, G. N. Brownrigg, F. J. Ryan and C. T. Biddison.

THE MORE-JONES BRASS & METAL COMPANY, of St. Louis, explained the merits of Tiger bronze axle bearings through S. W. Crawford and John B. Strauch.

ARTHUR S. PARTRIDGE, the well-known electric railway supply dealer, of St. Louis, was present, as usual, and was also represented by Harold R. Wilson and P. C. Murphy. At the annual meeting of the American Street and Interurban Railway Manufacturers' Association, Mr. Partridge was elected a member of the executive committee of that organization.

THE PATTON PAINT COMPANY, of Milwaukee, Wis., and Newark, N. J., was represented by John L. Brown and Jas. G. Mowry.

JOHN A ROEBLING'S SONS COMPANY, of Trenton, N. J., was much in evidence, being represented not only by its New York manager, Henry L. Shippy, but also by R. Raymond Newell, G. W. Swan and Albert Mann.

THE ST. LOUIS CAR WHEEL COMPANY, of St. Louis, Mo., was represented by John W. Nute, W. W. Talman, F. O. Grayson, S. E. Hodge, who explained to the delegates the superior features of the company's reinforced spoke wheels for city and suburban cars.

THE STONE & WEBSTER PUBLIC SERVICE JOURNAL was one of the periodicals represented at the convention and many compliments were extended to the representatives of the firm present upon the tasteful appearance of the November issue of that paper. The names of the different gentlemen attending the convention in the interests of the firm were published last week.

THE ELECTROSE MANUFACTURING COMPANY, of Brooklyn, N. Y., was represented by Louis Steinberger, president.

THE EGYPTIAN METAL COMPANY, of New York, manufacturers of Pyramid metal, was represented by its special representative, E. H. Chapin, who has attended many conventions. Mr. Chapin was kept busy receiving the congratulations of his friends for a quick recovery from a sprained ankle, and in explaining the merits of the new bearing metal which he is representing. This work is in addition to his connection with the National Car Wheel Company, of which he is still New York selling agent. Pyramid metal is new in this country only, as it is made from an old Egyptian formula secured by Nelson Grayburn, of the Montreal Street Railway Company, while in Cairo. It has been employed on a number of street railway properties in this country and Canada with great success, and remarkable results have been secured from its use.

WESTERN ELECTRIC COMPANY, of New York and Chicago, had an interesting and comprehensive exhibit at the convention. Electrose overhead line material and Electrose high-tension insulators formed the main part of the exhibit. All types of overhead line material were shown, including straight line single and double curve suspension; car barn, bridge and mine suspension; double trolley hangers, straight line, single pull-off and double pull-off; cap and cone suspension, straight line, single and double curve; bracket suspension; strain suspension; double trolley suspension, three types; round-top hanger suspension, straight line, single and double curve; goose-neck suspension, four types; insulated locking hanger; loop strain insulators, several types; single and double turn-buckle strain. Several types of trolley ears, a number of interesting overhead crossings; section insulators and Electrose high-tension insulators of several types were also shown. One insulator, made of Electrose insulation, capable of carrying from 50,000 to 60,000 volts was exhibited. The neatness and small size of this insulator was noticeable, considering the very high voltage it was designed to carry. Third-rail insulators of recent design were also exhibited, as were trolley wheels of various types and weights, including W. E. standard, competition, spoke ribbed, high speed and sleet wheels. There were also samples of Deltabeston wire for railway motors and all types of D. & W. fuses, including 500-volt indicating cartridge fuses, 500-volt car heater cut-outs and 500-volt porcelain cut-outs. Various other appliances for the use of electric roads were also exhibited and attractive catalogues and other printed matter was distributed. The representatives of the company at the convention were: R. H. Harper, manager of the railway department, New York; F. D. Killion, A. E. Meixell, W. N. Harkness, E. P. Heyer, D. C. Guest, C. A. Howlett, F. C. Jaeger and R. Roth.

FRANCHISE A CONTRACT ACCORDING TO MILWAUKEE RULING

Judge J. C. Ludwig, of the Circuit Court, has overruled the objections of the defendants in the case of the state against the Milwaukee Electric Railway & Light Company, to the examination under the "discovery statute," and has vacated the injunction restraining Court Commissioner Joseph Donnelly from proceeding with the examination. A temporary stay of proceedings was granted, however, pending the perfection of an appeal to the Supreme Court. Attorney-General Frank L. Gilbert brought suit against the Milwaukee Electric Railway & Light Company, the North American Company (holding company), officers and directors of both companies, and nearly all of the aldermen in Common Council in 1900, when the disputed franchise was granted the company, and asked that the franchise be declared null and void. Judge Ludwig holds that, while the passage of a franchise cannot be restrained on the ground of fraud, it is, after its passage, a contract, and that a court can either annul the franchise or permanently restrain its use.

PROGRESS OF THE NEW PARK ASSOCIATION

Through C. H. Oberheide, vice-president and general manager, of the White City, Trenton, N. J., who is secretary-treasurer of the National Amusement Park Association, the STREET RAILWAY JOURNAL learns that the arrangements are well under way for the meeting in November of the new park association, of which detailed reference was made in the STREET RAILWAY JOURNAL of Oct. 19. Mr. Oberheide has visited a number of park companies, and wherever he has been has secured the support of park owners, and he expects at the next meeting that the attendance will be large, due to the interest manifested in the new organization by people in this line throughout the country. The by-laws of the association, as prepared by Mr. Oberheide, are now in the hands of the by-laws committee and will be submitted for approval at the next meeting. Many interesting subjects will be taken up which will be of interest to street railway and park men. Mr. Oberheide plans quite an extensive membership campaign, and is devoting a large part of his time to furthering the interests of the association, which has for its main object the securing of the best attractions for the parks and the dissemination of such information as shall be helpful to the park managers.

THE REASON FOR PASSING THE DETROIT DIVIDEND

Henry A. Everett, chairman of the board of directors of the Detroit United Railways, in an interview, said that the company faced the alternative of increasing the floating debt, if a dividend was paid this year, since about $800,000 had been spent in improvements and in increasing and bettering the service. At the prices at which bonds of this or any other company would have to be sold now, he said, that the board preferred to take off the dividend until the improvements could be capitalized. It has been the policy of the company, he said, to give a first-class service and thus keep the good will of the people, so that the franchises may be renewed when they expire. The capitalization is low, in comparison with the value of the properties of the company, and everything is in good condition. Much of the stock is held in Canada, he said, and a good portion on margins, and this is what caused the sharp decline.

INTERBOROUGH EARNINGS FOR YEAR ENDED JUNE 30, 1907

The Interborough Rapid Transit Company made public Monday, Oct. 21, its statement of earnings for the fiscal year ended June 30, 1907, in comparison with the earnings of the preceding year.. The statement showed a gain of $1,475,700.77 in net earnings and of $547,553 in net income, while the surplus earned in the year after the payment of charges and the dividend on the $35,000,000 Interborough stock increased $286,053 over the surplus for the year ended June 30, 1906. The dividends declared on the Interborough stock went to pay the interest on the $70,000,000 Interborough-Metropolitan bonds when received by the holding company as owner of substantially all the stock of the Interborough. That was the only income derived by the Interborough-Metropolitan as holding company, the surplus earnings of the Interborough remaining in its own treasury. Following is the statement:

Interborough Rapid Transit Company statement, showing gross earnings, operating expenses, net income, and passengers carried for years ended June 30. 1907 and 1906—

Year Ended June 30, 1907.		Increase, 1907 over 1906.
Gross earnings	$22,363,802.33	$2,668,208.21
Operating expenses	9,593,331.03	1,192,507.44
Net earnings	$12,770,471.30	$1,475,700.77
Other income	815,832.63	100,329.47
Gross income	$13,586,303.93	$1,576,030.24
Interest on bonds and three-year gold notes and rentals	4,375,894.86	789,072.00
Taxes	1,377,965 37	*12.594.76
Total interest, rentals, and taxes	$5,753 860.23	$776.477.24
Balance	$7,832,443.70	$799,553.00
7% on Manhattan Railway Company stock	4,116,000.00	252,000.00
Net income	$3,716,443.70	$547,553.00
Dividends on $35,000,000 Interborough Rapid Transit Company capital stock	3,150,000.00	262,500.00
Surplus	$566,443.70	$285,053.00
Operating per cent	42.89	0.24
Passengers carried	449,287,884	53,571,498

*Decrease.

The Interborough also gave out at the same time a statement in answer to certain deductions drawn by investigators employed by the City Club as to the relative decrease of service on the elevated lines between 1902 and 1907, as compared with the increase in passengers carried. The Interborough's statement showed the figures on passengers carried and car mileage for the first six months of the two years in question, whereas the City Club's figures were based on train mileage and number of passengers. It is the assertion of the railroad that train mileage does not furnish a fair criterion on account of the fluctuation of the number of cars on trains operated from time to time.

This was the showing made by the company:

Elevated Lines.	Car Mileage. 1902.	1907.	Inc. P.C.
Second Avenue	3,178.982	4,746,109	49.3
Third Avenue	8,426,855	12,402,877	48.2
Sixth Avenue	7,091,135	7,671,172	08.2
Ninth Avenue	4,174,964	6,057,057	45.0
Total	22,871,936	30,967,237	35.4

Elevated Lines.	Passengers Carried. 1902.	1907.	Inc. P.C.
Second Avenue	14,788,283	23,886,006	61.5
Third Avenue	43,880.451	62,845.547	43.2
Sixth Avenue	44,187,599	44,053,340	*0.3
Ninth Avenue	12,880,164	16,513,617	28.2
Total	115,736,497	147,298,510	27.2

*Decrease.

THE SITUATION IN CLEVELAND

Alleging that the cars of the Forest City Railway Company have been leased to the Low Fare Railway Company in so far as the operation over its lines are concerned, their operation on Euclid Avenue was not stopped, notwithstanding the decision of Judge Lawrence that the Forest City Railway Company had no rights east of Ontario Street in the middle of the Public Square. Decision on the Low Fare Company's franchise around Erie Street Cemetery has been reserved, and until it is rendered the cars will, perhaps, continue to operate over Euclid Avenue to the connection at East Fourteenth Street. This is the same trick that was played, when an injunction was granted that should have effectually barred the Forest City Railway Company's cars from Superior Street.

As soon as the decision of the Common Pleas Court was made known, and it was found that the cure-all ordinance had been sustained, so far as the franchises on the West Side were concerned, a force of men were put to work laying track on Bridge Street. A single track had been laid on that street some time ago, and the company now proposes to complete the double track and operate its cars. It is said that a number of new cars have been received and will be put into operation at an early date.

City officials state that action will be taken by the City Council at an early date to legalize the franchises on Central Avenue and Quincy Street on the East Side, but it is a question of consents on those streets now. The Cleveland Electric officials say they have a majority of the consents on both streets and do not fear that they will not secure a legal franchise.

In Peter Witt's case against the Cleveland Electric to force it to cease spending money for advertising and in legal controversies, testimony was taken last week tending to show that the publicity bureau of the company is furnishing material for campaign purposes and that space has been purchased in some of the newspapers printed in foreign languages for that purpose. This was denied by those who conduct the publicity bureau of the company. As a result the editor of the *Press* and of the Scripps papers were put on the stand, and both of them testified that the headlines on some of the matter were written by a man formerly employed on the *Press*, but who is now in the employ of the Cleveland Electric.

The mayoralty campaign has resolved itself into a fight over the street railway subject. Mayor Johnson still asserts that his election means an immediate settlement of the matter. On the other hand, Mr. Burton emphasises the fact that his plan will result in an immediate reduction of fares, a settlement within one year and a greatly improved service.

Seven street railway ordinances were introduced in the City Council Monday evening, Oct. 21, all of them, with one exception, providing for extensions of the 3-cent fare lines from the West Side Road that is now in operation. These ordinances provide for the extension of the Fulton Road and Denison Avenue franchises to and around the Public Square and through the Square. From this point grants are asked on Euclid to East Fourtenth Street, on Superior to East Ninth Street, on East Ninth Street from Superior to Euclid; from the Square on Ontario Street to Eagle Avenue, from Ontario Street on Prospect Avenue to East Ninth Street, and on East Ninth Street to Euclid Avenue. This would give the Forest City Railway Company a right to operate on all the streets in the central part of the city, with the use of the various squares for loops. On all the streets named, it would be necessary to use the Cleveland Electric tracks. The proposed grant for the use of Central Avenue and Quincy Street provides that cars shall run from the center of the Public Square out Euclid Avenue to East Fourteenth Street, thence south to Central Avenue and east to Eighty-Fifth Street; also on Fifty-Fifth Street from Central Avenue to Quincy Street, and on the latter to Woodhill Road. Consents must be secured for the lines on Central Avenue and Quincy Street, and some arrangement must be made to use the tracks of the Cleveland Electric on all other streets mentioned, with the exception of the short line owned by the Forest City Railway Company on East Fourteenth Street. Other ordinances provide for grants on West Twenty-Fifth Street between Bridge and Lorain Avenues, on Lorain Avenue from its intersection with Fulton Road west to West Seventy-Third Street, and from the same point east to Abbey Avenue, across the bridge to West Fourteenth Street and to Kenilworth Avenue, on this street, on West Fourteenth Street to Central Viaduct, across this viaduct to Central Avenue, Ontario Street and Eagle Avenue, thus giving two routes to the central part of the city. These ordinances will probably be rushed through, with the exception of those requiring consents.

The Forest City Railway Company made a tender of $19,000 to the Cleveland Electric Railway Company a few days ago for the joint use of the tracks, lines, poles and other property between its lines on the West Side and the Public Square. This was refused, as was a tender made some time ago.

STORAGE BATTERY INSTALLATION OF THE NEW YORK CENTRAL RAILROAD

In the article on the storage battery installation of the New York Central Railroad in the Oct. 12 issue of this paper a reference was made to the fluctuations for rotary in sub-station No. 2 on Aug. 7, and a chart was published of the output of the sub-station and output of the rotaries. The statement was made that the extreme fluctuation for rotary was about 2500-amperes, whereas the correct figure should have been 250 amperes, as an examination of the chart will indicate.

MONTHLY MEETING OF THE NEW ENGLAND STREET RAILWAY CLUB

The regular monthly meeting of the New England Street Railway Club was held in the library of the Edison Electric Illuminating Company, Boston, on Thursday evening, Oct. 24. Through the courtesy of the Edison Company, the members of the club were favored with a most interesting address and inspected the Boylston Street exhibition department and the L Street power station in South Boston. This gave the members an opportunity to see the three 5000-kw Curtis turbines in operation, and the fourth of the same size and make now being installed. The company is at present engaged in doubling the size of the turbine station buildings, and is making preparations to install an 8000-kw Curtis turbine next spring.

The members assembled in the library of the Edison Electric Illuminating Company at 6:30 p m., and at 6:45 p. m. a lunch was provided by the club. At 7:15 p. m. a representative of the Edison Company described briefly the apparatus which the members saw in operation at the L Street power station later in the evening. At 8 p. m. the party boarded special cars, and through the courtesy of the Boston Elevated Railway Company, proceeded to the L Street power station of the Edison Company.

DECISION IN CALIFORNIA ON JOINT USE OF TRACKS

Judge de Haven has handed down in the United States Circuit Court of Appeals, in San Francisco, a decision in which he maintains that the municipal authorities have a right to grant a franchise to one railroad company to run its cars on the tracks of another company for five consecutive blocks. The decision will enable the California Street road to run over the track of the United Railroads of San Francisco to the ferry. The Geary Street road could also find a way to reach the waterfront. Under the ruling, it would be almost impossible for any one company to shut out another. The matter came up in the Apellate Court on the appeal from the order of the United States Circuit Court of the Northern District of California, enjoining the San Jose-Los Gatos Interurban Railway Company from constructing a railroad on San Fernando Street, in San Jose. It was made on petition of the San Jose Railroad Company.

The Geary Street road could thus reach the ferry going five blocks on Market Street and then over Sutter Street tracks on the last five blocks to the ferry. The Sutter Street is a separate corporation, and as such the United Railroads claims its monopoly of four tracks on Market Street, from the junction of Sutter to the ferry. The decision of Judge Sharpstein in the State Supreme Court, which has been considered the law for twenty years, in which he held that the municipal authorities had a right to grant exclusive franchises, Judge De Haven shows was not concurred in by the majority of the court, and, therefore, was not conclusive. In reversing the order of the lower court, Judge De Haven said that the authorities of San Jose had no right under the state of California to grant an exclusive franchise to the San Jose Railroad Company.

TRANSIT MATTERS IN NEW YORK

Fifty-six persons were killed on the railways in the four counties composing New York in September, according to the monthly report of the Public Service Commission. This is the second report of the kind which the commission has issued, and it includes the steam railroads, as well as the surface lines, the subway and the elevated. The figures for one line have not been completed as yet, therefore the increase in the number of persons killed over the figures for the twenty-six days in August which the commission's report for that month covered will be even greater than the present report shows. The report shows that there was a falling off in the total number of accidents, but the number of serious accidents was greater in September than in the twenty-six days of August. In 208 cases the victims of accidents were either killed or suffered serious injury, as against 189 such cases in August. The total number of accidents of all character was 4906, as against 5500. Comparing the reports for the two months, more persons were killed, more persons suffered fractured skulls, and more suffered serious injuries not classified in September than in August. The number of persons hurt in car collisions and on the stairways of stations was also greater. The tables in the commission's report are as follows, with the comparative figures:

	Aug. 5 to 31	Sept.
Persons injured in car collisions	145	214
Persons injured in collisions with vehicles	465	641
Persons struck by cars	405	309
Persons injured boarding cars	641	503
Persons injured alighting from cars	1263	915
Employees injured	641	597
Derailments	33	23
Injuries on stairways	26	35
Other accidents	1881	1669
Total	5500	4906

The serious accidents are further classified as follows:

	Aug. 5 to 31	Sept.
Persons killed	42	56
Fractured skulls	10	11
Amputated limbs	10	7
Broken limbs	44	39
Other serious injuries	83	95
Total	189	208

Inspectors in the employ of the Public Service Commission are engaged in learning the exact extent to which the vehicular congestion on certain streets interferes with the proper operation of the surface cars. It is the intention of the commission to go into this matter thoroughly and to bring about such changes, if possible, as will make it impossible for the traction companies to assert with truth in the future that the poor service they afford is due to the interference of vehicles and the constant blockading of the tracks by broken-down wagons.

It may be that in order to overcome the difficulty on Broadway and that at Twenty-Third Street and Fourth Avenue, the commission will ask the police commissioner to devise rules that will necessitate truck and wagon drivers going a considerable distance out of their way. In any event there is a possibility of trouble with the drivers, and the commission is now studying the methods of street traffic control in vogue in certain European cities with a view to ascertaining how its wishes can best be enforced.

The receivers of the New York City Railway Company have obtained an order from the court permitting them to spend $3,000,000 for new cars and other equipment. In the petition, the receivers said that the equipment of the roads was destroyed partially in a fire of the car barns at 146th Street and Lenox Avenue last April, which caused the total destruction of 300 cars. On Sept. 9 a second fire destroyed eighty cars. The destroyed cars, it is said, were closed or winter cars, and as the fire occurred during the simmer time the public was not then inconvenienced. The receivers informed Judge Lacombe that it is now imperative that winter cars be made ready for service at once. Although the New York City Railway Company had ordered new cars to take the place of those destroyed, but thirty of them have been delivered up to date. The petitioners are advised, they say, that nine new cars can be purchased, ready for delivery, and eighty additional cars of the closed or winter type contracted for, with deliveries on or about Jan. 15 next. It is also possible, the two receivers state, for 155 additional cars of special type and of large capacity to be bought for delivery from time to time before the close of the year. Properly to operate the system, the receivers, also ask permission to replace the destroyed car barns at 146th Street and Lenox Avenue, where repair shops were located. Since the fire the system has been seriously crippled in its operation, it is alleged, because of the lack of these shops. Cars have to be left at night on open tracks, exposed to the weather, which not only injures the cars, but prevents proper inspection.

RECEIVERS FOR THREE WESTINGHOUSE COMPANIES

Temporary receivers were named Wednesday, Oct. 23, for the Westinghouse Electric & Manufacturing Company, the Westinghouse Machine Company and the Securities Investment Company, as the result of a conference of Pittsburg bankers, who, finding the companies embarrassed by the money stringency, determined that there should be no shutting down of the works or hampering of operations by importunate creditors. T. Hart Given, president of the Farmers' Deposit Bank; H. S. A. Stewart, real estate man and financier, and E. M. Herr, vice-president of the Westinghouse Electric & Manufacturing Company, were named to assume charge of the Westinghouse Electric & Manufacturing Company. William McConway, president of the McConway & Torley Company; W. H. Donner, president of the Union Improvement Company, and E. E. Keller, vice-president of the Machine company, were appointed receivers for the Westinghouse Machine Company. The Fidelity Title & Trust Company, of Pittsburg, was named receiver for the Securities Investment Company. The Westinghouse Air Brake Company and the Union Switch & Signal Company are not affected.

The allegations in the bills were that owing to the stringency in the money market it was found impossible, at the present time, to obtain the money with which to carry on the business of the industrial companies. It was stated that it was deemed for the best interest of the stockholders of the company, the employees and the creditors that the court appoint receivers to carry on the business of the companies rather than close down. The bills set forth that each of the industrial companies has large orders and that it is to the best interest to all concerned that the contracts now on hand be carried out. The court made an order that the industrial companies be operated under the receivers and that they be authorized to purchase such material as might be necessary to carry on the business of the companies.

It is explained that the Securities Investment Company was purely a Westinghouse concern, being practically owned by George Westinghouse, and that the company has been advancing money to the two industrial companies. The receivers were ordered to give bond in the sum of $100,000 for each company, and the American Surety Company went on the bond.

George Westinghouse issued the following statement:

When the Pittsburg Clearing House Committee, after a full investigation and conference with me, concluded that, although the Westinghouse Electric & Manufacturing Company and the Westinghouse Machine Company were solvent, receiverships were advisable as the best means of protecting the interests of all concerned, it was clearly our duty to follow their friendly advice. The necessity for the receiverships is due solely to the acute financial stringency and consequent inability to renew our maturing paper.

Both the Electric and the Machine companies are solvent, and are doing the largest and most satisfactory business in their history, and each company is earning liberal dividends on its stock, and has quick assets substantially equal to its liabilities. I most confidently believe that every creditor of each company will be paid in full, and that, with wise management, under the direction of the receivers appointed by the court, the properties will soon be restored to the stockholders.

The loans to the Securities Investment Company and myself are secured by the stocks of the Westinghouse manufacturing companies, chiefly stock of the Electric and Machine companies, the sudden decline in the market value of which on Monday and Tuesday of this week has made it impossible for us to margin our loans. I strongly advise all holders of such loans to hold their collateral, the value of which I am confident will in time be sufficient to pay the loans. The sacrifice of the collateral in the present condition of the market can benefit no one. A policy of patience and forbearance is what the situation requires.

On the application of Herman Westinghouse and the Atha Steel Casting Company Judge Ward, in the United States Circuit Court, on Thursday, Oct. 24, appointed E. M. Herr, P. H. Given and Charles C. Burlingham ancillary receivers of the Westinghouse companies and their assets and properties in the judicial district of New York.

CHICAGO LITIGATION—REPORTS OF UNION TRACTION SUBSIDIARIES

Three angles of the traction litigation were before Judge Grosscup Tuesday, namely: Motions of Guaranty Trust Company for accounting by Receiver Sampsell before the master; motion of Central Trust Company for immediate payment of interest on bonds, and, thirdly, foreclosure cross bill filed by the Fidelity Trust Company, of Philadelphia. The Central Trust Company to-day will file a similar foreclosure suit. General Counsel Gurdy, of the Union Traction, says that this new mass of litigation will not delay the final settlement of the North and West Side troubles. The Guaranty Trust also gives notice it will ask leave to file a cross bill preparatory to foreclosing on a mortgage bond held by it. The Fidelity Trust Company's bill states that mortgage holders under trust conditions have deposited $10,000,000 bonds for the latest reorganization plan, the terms of which will be published this week. Sampsell's reply to attacks on his receivership is a full acknowledgment with justification on the ground of public policy as well as the company's interests. The Fidelity Trust suit is a cross bill to the creditors' bill of the Guaranty Trust; it makes all Union Traction interests defendants.

Clarence H. Venner, of New York, on Oct. 21, filed in the Superior Court a bill asking that a receiver be appointed for the Chicago City Railway Company, which operates in the southern part of Chicago; and also that the traction settlement ordinance passed by the City Council of Chicago on Feb. 11 be declared illegal and void. The bill makes the Chicago City Railway Company, its officers and directors, J. P. Morgan & Company, of New York, and all holders of bonds recently issued by the railway company under a trust deed, defendants. Venner alleges that the bondholders are not innocent purchasers without notices of defect in the bonds, and he, therefore, asks for the cancellation of the bonds and mortgage, and for the enjoining of further payments to the city as compensation. The ordinance is attacked on the ground that it is unconstitutional, and impairs the vested rights and obligations between the State of Illinois and the company.

The Fidelity Trust Company, of Philadelphia, has filed a cross bill for foreclosure of its mortgages on the property in litigation under the Union Traction receivership. The bill is filed against the Union Traction Company and the subordinate corporations through which the Union Traction Company holds control of the lines on the West and North Sides of Chicago.

The Chicago Union Traction Company reports earnings of the several operating companies for the year ended June 30, 1907, as follows:

NORTH CHICAGO STREET RAILROAD

	1907	1906
Gross receipts	$3,507,014	$3,518,004
Operating expenses	2,392,684	2,185,694
Net earnings	$1,114,330	$1,332,310
Other Inc.	21,069	25,172
Total Inc.	$1,135,399	$1,357,182
Fixed charges, etc.	1,111,506	1,260,877
Surplus	$23,893	$96,605

WEST CHICAGO STREET RAILWAY

Gross receipts	$6,850,050	$6,573,964
Operating expenses	4,651,086	4,335,737
Net earnings	$2,198,964	$2,238,227
Other Inc.	34,282	50,404
Total Inc.	$2,233,246	$2,288,631
Fixed charges, etc.	2,233,246	2,288,631
Deficit	.....	.....

CONSOLIDATED TRACTION COMPANY

Gross receipts	$1,951,270	$1,833,559
Operating expenses	1,667,869	1,314,409
Net earnings	$283,401	$519,150
Other Inc.	82,452	82,881
Total Inc.	$365,853	$602,031
Fixed charges, etc.	689,795	705,010
Deficit	$323,942	$102,979

The report of the committee on state legislation recommending the passage of the Fisher bill compelling all steam roads inside the Chicago city limits to electrify their roads within three years has been approved by the Chicago City Council.

NEW TRANSFER REGULATIONS IN PHILADELPHIA

A step toward correcting the abuse of free transfers has been taken by the Philadelphia Rapid Transit Company and notices have been posted in the cars announcing that transfers will be given only on request at the time fares are paid. It was also announced that transfers will not be given on transfers, thus curtailing a privilege heretofore granted at some intersections.

Representatives of the company have compiled a long list of business places where transfers are given as premiums. The slips are reported to have been found on sale at many saloons, cigar stores, billiard and pool rooms and barber shops, and it is even said that conductors have been getting drinks, cigars and their tonsorial work in exchange for transfers.

NEW ENGINEERING POCKETBOOK

The McGraw Publishing Company announces the publication of a new pocketbook for electrical engineers, which is to be on the market by Nov. 15 and will be known as the "Standard Handbook for Electrical Engineers." The field of electrical engineering has been divided into sections, and each section has been treated by a specialist. The section devoted to electric traction is the largest single section in the book.

A few of the authors are: A. H. Armstrong, "Electric Traction"; Geo. C. Shaad and R. C. Beardsley, "Central Stations"; Edw. Lyndon, "Batteries"; A. L. McAllister, "Transformers and Motors"; H. M. Hobart, "Electric Generators."

The book is divided into 20 sections: units, circuits, instruments and measurements, materials, magnets, transformers, generators, motors, batteries, central stations, transmission and distribution, illumination, electric traction, electrochemistry, telephony, telegraphy, miscellaneous applications of electricity, wiring, standardization rules, tables and statistics.

Although the book contains over 1300 pages, it will still be of pocket size, owing to the high quality of "bible" paper employed. The binding will be in flexible red morocco. The illustrations, over 1500 in number, were all especially prepared for the work. The price is $4 net.

THE STRIKE IN YONKERS SHORT LIVED

The strike of the employes of the Yonkers Railway Company, of which mention is made elsewhere in this issue, is doomed soon to peter out. New men have been engaged to take the places of those who left their posts, and President Maher, of the company, announced on Thursday that cars would be in regular operation again Thursday afternoon. The strikers, however, still insist that their demand for an increase of wages of 5 cents an hour must be granted before they will go back to work.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED OCT. 15, 1907

867,939. Line Wire Switch-Frog for Electric Railways; Harry J. Beck, Winburne, Pa. App. filed Jan. 7, 1905. Consists of a plurality of splice-pieces, one of which is movable and provided with a pivotal connection with the body part. Provides for shifting at will the angle of inclination of the main line splice-piece with respect to any branch line.

867,971. Wheel Fender for Cars; Joseph Hoefling, Grand Rapids, Mich. App. filed Jan. 29, 1907. Consists essentially of an arrangement of a horizontally arranged front fender and an inclined rear fender connected by such means that when the front fender rises over an obstruction the rear fender is moved downward in contact with or close to the roadbed.

868,035. Car Fender; James T. Tighe, Boston, Mass. App. filed Feb. 14, 1907. Details of construction.

868,043. Railway Brace; Jacob H. Waldschmidt, Fond du Lac, Wis. App. filed Oct. 25, 1906. Details of a brace to prevent spreading of the rails.

868,103. Car Fender; Benjamin Lev, Cleveland, Ohio. App. filed Jan. 23, 1907. Details of a fender adapted to fold and slide beneath the end of the car.

868,197. Derailing Switch; Leroy J. Lindsay and Joseph H. Carroll, Seymour, Iowa. App. filed March 18, 1907. A diagonally grooved plate designed to rest on top of the rail and means for holding the same in place.

868,212. Railroad Tie; William McCloy, Cressona, Pa. App. filed May 14, 1907. The tie consists of a U-shaped channel rail with wooden blocks therein to which the traction rails are affixed.

868,222. Electric Railway Switch and Signal; Alice A. Roth, Buffalo, N. Y. App. filed May 14, 1907. A pair of spring plates adjacent to the trolley conductor, with which a circuit is completed by the trolley wheel. Solenoid magnets have a lever connection with the switch point and are selectively energized according to the way the car takes current.

868,230. Electromagnetic Device for Use in Connection with Railway Appliances; Louis H. Thullen, Edgewood Park, Pa. App. filed March 18, 1905. An indicating mechanism for a lever of an interlocking machine, comprising a core, a coil designed to be traversed by an alternating current, a movable member inclosing a portion of the core and a stem connected with the movable member.

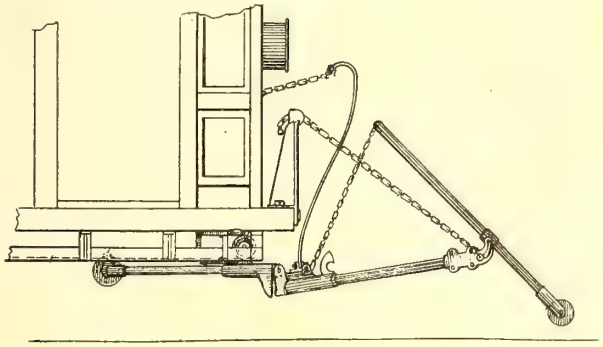
868,231. Signaling System for Electric Railways; Louis H. Thullen, Edgewood Park, Pa. App. filed April 30, 1907. Comprehends the prevention of an improper operation of a signal for one track by the signaling current from an adjacent track.

868,302. Signaling System for Railways; Louis H. Thullen, Edgewood Park, Pa. App. filed May 28, 1906. A block signal system of the type in which the track rails form part of the return path for the propelling current. The rails at the end of each block section are connected by inductive bonds. Has alternating current and polarized rails.

868,354. Signal System; Bernard F. Merkel, Salida, Col. App. filed May 1, 1907. Means for signaling a train from a distant station, consisting of a target containing electric lighting means, said target adapted to slide by gravity to a position directly over the track when released for signaling.

868,376. Rail Bond; Darwin Ulke, Chicago, Ill. App. filed July 28, 1906. Has a terminal with an extended contact surface and an attaching stud integral with the terminal and projecting from the inner end of the contact surface.

868,384. Insulated Rail Joint; Benjamin Wolhaupter, New York, N. Y. App. filed Jan. 26, 1907. The side joint plates



Pat. No. 868,103.

each carry a base section affording a support for one rail end only and are provided with a reinforcing flange. Insulating means.

868,402. Rail Joint; Bancroft G. Braine, New York, N. Y. App. filed Aug. 11, 1906. Contemplates a binding means for insulation or bonding plates which provides for firmly and tightly securing such plates in intimate contact with the opposing bearing surfaces of the rail and the rail joint members.

868,424. Signal System; Julien A. Gehrung, New York, N. Y. App. filed Feb. 15, 1907. A signal system adapted for steam railroads where a less expensive installation than the usual block signal is desired. Has semaphores along the track which may be selectively operated from a dispatcher's station over a single wire connection. In all cases the correct actuation is checked by a return signal. There are also means by which the condition of every semaphore signal along the line is constantly shown at the dispatcher's station.

868,481. Air-Brake System; Henry N. Ransom, Albany, N. Y. App. filed June 1, 1906. Consists in returning again to the source, in releasing the brakes, the air which is supplied from the source to brake cylinder in applying the brakes, so that the same air is used repeatedly.

868,482. Folding Car Step; Nelson L. Reeves and James B. Shane, Chicago, Ill. A swinging car door having a pivot extending below the platform, a turning step thereunder and gearing between the lower end of the pivot and the step, whereby the step is turned into or out of position for use when the door is opened or closed.

868,505. Rail Chair; Joseph W. Trotter, Dora, Ala. App. filed Jan. 19, 1907. Means for anchoring the rail chair to the tie.

868,517. Insulated Rail Joint; Benjamin Wolhaupter, New York, N. Y. App. filed Nov. 8, 1906. One feature of this invention is that of providing a divided rail-supporting base comprising separate complemental base plates, each of which constitutes an independent metal supporting base for one rail end.

868,518. Insulating Rail Joint; Benjamin Wolhaupter, New York, N. Y. App. filed Nov. 8, 1906. See preceding patent.

868,519. Insulated Rail Joint; Benjamin Wolhaupter, New York, N. Y. App. filed Dec. 3, 1906. Means for relieving the base insulation from the load, consisting of an auxiliary bridging rail which serves as a girder to strongly reinforce the joint parts and also presents a carrying head which receives and supports the car wheels in passing the joint.

868,520. Insulated Rail Joint; Benjamin Wolhaupter, New York, N. Y. App. filed Dec. 8, 1906. See patent 868,517.

868,531. Controller Operating Mechanism; Clarence T. Crocker, Norwood, Ohio. App. filed Nov. 29, 1905. Details of a pawl and ratchet whereby a step-by-step movement of the controller handle is necessitated in applying the current.

868,553. Car Axle; Langley Hall, Astoria, Ore. App. filed May 4, 1907. The axles are made of telescopic sections so as to revolve independently of each other. Lubricating means.

868,673. Controller; Charles E. Lorn, Norwood, Ohio. App. filed May 20, 1907. A controller for the motor of electric railways having an interlocking mechanism for the main switch and the cut-out switch of a railway controller.

868,592. Air-Brake System; Charles E. Barry, Schenectady, N. Y. App. filed May 14, 1906. Consists in providing two train-pipes, automatic valves on the several cars controlling the flow of air into and out of the brake cylinders, the pistons for operating the valves being exposed on opposite sides to pressures supplied from the two train-pipes, respectively, with means for varying at will the relative pressures in the two train-pipes.

868,596. Potential Starter Attachment; Herbert W. Cheney, Norwood, Ohio. App. filed Nov. 23, 1906. Consists of a controller biased toward "off" position when in a "starting" position and means for unbiasing the controller when it is moved to "running" position.

868,623. Adjustable Brake Head; Carl E. Bauer and Frank L. Susemihl, Hammond, Ind. App. filed Feb. 4, 1907. The brake head is rotatably mounted on a bearing on the brake-beam, adjacent laterally projecting winds carried by the brake-beam and brake head, respectively, and means for rigidly uniting the wings at various positions of relative angular adjustment.

868,614. Automatic Switch for Railways; Lewis C. McAdams, Sacramento, Cal. App. filed July 1, 1907. Means for actuating a drum and cable mechanism from a moving car to thereby throw the switch.

PERSONAL MENTION

DR. HANS GOLDSCHMIDT, of Essen, Germany, and inventor of thermit, arrived in this country Oct. 22. He will remain about two months.

MR. H. HOLBERT PORTER, of the firm of Sanderson & Porter, engineers, it has just been announced by the Interborough-Metropolitan Company, of New York City, has been appointed consulting engineer of the company.

MR. M. P. HERELEY has been selected by Mayor Busse, of Chicago, as superintendent of local transportation, to succeed

Dr. Maurice F. Doty. Mr. Hereley was at one time superintendent of the Union Traction Company, of Chicago, and has been employed by the company at various times in different capacities.

MR. D. W. McFETRIDGE, purchasing agent for the Lehigh Valley Transit Company, Allentown, Pa., since December 1, 1905, has resigned, to enter the employ of the Lehigh Portland Cement Company in a similar capacity. The duties of purchasing agent will hereafter be discharged by President Stevens and other officials of the road.

MR. JOHN E. OVERTON, formerly State Game Protector, has accepted the position of superintendent for the Suffolk Traction Company, of Port Jefferson, L. I. Mr. Overton states that his company is ready to begin work in Port Jefferson immediately upon receiving the necessary consents. The company is to build a line from Patchogue to Port Jefferson, and from Port Jefferson to Stony Brook.

MR. HENRY L. DOHERTY, head of the American Gas & Electric Company, and a member of the Emerson-McMillan syndicate, was tendered a banquet recently at Montgomery, Ala., at which many of the leading business men of the city made speeches. Mr. Doherty was at Montgomery on a visit to the Montgomery Light & Waterpower Company. Mr. Robert J. Chambers, manager of the local plant, was the toastmaster and introduced the speakers. Mr. Doherty said that his company was preparing to spend $100,000 in additions, and even more if need be, to keep the property up to the demands of the public upon it. He paid a visit to the power plant at Tallassee.

MR. W. B. TARKINGTON has resigned as superintendent of transportation of the Milwaukee Electric Railway & Light Company, his resignation to take effect Nov. 1. Mr. Tarkington at one time was general superintendent of the Omaha & Council Bluffs Street Railway Company, of Omaha, Neb., and has long been identified with street and steam railroad work. He began his career in the mechanical department of the Chicago & Northwestern Railroad as machinist's apprentice and was later made division master mechanic on the Iowa division of the road. Since then he has been connected with a number of important street and interurban companies. He has not yet announced his plans for the future.

MR. W. H. WILLIAMS has been elected second vice-president of the United Traction Company, of Albany, N. Y., and Mr. W. H. Davies has been chosen as comptroller of the company. Mr. Williams was recently made third vice-president of the Delaware & Hudson Railroad, the parent company of the United Traction Company, in charge of the financial and accounting departments. His election as second vice-president of the United Traction Company will also place him in charge of the same departments in that company. The office to which Mr. Williams has been elected is a new one and was created because of the desire to have in New York City an official of the company who can look after the detail work. President Loree is engaged constantly with Delaware & Hudson Company matters and the other officers of the company are all located in Albany. Mr. Williams was until a short time ago assistant to President Loree. The new comptroller, Mr. W. H. Davies, is now the acting comptroller of the Delaware & Hudson Company. Mr. Luman H. Stewart, who, until a short time ago was comptroller of the Delaware & Hudson Railroad, also acted as comptroller of the United Traction Company. With the resignation of Mr. Stewart because of ill health, Mr. Davies, the assistant comptroller, was assigned to his duties by General Manager Sims.

MR. W. J. HARVIE, for some time electrical engineer of the Utica & Mohawk Valley Railway Company, has been appointed chief engineer of the Utica & Mohawk Valley Railway, the Oneida Railway Company and the Syracuse Rapid Transit Railway. For the present, Mr. Harvie will remain at his offices in Utica, but the supposition is that he will finally be located in Syracuse. Mr. Harvie joined the engineering force of the company, in a subordinate capacity, when work was progressing on the Little Falls extension. The work of electrification on the West Shore Railroad was mainly in his hands, he having charge of placing the sub-stations and the third-rail, and equipping the cars. Mr. H. S. Williams, who has been Mr. Harvie's assistant, succeeds him as electrical engineer of the Utica & Mohawk Valley Company, his duties to remain the same as heretofore. Mr. F. J. Jewell is given the title of chief operator of the Oneida Railway Company, which has charge of the West Shore, with jurisdiction over the power department and the transmission line of the company. Mr. T. F. Daly, general foreman of the Oneida Construction Company, will devote such time as may be necessary to maintenance of the third-rail and have jurisdiction over the third-rail patrolmen.

MR. D. W. DOZIER, chief engineer and superintendent of power stations for the Twin City Rapid Transit Company, of Minneapolis and St. Paul, has resigned from the company to take effect Nov. 1, and will retire from active engineering to his fruit farm in the Ozark Mountains, near Springfield, Mo. Mr. Dozier has been employed by the Twin City Rapid Transit Company as chief engineer for the past five years and has superintended the construction of the new power station in Minneapolis, which is one of the largest and most complete in the West. The installing and operating of all machinery has been under his supervision, besides operating the old stations of St. Paul and Minneapolis. Mr. Dozier came to the Twin City Company from Kansas City, Mo., where he was for many years with the Metropolitan Street Railway as chief engineer, designing, building and operating power stations. He first entered street railway work in 1886, when he went from the E. P. Allis Company, of Milwaukee, to Kansas City, with the first pair of engines to be installed for the Grand Avenue Cable Railway Company. After erecting the engines and starting the station under the Allis contract, Mr. Dozier was retained by the company as chief engineer, and remained with the company for more than sixteen years. Eight or nine years after he entered the service of the Kansas City Company followed the consolidating of all the cable railways, the equipment of the system with electricity, creating a demand for new power stations, which Mr. Dozier designed and built for the Metropolitan Street Railway, notably the Kaw River Station. Before entering street railway work, Mr. Dozier was for six years chief engineer on river boats and connected with some of the leading engine builders of this country. He superintended and started the large cable power station for the Washington & Georgetown Cable Railway Company, of Washington, D. C., in 1892 and 1893. He will be succeeded in the Twin City Company by Mr. George Caywood, of the Allis-Chalmers Company, of Milwaukee, Wis.

MR. JOHN W. CORNING, the new secretary of the American Street and Interurban Railway Mechanical Association, is a man well known in the affairs of the association, and thoroughly qualified to succeed Mr. S. W. Mower, who, as secretary of that body since its organization in 1902, has worked faithfully in its interest. Mr. Corning at present is electrical engineer of the Boston Elevated Railway Company, with which he has been continuously connected since his graduation from John Hopkins University in 1894, when he obtained a position with the West End Street Railway Company on construction work connected with the rewiring of the company's central power station. After this work was finished, in the course of a few months, Mr. Corning was put at work upon one of the regular operating shifts in the power station, where he spent several months. After the first installation of the underground feeder cables was finished, Mr. Corning was assigned to the test house, where the general work of testing and locating faults on the system was carried out. Here he remained for two or three years, when he was made private secretary to Mr. Charles F. Baker, the master mechanic. After two years of service under Mr. Baker, Mr. Corning entered the department of wires and conduits, taking up the general supervision of the lay-out of the feeder and return systems, overhead and underground, the cable testing, and the records of the department of wires and conduits relating to trolley wire, poles, feeders, etc. In 1901 his jurisdiction was increased to cover the general electrical testing work and other duties that had come under the charge of the electrical engineer, who had recently resigned. This work Mr. Corning carried on with gradual increase of duties until in 1905 he was given the title of electrical engineer. Mr. Corning was chairman during the past year of the committee of the American Association on Car Wiring.



J. W. CORNING.

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DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

Of this issue of the Street Railway Journal 8300 *copies are printed. Total circulation for* 1907 *to date* 362,950 *copies, an average of* 8248 *copies per week.*

Retrospect and Prospect

The present is the time when electric railway companies have before them the records of the business done last summer and are making preparations for the traffic to be carried during the coming winter. It may not be an inappropriate season also for us to review what the STREET RAILWAY JOURNAL has given its subscribers during the past year and to outline briefly the policy of the paper during the twelve months to come. Our last volume was that for the first six months of 1907 and, as shown in the statement published at that time, the reading pages of the paper were 14 per cent in excess of those of the corresponding volume during the first half of 1906. The increase in number of reading pages published in the STREET RAILWAY JOURNAL during the twelve months ending Nov. 1, 1907, as compared with the same period in 1906, was 190, or 8 per cent. The total number of reading pages printed during that time was 2734; the number of advertising pages for the same period was 4116, making a total of 6850. This is equivalent to practically twenty-three pages, nine reading and fourteen advertising, for one cent to our subscribers. Last month this average was materially surpassed, as during October we published 486 reading pages during the four issues, or an average of over 140 each week. This is exclusive of the Dictionary of Electric Railway Material, of 169 pages, which was published in book form and mailed under separate cover gratis to every subscriber. This monthly record is by far the largest with which we are acquainted in technical journalism, and the yearly figures are equalled by few papers in the country. Of the character of the articles we shall not speak, but many complimentary letters have been received in regard to recent issues, particularly our Convention Number, one of which, from a prominent electric railway engineer, says "it cannot fail to be extremely valuable to all, if simply for the interchange of ideas that will be effected by placing so much material of the same character in the same set of pages. It is worth more than a whole lot of theoretical treatises on the electrical equipment of steam railroads."

Speaking for the future, we expect to make the STREET RAILWAY JOURNAL the very best paper possible for all departments of the street railway business. We shall not intentionally neglect any branch of the work, as we believe that in an industry in which all branches are so interrelated as they are in a street railway company, and in which there are such frequent changes in the personnel, most of our readers desire to keep informed at least in a general way as to what improvements are being made in all departments. One can specialize if he wishes, in accounting, in electrical or steam engineering, in repair work, in the claim department, or in some other branch, but on the small road it is very necessary for each department to be in close touch with every other and on the large roads promotions to the managership or manager's office are very likely to come to him who, besides knowing all about his own work, has somewhat of an acquaintance with the practices followed in other services of the company. For those who prefer a narrower view and are interested only in their particular department we extend our assurance that their especial topics will be fully covered.

A publication of this kind could not and cannot be successful without the cooperation of the active workers in the field, and we realize that we owe a great debt to those

who have liberally supplied us in the past with information and contributions. To many busy operating men and successful consulting engineers with a large practice this has frequently involved a serious sacrifice of their time, but we believe that they have felt it not only a pleasure, but a duty to the profession in which they are engaged. Viewing the matter in a broad way, improvement and advance in any industry depends largely upon the exchange of experience among the practical workers in the field, and this object is accomplished more effectively and more frequently by the technical papers than by any other method. The necessary corollary to this proposition is that the larger and more influential the audience reached by a technical paper, the more effectively is the work done. The technical paper interferes in no way with the work of the associations. The latter can hold meetings only occasionally. The subscriber to the weekly technical paper enjoys the equivalent of attendance at a convention fifty-two times a year without being obliged to leave his desk.

Speculation in Copper

The wide fluctuations in the price of copper almost make speculation in the metal a legitimate phase of good electric railway management. By such speculation is meant the anticipation of the needs for the next three or four years. Such an investment might be the means of saving many a company several thousand dollars. Again it might result in direct loss inasmuch as the price of the metal may remain stationary, in which case the interest on the investment would be lost, or the price may drop and remain for some time below even the present figures. Again a manager does not care to dispose of scrap copper at the present low prices, particularly when he has purchased this same metal at almost double what he can get for it, and there is a strong temptation to let the scrap accumulate with the hopes of getting better prices. Such temptation is particularly strong to the company which has purchased any quantity of copper during the past two years and now finds itself, at present prices, a loser of several thousand dollars. The increase in price of the metal during the past week emphasize the ease with which such an advance can be brought about. This much is certain, the existing price should act as a wonderful stimulant to new construction.

The Economies of the Motor 'Bus

We have several times recently commented on the motor 'bus situation, and were it not for the fact that some interesting studies on the cost of operation have recently been made abroad, we should hardly care to follow up the matter. In a recent number of the London *Electrical Engineering* some figures, however, are given which are exceedingly pertinent and are of considerable value in showing both the sphere and the natural limitations of this type of vehicle. In the past year or two the motor 'bus has been extensively exploited in London, and its use has reached the stage in which the effects of competition in the reduction of fares have been keenly felt. One must bear in mind at the start that a 'bus line can be started in London without much difficulty, so that competition for good or ill must be regularly expected. The two years past have enabled the investigator to substitute facts for fancies in his estimates, and, as usual, the facts are less encouraging than the fancies. An estimate of the cost of working a 'bus line with gasoline-propelled vehicles, made less than a year ago, added up to 19 cents per mile run. This estimate figured depreciation at 20 per cent, which is not unreasonable, but underestimated the cost of fuel, taking it at about 18 cents per gallon, as against an ordinary cost in London of nearly 30 cents. Under American conditions, the former figure would be sufficient, but the costs of labor would run enough higher to make up the difference with something to spare.

On the other hand, the auditor of the London Power Omnibus Company reported last July that the expenses actually came to 36 cents per 'bus-mile, which is a very different story. The depreciation in this case was taken at 22.5 per cent, and the striking fact was brought out that the up-keep had been thrown back upon the company by a contractor who had undertaken the maintenance at 9 cents per 'bus-mile. Here seems to be the chief trouble with the system. Not only is the actual item of repairs considerable, but the fact of repairs requires the purchase and maintenance of a considerable number of spare cars, apparently 40 to 50 per cent of those in continuous service. Still another recent estimate based on the London situation was recently made which footed up to about 24 cents per mile, which would have to be raised at least another cent if one took American rates of wages for drivers and conductors, to say nothing of other labor. It would seem, therefore, within conservative limits to say that in this country such a 'bus service would cost at least 25 cents per 'bus-mile exclusive of fixed charges, and would more than likely run to 30 or even 35 cents per 'bus-mile. The London motor 'bus carries some 34 passengers at a pinch and is assumed to cover about 100 miles in, say, a sixteen-hour working day. Evidently, if it could be kept well filled all the time, the chances of paying would be good. But the auditor of the London Power Omnibus Company reported that the earnings were only 22 cents per mile, so that the net result was a serious deficit. Certainly it is evident that the motor 'bus demands either fairly dense traffic or higher fares than in London to stand a chance for good returns.

As regards American conditions there are some favorable and some adverse factors to be considered. Fixed charges, labor and maintenance costs are all higher here than in London. Fuel is somewhat less, but as fuel in the English estimates constitutes only about 20 per cent of the operating costs, the gain here is not very great. But while expenses will probably exceed the English figures, there is good reason to believe that the receipts would increase in a higher ratio. American cities have bad and costly public carriage service, *e. g.*, New York, with the worst and dearest, so that a good 'bus service with carefully planned routes has a capital field for competition, with everything in its favor. The tramway service, rather meager in London as compared with an American city of the first rank, is here pretty effective, for the main lines of traffic, but it leaves a large opportunity for really non-competitive work with 'bus lines. Particularly in cities like New York and Chicago there is ample opportunity for every available means of transportation, since the congestion is so extreme that any material aid will be welcomed. 'Bus service in these circumstances need not feel compelled to get into

competition with tramways at all. By charging moderate fares and picking routes carefully a metropolitan motor 'bus line could find a profitable field ready to be worked even were its operating expenses higher by considerable than the London figures. The tramway lines would never know the difference, and the atrocious cab service would neither deserve nor get sympathy. From the viewpoint of street railway operation, a motor 'bus service on the basis of the London costs is not seriously to be feared in competition, while from the viewpoint of the public it is a thing to be encouraged as a relief from extortionate cab rates.

Electric Railway Appraisals

Few engineering problems in the traction field are more difficult than the appraisal of a large electric railway system. In connection with the sale or purchase of an electric road, an appraisal on the basis of earning capacity is quite as important as the valuation of the physical property belonging to the system; and in relation to the issue of securities, determination of rates, replacement of partly worn equipment by new apparatus, assessment for taxation, the engineering appraisal and the valuation of the expert accountant, each has a legitimate place. Clear ideas of the results desired and of the permissable assumptions and methods are absolutely essential in this class of work.

Mental confusion leading to valueless reports is not seldom found in railway appraisals. Very few electric railway appraisals have as yet been published in detail, with full explanation of the methods employed, and it is not strange, therefore, that engineers called upon for such work, carry it out along individual lines. Contrary to the old customs, the engineer is being called upon more and more to appraise steam and electric railway properties, and the reason is not far to seek. The dividing line between accounting and the advisory work of consulting experts along technico-financial channels is no longer clearly defined, for knowledge of technical equipment and processes has become necessary throughout the whole industrial structure. In electric railway work, particularly, the problems are of so technical a nature that neither the engineer nor the accountant can stand alone in appraising a transportation property from the combined standpoints of existing equipment value and earning capacity. The work as a whole may be done by a single expert, but several different attitudes must be taken.

The object of an appraisal must be definitely settled at the outset. In theory, the value of a piece of ordinary property is the same, no matter for what purpose it be appraised. The principle of a fixed value cannot rightly be held, however, to apply to railways. It depends very much upon the purpose of an appraisal as to whether the interest of the owners leans toward a high or a low valuation. In an appraisal for total valuation, as for sale or purchase, the interest of one road or company will lean toward a high, and of the other, toward a low valuation. In appraisals made in reference to the issuance of securities or for determining permissible rates the interest of the owners leads toward a high valuation, and in an appraisal for taxation, the same interest leads toward the lowest possible valuation. It is also perfectly proper to include in the value of a property for the first purpose expenditures which are not part of the value for the purpose of taxation, as shown in a recent issue of this paper.

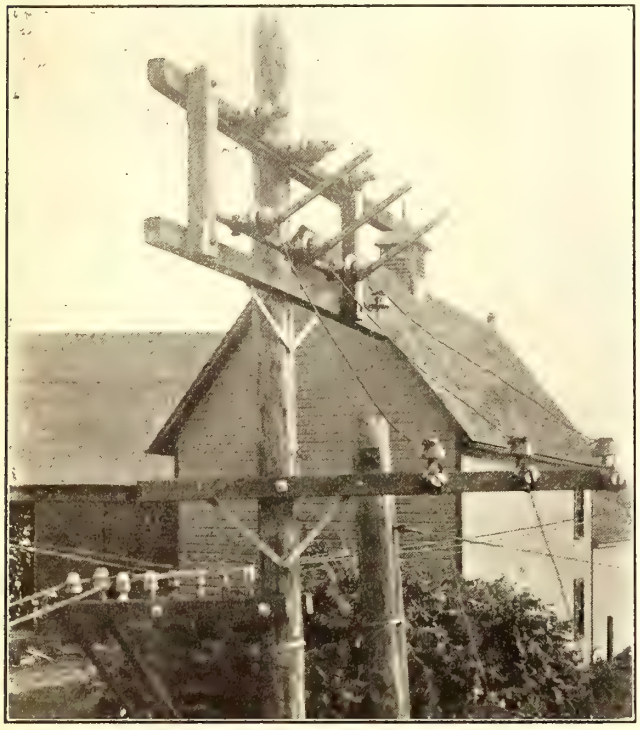
The purpose of an appraisal alone can settle many of the disputed points which are sure to come up during the progress of the estimate. Important as it is to have a sound reason for every departure from straightforward computations, it is equally essential to note the reason at the time, and to incorporate it in the final report so that every step can be followed at any subsequent date. If the valuation of the property is taken on a physical basis, it must be decided whether the cost of reproduction of the property with all equipment new, or with all equipment in the existing deteriorated condition shall be used. The argument is sometimes advanced that no deductions should be made for depreciation in the value of materials and machinery on account of wear and use, because it is held that a company should at all times keep its property in first-class condition. As a matter of fact few companies are able to keep their physical plant within 75 or 85 per cent of the condition it was in when new and it is doubtful if even these figures can be maintained over a large system where the service is severe and where apparatus of one kind or another is constantly being replaced by new and improved designs of equipment. In connection with the issuance of securities and the determination of rates it would appear that an appraisal should include the cost of reproduction with all properties new, without a depreciation allowance, but including all construction expenses and the cost of work abandoned later for one cause or another. An appraisal made for sale or purchase would, on the other hand, take into account the depreciation of the property, or its appreciation in the case of real estate and right of way. The same point of view applies to an appraisal made for taxation purposes. Although it would be an absolute impossibility to reproduce an electric railway with its tracks, trolley suspension, poles, rolling stock, power and substations, shops, car houses and other buildings in the exact condition found at any single time, it ought to be clear that the taxation, sale or purchase of such a road should allow for the deterioration which cannot be made good by maintenance, but calls for periodical replacement.

The maintenance of careful records of construction cost, life of equipment, expense of replacement and current market quotations on electrical apparatus, mechanical equipment, real estate and structural materials, is a great help to the engineer charged with an electric railway appraisal. Seldom do such records exist in complete form, but as far as they go they are almost invaluable. There should be little difficulty in appraising a trolley system on the basis of its earning power, but the value of franchises and the necessity of operating at a high ratio of expenses to gross earnings should be carefully analyzed as well, before an expression of the value of the whole property in round millions or hundreds of thousands, is attempted. In annual reports the grand total cost of construction to date may be taken as an appraisal of value satisfactory to stockholders, but the chances are that more detailed estimates will be required before many years, if the power of publicity continues to be manifested in the handling of public service corporations.

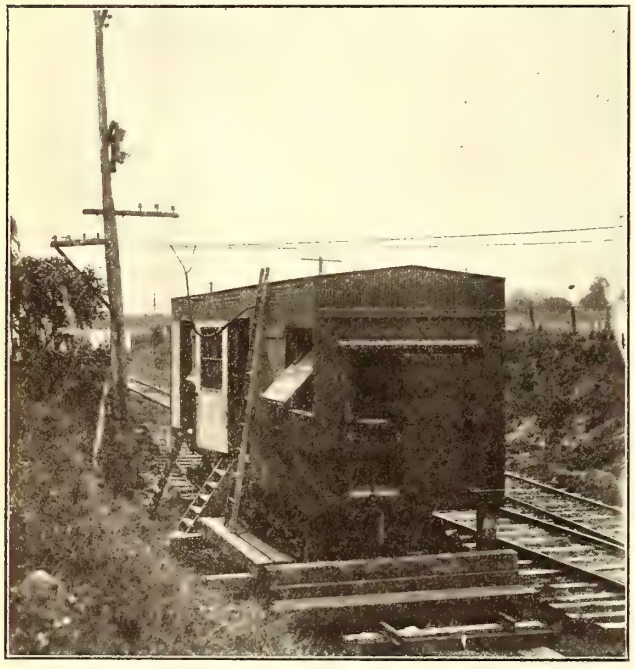
PORTABLE SUB-STATION FOR ROCHESTER & SODUS BAY RAILWAY

BY B. C. AMESBURY, SUPERINTENDENT ROCHESTER RAILWAY COMPANY.

The Rochester & Sodus Bay Division of the Rochester Railway Company operates between the City of Rochester, N. Y., and Sodus Point, at the junction of Sodus Bay and Lake Ontario. The route followed is approximately 40 miles long and for the greater part of the distance is along the Ridge Road, a public highway running parallel to the southern shore of Lake Ontario and about 4 miles from it. The road runs through a rich fruit district and in the spring when it is lined with apple blossoms from nearly one end to the other, the railway company makes a special feature of its "Apple Blossom Excursions."



HOOK SWITCHES ON POLE OUTSIDE OF CAR



ROTARY CONVERTER AT LOW-TENSION END

The Rochester & Sodus Bay Railway has a steam generating station at Float Bridge, about 5 miles from the west, or Rochester end of the line. The power generated in this station is 11,000-volt 25 cycles and supplies a rotary converter in the station and also rotary converters in two sub-stations, one located at Sodus, about 7 miles from the east terminal and the other at Ontario, slightly over half way from Float Bridge to Sodus. Each of these sub-stations has three 100-kw air-blast transformers and a 250-kw rotary converter. More recently a couple of storage batteries have been installed, one being at Webster, about midway between Float Bridge and Ontario, and the other at Williamson, about midway between Ontario and Sodus. The trolley line is thus divided into six sections of from 5 to 7 miles in length. The steam plant originally supplied all the power used, but since the line has been operated by the Rochester Railway Company the 11,000-volt transmission running east from Float Bridge Station has been extended westward into Rochester to the Rochester Railway & Light Company's hydraulic station at the Lower Falls of the Genesee River, and the steam plant at Float Bridge is now only used as a reserve.

The rotary equipment at this Float Bridge power house was originally a duplicate of those at the sub-stations, but during the past spring a new outfit of double this capacity was installed at the station and the old outfit has been turned into a portable sub-station for use at such points on the line as may at any time require special power. To facilitate this use the 11,000-volt transmission has been extended to a point about half way from the sub-station at Sodus village to the eastern terminal at Sodus Point and a siding put in just outside the Rochester City line near the western terminal, so that this portable sub-station can now be located very nearly at either terminal of the line. During the past summer the car has been located at the latter place, supplying power for the large Saturday and Sunday crowds to Glen Haven, an amusement park between the city and Float Bridge near the head of Irondequoit Bay.



HIGH-TENSION END OF CAR

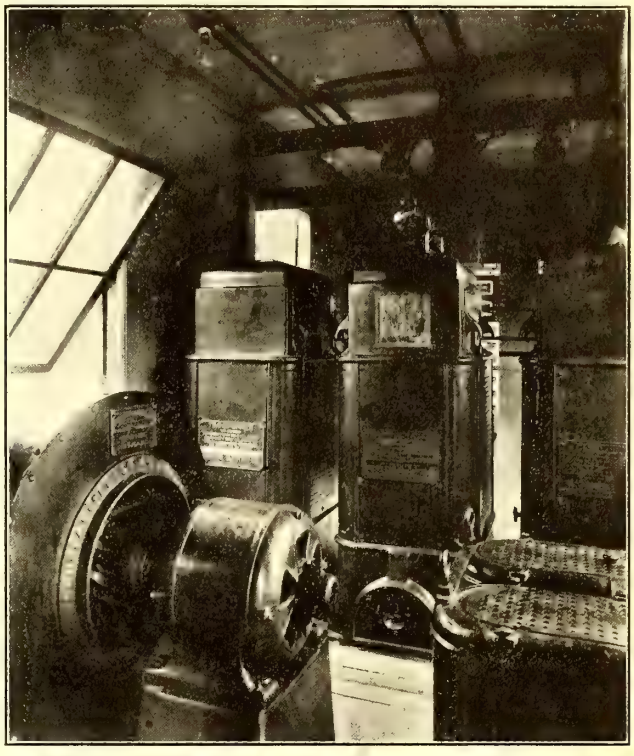
The car is 33 ft. long inside and is 7½ ft. wide. In height it is 8½ ft. from the floor to the ceiling and 13 ft. 7 ins. from the track to the top of the roof. The 250-kw rotary converter is placed over the truck at one end of the car and provision for its entrance into the car and future

removal, if ever desired, has been made by making a removable section or panel in the end of the car. This removable section is the full width of the car and 7 ft. in height. The three 100-kw air-blast transformers are about 8 ft. from the other end of the car and are placed alongside of each other across the car, thus forming an effective barrier between the attendant and the high-tension apparatus; the high-tension lightning arresters, hook switches, series transformers and oil switch being located between the transformers and the end of the car, and it is necessary for him to go outside the car and re-enter it to reach them. Removable panels similar to that for the rotary are provided opposite the transformers on either side of the car for use if required. The air blast for the transformers and also for the two reactive coils is obtained through an air box under the car to which it is supplied by a motor-driven centrifugal blower between the transformers and switchboard.

The alternating current enters the car through sheltered vertical bushings, passes through hook-disconnecting switches, choke coils, series transformers and an oil switch to the high-tension side of the transformers. The oil switch is of the remote control type, operated by an alternating-current trip with a double pole relay and diaphragm-type inverse time element. The wiring between transformers, switchboard and rotary has been carried under the floor of the car as far as possible.

The switchboard is composed of two marble panels placed crosswise of the car near the center. The a. c. panel has an ammeter, the time-limit relay, and the oil switch handle and trip. The d. c. panel has a circuit breaker, ammeter, bracket voltmeter, line switches and a make-and-break switch for the end-play device on the rotary.

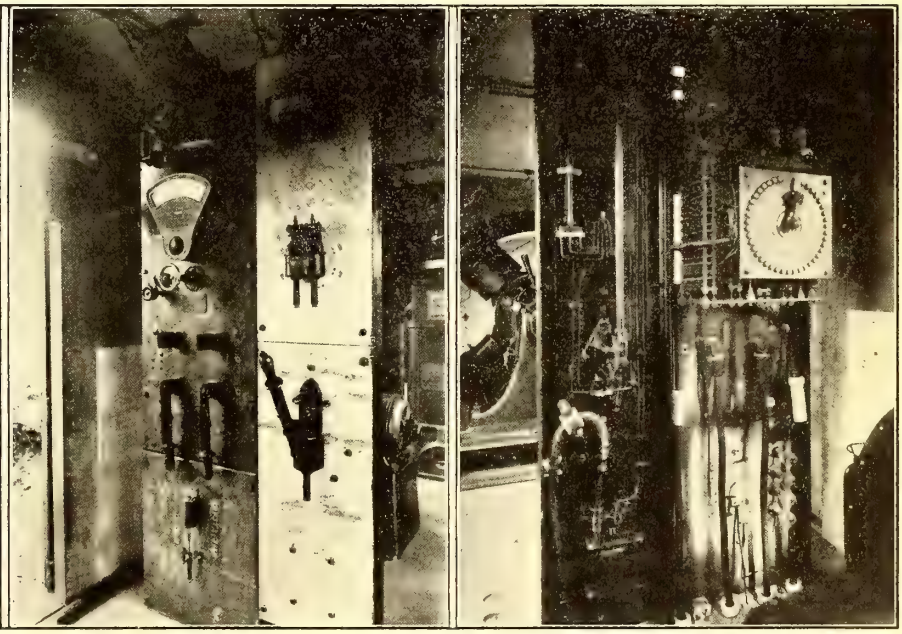
The accompanying views were taken while the car was at the city end supplying power to the summer traffic to and from Glen Haven Park. It will be noticed that the rotary end of the car has been blocked up somewhat, this being done to do away with the vibration noticed



REACTIVE COILS AND BLOWER TRANSFORMERS



ROTARY CONVERTER, LIGHTS AND TELEPHONE



FRONT AND REAR VIEWS OF THE SWITCHBOARD

The ventilation of the car is taken care of not only by the doors and windows, but also by a number of ventilating openings placed in the sides of the car near the ceiling. Three of these openings are provided on each side of the car and all six are protected from the weather by hinge-cover flaps which open outward and can be shut.

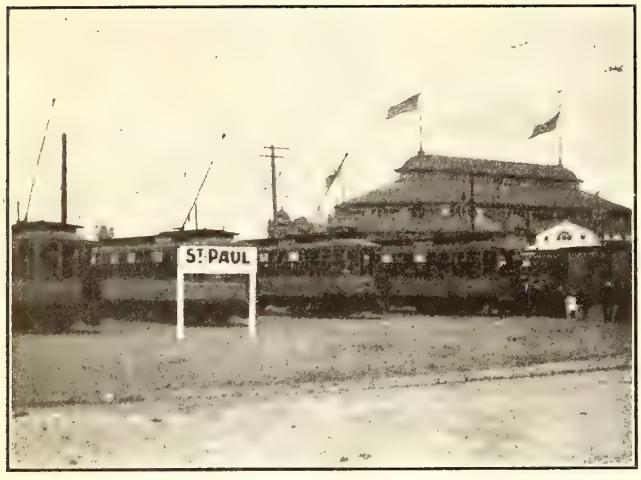
All inside woodwork, including the floor, walls, ceiling, is protected from fire by being covered with asbestos board, thus making the car as nearly fireproof as can be done with a wooden-bodied car.

when starting or stopping the rotary. The views show not only the outside of the car and the apparatus inside, but also the hook switches which were mounted outside the car in order that the 11,000-volt power might be entirely cut out of it when not in use.

The car has proved a considerable help in handling the traffic at its summer location and is likely to prove of equal or greater assistance at its next location, which will probably be at one of the permanent sub-stations where alterations are contemplated for the coming winter.

HANDLING TRAFFIC AT THE MINNESOTA STATE FAIR

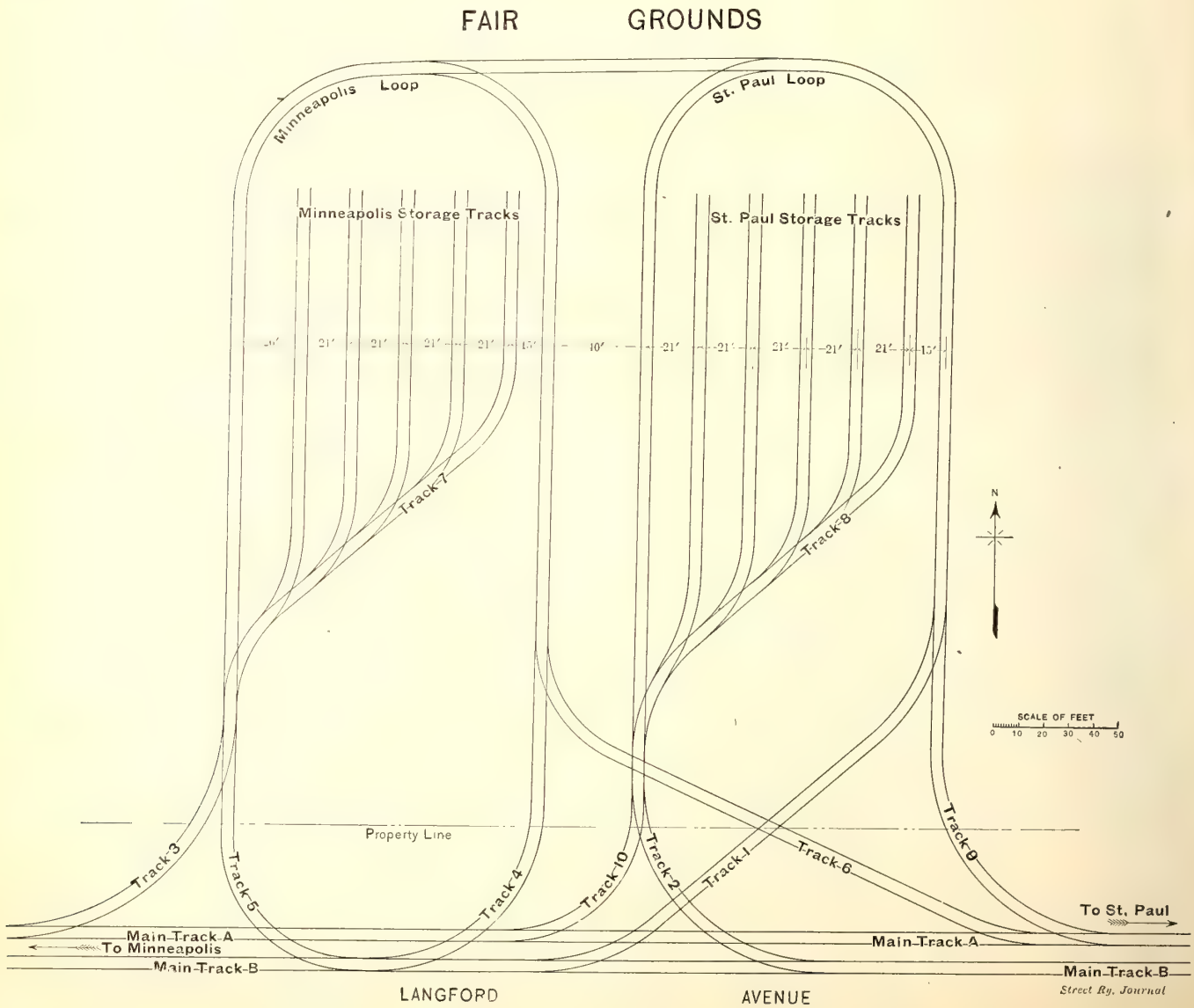
To handle the immense crowds attending the Minnesota State Fair during the first week of every September the Twin City Rapid Transit Company, which operates the street car system of Minneapolis and St. Paul, has built an extensive and interesting terminal station at the fair grounds. During the six days of the fair this year, from Sept. 2 to 7, the company carried approximately 250,000 people to and from the grounds; the heaviest single day was Sept. 2, Labor Day, when the attendance mounted to 80,000.



ST. PAUL CARS ON STORAGE TRACKS, WITH CAR ON THE RIGHT UNLOADING

The fair grounds are located midway between Minneapolis and St. Paul on the Como-Interurban car line. As is seen from the accompanying plan, the terminal consists of two great loops, enclosing five storage tracks between each loop. This duplicate arrangement is adopted to separate the Minneapolis and St. Paul traffic; the St. Paul cars enter and leave on the east or St. Paul loop, while the Minneapolis cars use the west or Minneapolis loop. Large signs direct the passengers to the proper points and absolutely no confusion occurs. The main loops are so connected to the two main tracks that cars can be run in and out of the terminal in almost any conceivable manner, making a very flexible arrangement.

The method of handling and dispatching cars in and out of the terminal is as follows: Through service, running on a five-minute schedule, is maintained between Minneapolis and St. Paul. These cars come from Minneapolis on main track B and enter the St. Paul loop by means of track 1. They proceed around this loop, stopping at the upper end to receive and discharge passengers, and then go out to



GENERAL TRACK PLAN AT THE MINNESOTA STATE FAIR GROUNDS

main track B again via track 2. Through cars from St. Paul enter the Minneapolis loop from main track A via track 6, proceed around the loop, stopping at the loading platform at the upper end as described above and then leave the terminal over track 3 which switches the car again on to main track A.

Local cars are run from both cities on a 1¼-minute schedule. The Minneapolis cars enter from main track B via track 4 and proceed to the unloading platform, from which they return either to Minneapolis over track 3 or enter the storage yard via ladder track 7. St. Paul cars are run around the St. Paul loop in a similar manner. This method gives a continuous, uninterrupted stream of both through and local cars, all moving in the same direction on each loop; the traffic from each city is completely separated, an important feature in operating a terminal of this nature. While under normal conditions the cars are dispatched as described above, the main line connections are purposely arranged to permit any variation from the usual procedure that an emergency may dictate.

Two or three repair men and a dispatcher is all the operating force necessary at the terminal. A repair car is also maintained in readiness for any emergency.

Twin City standard cars are designed to load and unload from the rear platform only. At the fair terminal, however, special steps were provided so that passengers were unloaded from both platforms at once. Ninety-five per cent of the travel was either in one direction or the other. By using both platforms for unloading or loading, a car could be emptied or filled in practically one minute.



CARS READY TO LEAVE THE MINNEAPOLIS TRACKS

The fair exodus reaches a maximum at 5 and 10 p. m. To provide for these rush periods from thirty-five to fifty cars are stored on the Minneapolis tracks and from twenty-five to thirty on the St. Paul tracks. Cars are dispatched from these storage tracks in order of their occurrence, so that during the rush periods one-quarter-minute service is maintained to Minneapolis and St. Paul. This amounts to 240 cars per hour to each city. Each car carries about 100 passengers, which means that the maximum number of passengers moved per hour to each city is 24,000.

This record was actually attained several times during the week, and the traffic was handled without undue crowding or congestion. Every passenger did not get a seat, but this could not be expected. The company made an honest effort to provide and keep moving a sufficient number of cars to carry the crowds. By means of this terminal this was accomplished throughout the week without a single hitch.

FIREPROOF CAR HOUSE AND REPAIR SHOP FOR THE SPRINGFIELD CONSOLIDATED RAILWAY COMPANY

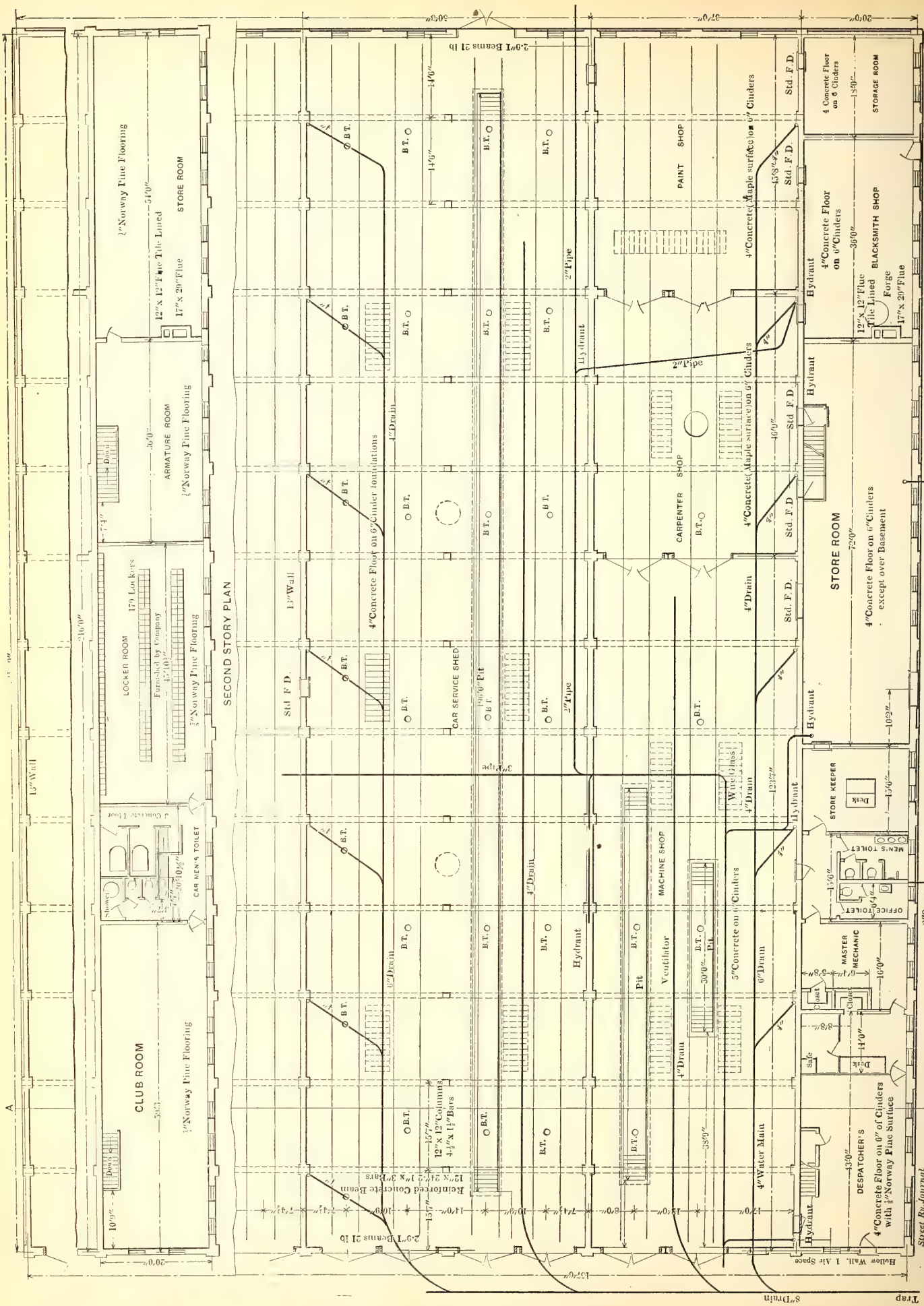
The Springfield Consolidated Railway Company, of Springfield, Ill., recently secured fifteen acres in the southern end of that city, where it is erecting a model car house and repair shop. This will be used as an operating depot and will include offices and store rooms. The latter will adjoin the car house and also contain locker and club rooms with bathing and toilet facilities for the trainmen. The building will be 216 ft. long and 107 ft. 6 ins. wide, but sufficient space is reserved for future extensions to the car house now under way. In the meantime extra cars will be stored in one of the company's old structures.

The installation is a notable one for a company of this size in view of the care given to secure a durable and fireproof construction. The walls are of hard brick with concrete foundations and the pits and floors, also of concrete throughout, except that in the carpenter and paint shop, the concrete floor is overlaid by ⅞-in. maple on 4-in. x 4-in. yellow pine stringers. The car house is divided into two sections by a 13-in. wall with a fire tile coping above the roof. The openings in this wall are protected by standard fire doors. The larger section, which is 50 ft. 3 ins. wide, is known as a "car service shed." It is furnished with three dead-end tracks and one through-pit track extending 196 ft. The other section is 37 ft. wide and contains the machine, carpenter and paint shops. Two dead-end tracks extend through this part of the building with a 30 ft. and a 70-ft. pit in the machine shop. The division walls between the shops are 13 ins. thick and have the track openings protected by standard fire doors. All of the track doors and windows in the car house are made with wire glass.

The roof is of reinforced concrete supported on reinforced concrete beams. Over the shop portion the beams are 20 ins. wide and 30 ins. deep with a reinforcement of three 1¾-in. x 3¾-in. Johnston bars. The beams over the car storage section are 12 ins. wide and 24 ins. deep with two 1-in. x 3-in. bars; these beams are supported at the center of this bay on 12-in. square concrete columns, reinforced by four 1½-in. x 1½-in. bars. The bottoms of all beams have bolted thereto 2-in. x 4-in. oak planking for trolley supports and lightning fixtures. The roof slabs are 4 ins. thick and are reinforced by ½-in. bars laid 16 ins. centers and one layer of 4-in. x 6-in. Nos. 9 and 11 wire fabric. The concrete mixture used in the roof work consists of one part Portland cement, two parts sand and five parts of crushed screened limestone. The roof is capable of bearing a live load of over 50 lbs. per square foot. It is finished with five layers of tar felt.

Aside from the doors and windows of the car house, plenty of illumination is secured through the wire glass skylights. There are six 4-ft. x 12-ft. lights in the roof of the bay section, but in the shop section there are four over the pits alone; there are also two lights in the carpenter shop and one 4-ft. x 20-ft. transverse skylight in the paint shop. The paint shop, being at the end of the building, also has side lights. The car house is ventilated by four 48-in. Burt roof ventilators, two in each bay. Inside fire protection is secured by four 2-in. fire hydrants placed as shown on the plan. These are supplied with water from the city waterworks through a 4-in. main. The general scheme of floor and pit drainage is clearly indicated on the plan and section.

The third section of the installation is devoted to miscellaneous purposes and extends the full length of the car house proper, but is only 20 ft. wide. It will be noted that

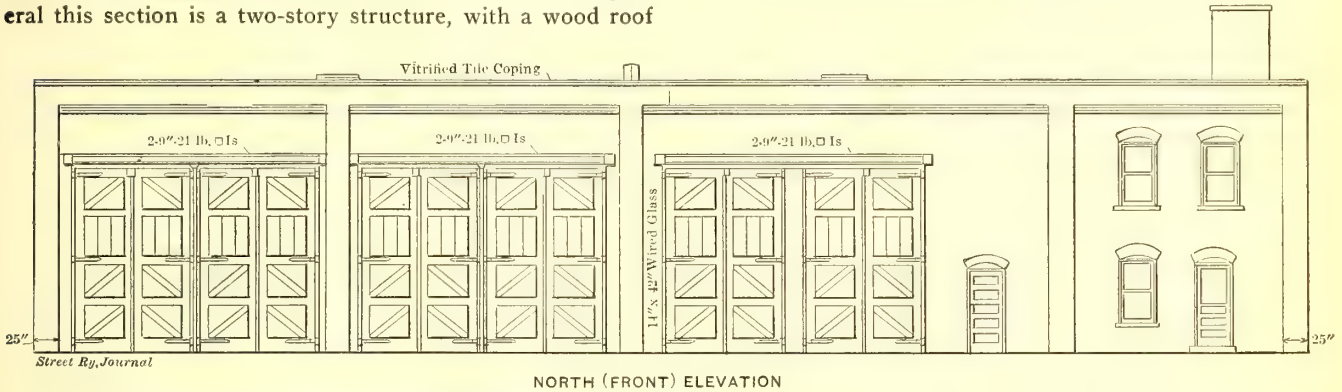


PLAN OF CAR HOUSE AND SHOPS OF THE SPRINGFIELD CONSOLIDATED RAILWAY COMPANY

the office section and main store room are not of fireproof construction, because the reduction in rates offered by the underwriters was not large enough to warrant the extra expenditure for fireproofing this portion of the work. However, protective means are secured by the installation of standard fire doors at all openings in the division wall between this section and the car house, as well as by the two fire hydrants. The blacksmith shop, constituting the main fire risk, is isolated from both store rooms by a 9-in. brick wall, and the flue is lined with fire tile to the roof. In general this section is a two-story structure, with a wood roof and hollow walls, except where joists are carried. There is no basement except under the large store room. This basement and all the rooms on the first floor have concrete floors, but in the offices there is a surfacing of 7/8-in. Norway pine on 4-in. x 4-in. yellow pine stringers. The floor over the basement is of 4-in. concrete, reinforced with 3-in. mesh No. 10 expanded metal, and is carried on 12-in. x 24-in. concrete beams placed 8-in. centers and reinforced with four 1-in. x 1½-in. bars. This floor is figured to carry a live load of at least 150 lbs.

It will be noted that the dispatcher's room is located at the front of the building where he may conveniently see all passing cars and the trainmen who pass through his office before going up stairs to the club room. The master mechanic's office and the general office adjoin the dispatcher's room and communicate with the car house through the fire-door opening shown opposite the hallway. The employees' facilities rooms on the upper floor consist of a club room and toilet room with bathing arrangements and a locker room for 179 men. The rest of the floor is divided into an armature shop and store room. The upper flooring throughut is of 7/8-in. pine, except in the toilet room, which is of concrete. The roof of this section is of wood-frame construction.

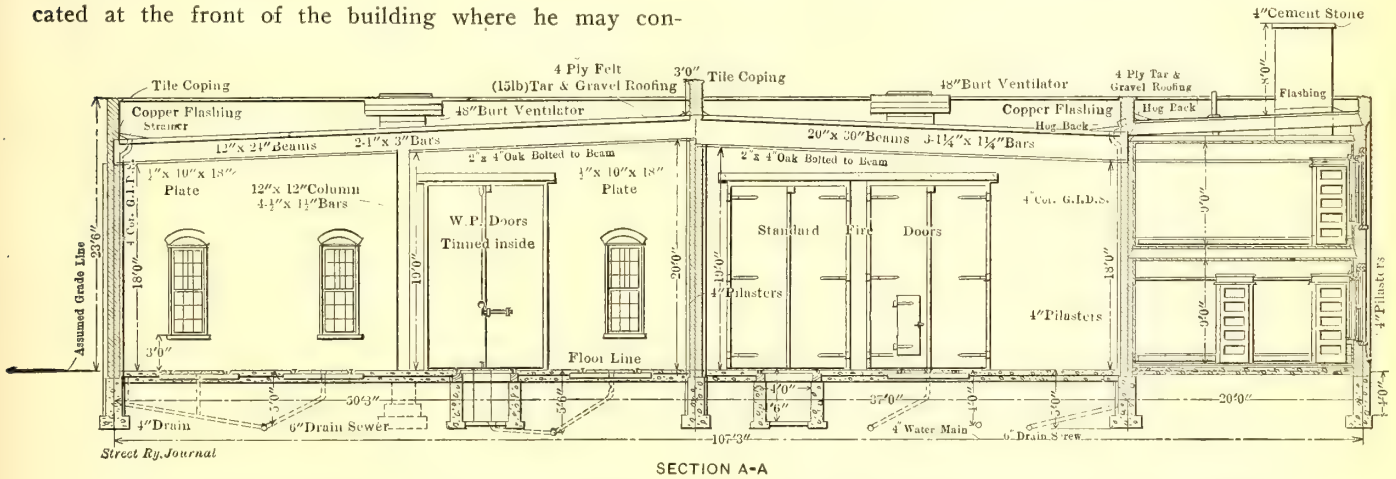
No definite decision has been reached regarding cranes, hoists and machine tools. It is probable, however, that a locomotive crane will be used for handling all material outside of the car house throughout the storage yard, and a traveler of some kind installed in the shop portion. The present tools, consisting of lathe, drill-press, forge, emery wheels, field coil winding machines, and some few smaller tools of course will be placed in the machine shop. It is probable that some few additions will be made to this installation, principally in the way of woodworking machinery.



NORTH (FRONT) ELEVATION

FRONT ELEVATION OF THE SPRINGFIELD CONSOLIDATED RAILWAY COMPANY'S CAR HOUSE AND SHOPS

The American Korean Electric Company operates at Seoul, the only street railway in Korea. On this railway the average number of passengers carried daily in 1904 was 11,442; in 1905, 12,963, and in 1906, 13,714. The car mileage was in 1904 (five months), 145,110 miles; in 1905, 326,793, and in 1906, 398,616. The equipment included thirty-seven passenger cars and eighteen freight cars. The company operates twelve miles and 408 feet of tracks with overhead electrical equipment. The gross receipts in 1906 were $98,221 and the net earnings $25,324, the increase in net earnings in 1906 over 1905 being 48 per cent. The company announces that the operating expense has been reduced from 80 per cent of the receipts in 1905 to 74 per cent in 1906, but with the decrease in the cost of coal and with an increased service without addition to the expense of management, it is hoped a further material reduction will occur in 1907. With the exception of an injury to a boy, who fell under the car when stealing a ride, no accidents occurred during 1906.



SECTION A-A

SECTION THROUGH THE CAR HOUSE AND SHOP OF THE SPRINGFIELD CONSOLIDATED RAILWAY COMPANY

CONVENTION OF THE MUNICIPAL TRAMWAYS ASSOCIATION

The sixth annual convention of the Municipal Tramways Association of Great Britain was held at the town hall, Manchester, Sept. 25 to 27.

J. M. McElroy, general manager of the Manchester Corporation Tramways and president of the association, in delivering his annual address, referred to the discussion on the subject of private and municipal ownership of tramways which had been active recently. Mr. McElroy acknowledged that the policy of taking over the tramways by the municipalities had delayed the development of electric tramways in Great Britain for a number of years, but he believed that the final results of the policy had been in the interests of the public. In practically all the cities and towns in the kingdom the tramways are now being operated by the municipalities, and the benefits accruing to the traveling public, taxpayers and the employees have been enormous. During his recent visit to America he had noticed that there the tramway precedes the population; transit facilities are provided before a district develops. This is an excellent plan. He considered the success of any undertaking, municipal or private, depends upon the men who direct and control it. If municipal tramways have men of integrity, tact and judgment, the system will be a success.

RAIL CORRUGATION

A paper on this subject was read by A. L. C. Fell, chief engineer of the London County Council Tramways. Mr. Fell referred to a report on the subject presented by him in May, 1905, to the London County Council and published in abstract in the Street Railway Journal for Feb. 3, 1906. In this report he described the rail corrugations in England and America and suggested that the trouble was caused by unevenness of the rail surface setting up a slight jumping and bounding action in the car wheels. Later study has lead him to believe that corrugations are not due entirely to one cause. The following are in his opinion some of the chief producers of the trouble: (1) Original roughness of rail after rolling, (2) cold rolling of rails by the car wheels, (3) soft rails and heavy cars, (4) sand and grit on head of rail, (5) defective and open joints, (6) tight or wide gage of track or wheels, (7) loose or springy rails and points, (8) defective trucks being out of square and buckling, (9) slip of wheels at curves, (10) wheels not being same diameter, (11) flats on wheels, (12) rapid acceleration and retardation causing wheels to slip, (13) defective brake mechanism, or too rapid application of the brakes, causing chattering and a series of short skids. Referring to cause 12, the author made some experiments with a traveling crane in one of the London car houses. Its weight is fifteen tons and it is driven by one Westinghouse No. 200 motor. When the controller was turned rapidly to the fifth notch the wheels slipped badly and corrugations appeared with about 2-in. centers. The rails were then painted with grease, but the corrugations were not visible. This indicates, in the author's opinion, that corrugations caused by rapid acceleration are more liable to occur when the wheels have good metallic contact with the rail, and not when the latter is covered with a film of grease or soft ungritty matter. The speaker does not agree with Mr. Panton that the chief trouble is truck design. The following suggestions will, in the author's opinion, be found beneficial:

Track

(1) The rail should be anchored down at intervals of not less than 7 ft. 6 ins.

(2) A hard-wood packing block ¾ in. thick should be placed between the anchor and the rail flange.

(3) All joints should be close-butted and carefully filed. Possibly it would be an additional safeguard if the rail joints were welded.

(4) A water car fitted with carborundum grinding blocks should be run over the line to remove all irregularities before the cars commence running. This will be found a simple, quick and inexpensive process if carried out immediately after the track is constructed, and the development of corrugations will be deferred for a considerable time.

(5) Immediately the slightest sign of corrugation appears to grind the rails, as suggested above.

(6) By partly filling up groove of outer rail so that outer wheels run on flanges at sharp curves.

Rolling Stock

(1) Secure first-class trucks of good mechanical design which will not buckle or get out of square at sharp curves.

(2) See that the trucks are absolutely square.

(3) The diameter of the wheels should be kept equal as nearly as possible.

(4) By separately driving each wheel or by introducing differential gear, as in the case of a motor car.

(5) By using continuous flow sand boxes.

(6) By using magnetic track brakes as service brakes.

STAFF ORGANIZATION

A paper on this subject was read by James Dalrymple, general manager of the Glasgow Corporation Tramways. The first consideration in a municipal tramway organization is that the manager should have full control. Nevertheless, the manager is frequently appointed last, after the rest of the organization has been determined upon. In a large undertaking the manager should have three heads of departments, viz., a chief engineer, a traffic superintendent and a secretary. The engineering department should be sub-divided into departments in charge each of an electical assistant, a mechanical assistant, a civil engineering assistant and a chief draughtsman. The traffic superintendent would be directly responsible to the general manager, and would have control of the whole traffic staff, including inspectors, timekeepers, motormen and conductors, clerical staff in the traffic office and depots, ticket and cash clerks, etc. The secretary would have general charge over the office staff, including the accountants, cashiers, pay clerks, stores clerks, purchasing clerks, correspondence clerks, etc. This allocation of duties would embrace all the work of the tramways departments, except the work caused by accident claims, which might be either put under the traffic superintendent or under the secretarial staff. Of course, the organization of the smaller undertakings must differ very widely from the above. In a small tramways undertaking, the manager very often has to be mechanical engineer, electrical engineer and traffic superintendent all rolled in one.

The next point is whether a tramway department should have its own power station. In all large undertakings Mr. Dalrymple recommends a separate power station. For small undertakings the tramway department should purchase its power from the electric light department where there is such a department of the municipality. All track work should also be in charge of the tramway manager. In large undertakings the accounting staff should also be a part of the tramway department, but in small undertakings it should be undertaken by the principal accountant. The

author submitted an organization chart showing his ideal of a staff organization.

HOURS OF LABOR AND RATES OF PAY

A paper on this subject was presented by Alfred Baker, general manager of the Birmingham Corporation Tramways. He referred to a paper which he read on the subject at the meeting in Glasgow in 1903, and said that since that time there had been an increase of about 5 per cent in wages paid in the thirty-four towns mentioned in that paper. Other changes which had been made and questions which had come up during the last few years were also discussed. Thus, men were formerly paid only for the time actually on the car. They are now usually paid for the time at work, including that for inspecting the car before taking it out and while returning to the shed. In 1903 only two towns paid anything in excess of ordinary pay for Sunday work. To-day twenty-one towns pay overtime, usually a time and a quarter. Several companies have introduced the practice of paying bonuses for freedom from accidents. In Leeds the bonus is a half-penny per hour to all motormen who during any calendar month have been free from blame in the matter of accidents. During September, 1906, 97½ per cent of the men qualified for this bonus. The plan has recently been adopted in Birmingham. While theoretically it should not seem necessary to pay extra remuneration to a motorman for being diligent and cautious at all times, with the majority of men engaged in tramway work such an extra inducement seems necessary. It also has the good feature that it advertises the fact that the management is anxious to avoid accidents.

LONG WHEEL BASE TRUCKS

A paper on this subject was read by R. L. Ackland, manager of the Chesterfield Corporation Tramways, who advocated long wheel base single trucks. He presented drawings of single trucks used in Nuremberg, Vienna and Budapest, where the wheel base varied from 8 ft. 2 ins. to 11 ft. 10 ins. In these cases the flexible running gear used on the Continental steam railroads was employed. The double-truck car is less hard on the track, the truck frames and the car body than the single-track car, but is not so economical for city service. The objections to the single-truck car are largely avoided where a long wheel base is used with flexible axles to give the minimum amount of flange friction on short radius curves. In addition to this long wheel base truck the author is using in Chesterfield a V-shaped flange on the wheels.

TROLLEY EXPRESS ACTIVITY IN VICINITY OF BOSTON

Activities of the street railway companies on the outskirts of Boston to secure the right to carry freight and express matter are resulting in the framing up of a complete system for trolley express service from points south, west and north of the city, up to the outlying lines of the Boston Elevated Railway Company, which controls the business within city limits. Whereas two years or more ago a petition for trolley freight rights in the district around Boston was a novelty, hardly a week now passes without one going to the Railroad Commission.

Special stimulus was given this past summer by the passage of a state law allowing the Railroad Commission to grant a right through any city or town which appears to be blocking a through trolley express route that seems likely to be of advantage to other towns along the line, provided the obstructing community has had sixty days to pass on the matter. This law was the one under which the Old Colony Street Railway Company was very recently before the commission to get a grant through a remote section of Quincy. The city has had petitions for this grant pending for almost two years, but has neglected to act. The Old Colony Company needs only this short stretch in order to complete a wide ramification of freight and express routes, many of them now operating, extending from Providence, R. I., New Bedford, Taunton and Brockton to the end of the Boston Elevated Railway Company's Blue Hill Avenue line at Mattapan Square, touching Boston on the south.

On the west the Boston & Worcester now has its rights clear up to its junction with the Boston Elevated at Chestnut Hill; and the companies of the Boston Suburban Electric Companies, generally spoken of as the Newton System, have rights for the Lexington & Boston line, coming in from the northwest to a connection with the Boston company's tracks at Arlington Heights, and also in Newton, Waltham and other places having several points of contact with the Boston Elevated. The latest grant for this system now awaits approval of the Railroad Commission, covering Natick. There is also evidence that the comsome chance of being used to be delivered at once to the Boston & Worcester; and there is evidence that the company will be active this coming winter to secure a Boston entrance, although the proposed automobile truck service from Chestnut Hill into the city is not a probability now.

On the north of the city the Boston & Northern Company is meeting general success getting its local rights in the cities and towns between the end of the Boston Elevated system in Malden and the Merrimac River cities of Lowell and Lawrence. Very little opposition has been encountered, and the communities on the line exhibit a favorable sentiment toward trolley freight, especially since they have been informed that the company will use the wagons of the local express companies for local collections and deliveries. That is the system of delivery and collection now used by the sister company, the Old Colony, south of Boston. James F. Shaw of the Boston & Worcester says, however, that while his company intended to use the local expressmen as auxiliaries, it would have an express company of its own to systematize the handling of express matter by trolley, and relieve the operating department of all care of that branch of the business.

With the express system thus closing in around the city, there is at present no change in the Boston Elevated's situation as to trolley freight. The company has had a voluminous report made up as to trolley express experience in other large centers, and it has a petition for general rights on its surface lines pending in a committee of the Boston Board of Aldermen. But hearings on the petition have been from time to time postponed, without action. The local wagon expresses are warmly opposed to any carrying of express on the Boston cars, and have counsel engaged to fight the project at every point. Gen. Bancroft has stated publicly that the company is not opposed to carrying freight and express matter wherever it can be done without interfering with passenger traffic, and very likely, by the time the outside companies are all fully prepared to take the business up, the Boston company will find a way to get its cars in and out of the business district.

An interesting factor may be the bill giving railway companies the right to appeal to the Railroad Commission, now invoked in the Quincy case; for this bill, in the case of Boston, practically allows the company to put the whole question in the hands of the Railroad Commission, regardless of any local boards.

MEETING OF THE NATIONAL ASSOCIATION OF RAILWAY COMMISSIONERS

The large amount of space given to convention reports in the last two issues of the Street Railway Journal has prevented the publication of an account of the meeting of the National Association of Railway Commissioners, held at Washington, D. C., on Oct. 8 to 10. Several subjects were discussed of interest to electric railway companies. One of these was the question of standard classification of construction and operating expenses of electric railway companies. The committee on this subject was William O. Seymour, W. F. Ham, Martin S. Decker and Parker Spofford. Mr. Seymour in presenting his report referred to the annual meeting of the association at Denver in 1899, at which the standard classification of operating accounts of the Accountants' Association was adopted, and to the meeting in Portland in 1903 when the standard form of annual report of electric railways was adopted. He continued: "This system of classification and form of account has been generally satisfactory to the companies and the States which have adopted them. The substitution of electricity as a motive power in place of steam on a number of roads where the accounts are modeled after the forms of steam railroad accounting has introduced the question how the two forms of accounting can be combined so as to preserve the integrity of the accounts of the company while passing through this transition stage. The only cure for this state of things is eventually to apply the same system of accounting to both steam and electric roads. This can not be done without the co-operation of the accounting associations of both the steam and electric roads, and this can not be secured at the present time. Each of these associations is satisfied with its present forms of accounting and naturally shrinks from modifying or changing them. Hence, for the present, the only alternative seems to be to continue the use of special forms of accounting until some method making them uniform can be devised. The committee, therefore, asks to be discharged."

Mr. Ham, the representative on the committee of the American Street & Interurban Railway Accountants' Association, stated that the subject was to be taken up by that association at its Atlantic City Convention, and invited the members of the association, their statisticians and accountants, to be present. Mr. Decker, of New York, urged the importance of a uniform system for the two classes of roads. It was supposed last year that after the organization of the Interstate Commerce Commission that commission would prepare a schedule of accounts for the electric railway companies. In New York, owing to the appointment of the two Boards of Public Service Commissioners it is very necessary to have a standard form of accounting. Mr. Kilpatrick, of Illinois, referred to the fact that a number of electric railway companies in his State engaged in the sale of power and current for electric lighting and that the subject of the separation of these accounts from the railway business was a matter of serious consideration in that State. He suggested that this should also be taken up by the committee.

Another subject discussed was that of grade crossings. A. T. Siler, of Kentucky, the chairman of the committee, reporting on this subject, stated his belief that it is economical in the long run to abolish grade crossings, and recommended that in every State the grade crossings should be placed under the control of the railway commission. The discussion indicated a very wide range of practices in the different states in regard to grade crossings. One of the strictest rules was that of Connecticut, where Mr. Seymour stated the law prohibited new crossings of steam and electric roads at grade, and that all new steam roads must be built either so as to carry the highway over or under the railroad, not at grade. There is also a grade-crossing law which permits grade crossings now existing to be removed in three different ways; first, upon the application of the selectmen of the town, the warden and burgesses of a borough, or the Mayor and City Council of a city, to the railroad commission, and upon that application the railroad commissioners may order such crossing to be eliminated. If the petition proceeds from a municipality, one-quarter of the cost of eliminating the crossing is taxed upon the municipality and three-quarters upon the railroad company. Another way is by the railroad company bringing the petition, and in that event the railroad company pays the entire cost of eliminating the crossing. The law also prescribes that every railroad company in the State shall remove or apply for the removal every year of at least one grade crossing for every 60 miles of road operated by it. There is a third method by which the railroad commissioners can of their own motion, remove one grade crossing every year on every line of road in the State.

Mr. Kilpatrick, of Illinois, said their policy has been to separate grades wherever possible. At the last session of the Legislature the grade-crossing act was changed so that when the separation of grades is ordered by the commission the senior line may be assessed not to exceed one-third of the cost of separation. The question of highway crossings has not been taken up by the legislature or by the commission.

Mr. Whiting, of New Jersey, said that future grade crossings are prohibited in cities in that State without the consent of the municipality. The crossings of steam and electric roads are left to the discretion of the Court of Chancery. There is no law giving the power to the railroad commission or any other body in New Jersey to require the elimination of a grade crossing or to apportion the expense. The most that the State can do is to permit the municipalities and railroads to come together and contract for the elimination of grade crossings. Mr. Keith, of the Second District of New York said that in New York the State pays a portion of the expense. Any railroad company or municipality can petition for the elimination of a grade crossing. A hearing is then held and if the commission considers it desirable to do so the State pays one-fourth, the municipality one-fourth and the railroad company one-half. At the last session $300,000 was appropriated by the State for this purpose. He thought that highway grade crossings of high-speed electric roads were more dangerous than those of steam roads, and it was now a question as to extending the State law so as to provide for the elimination of grade crossings in connection with electric roads. Another question undecided in New York State is whether, where a street railway company's tracks occupy a highway at a grade crossing, the street railway company should bear any part of the expense of eliminating that grade crossing. At present the street railway company cannot be assessed.

In the discussion on safety appliances Mr. Fairchild, of Washington, said that the association should request Congress to pass a law requiring the adoption of a covering for third-rails on electrically equipped steam railroads.

The official figures of traffic for Old Home Week in Baltimore place the total passengers carried for the six days at 4,230,000.

PRACTICAL WOOD PRESERVATION

BY ERNEST F. HARTMANN

Any practical study of the subject of wood preservation must include an investigation of the causes of decay, for research has proved that living organisms, such as fungi and bacteria, or even insects in some localities, do far more to shorten the life of timber than wear through service. Decay, in fact, is the disintegration of the wood caused by the low organisms whose food supply is in the albuminous contents of living cells. The fungi prosper best in humid places where the temperature ranges between 60 and 80 degs. F. and there is enough air exposure to permit the settlement of spores. The most favorable place for decay in construction above ground is at points of contact, joints, and mortises; on posts, decay usually sets in at the ground line, and in water at the water line.

Considering the possible methods of preservation, it may be asserted at once that paints of tar, lead and oil, etc., do not prevent decay. While they may form an attractive coating, they only cover the surface of wood, close its pores and at best keep off dampness but for a limited time.

Impregnation of wood with preserving liquids, such as creosotes or heavy oils derived from coal tar by a vacuum process and forcibly injected, does protect wood against premature decay. This process however, requires costly machinery, making the treatment too expensive for general use. Again, if this or any other process requires artificial seasoning of the wood by superheated steam, it has the tendency to soften and thus weaken the wood. The coagulation of the albumen in the wood by steam will not help towards its preservation, just as a hard-boiled egg exposed to the atmosphere will soon decay. Furthermore, the grade and quality of the tar-oil used must be fully and carefully considered; a light volatile oil will quickly evaporate from the wood, and in case an oil contains naphtalene, a large percentage of phenols (i. e., carbolic acid), or other solvents in water, it will leach from the wood and also cause a weakening of the wood fiber. Professor Allerman in his paper on the quantity and character of the oil in well-preserved timbers states: "That it is the heavy, high-boiling compounds which stay in timber and are an efficient barrier to the entrance of water and to the attacks of fungi and borers." Purchasers should buy according to a known chemical standard. Some railroads impregnate ties, etc., with a weak solution of chloride of zinc (Burnettizing process) in place of the more expensive tar-oil; but this treatment will not benefit ties laid in moist climates or in poorly drained roadbeds, as zinc-chloride being easily soluble in water, will soon leach out of wood; otherwise it would be an excellent preservative.

The efficiency of a chlorine as an antiseptic is unquestioned, and the durability, we may almost say the indestructibility, of such coal tar products which are recognized as the preservative elements are well known. Hence, if these elements can be combined in a form readily absorbed by wood without the intervention of expensive machinery and can be applied by ordinary unskilled workmen to the timber at the place of using, there is not much left to be desired except to get down to the practical use of the treatment. Proper seasoning will considerably increase the life of timber and again will also permit of simpler methods of preservation. Since the decay-germ reaches the wood from the outside and finds its food in the albuminous contents of the wood, it is unnecessary to permeate the wood throughout with such a fluid.

The first step to prolong the life of any timber is proper air seasoning. Too much stress cannot be laid on this subject. The proper preservative when applied should destroy or make harmless those decay-producing germs already in the wood; fill the pores of the wood with an insoluble oil and exclude air and water; require no expensive and complicated machinery nor skilled labor, but be so simple that any one can make the application regardless of season and when and where the wood is to be used, avoiding all unnecessary transportation; be neither explosive or poisonous; be non-corrosive, and under no condition make wood more inflammable than in its natural seasoned state. For electrical transmission service, it is absolutely necessary that the impregnating material should be a non-conductor of electricity.

PRESERVING RAILROAD TIES

E. A. Sterling, forester of the Pennsylvania Railroad to supervise extensive tree planting operations, has just returned from an inspection of the large wood-preserving plants of the Far West and reports that with the growing scarcity of timber for ties and other railroad lumber the large Western railroad systems are going into tree planting and wood preserving on a large scale. Mr. Sterling says that among the railroads in the West now treating timber is the Santa Fé, which has a large creosoting plant at Somerville, Tex., with a capacity of 15,000 ties a day. The Santa Fé is also building a new plant at Albuquerque, N. M., where a crude oil will be substituted for creosote. In addition to treating the timber, the Santa Fé is planting Eucalyptus trees on a 9000-acre tract near San Diego, Cal. The timber manager of this company has been sent to Australia to look up new species of trees.

The Southern Pacific operates two plants at West Oakland, Cal., one at Houston, Tex., and another at Los Angeles, Cal. Red fir and pine are being treated. In the Northwest the Oregon Railway & Navigation Company maintains a zinc chloride and creosoting plant at Wyeth, Ore., while commercial plants are located on the Puget Sound. Among the more important new treating plants in course of erection are two by the Northern Pacific, one very large plant by the Burlington at Galesburg, Ill., four by the Rock Island and two or three by the Illinois Central.

As a protection against a possible diminution of lumber for railroad ties in the future, the Pennsylvania Railroad has undertaken large tree planting operations since the apppointment of a forester. Work upon a large basis is progressing at Mt. Union, Pa., where about 225,000 trees have been planted. At Altoona 250,000 or more red oak trees were set out last spring. At Hollidaysburg a "forest nursery" is being created, about 135 lbs. of seed being planted this year in nursery beds and many trees being set in nursery rooms for use next year.

With the planting of last spring, the Pennsylvania Railroad has about 1000 acres under cultivation. Some 2,250,000 trees have been set out in addition to the seed planted.

The United Railways & Electric Company, of Baltimore, Md., has recently issued a booklet devoted to trolley trips in and out of Baltimore which, besides describing a few pleasing trips out of the city and the lines within the city, gives the location of the principal parks in the city and the suburbs, the hotels, the theaters, the railroad depots and the suburban towns on the company's lines, together with a schedule of all-night cars.

CORRESPONDENCE

INSTRUCTIONS TO TRAINMEN

Editors Street Railway Journal:

The editorial in your issue of Sept. 14, entitled "Instruction to Trainmen," discusses a subject which has received very careful consideration on the part of writers and managers, but from which any direct results are rarely obtained. The plan suggested by you, however, is very practical and in many parts of the country could be carried out economically.

Any operating man or manager will testify to the great number of men hired and qualified, and of the small percentage who remain in the service six months, one year or two years after engagement. Their experience will also undoubtedly show that a large proportion of collisions, derailments and other accidents is caused by these new men, and that it is a serious question whether it is profitable in the long run to keep a man of four months', six months' or a year's service, after he has had his first serious trouble. While the average manager is wrestling with this perplexing question, he is spending about 50 per cent of his time in interviewing candidates, is giving up 100 per cent of one or more other men's time on the same work, and is using up a lot of stationery and other people's time in obtaining a history of the applicant's life and securing his family genealogy. At the same time the company's physician is busily engaged in making a record of the candidate's chest expansion, waist and hip measurement and the per cent of wildkirschenrinde in his blood and is gathering other important data for the benefit of the American Physicians' Congress.

After spending all this special and professional labor, the company turns the poor fellow loose and tells him to go forth and "do things," and the candidate, having passed his senior year's examinations, as a rule receives no further official attention until he gets into trouble. Wherever this is the general procedure its injustice is apparent to any man who has followed railroad or street railway work long enough to appreciate its multitude of perplexing troubles. It is equally self-evident that a close "follow-up system" is the only way by which a greater percentage of these men who cost the company so much time and money can be retained in the service, appreciating more each day the importance of the great work they are engaged in, and acquiring gradually a full knowledge of their special vocations.

To this latter end your plan comes more nearly to being practical than many suggestions heretofore made, except that I think a traveling lecturer and demonstrator who would take in a circuit of one to five cities—depending on the number of men employed and the frequency of visits—would be the most effective plan. His lectures should be accompanied with illustrations by lantern views or some such system, all of which could be determined on when the details are worked out.

For text-books, I should advocate that the American Street & Interurban Railway Association, through its secretary, Mr. Swenson, should collect data for a book to be called possibly "The American Railway Practical Text-Book." This book could be made to cover every practical operating problem if contributions were suggested and obtained systematically from each railway company. The railway companies could gather these suggestions from those men on their systems who have had instruction work in charge.

W. H. M.

CHANGING RESISTANCE STEPS TO ELIMINATE FUSE AND CONTROLLER TROUBLES.

At the Atlantic City Convention of the American Street and Interurban Railway Engineering Association, during the discussion on control apparatus, J. W. Corning mentioned how he had eliminated controller and fuse troubles by changing the resistance steps. As Mr. Corning, who is electrical engineer of the Boston Elevated Railway Company, has kindly furnished some diagrams illustrating this practice, it is possible to explain his method in further detail.

The company was operating some 25-ft. box cars, equipped with two G E-58 motors and K-10 controllers. Complaints were made of the uneven acceleration of these cars and an investigation with a recording ammeter showed there was bad setting of the resistance connections. It was found that on the last parallel step, just before going into full multiple, there was a peak of

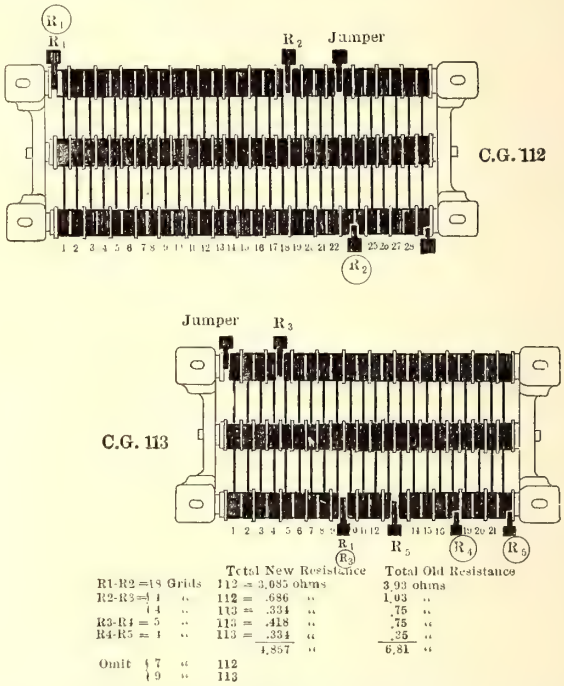


FIG. 1.—DIAGRAM ILLUSTRATING CHANGES IN RESISTANCE GRIDS, WITH THE OLD RESISTANCE STEPS ENCLOSED

about 290 amps in accelerating on a grade of about 5 per cent. By readjusting the resistances the peak has been brought down to about 200 amperes. Since this change has been made, fuse blowing, motor flash-overs and controller short circuits have been practically eliminated. Under the old conditions the motormen were afraid to carry the controller to the last notch, because they often blew fuses when they did it. Hence the tendency was to remain on the next to the last notch a long while before advancing to the last point, which practice resulted in numerous burnouts of resistance grids.

The changes in the resistance connections are shown clearly in the grid diagrams of Fig. 1, under which will be found a statement of the corresponding new and old intervals with a reference to the number of grids removed. From the latter it will be noted that the total resistance in the rheostat circuit has been cut down from 6.81 ohms to 4.857 ohms. The benefits mentioned with regard to reduction of current peaks, when accelerating on a 5 per cent grade, are graphically shown in Fig. 2, the dotted line showing the old and the full line the new conditions.

The acceleration with the old set of connections was made at a rate of advance of the controller handle of four seconds per notch, while the acceleration with the new set of connections was inadvertently made with a rate of advance of the controller handle of three seconds per notch, so that the peaks in the multiple position in the new curve would at a rate of four seconds per notch be slightly lower than shown on the curve with three seconds per notch. It will be understood, therefore, Fig. 2 does not show the full advantage obtained by the readjustment of the steps of the rheostat.

Another point which Mr. Corning mentions in this connection is this: For a given equipment there is a certain current value, which if the motors are called upon to commutate too frequently will cause more roughening of the commutator than the brushes will be able to smooth off during the time that current is off the motors; and if the resistance connections are so made that this greater current is exceeded in normal acceleration, the commutator will go from bad to worse, and motor flashing is likely to occur. This was noticed very particularly in one case where certain equipments were being taken out of service every three days on account of rough commutators and flashing. After the resistance steps had been changed

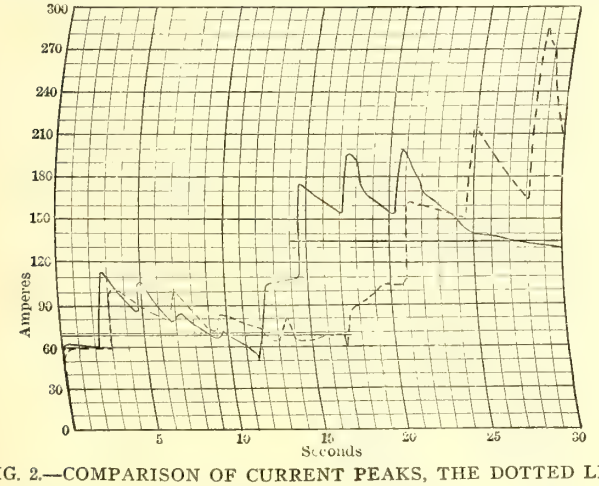


FIG. 2.—COMPARISON OF CURRENT PEAKS, THE DOTTED LINE SHOWING THE IMPROVEMENT EFFECTED BY CHANGING THE RESISTANCE CONNECTIONS

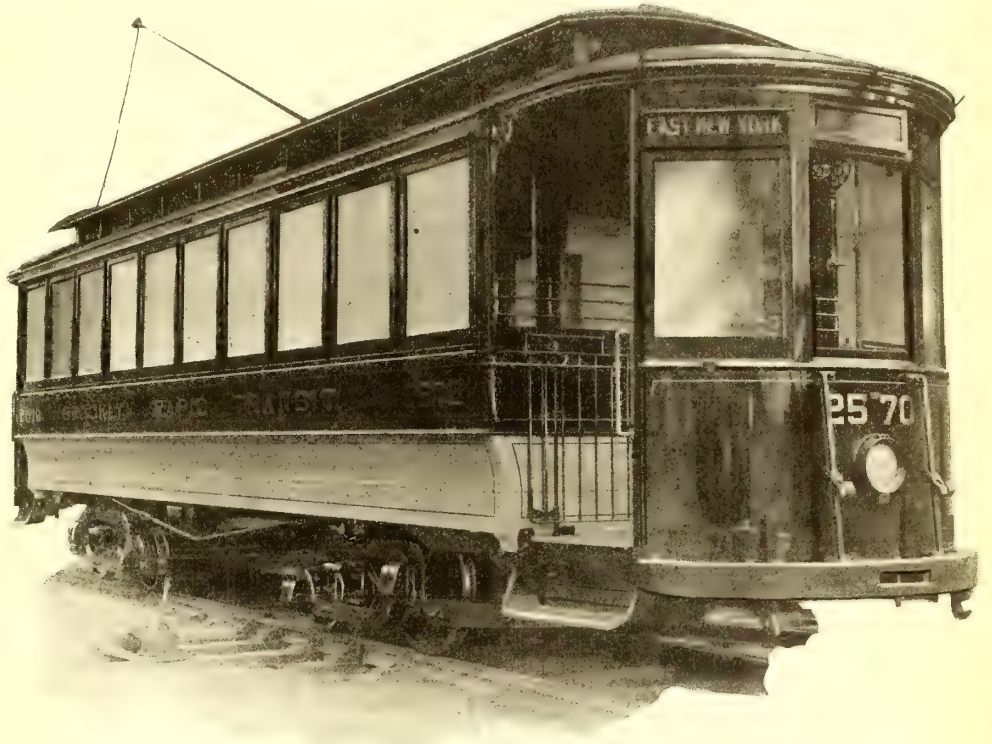
and a great deal better acceleration had been obtained the commutators ran smooth and clean, and the motor flashing was practically eliminated.

It may be of interest to add that the gear reduction of the motors used in this case is 3.42 (19:65) and on lower speed cars with the same equipment is 4.60 (15:69).

The New York, New Haven & Hartford R. R. is now running thirty-five electric trains between New York and Stamford.

NEW SURFACE PASSENGER CAR FOR BROOKLYN

The Transit Development Company, which supplies and maintains the rolling stock for the Brooklyn Rapid Transit Company, is now equipping and placing in service 100 new surface passenger cars of its standard 28-ft. body semi-convertible type. Several improvements have been made on this lot of cars not contained in previous cars of the same type, and a general description at this time should be of interest.



NEW SEMI-CONVERTIBLE CAR WITH 28-FOOT BODY, PLACED IN SERVICE OF THE BROOKLYN LINES

A change in type of car from the company's 42 ft. 6 ins. convertible type, of which 452 have been placed in service prior to the present lot, was made after carefully investigating the peculiar and perplexing traffic conditions existing during the rush hours in Brooklyn, and considering the type of car that would best meet the exacting requirements for handling the enormous and concentrated traffic with which the Transit Development Company is required to cope.

The crowds handled to and from one terminal (the New York end of the New York and Brooklyn Bridge) for several hours during the morning and evening are unquestionably the largest encountered by any street railway system in the world. With this in mind, a medium size car has been designed and arranged for quickly taking on or unloading large crowds at one point. Longitudinal seats are the only kind suited for these conditions, and doors of the accelerator type have been provided for facilitating ingress and egress. The main feature of this door, which is placed near the step, is that the platforms cannot be easily blocked, thus obtaining an unobstructed entrance.

The car is arranged for operation from both ends, and has vestibules open at the sides. The sides are of the usual cove panel type with ⅜-in. whitewood panels, each in two pieces, spliced diagonally opposite.

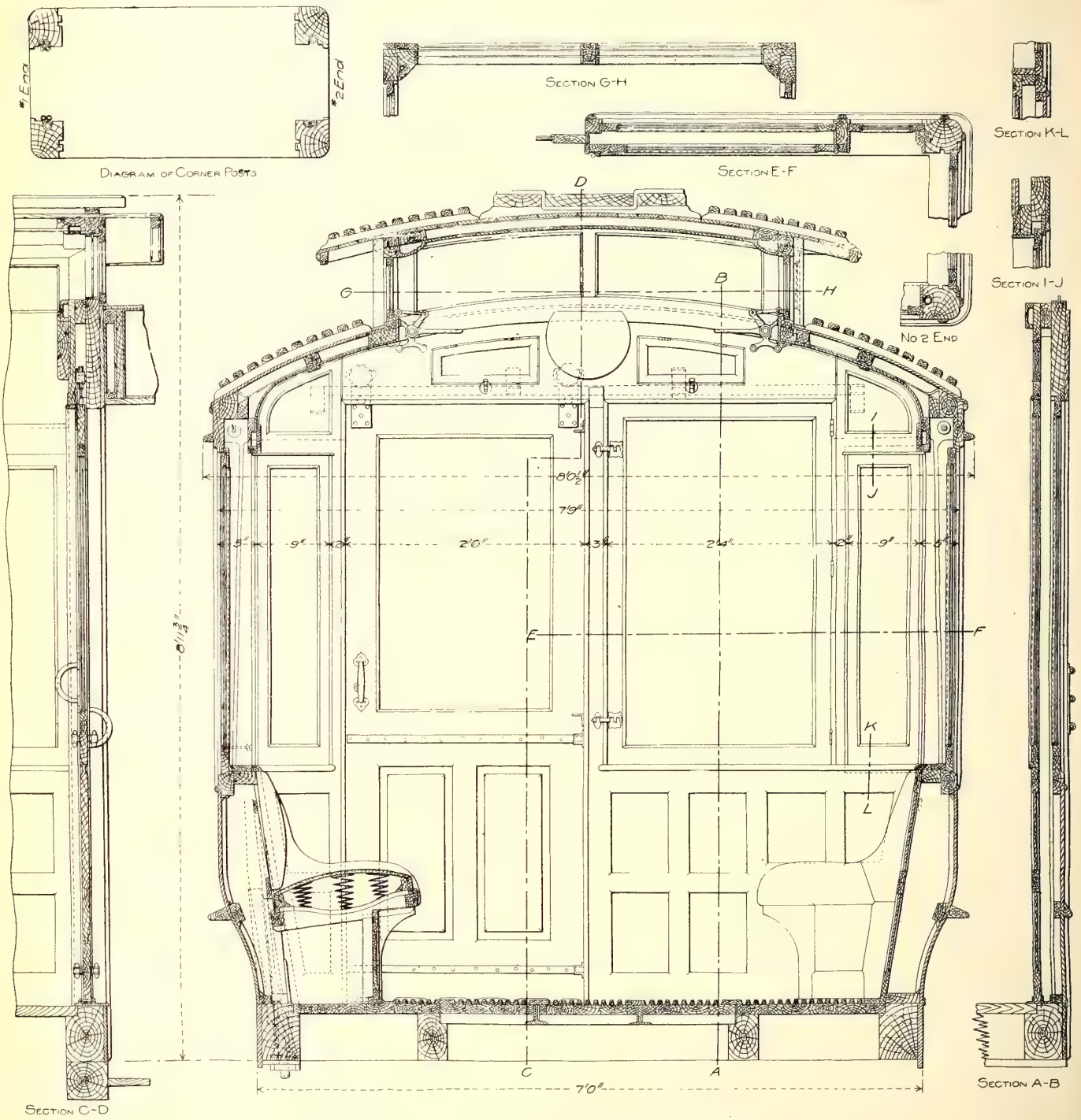
There are ten large removable sash on each side of the car, held in place by malleable iron retainers extending from belt rail to letter board and fastened to posts by three

5/16-in. phosphor bronze screws running through posts, with neat polished bronze cup washers on inside of post. During the summer months these sash are removed and stored.

The following are the general dimensions of the car: Length over corner posts, 28 ft.; length of platform, 4 ft. 7 ins.; length over buffers, 38 ft. 3¾ ins.; length center to center of bolsters, 15 ft. 1¾ ins.; width over sill plates 7 ft.; width over drip rails, 8 ft. ½ in.; height from bottom of sill to top of trolley board, 8 ft. 11¾ ins.

The entire underframe is double mortised and tenoned joints are secured by knee forgings and standard structural steel angles. A steel plate 8 ins. x ⅝ in. is securely bolted to the side sills, extending the entire length of car body. The bolsters are of steel plates framed into underframe top plate 8 ins. x ¾ in. and bottom 8 ins. x 1 in.

The platform bearers extend from the sub-end sill and side sills to buffer angle iron, hung by bolts and steel castings to end sills; the outside bearers are 3½ ins. x 6 ins. x ½ in.



CROSS-SECTION OF LATEST BROOKLYN SURFACE CAR

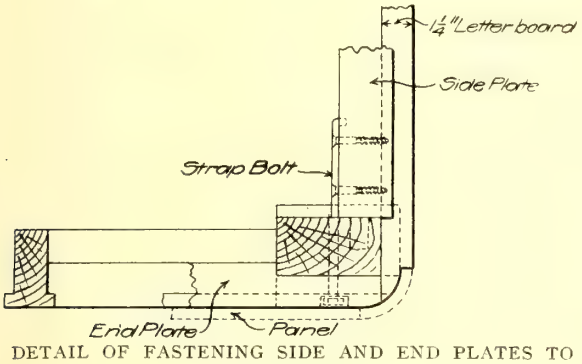
The underframe is of unusually strong and rigid construction. All timbers are of white oak, except the side sills of yellow pine. The side and end sills are 4¾ ins. x 7 ins.; the cross timbers are 3¾ ins. x 5¾ ins.; longitudinals, 3 ins. x 5¾ ins.; auxiliary end sills, 5¾ ins. x 5¾ ins.; sub-end sills, 5⅛ ins. x 4⅞ ins.; trap door timbers, 3¾ ins. x 4½ ins.

angles, reinforced at the bend by a 5 ins. x 3 ins. x ⅜ in. angle, and the middle bearers are of 5 ins. x 3 ins. x ⅜ in. angles, reinforced by an angle of the same size at the bend.

The flooring is of 1¼-in. yellow pine, 3½-in. face tongue and groove run lengthwise and sunk flush with and rabbitted into side sills. Each board is secured to each floor timber with two 2½-in. No. 14 screws, sunk ⅛ in. into

boards and covered with putty. The floor space between is covered with beveled maple strips.

The side posts are of white oak 2¼ ins. thick, with rounded inner edges; each post is mortised into the side sill and plate gained into plate furring and secured to the sill by ½-in. strap bolts. The corner posts are of ash 4⅛ ins. x 5 ins. The strainer rails are gained into and screwed to the post with three strainers between each two posts, to which the panels are screwed and double scrimmed. The sash rails are 3 ins. x 2 ins. gained into posts and wedged in position. The letter boards are of ash.

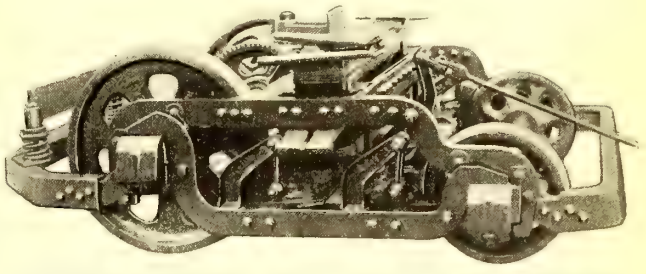


DETAIL OF FASTENING SIDE AND END PLATES TO CORNER POST

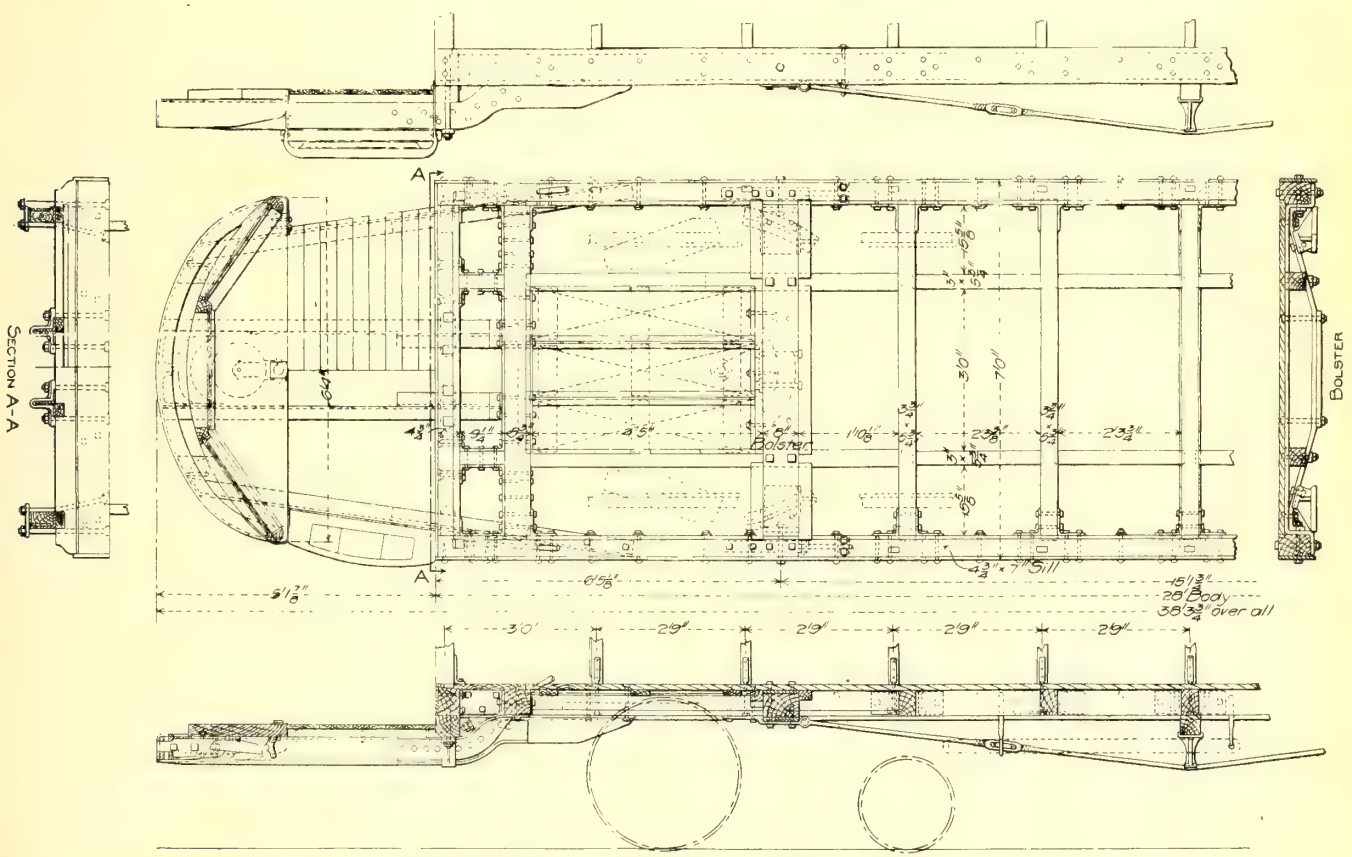
descent lamp is placed in the hood of the vestibule above and is in front of sign for illumination at night. One R. W. Bliss Company's Wood gate is provided on the outer or alighting side of each platform, and one Brooklyn Rapid Transit pantograph gate at the inner side.

All light wiring is run in electrobestos conduit with transite backing. The control wiring and all wires running down in corner posts are run in loricated iron conduit. The cars are equipped with two Westinghouse 93-A2 60-hp motors, geared 17:70, giving a maximum speed of 26 miles per hour at 550 volts. K-28-L controllers are used.

The thoroughly compact arrangement of the maximum traction truck used will at once be noted. The trucks are equipped with double elliptic springs, which give ex-



MAXIMUM TRACTION TRUCK FOR BROOKLYN SERVICE



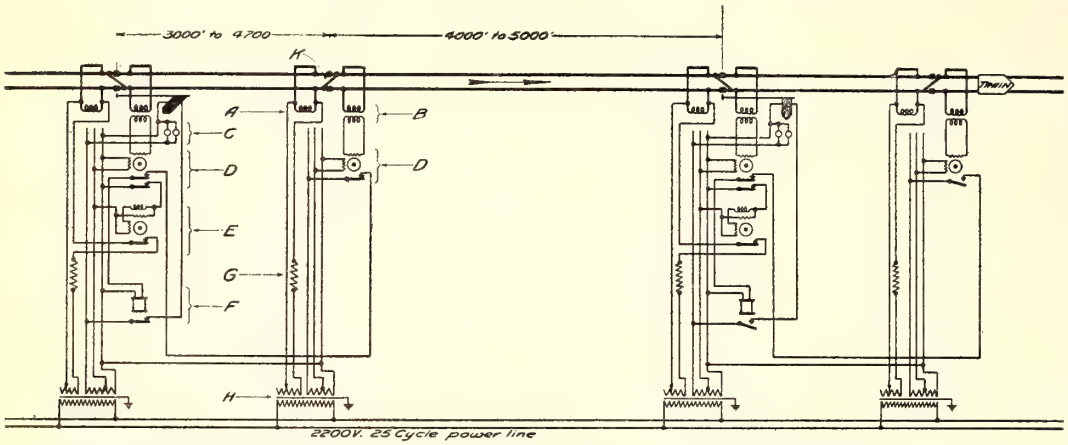
HALF-PLAN AND SECTIONS OF BROOKLYN CAR

The roof framing is of the monitor type of ash, excepting clerestory posts, which are of cherry, and the clerestory sill, which is of yellow pine. A steel carline 5/16 in. x 1¼ ins. is provided at each post, bolted to the upper and lower rafters, turned over at ends and screwed to the plate. The roof is covered with whitewood boards, nailed to the rafters and covered with No. 6 cotton duck.

The destination signs are of a novel design and consist of a four-sided block sign painted black, with destination painted with aluminum paint on each side. An incandescent easily riding qualities. The brake rigging is hung from brackets attached to the equalizer bars, thus providing an even shoe wear and giving an arrangement that will always keep the shoes at the same point on wheel, irrespective of the weight on the truck. The car body swivel plates are provided with conical rollers, which allow the truck to take curves easily and with less friction on wheel flanges. The trucks were designed and built by the Standard Motor Truck Company, subject to approval of superintendent of equipment, Transit Development Company.

THE PHILADELPHIA & WESTERN RAILROAD'S AUTOMATIC ELECTRIC BLOCK SIGNAL SYSTEM

One of the most noteworthy features of the Philadelphia & Western Railroad is the automatic electric block signal system. This road is a double track, high speed, direct current electric line extending westward from the union station at Sixty-Ninth Street, Philadelphia, to Stafford, Pa., a distance of eleven and one-half miles. A description of the road was published in the Street Railway Journal of June 15, 1907, but as the block signal system had not been completed at the time, the following extended description should be of interest.



A—Single Coil Reactance Bond
B—Double Coil Reactance Bond
G—Resistance Grid
D—Track Relay
E—Track Circuit Control Relay
F—Motor Control Relay
G—Resistance Grid
H—Line Transformer
K—Diagonal Bond

FIG. 1.—CIRCUIT PLAN

It has not been customary in the past for suburban lines of this character to do much, if anything, in the way of signalling. The management of the Philadelphia & Western Railroad, however, recognized the importance of block signal protection and wisely determined to install a first-class automatic block system, feeling that the high speeds, heavy grades, density of traffic and other governing conditions fully justified the outlay.

After consideration of the systems proposed it was decided to adopt the one offered by the General Railway Signal Company, of Rochester, N. Y., which is similar to this company's installation in the New York Central Railroad's electric zone, previously described in these columns. The essential features of this system are as follows: The retention of both rails of each track for the return of the propulsion current; cross bonding facilities between all rails of both tracks at the ends of all track circuits and between one rail of each track intermediate between the ends of said sections, wherever desired; the use of ironless reactance bonds, permitting very long track circuits to be operated with a minimum expenditure of energy; the use of alternating currents only for the track circuits and the operation of all the devices connected with the system, thus doing away with all batteries and the expense incident to their maintenance.

Single arm, two position home signals arranged on the normally clear principle are employed with an overlap. On account of the heavy traffic between Philadelphia and Beechwood Park the signals average about 3300 ft. apart and a full block overlap is being employed to permit a two-minute headway. West of the park the signal spacing averages one and one-half miles with a uniform overlap of about 3700 ft., allowing a headway of approximately five minutes. If required by traffic conditions it is intended to put in more signals at a later date.



FIG. 3.—SEMAPHORES AND TRANSFORMER POST OF AUTOMATIC BLOCK SIGNAL SYSTEM

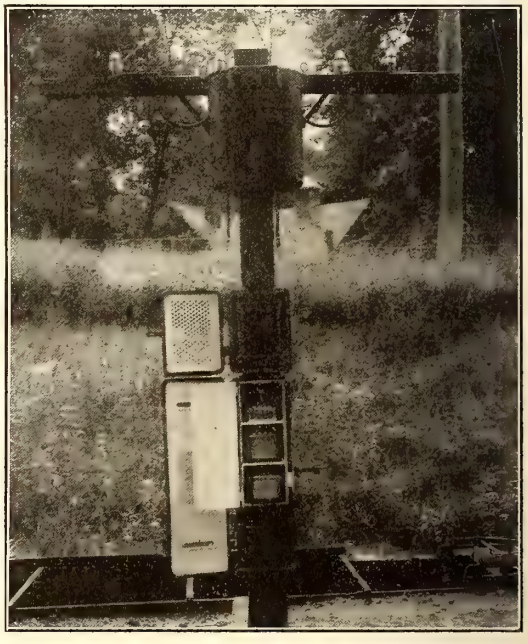


FIG. 4.—RESISTANCE GRIDS IN PERFORATED CAST-IRON BOX

Twenty-five-cycle, single-phase current from transformers in the railway's power plant is used for operating the entire signal system.

Fig. 2 shows the switchboard controlling the two feeder circuits which run in either direction from the power house.

Power is delivered to the switchboard through a remote controlled automatic oil switch not shown in the cut. Each feeder circuit is equipped with an ammeter and an electrically tripped, hand-operated oil switch whereby the system may be relieved in case of a cross on either transmission line. The latter consists of two No. 6 B. & S. hard drawn bare copper wires strung on separate cross arms on the railroad company's high-tension pole line, which is protected by lightning arresters.

"Line transformers" are installed at all signal and overlap locations. They step down directly from the transmission line voltage of 2300 to the voltages required for the signal system. These transformers are protected on the primary side by cartridge fuses mounted in water-tight cast iron boxes and so arranged that a fuse can be replaced without danger. The secondary windings are three in number, a 55-volt winding for the operation of the signal motors, lights and line relays, and provided with a tap for the local phases of all polyphase relays; and two windings for supplying energy to the track circuits, taps being provided on these windings so that the voltage can be varied from 2½ to 15, as required for track circuits of different length. A copper shield is placed between the primary and secondary windings and connected to ground, affording protection in case of a breakdown in insulation. These transformers are manufactured by the General Railway Signal Company. All coils are insulated with an oil and moisture resisting compound by the "vacuum treatment" process, in which the coils are heated in an air-tight tank. After a vacuum has been secured and the moisture thereby extracted, insulating compound is forced into the coil under heavy pressure which causes the liquid to penetrate

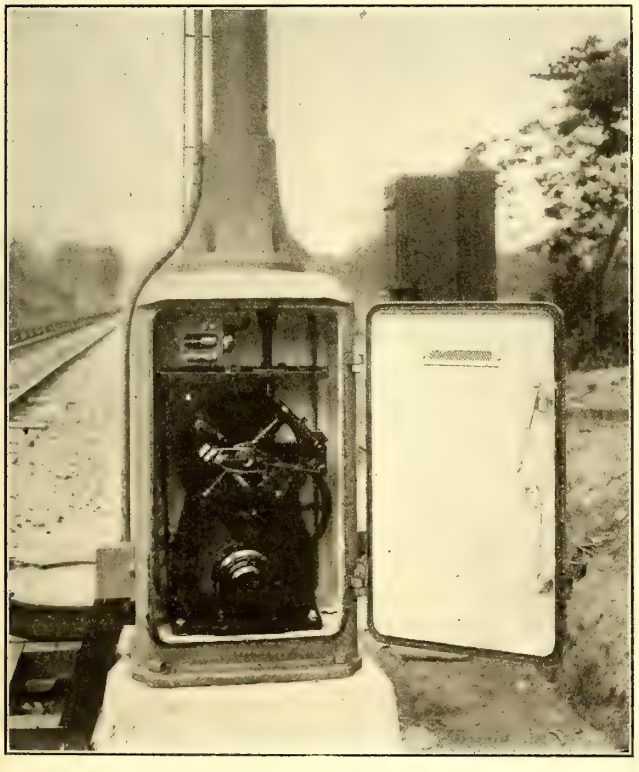


FIG. 6.—SIGNAL MECHANISM EXPOSED

to the heart of the coil, with the result that every wire is surrounded with a highly insulated covering.

Both rails of each track are made available for the propulsion current by ironless "reactance bonds" connected to the rails as shown at *A* and *B* on the circuit plan, Fig. 1. When so connected they form a path of low ohmic resistance and large current capacity for the traction current, and at the same time offer an impedance to the passage of the alternating current from rail to rail, whereby a portion of said current is forced down the rails to operate the track relay. The reactance bond *A* at the transformer end of the track circuit has a single winding connected directly

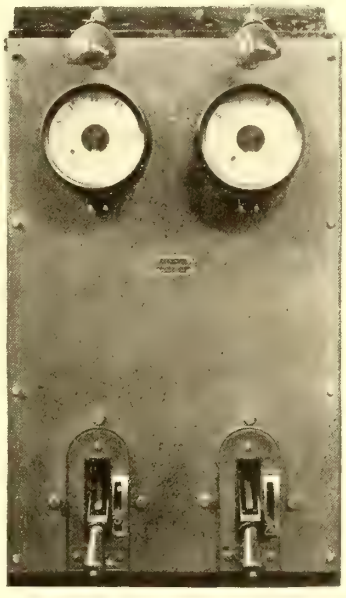


FIG. 2.—SWITCHBOARD CONTROLLING FEEDER CIRCUIT

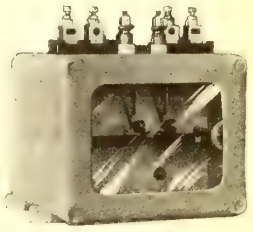


FIG. 5.—TRACK RELAY

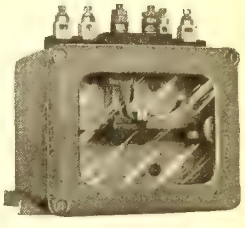


FIG. 8.—TRACK CIRCUIT CONTROL RELAY

to the rails. The bond *B* at the other end of the circuit has two windings, one connected to the rails and the other directly to the relay. The winding connected to the relay acts as the secondary of a transformer, its object being to prevent an excessive flow of direct current through the relay which, owing to the low ohmic resistance of the relay, would otherwise result were the relay connected directly to the track rails. Attention is called to the fact that these bonds are of the ironless type and hence are not subject to saturation due to an unbalanced condition of the traction current in the rails, the reactance, therefore, remaining constant under all such conditions. It is also to be noted that alternate rails in adjacent track circuits are connected by heavy "diagonal bonds" *K* so arranged that the breaking down of any insulated rail joint will short-circuit either the relay or transformer and prevent the giving of a false clear indication. Cross-bonding between tracks may be effected by making connection, at any point desired, to the rails which are made continuous by the diagonal bonds *K*.

The bonds in question are made up of flat copper strips of large cross section wound in the form of a spiral, the turns being suitably insulated from each other. The coils when wound are heavily taped and then impregnated as in the case of the transformer coils. These coils are assembled in pairs in flat iron cases and mounted on extended ties as shown in Fig. 10. A connecting chamber is provided in the case between the coils in which all the coil ends terminate and where all connections to the rails, relays and transformers are made and then concealed by a suitable cover. The copper connections to the rails after leaving the bonds go directly downward and under ground to the rails where, after passing a short distance above ground to insure flexibility, are connected to the rails. This construction conceals the copper as much as possible and reduces theft to a minimum. Energy is supplied to the track circuits directly from the low voltage high current wind-

ings on the line transformer, as shown on the circuit plan (Fig. 1), through adjustable cast-iron resistance grids which limit the current flow when a train is standing at the transformer. These grids are mounted in separate perforated cast-iron boxes as shown in Fig. 4.

The track relays, as shown in Fig. 5 and at *D* (Fig. 1), are of the company's standard polyphase construction. The moving contacts are mounted on a horizontal wooden bar to which motion is imparted by a small split-phase induction motor having two stationary windings. One of these windings is connected directly to the reactance bond secondary, as shown in Fig. 1, and the other directly to a low voltage tap on the line transformer. When thus connected, a phase difference exists between the two coils and rotation of the armature is thereby produced.

Of the energy in the two relay windings, that supplied by the transformer direct is by far the greater. This requires but a small amount of energy from the track to give

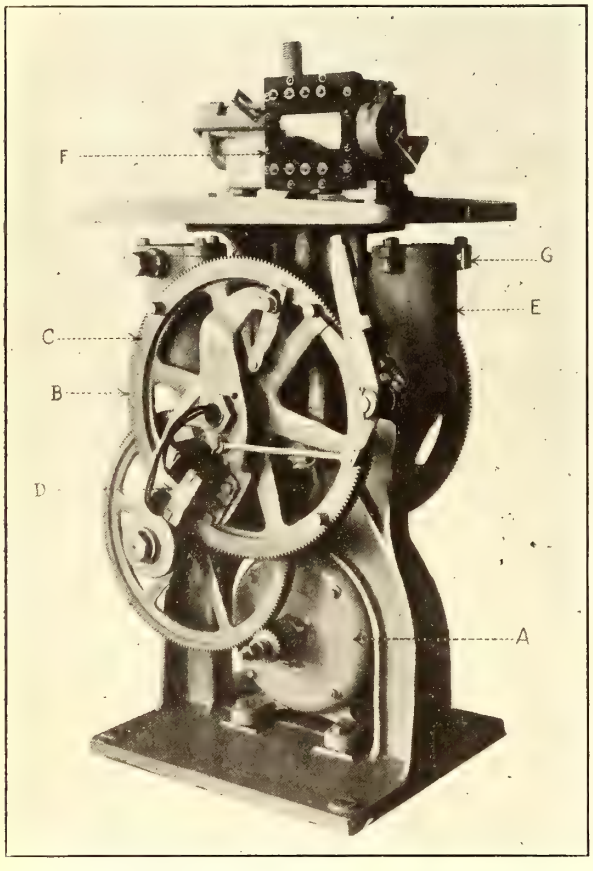


FIG. 7.—DETAIL OF SIGNAL MECHANISM

positive action of the relay, and as a result very long blocks can be operated with comparatively little energy, as evidenced by the fact that in this installation track circuits 8800 ft. long are operated with energy fed in at one end. As alternating current only can cause the relay to operate, it is immune to the effects of direct current. All contacts and other working parts are made visible by glass covered openings. Water-tight construction is effected by using rubber gaskets. These relays are positive in action and give an exceptionally heavy rubbing pressure between the contacts in closing and an extra wide opening when de-energized. Contacts can be provided, as required, up to a maximum of four front and four back per relay. They are insulated to withstand a breakdown pressure of 3000 volts alternating current.

The track circuit control relays, as shown by Fig. 8 and at *E* (Fig. 1), are to hold a given signal at stop until the train is out of the overlap for the next signal in advance. The method for controlling the signals will be evident by reference to the circuit plan, Fig. 1. These relays must be able to carry continuously and break the entire current flowing to the track circuit at the rear of a signal, and of course must continue to do so without injury. These relays as designed will carry an alternating current of from fifty amperes to seventy-five amperes and break the same at twenty-five volts continuously without overheating and without perceptible arcing, although the current required to be carried in practice is much less than this. The construction and operation of these relays is similar to that of the track relays except that the contacts are made very much heavier and the necessary phase displacement to produce rotation is effected by a small reactance coil, placed in series with one of the relay windings.

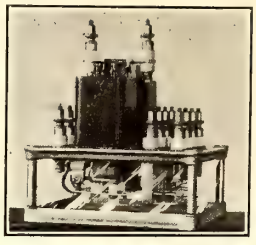


FIG. 9.—MOTOR CONTROL RELAY

Having thus described two combinations of these polyphase relays, the liberty is taken of departing for a moment from the description of the Philadelphia & Western installation to direct attention to the great variety of uses

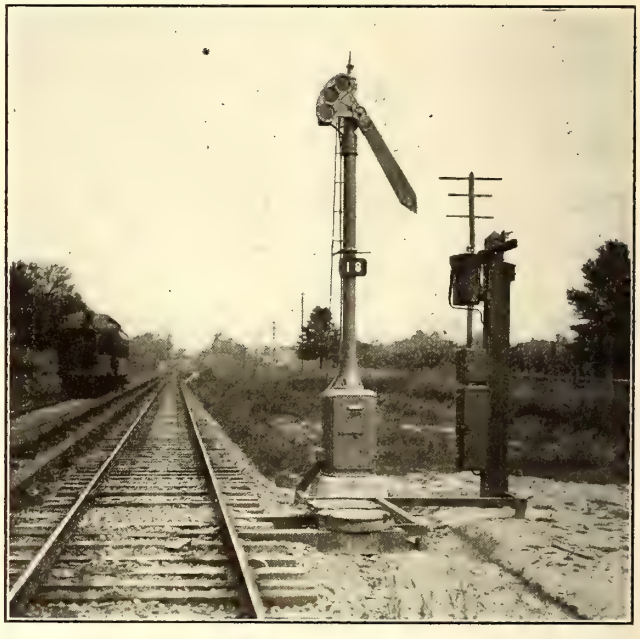


FIG. 10.—REACTANCE BONDS IN CIRCULAR CASES IN PLACE ON EXTENDED TIES

to which these relays can be adapted by simply changing the windings or contacts or by the addition of stock parts.

When wound to a low resistance they may be used as track relays with contacts to the number of four front and four back, and when equipped with heavy contacts they can be used for the control of low voltage heavy currents as already described. When equipped with carbon to carbon contacts they will break small currents of high voltage (up to 600). When wound to a high resistance they may be used as line relays with any reasonable equipment of contacts desired. By adding an upward extension to carry a small semaphore arm they can be used as tower indicators and, when placed in a suitable case, as switch indicators. The movements when placed in a case and equipped with a shutter and suitable contacts can be used as light signals for tunnel work. Furthermore, the feature which this re-

lay possesses of operating in one direction with a given phase relation and in the opposite direction when said phase relation is reversed (and since a given reactance or resistance is necessary to produce rotation in a given direction) the possibility of false operation due to foreign currents or crosses is much more remote than in the case of direct current relays and certain other a. c. relays. This feature also makes it possible in many cases to use but one line wire where two would otherwise be required.

The motor control relay is shown by Fig. 9 and also at F (Fig. 1). It is so controlled by the three track circuits in advance of a given signal that it cannot close until the train is out of the overlap for the next signal in advance as shown by the circuit plan, Fig. 1. This relay directly controls the clearing of the signal and is of the alternating-current tractive type. It is designed so that a uniform magnetic pull is exerted on the armature, notwithstanding the fact that the current in the magnetic coils alternates. In many respects it is similar to the direct-current track and line relays manufactured by this company.

The signal mechanism employed is shown in Fig. 6, and in Fig. 7 is shown a two-arm movement which, although not employed on this installation, will serve to illustrate the principles of operation. The mechanism is operated by a small single-phase induction motor *A* which is connected through suitable gearing to a slot wheel *B*. Projecting from the sides of said slot wheel are pins which as they come around engage the slot dog *C* in such manner as to clear the signal in case the slot is energized. The slot magnet *D* is designed to operate on alternating current and to give a uniform pull without noise and vibration. It has an exceptionally high "drop away" point. The movement of the blade in clearing is limited by the stop arm *E*, said arm becoming effective only when the slot is energized, and is so arranged that the signal blade is brought precisely to, and held at, the clear position no matter what the speed of clearing. The circuit-breaker contacts are enclosed in a dust-proof case *E* with a glass front which is mounted at the top of the mechanism. The dash pot *G* is of the buffer type, allowing a free initial movement of the blade in returning to the stop position. All signals are lighted by two 4 c. p. 50-volt lamps in multiple.

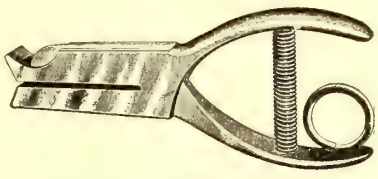
All relays are housed in wooden boxes which in turn are enclosed in cast-iron boxes as shown in Fig. 4. In the lower part of the iron boxes are mounted the terminal boards where all outgoing wires terminate on suitable binding posts and to which all apparatus within the boxes themselves are connected by flexible leads. All transformer secondary fuses are also mounted on this same board. The relay boxes, grid boxes, and line transformers are mounted one above the other on suitable stub poles provided for the purpose as shown, for example, in Fig. 4.

The different circuits employed for the control of the signals are shown in Fig. 1. A train is shown as having just passed out of the overlap. The functions of the pieces of apparatus having been described hereinbefore, the operation of the circuit will be self-evident without comment.

Street railways with cars operated by manual power are in use at Mombasa, in East Africa. The light, narrow gage tracks are laid through the street, and the cars are for hire; like cabs, or are the private property of officials and wealthy residents. They are little four-wheel cars with one or two cross seats, and each is propelled by two natives. Spur tracks are run into private grounds, so that persons can take the cars to their doors.

A STRONG PUNCH FOR STREET RAILWAY SERVICE

Of all the various uses to which punches are put, there is none, perhaps, more severe on the instrument than its use in street railroading. In many cases the punch is almost constantly in service and frequently is used to punch tickets and transfers in bulk, in which event it is likely soon to fail unless there is a large factor of safety. In addition, the punch does service in all kinds of weather, and soon begins to deteriorate rapidly unless it has been carefully nickeled. To meet these requirements a number of punches have been developed, among them one by the Bonney-Vehslage Tool Company, of New York, which has met with favor among street railway companies and has been adopted by a number of them. This punch is very strong, with thumb hole and spiral spring between the handles, and is so designed that the numbers to be punched are plainly visible through the punch. It cuts 1⅛ ins. from the edge and is so arranged that it will take any single die in the company's list, which is very extensive.



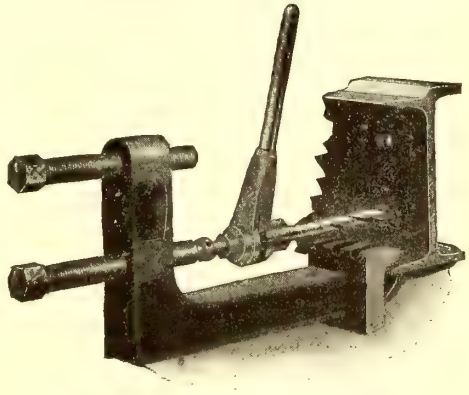
PUNCH THAT SHOWS NUMBERS

MEETING OF THE A. S. M. E.

The fifty-fourth annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, New York, Dec. 3-6, 1907. Symposiums on foundry practice, giving the experiences of prominent men in that work, have been arranged. Other live topics, such as industrial education, power transmission by friction driving, cylinder port velocities, etc., will be discussed. The committee has arranged an excursion for Wednesday afternoon and an address in the evening.

A NEW TYPE OF DRILL CLAMP

The Security drill clamp is a device for drilling rails which the F. Bissell Company, of Toledo, Ohio, the maker, says remains firmly locked while in use. It has no bend or spring. A vertical headpiece makes the device adjustable. The vertical arm holds two adjusting screws, each one by eight inches, which follow the drill forward. They are of ample size for heavy use and are cupped to receive a ratchet head. Two screws are provided with their centers set respectively two and six inches above the horizontal arm. In use this arm comes tight against the rail base, so these measurements apply to the rail itself. If the screws do not fit the holes a loose bar may be placed across the screw tips and the bar cupped to receive the ratchet. The company is offering this clamp on approval.



DRILL CLAMP IN POSITION

A NEW ELECTRIC RAILWAY SIGNAL

A new automatic electric railway signal has recently been developed by Prof. Alexander Bevan, of Providence, R. I., with special reference to the requirements of single-track service. It is also capable of spacing cars or trains on double-track roads. Each block is provided with two signal boxes and two circuit closers or trolley switches, one being located at each end of a single stretch of track. The signal is operated entirely by trolley current, no batteries being used in its working. It indicates whether the block is clear or occupied, and in which direction the car or cars are moving, a red signal indicating that the car is coming toward, and a green signal that the car is going from the observer. It is operated by the trolley whether the car is coasting or using power.

Fig. 1 is a photographic reproduction of the signal outfit for a block, and Fig. 2 is a wiring diagram for a block. Any car entering an unoccupied block sets the danger signal at the farther end, and the setting of the danger signal lights a green light directly in front of the moving car, thus giving positive assurance that the danger signal has set. This condition remains until the car leaves the block, when the signals are restored to normal. Should more than one car enter the block, each follower operates a mechanism in the farther signal, which flashes the green lamp in front of the entering car, and prevents the signal from returning to safety until the last car has left the block.

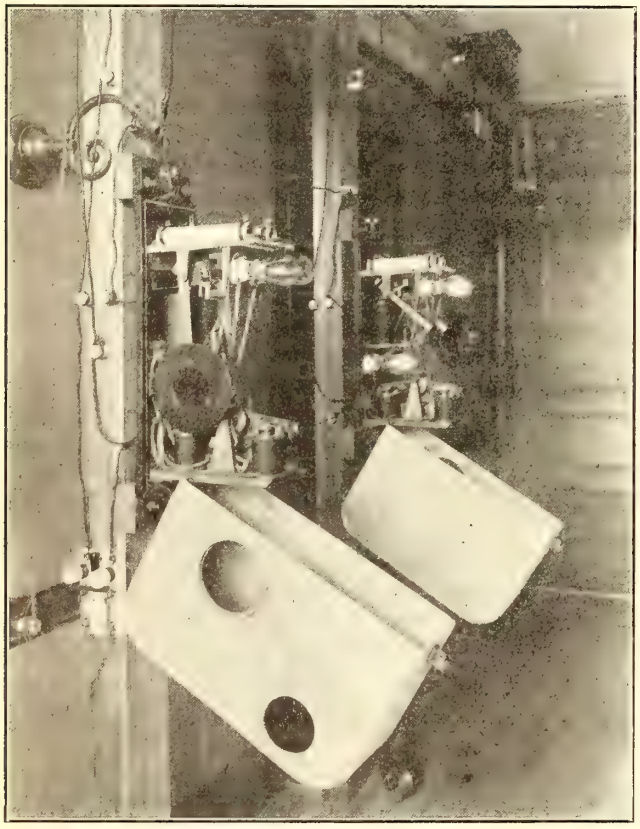


FIG. 1.—SIGNAL OUTFIT FOR ONE BLOCK

In case either red or green lamp burns out, reserve lamps are arranged to be automatically thrown into circuit until the regular lamps can be replaced. In case of any interruption of current the red semaphore targets drop to danger by gravity. The circuit-closing mechanism is adapted to high-speed service on either trolley or bow construction. The time of contact is practically the same for all speeds, and is sufficiently prolonged at any speed to operate the signal positively. The resistance to the trolley wheel is insignificant, and rebound or double action on the signal is impossible. No straight safety signal can be given without an indication from the distant end that all is clear in the block.

Referring to Fig. 2, when a car enters a block from the right the trolley wheel comes in contact with a switch lever in the overhead circuit closer on the trolley wire. The movement of this lever energizes the setting magnet A, causing the switch bar attached to its armature lever to break connection and open the circuit of the solenoid or semaphore magnet B by the movement of the finger on the ratchet wheel shown. This allows the target in the signal at the opposite end of the block to fall to the danger position. As the target falls it closes the circuit of the green lamp in the signal box at the home end of the block. This green lamp is a cautionary signal and shows through an aperture in the casing either day or night at the entering end of the block, to notify the car that the danger signal at the opposite end of the block has been set. This green light can only be lighted when the danger signal is set at the other end of the block.

When more than one car enters the block from the same direction the setting magnet A is energized by the operation of the circuit closer in the trolley wire at the entering end of the block, and the finger on the ratchet wheel is turned back a step at a time as each car enters after the signals have been set, and this finger is returned again by the closing magnet C a step toward its normal position each time a car leaves the block until but a single car remains in the block. When the last car passes out the finger closes the contacts, throwing current into magnets BB, and pulling up the target from the danger to the safety position. At the same time the circuit leading to the green lamps in the distant signal case at the entering end of the block is broken by the downward movement of the magnets BB. These plunger magnets exert a gradually increasing power to move the target, the power increasing in proportion to the increase of leverage as the target is raised, thereby insuring a smooth and uniform movement and avoiding shocks which result in injury to the parts. The cores of these magnets are also arranged to exert a straight pull, and there being no unnecessary lateral play in the cores, losses of power by leakage are avoided.

A feature of the signal is the construction by which the connection to the green lamps is broken for a short period when each car after the first one enters the block, thus showing to the entering car by the flashing of the green lamp at the entering end that the mechanism has again been operated. This flashing is caused by the movement of the switch bar attached to the armature of magnet A, which remains away from the contacts as long as the switch in the contact box on the trolley remains in contact, which is but a few seconds. The providing of a reserve lamp for both the cautionary and the danger signals is a most important feature of the rear signal, as a lamp is liable at any time to burn out and cause the system to become apparently inoperative. By the solenoid relays shown in Fig. 2, however, at the right of magnets BB, a reserve lamp is at once lighted automatically by the breaking of the circuit in the first lamp, and the system continues operative as if nothing had happened. When it is noticed that the first lamp is not lighted, it is replaced by a new one, which lamp then operates the solenoid automatically to break the circuit to the reserve lamp and cause the first one to be lighted again.

In case of a break in the wiring or other disorder in the apparatus, the danger signal is automatically set, and should this danger-indicating target fail to fall into the danger position, then the green or indicating lamp at the entering end of the block will not be set and the failure of this lamp to light will indicate to the approaching car that the signal is out of order, and there is danger ahead.

The overhead switch is designed to make a positive contact, whether the car is traveling at high or low speed. The contact made by the trolley upon the actuating lever is ordinarily very short, even at moderate speed, and when the car proceeds at a high speed the contact is so short as to be ineffective. For this reason the switch is designed for a prolonged contact released by a dash-pot. The arrangement of the retarding mechanism completely controls the period of contact, entirely independent of the throw of the actuating lever. At high-speed car operation the actuating lever and its engaging mechanism is thrown farther than

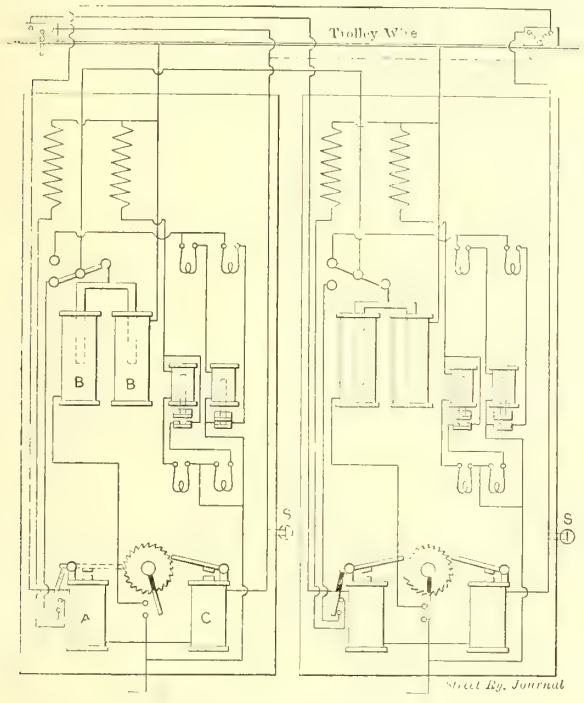


FIG. 2.—WIRING DIAGRAM FOR ONE BLOCK

when the car is passing more slowly. Then again, all trolley wheels are not of the same depth, some after having been worn having deeper projecting flanges. This also has a tendency to throw the actuating lever a greater or less distance. To compensate for this uneven stroke in the mechanism, a vent hole is bored in the dash-pot, so that the attending mechanism will return quickly to a given point. It then moves more slowly until the contacting finger is about to break its connection, when the break occurs quickly. A stop is provided to prevent the lever after being struck from bounding over to the opposite side of the case and giving the clearing indication at the distant end of the block. In case a motorman should pass the overhead trolley circuit closer with his trolley off he would receive no signal to allow him to pass, and if he did proceed under the circumstances it would be by a deliberate infraction of the rules.

In a test of Prof. Bevan's signal on the tracks of the Rhode Island Company, extending over about two weeks, the signals averaged about 80 hours of continuous work, comprising 4000 complete operations. During this test a slight change was made in the air cushions on the contact. None of the parts showed any wear. The number of half trips per day varied from 176 to 565, the total being 3931, making 7862 contacts on the trolley circuit closer. The apparatus worked properly during the entire period of experiment. The number of times the signal operated was equivalent to having it in service on a 20-minute headway for 2.5 months.

In case two cars enter from the opposite ends of the block at the same time, or nearly the same time, both cars can be run back far enough to operate their respective trolley contacts, which clears both signals. The car having the right of way may then proceed regularly, setting the danger signal ahead and leaving a cautionary signal in the rear, while the other car waits for its passage. This arrangement permits any number of cars to follow regularly the car having the right of way, but the signal indicates danger to the car waiting on the siding till all the following cars pass. In Fig. 2 the yoke wire joining the wires leading to the clearing magnets was intended primarily to permit a car to run into a block for the purpose of unloading freight, etc., and then back out and clear the block without having to go through the block to clear the signal. As this yoke wire operates both clearing magnets in multiple from either end of the block, the switches SS can be introduced to enable the conductor of a car which has carelessly or unavoidably entered an unoccupied block against a danger signal, to open the circuit of the clearing magnet in the rear signal, run his car back and clear the signal at the farther end without operating the rear signal, then close the clearing magnet circuit just opened by means of the switch, and thus leave the signals in the condition in which he found them. With this arrangement it is never necessary to remove the trolley from the wire, which might sometimes be objectionable at night.

OHIO MERCHANTS TOUR ELECTRIC RAILWAY LINES

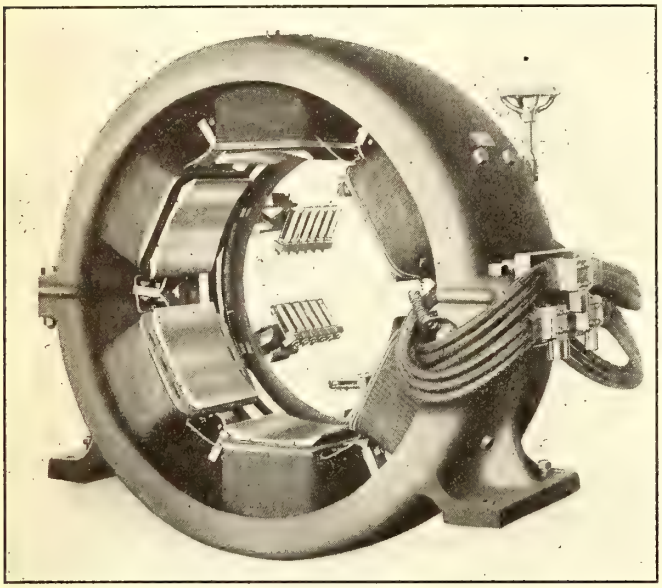
Representatives of forty wholesale houses at Cleveland, Ohio, took a two days' trip over the electric railway lines of the northern part of the state recently. These men are members of the wholesale board of the Cleveland Chamber of Commerce and have for several years made two trips on steam roads each year through various sections of the Central West for the purpose of meeting and getting acquainted with retail merchants who patronize them. These trips are known as trade-extension tours and have been quite successful. This time the board decided upon an electric railway trip that would take them to both the larger and smaller towns close home.

On a Thursday morning the start was made over the Northern Ohio Traction & Light lines, two large coaches having been chartered for the purpose. After stopping at a number of towns en route, they reached Canton in the evening and attended a smoker at the McKinley Hotel. This gave them an opportunity to meet the merchants in a social way, as well as at their business places. A number of towns in that vicinity were visited, including Massillon, and on the return trip stops were made at Barberton and other places. The second evening was given to a smoker at the Buchtel Hotel, Akron. On the return trip the merchants stopped at many small places that would have been omitted from the itinerary on a steam road and they had the advantage of meeting customers at their places of business and sizing up the surroundings, thus getting a better idea of the standing of the various houses and the question of credit that may be extended. The trip also suggests the possibilities of additional business to roads which have a terminus in a large city.

A NEW TYPE OF DIRECT CURRENT GENERATORS

To meet the increasing demands for continuous current direct-driven generators for lighting and power the Sprague Electric Company, of New York, has brought out the new type S generators which embody all the excellent features of the older machines, together with many improvements.

One of the distinctive features of the new generators



TYPE S GENERATOR, WITH ARMATURE REMOVED

is the use of soft steel castings for the magnet yoke. The generators also have a small armature reaction, which means a small number of armature turns, and, consequently, a short length of conductor to be traversed by the main current in the armature. Another advantage of type S generators, due to their small armature reaction, is that the armature is magnetically weaker, and the magnetic effect of the armature current tending to shift the main magnetic field is consequently less. It follows, therefore, that these generators will operate with satisfactory commutation without shifting the brushes at greater overloads than will those having large armature reaction. The use of laminated poles not only prevents eddy-currents in the pole faces and an accompanying loss of energy, but also prevents eddy-currents in the body of the poles whenever there is a change of the magnetic flux.

The generators are made in standard sizes, from 25 kw upward, at speeds recommended for the several sizes by the committee of the American Society of Mechanical Engineers on standardization of engines and dynamos. Their general appearance, as the illustrations herewith show, is quite similar to former types of Sprague direct current multipolar generators. The yoke is circular, with inwardly projecting poles, each surrounded by shunt and series windings. The armature spider supports the commutator so that the shaft may be inserted or withdrawn without disturbing any electrical connections on the armature. The brush rigging is of the well-known type used for years on Sprague generators.

Each of the spools upon which the field coils are wound consists of a thoroughly insulated sheet-iron body with substantial fiber heads. A compound field winding is used. The series coil, formed of flat strip, is wound first. This is separated from the shunt coil, which consists of insulated copper wire, by insulation and a half-inch air space. This air space communicates with the outside air through holes in the fiber heads, affording ample ventilation of the windings with a consequent low and uniform operating temperature.

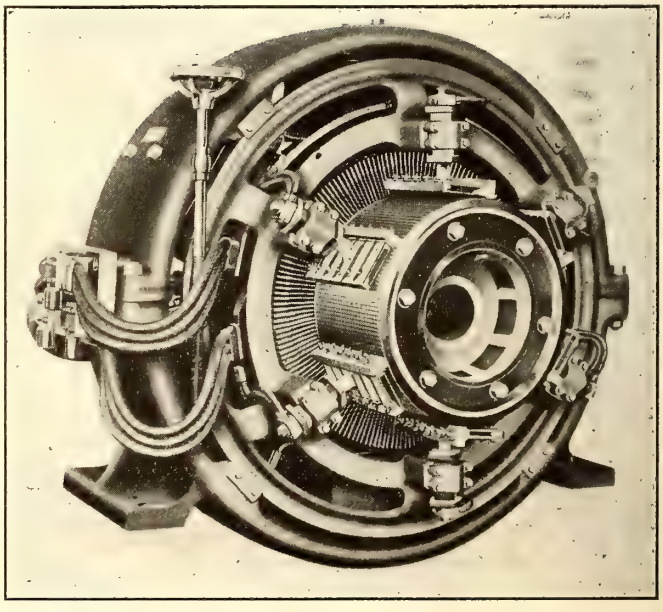
The magnet yoke is made in two pieces, and the division being horizontal enables the upper part to be removed to facilitate handling and inspection. Accurately bored surfaces projecting inwardly from the magnet frame provide seats for the pole pieces. The feet on the lower half of the yoke are drilled for foundation bolts and are provided with jack screws for adjusting and leveling.

The pole pieces are built up of riveted sheet-iron punchings. Each pole is secured to the magnet yoke by two bolts. This construction facilitates the removal of pole pieces and field coils at will. As previously stated, the pole tips are designed to give the proper spreading of the magnetic flux in the air gap, to secure the best results in commutation, and they also serve to hold the field coils in place.

The armature core is built up of thin notched punchings of annealed and japanned sheet-steel clamped between cast-iron plates, which have a projecting flange for supporting the end winding, on a substantial cast-iron spider, and keyed to the latter. Excellent ventilation is provided the core by space plates assembled at the ends and at intervals between the punchings. A large opening through the center of the core permits a free passage of air through the core, windings and commutator, thereby affording additional ventilation. The armature conductors, except where connected to the commutator segments, are without joints.

The commutator consists of hard-drawn copper segments insulated with micanite and clamped by a cast-steel ring to a cast-iron shell rigidly supported by the armature spider. Thick mica cones insulate the segments from the clamping ring, and the mica used between segments is selected to wear evenly with the copper.

The brush holders are liberally designed as regards their current capacity, are light in weight and do not utilize the tension springs for carrying current. There is individual



THE TYPE S GENERATOR READY FOR SERVICE

adjustment for each brush and the removal or replacement of a brush is accomplished with the greatest ease. The brush holders are supported by a cast-iron rocker ring, which fits into a machined seat on the magnet yoke, and is capable of being rotated for adjusting the position of

all the brushes simultaneously. The brushes are of carbon with sufficient area to prevent undue heating.

On generators below 100 kw capacity a single marbleized slate terminal panel is provided, while on the larger machines two such panels are used, one on each side of the frame. The generator terminals are attached to lugs on these panels, and cable lugs are provided for connecting to the outside circuits. The location of the single panel and the position of the positive terminals, where two panels are used, are made to suit the requirements of the customer.

ANCHOR BOTTOM TIE PLATES

It may be said that there are two things worthy of particular consideration in connection with tie plates. First, the design of the plate. This should be such as to protect the tie from cutting and abrasion and resist as strongly as possible the tendency of the track to widen. Second, the material of which the plate is made in order that a maximum of resistance may be offered to the deteriorating effects of the atmosphere, as well as to the effects of service. It is in accordance with these considerations that the Sellers anchor bottom tie plate, made by the Sellers Manufacturing Company, of Chicago, is designed. The bottom of the plate is provided with diagonal corrugations, which offer maximum service to resist track spreading. A shoulder is provided to insure against the shearing strain on the outside spikes. It is said that the corrugations on the bottom compress and engage all of the top fibers of the tie, but do not cut into the tie in such a manner as to allow water and other substances to enter the tie and cause rotting. The corrugations cross the fibers, the theory being that though they firmly grip the tie, they do not enter into the fibers of the wood parallel to the fibers, or, in other words, in the direct line of the lateral pressure, which causes track widening.

The plate is rolled from wrought iron because it is believed this material affords fully as great strength as rolled steel and is better able to stand the effects of the weather and atmosphere. The manufacturer says the constant movement of the rail on the tie plate is caused first by expansion and contraction by varied temperatures, and second, by the creeping of the rail under a moving load, causing a waveline of deflection moving ahead of the load and moving backward as the load passes. Steel in the rails and steel in the tie plate conduces to destructive wear. Iron being fibrous and the fiber running in the direction of the longitudinal motion reduces this abrasion to a minimum and precludes the tie plate from wearing up into the rail, as it is most likely to do when two identical metals are brought in contact.

The Sellers tie plate is made in any size, weight and thickness desired and punched for any size rail with two, three or four hole punchings. The manufacturer says that the plate when properly applied will not buckle and will hold the track to gage on the sharpest curves and under the most severe conditions. It is the usual method when installing the plate to insert it under the rail and spike it to gage. The weight of a train is considered sufficient to seat the plate and the spike may then be driven home. The plate is being used by many of the leading railroads throughout the country, though more particularly in the West.

SOFT DRAWN STEEL INSTRUMENT CASES

To give the best results an instrument case should be dust proof, it should be capable of being made fume and moisture proof, and in addition the material of which the case is made should be of such a character as thoroughly to protect the instrument from the disturbing effects of external magnetic fields. In designing cases for "American" switchboard instruments the American Instrument Company, of Newark, N. J., has given special attention to these points and has produced a case drawn from sheet steel uniformly soft and of the same thickness throughout, which is said to be a very efficient magnetic shield and to possess the other virtues mentioned. Careful laboratory tests and tests under actual working conditions have been performed to determine just what influence strong external fields would have upon the readings of a permanent magnet moving coil instrument, when housed in the type of case described above, and the illustrations, Fig. 1 and Fig. 2, show the result of one of these tests. Fig. 1 shows an instrument without the ornamental name plate carrying constant current of the value indicated by the pointer. This current was maintained at constant value and a magnet the same as regularly used in the instruments placed on the case directly over the poles of the inside magnet. The very slight change of reading resulting from this is shown in Fig. 2. With the polarity of the outside magnet reversed the effect upon the reading was even less than indicated, which shows the unusual efficiency of the case and its special adaptability for use in close proximity to cables carrying heavy variable currents or other strong magnetic fields. To prevent the entry of dust these improved cases have ample bearing surface where separate parts join, and the scale openings are covered by unusually large glasses, and the full size of the front of the case cemented in position. Where necessary they can easily be made proof against moisture and injurious fumes. James G. Biddle, of Philadelphia, is general sales agent for the company

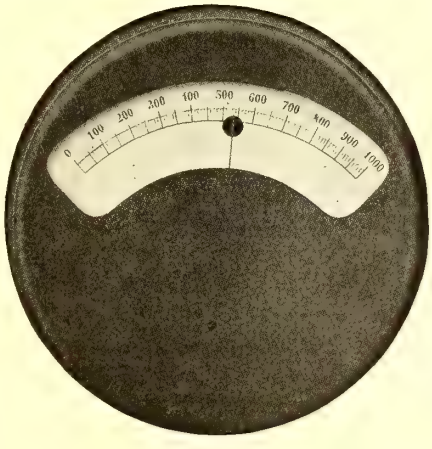


FIG. 1.

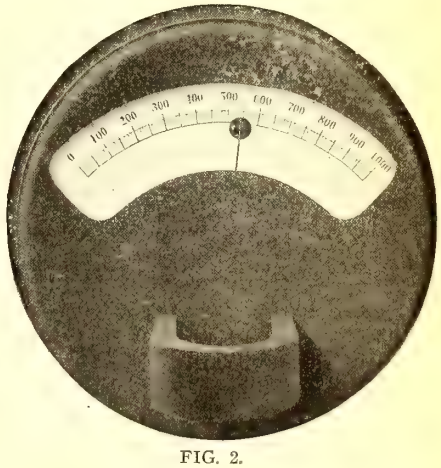


FIG. 2.

The Missouri Traction Company has been incorporated to build an electric railway from St. Joseph to Excelsior Springs and Mirabile, Mo.

EMERGENCY VALVE FOR STRAIGHT AIR-BRAKE EQUIPMENTS AND A PNEUMATIC GOVERNOR

The Allis-Chalmers Company, of Milwaukee, has designed a straight air emergency valve which makes it possible to equip with straight-air trains of two to four cars and secure to them all of the advantages of the simplicity and positive action of the straight system and, at the same time, possess the automatic safety features to be applied in case of a break in couplings or hose connections. This, it will be readily seen, puts the control of the brakes in the hands of the conductor as well as in those of the motorman, and the application of the emergency valve adds to the equipment the emergency device only.

The working parts of the emergency valve consist merely of a slide valve operated by a piston and a release spring moving in the air chamber. The train pipe is required as a part of the equipment only in cases where the motor car pulls trailers on which there is no controlling apparatus. Where two or more motor cars or the motor and the trailer car are provided with a controlling device, no additional hose connections are required, as in such cases it is only necessary to connect all reservoirs by means of an auxiliary hose in addition to the one provided for the straight air-brake train pipe. The manner of applying the straight air brake, when equipped with the emergency valve, remains unchanged, since there is an unobstructed opening between the straight air train pipe and the brake cylinders when the emergency valve is in released position. A passage between the main reservoir and the emergency line is provided to maintain, throughout the train, pressure in the latter equal to that in the main reservoir, while pressure is being raised in the main reservoir by the compressor. An additional orifice between the main reservoir and the emergency line, connecting the latter to the slide valve chamber, while being in direct communication with the auxiliary reservoir, also keeps the auxiliary reservoir charged to the same pressure as the emergency line and main reservoir.

Should a conductor's valve be opened or the train become disconnected, air is allowed to escape to the atmosphere from the emergency line, causing rapid reduction of pressure on that side of the piston towards the emergency line and unbalancing the pressure, the result being that the greater pressure in the auxiliary reservoir forces the piston and slide valve to the extreme length of their travel. In this way the reservoir is disconnected from the emergency line and is connected directly to the brake cylinder through a large orifice, which results in an instant equalization of the pressure in the brake cylinder and the auxiliary reservoir, thereby causing maximum brake pressure to be applied almost instantaneously, since the supply of air from the auxiliary reservoir has a much shorter distance to flow to reach the brake cylinder than is the case when it must travel from the main reservoir through the main air pipe, as in regular straight air-brake systems. In the same way the opening from the main reservoir to the emergency line is closed by the piston when it has travelled the full length of its stroke, which permits no escape of reservoir air through the open emergency line.

The type "OB" pneumatic governor, now offered by the Allis-Chalmers Company, received its first test in actual service on the Manhattan Elevated Railway, New York City, where it was put through a series of 284,000 continuous operations, breaking a current of 35 to 40 amperes, at 600 volts, without any attention whatever during the period of the test, which would be equivalent to about two and one-half years' service under ordinary conditions. The claims made for the governor are that it is light, compact and substantial, and suited to serve continuous service. The main body contains a compression spring and piston upon which the air pressure acts. The cap is machined to receive and secure the diaphragm; it is bolted to the main body and tapped for pipe to connect to the main reservoir. The cap is so arranged that pipe connections may be brought from any side to the governor, which is in direct communication with the main reservoir. The diaphragm is made of pure rubber. The piston and rod are made of steel. The compression spring, which is enclosed within the main body and well protected against tampering, acts upon the piston. The pressure is varied by adjustment of screws acting upon the spring washer, whereby the spring may be compressed or relieved to suit requirements. The piston-rod end is so shaped as to engage with a trip-hammer, and moves this over the center position past the pivot point. When the pressure in the cap chamber above the diaphragm increases, the piston is forced downward, compressing the spring.

The hammer being forced by the piston rod past the dead center, and aided by a spring in the housing, delivers a sharp blow to the yoke, carrying the contact blades through which the current is opened and closed, which are made of bronze metal and well insulated against short circuit or ground. The copper tips are quickly separated and the arc completely extinguished by the powerful magnetic field.

As the air pressure is reduced the compressed spring at once commences to return to its former position; the piston rod again comes in contact with the trip-hammer and reverses the movement of the latter; the yoke, being carried over the center line of pivot point by the hammer, returns with a snap, aided by the springs and closes the circuit. This quick return is important, as it prevents arcing and gives a wiping effect to the contact tips. The yoke is firmly held in either position by the tension spring, and, in addition, is securely locked by the trip-hammer. The quick brake mechanism is mounted upon a substantial brass frame and securely fastened to the main body. The blowout coil and chute are mounted upon an insulating block, which, in turn, is attached to the frame.

The small tension springs are protected by brass tubing, and are interchangable, without affecting the accelerating action of the mechanism. The electric terminals are brought out through the governor body and are well insulated by means of insulating bushings. They may be connected to either side of the line. All pins and moving parts are made of hard brass, thus preventing corrosion. No lubrication to moving parts is necessary. The mechanism is protected against dust and water by a light and strong cover, easily removable, which permits free access to the moving parts. The variation of maximum and minimum pressure is accomplished by the adjustment of a set screw. The governor may be set between the pressure of sixty-five and ninety-five pounds with an operating margin of ten pounds. For example, the governor can be adjusted to cut out at eighty-five pounds pressure, and it will automatically cut in and start the compressor when the pressure drops to seventy-five pounds. Care should be exercised in connecting the governor to the air reservoir. The piping must be carried directly from reservoir and insulation coupling inserted in the line. The governor will operate successfully in any position, and can be mounted below the cars or under a car seat. It occupies a space of 12 ins. in height, 7 ins. in length and 5½ ins. in width.

TURBINES FOR THE UTILIZATION OF EXHAUST STEAM

Willans & Robinson, of Rugby, Eng., well known for their high-speed turbines and steam engines, have been recently engaged on the construction of turbines for the utilization of exhaust steam, and have under construction at their Rugby Works two machines of the normal output of 1350 kw with an overload capacity of 2000 kw. The machines are for the works of Sir Bernard Samuelson & Company, Middlsbrough, and have been arranged to take steam from a number of non-condensing blowing engines, used for supplying air to a number of blast furnaces. They are coupled to three-phase generators working with a periodicity of 40 with a pressure of 3000 volts and running at a speed of 2400 r. p. m., and will work in parallel with a number of other turbines in the same district to supply power to iron works and the local power distribution company.

Each turbine exhausts into a surface condenser of the Willans & Robinson's type designed to give a vacuum of 29 ins. with a temperature of circulating water of 60 degs. F. The quantity of steam to be dealt with at normal load is 45,000 lbs., and about 70,000 lbs. at the overload. A special feature of the plant is the arrangement of relief valves. All low pressure steam that is not required for doing work in the turbine is by-passed into the condenser, so that all the steam output of the blowing engine is returned to the boilers as condensed water. The condensing plant is fitted with Edwards type three-throw air pumps driven by means of three-phase induction motors through machine-cut gearing. The circulating pumps are of the centrifugal type, and are also driven by low-tension induction motors. The water for circulating about 4500 gallons per minute is pumped from the river and is forced through 27-in. cast iron mains to the turbine house, a distance of some 250 yards.

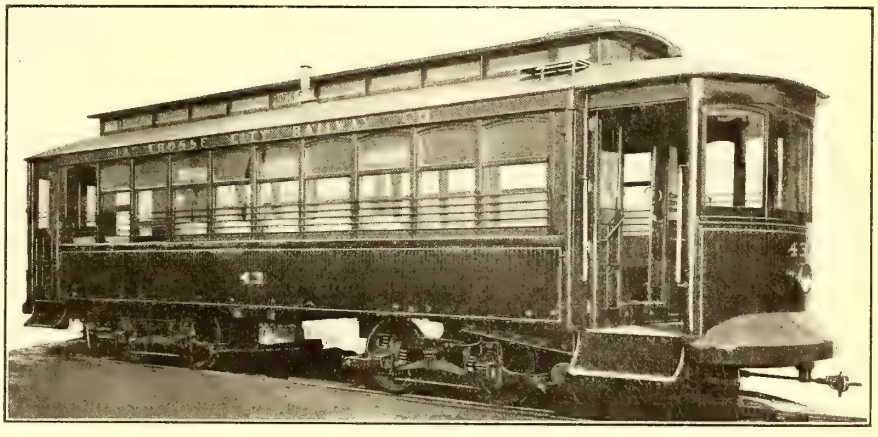
Willans & Robinson have also on hand 200-kw exhaust turbines for the South Wales District, arranged to work in conjunction with heat accumulators. The exhaust steam in this case is furnished by colliery winding engines. Among other sets on hand at the works at Rugby is a 500-kw exhaust turbo-alternator for supplying power to an iron works and colliery in the Staffordshire district working in conjunction with a vertical non-condensing blowing engine. The Willans & Robinson exhaust turbine is suitable not only for driving electric generators, but also for driving blowers, exhausters, ventilators and also high lift centrifugal pumps. The firm also supply high pressure steam turbines of all outputs from 2000 to 10,000 hp, and have supplied years nearly 250,000 hp in steam tur- or have on order within the last three years nearly 250,000 hp in steam turbines, the machines being exported to all parts of the world.

The Public Service Commission of the first district of New York has ordered an increase in the service on the Madison and Fourth Avenue surface lines. The order sets forth the number of cars which shall constitute the minimum hourly service in the day, and only the evening rush hour is left out. Mr. Maltbie says the rush hour situation demands more study.

SEMI-CONVERTIBLE CARS FOR LA CROSSE

The North Side in La Crosse is separated from the main part of the city by the La Crosse River and has a population of 8000. It contains many factories is the terminus of four divisions of the Chicago, Milwaukee & St. Paul Railway and the site of the shops of the Chicago, Burlington & Quincy Railway. As the situation stands at present all traffic between North La Crosse and La Crosse proper is handled by one double-track line which crosses the river on the only available bridge connecting the two sections. The total mileage in La Crosse at present is fifteen miles, of which about four miles are double track. All lines center at Fourth and Main streets, the business center of the city; a ten-minute headway is maintained. Improvements under way consist of a half-mile extension south from Gunds' Brewery and a half-mile extension to be built east on Main Street from Sixteenth to Twenty-fifth Street next spring. An addition to the car barn at Third and La Crosse Streets is now being made to accommodate the new cars. A new storage barn for trailers and extra cars will be built on property owned by the company on the North Side; this work will also be accomplished next spring. Upon the completion of the new water power plant of the La Crosse Water Power Company at Hatfield, the company will install a motor generator set of 300-kw capacity and use this as its main power unit. The plant is now under construction and will generate 5000-8000 hp, to be used in La Crosse and Winona, Minn.; the power will also be used to operate a proposed interurban line between the cities mentioned about thirty-six miles in length.

Four semi-convertible cars built by the American Car Company have recently been placed in operation on the busiest line in La Crosse. They have generous aisle space and commodious seats, the seats being 35 ins. long and aisle 24 ins. wide. On account of the low window sills five-bar guards are provided. The doors are protected in a like manner. The bottom framing includes 12 in.



CAR FOR SERVICE IN LA CROSSE

x ⅜ in. sill plates—a standard feature of this type of car which obviates the use of inside and under truss rods in cars of this length. The plates are screwed to the posts and are an additional means of stiffening. The seats are of Brill make; the inside finish is of cherry; ceilings of 3-ply birch. The No. 27-G1 trucks are employed. The chief dimensions of the cars follow: Length over end panels, 28 ft.; over crown pieces, 38 ft.; width over sills, including sheathing, 8 ft. 2 ins.; height from floor to ceiling, 8 ft. 5⅜ ins.; from track to under side of sills, 32⅝ ins.; size of side sills, 4 ins. x 7¾ ins.; end sills, 5¼ ins. x 6 13/16 ins.

MEETING OF THE AMERICAN RAILWAY ASSOCIATION

The fall session of the American Railway Association was held at the Waldorf-Astoria, New York City, on Wednesday, Oct. 30, 1907. There were present seventy-five members, represented by 175 delegates. The executive committee reported that the present membership of the association comprises 331 members, operating 235,457 miles; also forty-six associate members, operating 1457 miles.

Among the subjects discussed of interest to electric railway companies were those of a standard location of third-rail, definitions and terms used in electrical equipment and a standard rail and wheel. The definitions are given below, while the report on standard location, which requires illustrations, will be published next week. The committee on standard rail and wheel sections presented a progress report which was referred back to the committee with instructions to investigate further, and with authority to employ experts for this investigation. The committee made no express recommendations, though the suggestions offered were, in the main, concurred in. The committee is composed of G. L. Peck, of the Pennsylvania, chairman; J. T. Richards, of the Pennsylvania; Julius Kruttschitt, of the Union Pacific; W. J. Wilgus, of the New York Central; R. Montford, of the Louisville & Nashville; E. C. Carter, of the Chicago & Northwestern; William Garstang, of the "Big Four"; R. Ettinger, of the Southern Railway, and W. E. Fowler, of the Canadian Pacific. Special attention was called by the committee to the disputed percentage of discard from the ingot, and it is understood that in the further investigations special attention will be given to this point in order to reach a specification satisfactory to the railroads and the manufacturers.

REPORT OF THE COMMITTEE ON THIRD-RAIL

This committee consisted of W. G. Besler (chairman), vice-president and general manager, Central Railroad of New Jersey; D. D. Carothers, chief engineer, Baltimore & Ohio Railroad; J. F. Deems, general superintendent of motive power, rolling stock and machinery, New York Central lines; Theo. N. Ely, chief of motive power, Pennsylvania Railroad; Geo. Gibbs, chief engineer of electric traction, Long Island Railroad; J. M. Graham, vice-president, Erie Railroad; W. Renshaw, superintendent of machinery, Illinois Central Railroad; W. J. Wilgus, vice-president, New York Central & Hudson River Railroad. The terms suggested were as follows:

1. Third-Rail.—An electrical conductor placed adjacent and parallel to the track rails as a means of conducting electric current to the locomotive or cars. It is maintained in permanent relation to the tracks by suitable supports and is insulated from ground.

2. Third-Rail Contact Shoe.—A conductor attached to the car or locomotive for the purpose of collecting current from the third-rail.

3. Third-Rail Contact Surface.—The surface of a third-rail with which the contact shoe makes contact.

4. Top Contact Third-Rail.—A third-rail with the contact surface on the top.

5. Under Contact Third-Rail.—A third-rail with the contact surface on the bottom.

6. Gauge of Third-Rail.—The distance measured on the plane of the track between the gauge line of the nearest track rail served to the nearest gauge line of the third-rail.

7. Elevation of Third-Rail.—The distance at right angles to the plane of the track between the top of track rail and the contact surface of the third-rail.

8. Third-Rail Support.—The support which holds the third-rail in position as regards elevation and gauge.

9. Third-Rail Insulator.—That part of the third-rail support which isolates, electrically, the third-rail from the ground, ties, track work and other grounded structures.

10. Third-Rail Protection.—A covering employed to guard the third-rail against the weather and from accidental contact of persons and material.

11. Third-Rail Platform Protection.—The guard used at low station platforms to protect the contact shoes from persons on the platform.

Note.—This term applies principally to the protection along edges of platforms when the third-rail is on the opposite side of the track from the platform.

12. Third-Rail End Incline.—The sloping approach at the end of a section of third-rail made to receive contact shoes moving in line with the third-rail and bring them from their free position to contact with the normal surface of the third-rail.

13. Third-Rail Side Incline.—The sloping approach at the side of a third-rail made to receive contact shoes moving laterally toward the third-rail and guide them from their free position to contact with the normal surface of the third-rail.

14. Third-Rail Tie.—The tie which is extended beyond the end of the standard track ties to provide a base for the third-rail support.

15. Third-Rail Anchorage.—A device that holds the third-rail in position longitudinally, preventing creeping.

16. Third-Rail Jumper.—A cable connecting the ends of the third-rail at openings made necessary by track and road crossings or other local conditions.

Note.—On surface roads the third-rail jumpers are usually placed in conduit under ground.

17. Third-Rail Jumper Head.—A device placed at the end of a conduit for third-rail jumper to protect and insulate the end of the jumper.

Note.—This is usually an insulated structure projecting above the track ballast and from which the third-rail jumper may be flexibly attached to the third-rail.

18. Third-Rail Bond.—An electrical conductor bridging a joint in the third-rail used to secure electrical continuity of the third-rail.

19. Third-Rail Feeder.—The connection between the source of power supply and the third-rail.

Note.—This is usually a cable carried either overhead or in conduits underground.

SEEING VIENNA BY TROLLEY

In accordance with a recent permit from the City Council, the Vienna Municipal Tramways have instituted a "Seeing Vienna" service, with specially furnished parlor cars. At present there are four principal routes, each including some noteworthy points of interest, but as the service develops other routes will be added. Most of the trips are planned to last a day, so that the cars may stop at the more important institutions long enough for the passengers to be guided through them. Tourists, of course, may return via another line if they desire to save time. When the cars are engaged by parties, the management is prepared to follow any desired route provided the same does not interfere with regular operation.

The excursions offered are fully described in 5½ in. x 8 in. 36-page handbooks which contain many fine half-tone illustrations of the objects seen on the particular route. Each book also contains a bird's-eye view of Vienna on which the four principal excursion trips are shown by differently colored lines.

The Youngstown & Southern Railway has begun the operation of through cars between Youngstown and Lisbon. An hourly schedule will be maintained, the cars leaving Youngstown on the even hour and Lisbon on the half hour. The distance is about twenty-eight miles and the trip will be made in one hour and twenty-five minutes, with a fare of 60 cents, or 25 cents less than that charged by the steam roads. A portion of the trip is made over the tracks of the Youngstown & Ohio River Railroad.

LONDON LETTER

(From Our Regular Correspondent.)

Two disastrous accidents occurred during the past month: one in Halifax and the other in Birmingham. The Halifax accident seems to have been the more serious, resulting in three persons being killed and thirty injured. It was one of the first of the workman's cars from Sowerby Bridge, and was practically full of workmen. Halifax is a particularly hilly city, and it was on one of these long hills, known as Bolton Brow, that the accident occurred. After safely reaching the top of the hill the car began to run down the hill backward. The conductor applied the brakes, and both he and the driver stuck to their posts, shouting to the passengers to keep their seats, trusting that the car would not leave the rails and stop when it reached a level. The car, however, left the rails at the bottom of the hill, smashed into a building and turned over, with the result already stated. The Birmingham disaster, which resulted in one person being killed and sixteen injured, also occurred to a workman's car, which left the city about 7 o'clock in the morning. It is stated in this case that the motorman complained to an inspector who boarded the car that the brake was not working well, and in going down a steep hill the car seems to have run away, and as there was a sharp turn at the bottom of the hill, the inevitable result was that the car overturned after leaving the rails and smashed into a stone wall. The cause of these accidents will undoubtedly be carefully investigated by the Board of Trade, and it would appear that, though much thought has been given to the subject of braking electric cars in these cities, a thoroughly satisfactory solution has not yet been arrived at. There appears to be no doubt that a constant immunity from accident on these steep grades makes drivers more reckless than they ought to be, with the result that sometimes, when even a partial failure of the brake takes place, a serious accident occurs. An accident almost of the same nature to that which took place at Halifax was happily obviated on the Nottingham by the presence of mind of the driver of another following car. As the cars were going up a steep hill the one in front suddenly began to run backward. The driver of the following car increased the speed of his car and stopped the runaway before it got up any great speed; then, putting on full power, he succeeded in pushing the runaway to the top of the hill.

There is only one London company which seems to have made any financial success of the motor bus. This is the Great Eastern London Motor Omnibus Company, which runs into the northeastern suburbs. Perhaps the success of this company is attributable to the fact that the directors and officials are all men who have had long and extended experience in tramway work, and took up the motor omnibus business a year or two ago as a new enterprise. All of the other motor omnibus companies are in a bad way, and the largest of them all, the company which runs the well-known "Vanguard" service, is evidently in a serious condition, the pound shares being purchasable on the market for perhaps one or two shillings. The two largest horse omnibus companies, which have also gone in to a large extent for motor omnibus traffic, appear to have failed miserably. The London General Omnibus Company, the largest of these companies in London, whose hundred pound shares stood perhaps at two or three hundred pounds only a few years ago, has had to face such reduced profits, evidently from the use of the petrol motor omnibus, that its shares are now quoted at about half their par value, the dividend having been passed at the last annual meeting. While the motor omnibus has carried many passengers, and has given good service at increased speed, the depreciation has been so great that most of the companies, as has been stated, are in a lamentable condition. Perhaps the newer types of motor omnibuses may be more satisfactory. In the meantime it is interesting to note that the Electrobus Company, which came out a year or two ago, has now had for nearly a year some half dozen electrobuses on the streets, operating very successfully. This company is using the regular storage-battery system, and it will be extremely interesting to find out whether or not it is actually going to pay in the long run. The history of the storage battery as applied to electric traction is a sad one. Its application to an omnibus in London, however, may be different, and in conversation with the managing director of the company, the writer was told that so far the results had been most satisfactory. These results, however, are, in the writer's opinion, due to the contracts which the company originally made. It has contracts for the maintenance of the batteries, the maintenance of the wheels, and practically the maintenance of the whole operating parts, so that its expenses are known and the success depends entirely upon the receipts. Except for depreciation upon the body of the omnibus, therefore, the company is not concerned with depreciation on any of the other parts. It would be interesting to find out, however, whether the sub-contractors have met with losses and whether these sub-contracts can be renewed. As far as comfort is concerned, the electrobus is infinitely superior to the other omnibuses.

The recent report of the Highways Committee of the London County Council is, on the whole, satisfactory reading, as on the southern system, which is the furthest advanced toward completion, a profit of more than £90,000 has been realized. This profit, however, has been greatly depleted by the losses on the northern system, which has been undergoing the process of electrification. The total result is a net balance of between £9,000 and £10,000, after providing liberally for all expenses. The report is the most satisfactory yet, and would undoubtedly go to show that, when the system is completed, which will not, however, be for two or three years yet, a handsome profit should be shown on the system. Details of this account will be found in another column.

No settlement has yet been made of the disputes between the London County Council and its men, and the latter are still holding meetings to protest against their alleged grievances. The medical examination still appears to be the chief bugbear, though many other questions still await settlement. The writer recently had a conversation with Mr. Fell, chief officer of the tramways, and so far as he can gather it would appear that this objection to medical inspection is after all a ridiculous one. An examination is absolutely necessary and will doubtless have to be made in due time. Nothing, however, has yet been decided, and it is hoped that the whole unpleasantness will gradually pass away. In the meantime the work of electrification is proceeding satisfactorily and new routes are constantly being opened to the public. The most important ones recently opened in South London are the new extensions from Tooting Broadway, the effect of which will be to bring Mitcham, Wimbledon, Kingston and Hampton Court into direct tramway connection with the center of London, with only one change at Tooting.

There is also proceeding a general linking up of the tramway systems all around the southwestern portions of London, and it would appear at last that the Crystal Palace will be reached by a County Council tramway. There has, however, been great hostility to this extension from the inhabitants of Dulwich, who are naturally proud of their beautiful roads and do not wish them desecrated. A rather circuitous route has, however, been adopted, which will not interfere with these beautiful wooded roads, and the work will be commenced at an early date.

J. B. Hamilton, manager of the Leeds Tramways, was recently appointed arbiter in the dispute between Kirkcaldy Corporation and the Wemyss Tramway Company with regard to the through running powers of the latter company over the Kirkcaldy lines. It has now been agreed to a make a trial of the arbiter's recommendation, and to transpose the termini on the upper and lower routes of the Kirkcaldy system, to enable the cars from Wemyss or Galatown to run through to Whyte's Causeway, the lower route to extend only from Junction Road to the Linktown. It was estimated by the convener of the Tramway Committee that the new arrangements would probably mean a saving of £1,000 yearly.

A new tramway track brake which has been invented in the offices of the Leeds City Tramways Department was recently tested and proved very effective. The brake, which is electrical and mechanical, presents several novel features, but the chief point is that it is impossible for the motorman to skid his wheels on applying the brake. The Board of Trade has issued licenses to the Leeds Tramways Committee to put three of these brakes into operation, and they are now being used with success on the system. We hope to publish fuller details in a later issue when the particulars are available.

Bacup Town Council has resolved that £5,200 be offered to the Rossendale Valley Steam Tramways Company for its undertaking within the borough, and also that in the event of Rawtenstall Corporation not expressing satisfaction with the corporation's powers under its agreement for the purchase of tramways, the town clerk take steps to promote a bill in the next session of Parliament to acquire such powers.

At a recent meeting of the Harton Parish Council, a deputation from the Whitburn Parish Council attended and laid before the members the desirability of a tramcar service between South Shields and Sunderland being established. The present travel-

ing facilities, it was submitted, were inadequate to the needs of the neighboring parishes, and also expensive to the residents. The deputation was under the impression that if the matter was taken up seriously by the parish councillors, and the various authorities approached, it would be brought to a satisfactory issue.

The tramways committee of the York Corporation has unanimously resolved to recommend the City Council to apply to the Board of Trade in November for a light railway order or a provisional order authorizing the City Council to make, lay down, and construct or to lease, for the purpose of an electric tramway system, four routes, from the railway station as a center, to the city boundary at Fulford, Tadcaster Road, Acomb Road and Haxby Road, respectively. It was also unanimously resolved that before exercising any of these powers a poll of the citizens shall be taken to determine whether the corporation shall work the tramways or lease the same to a company.

A. C. S.

LONDON COUNTY COUNCIL TRAMWAYS

The Highways Committee of the London County Council has issued an account of the receipts and expenditures for the year ended March last in connection with the whole of the Council's tramways undertaking. The tramways system in March of the present year extended over a total length of 116¾ street miles, all of which is worked by the Council, with the exception of a short length of three-eights of a mile, which is worked by the Metropolitan Electric Tramways Company. The capital expenditure on the undertaking up to March 31, 1907, amounted to £6,946,310 11s., of which £2,064,621 4s. 5d. represents expenditure during the year 1906-7. The total debt repaid up to the same date amounted to £603,173 7s. 9d. out of revenue, and £209,573 5s. 7d. from the proceeds of sales of horses and old materials, etc. The debt outstanding on March 31, 1907, was £6,133,563 17s. 8d., or, deducting £24,658 for the value of surplus land, £6,108,905 17s. 8d.

The total receipts from the undertaking during the year and the working expenses were as follows:

	Electric Traction	Horse Traction	Total
Total receipts....	£829,258 19s. 5d.	£585,345 7s. 9d.	£1,414,603 18s. 2d.
Working exp.....	478,418 11s. 0d.	596,697 15s. 4d.	1,075,116 6s. 4d.
Surp. on working..	£350,839 19s. 5d.	£11,352 7s. 7d. (Deficiency)	£339,487 11s. 10d.

The undermentioned charges have to be set against the surplus on working, namely:

Debt charges	£324,656 10s. 2d.
Income tax	1,425 18s. 5d.
Interest on purchase money	3,275 18s. 1d.
Parliamentary expenses	4,780 6s. 5d.
Deficiency on Drake buildings	74 1s. 1d.
	£334,211 14s. 2d.
Less net interest in cash balances	4,397 17s. 4d.
	£329,813 16s. 10d.
Leaving a net balance of	£9,673 15s. 0d.

The balance brought forward on the appropriation account on April 1, 1906, was £31,249, and the surplus revenue balance of £9,673 15s. for the year 1906-7 increased this amount on March 31, 1907, to £40,923 1s. 11d. Out of this sum £35,000 has been transferred to the renewals reserve fund, and the balance of £5,923 1s. 11d. is being carried forward in the accounts for the current year.

The total number of passengers carried and the car miles run during the year were as follows: Number of passengers—electric traction, 183,062,063; horse traction, 131,165,027; total, 314,227,090. Number of car miles run—electric traction, 16,267,579; horse traction, 13,862,718; total, 30,130,297. Of the total number of pasengers 20.12 per cent were carried at ½d. fares, 62.29 per cent at 1d., 8.78 per cent at 1½d., 6.22 per cent at 2d., 1.38 per cent at 2½d., 1.08 per cent at 3d., .09 per cent at 3½d. and .04 per cent at 4d. The average fare per passenger was 1.05 d., as compared with .99d. in 1905-6. In considering the above percentages it should be borne in mind that ½d. fares were not introduced on the northern tramways until February, 1907, and that 3½d. and 4d. fares are only in operation on certain routes on the southern tramways, on which, however, the percentage of passengers at these fares represents a fair proportion of the whole. The total number of units generated up to March 31, 1907, at the Greenwich generating station since its opening on May 26, 1906, was 25,009,345, and the cost amounted to about .676d. a unit, including interest and sinking fund charges. The tramways stud on March 31, 1907, numbered 5,848 car horses and 20 cart horses. The average weekly cost for provender and litter during the year was 8s. 11.29d. a horse, as compared with 8s. 2.59d. in 1905-6.

SHOP MEN REORGANIZE

At a meeting of the shop foremen of the Public Service Corporation Company of New Jersey it was suggested that the electric railway shop foremen's association be reorganized, with the result that a new staff of officers was elected, as follows: W. Rickes, president, Public Service Corporation; Henry Dupras, vice-president, Public Service Corporation; J. R. Case, secretary, Public Service Corporation; H. W. Wightman, treasurer, Public Service Corporation.

LARGE ORDER FOR ELECTRIC RAILWAY EQUIPMENT

J. G. White & Company, operating managers and purchasing agents for the Eastern Pennsylvania Railways Company, have just ordered $200,000 worth of electric railway material for the Tamaqua & Middleport Railway, the connecting link between Mauch Chunk and Pottsville. The order includes all the material required for the permanent way and overhead electrical work of a standard interurban railway. Considerable grading has already been done. When the line is finished Pottsville and neighboring towns will be nearer New York in actual time by trolley to Mauch Chunk and the Lehigh Valley Railroad than by the usual railroad detour through Philadelphia.

1908 M. C. B. AND M. M. CONVENTIONS

At a meeting of the executive committees of the Master Car Builders' and American Railway Master Mechanics' Associations, at the Hotel Belmont, New York City, Oct. 21, it was decided to hold the 1908 annual conventions of those associations at Atlantic City, N. J. The Master Car Builders' Association will meet June 17, 18 and 19, and the American Railway Master Mechanics' Association, June 22, 23 and 24. The headquarters of the associations will be at the Marlborough-Blenheim. The same special rates made by certain of the Atlantic City hotels last June will apply for the 1908 conventions. The meetings of the associations, as well as the exhibits, excepting track exhibits, will be on Young's Pier. The track exhibits will be placed not more than four blocks from the pier. Nearly all of the exhibits will be under cover, 60,000 sq. ft. net (exclusive of aisles), of space having been allotted for exhibits. In June last the exhibitors on the Steel Pier used about 55,000 sq. ft., exclusive of aisles.

POWER OF INDIANA RAILROAD COMMISSION CONTESTED

A suit to contest the power of the Indiana Railroad Commission has been filed by the Big Four Railroad Company in the Superior Court of Indianapolis. The railroad commission on Sept. 26 made a ruling to the effect that steam and electric lines were in the same class relative to freight traffic and ordered the Big Four Railroad to turn over to the Indiana Union Traction Company, at Winchester, cars loaded with coal for the Farmland Stone Company, a concern engaged in crushing stone, about six miles from Winchester, on the line of the traction company. The Stone Company filed a petition for such an order, which was resisted by the steam road.

In the suit just filed the Big Four alleges in its complaint that the railroad commission law is unconstitutional in that it seeks to give the Commission powers that properly belong to all three departments—Legislative, Executive and Judicial. The complaint cites a number of other reasons why the order of the Commission should be set aside, but the principal one, aside from the unconstitutionality of the law and the one upon which it depends most for a reversal of the order, is the alleged inadaptability of the rolling stock of the railroad to the tracks of the traction company. While the suit is to set aside the one ruling of the Commission, back of it is a feeling that the steam roads are going to test to the limit of their power the control of the Commission over railroad affairs in Indiana.

REPORT OF SPOKANE & INLAND FOR YEAR

The Spokane & Inland Empire Railroad Company has filed its first annual report with the State Railroad Commission, covering the year ended June 30, 1907. It shows the company was organized Jan. 15, 1906, under the laws of Washington, and is a merger by reason of its ownership of the entire capital stock of the following companies: Coeur d'Alene & Spokane Railway Company, Ltd., organized Oct. 20, 1902, under the laws of Idaho; Spokane & Inland Railway Company, organized Dec. 13, 1904; Spokane Terminal Company, March 1, 1905, and Spokane Traction Company, March 15, 1903; the last three named being Washington corporations.

The Spokane & Inland Division, Sept. 24, 1906, begun the operation of 34 miles. This mileage was increased as follows: 11 8-10 miles Feb. 1, 1907; April 5, 24 8-10 miles; June 1, 47 6-10 miles. The Coeur d'Alene & Spokane division, July 19, 1907, begun the operation of an extension to Hayden Lake, Idaho, 8 2-10 miles. The company operated 123½ miles aside from its street-car lines in Spokane. The stock of the Spokane Terminal Company is owned jointly by the three companies.

The company has $20,000,000 capital, of which half is preferred. The total amount issued and outstanding is $9,733,900 common and $521,000 preferred, and on the preferred stock a 2½ per cent dividend was declared during the year. Of an authorized issue of $15,000,000 mortgage bonds the company has issued $418,000 of 5 per cent obligations, of which $4,216,000 is now outstanding. Capital stock represents $99,121.45, and bonds represent $31,214.45, or a total of $130,335.90 per mile of line. The total cost of the road to June 30, 1907, is given at, for construction, $12,981,741.69, and for equipment, $959,725.18, or a total of $13,941,466.87, or at the rate of $112,886.35 per mile.

The gross earnings from operations of the entire line for the year aggregated $478,784.08, less operating expenses of $259,604.80, leaving a net income from operation of $219,179.28. To this was added $189,204.56; net income from the city traction lines, $37,864.37; intrest received from funds loaned, $146,687.24; rent of buildings, $4,652.95; and there was also added $60 earnings as interest on bonds owned by the company of the Spokane Country Club. This made a total net income from all sources of $408,443.84. From this the company paid $7,500 in taxes, a dividend aggregating $91,940 and interest on funded debt of $146,992.89, leaving the surplus for the year $162,010.95. The gross income from the city traction lines was $180,927 and the expenses were $142,964. A summary of the expenses of the entire line shows $29,461 for maintenance of way and structures, $19,959 for maintenance of equipment, $176,100 for conducting transportation and $34,083 for general expenses, which aggregate 54.22 per cent of the earnings of the entire line.

The company reports the following contracts with other companies: With the United States for the transportation of mails, at $2,747.47 per annum. With Spokane International Railway for interchange of freight, dated April 14, 1905; on lumber this company received 3 cents per 100 pounds; on other freights, rates are divided on a mileage basis, with minimum of 25 cents for one shipment. With Great Northern for interchange of freight, dated May 9, 1907, divided on mileage basis, with minimum of 25 cents. Agreement with Coeur d'Alene & St. Joe Transportation Company for interchange of passengers and freight, the company receiving the local rate.

None of the equipment of the company is mortgaged. The mortgages on the other property are $287,272 a mile for the 11-10 mile track on the property used in freight and passenger terminals in Spokane; $16,176 a mile for the 30 9-10 miles of track from Spokane to Coeur d'Alene; $7,644 a mile for the 25 9-10 miles of traction lines in the city, and $5,000 a mile for the 91 49-100 miles of the Spokane & Inland trackage. The entire line employs 182 men at an average compensation of $3.01 a day.

The road carried a total of 672,412 passengers, receiving a revenue of $274,781, or a little more than 40½ cents per passenger, or about 18½ mills per passenger mile. It carried 194,583 tons of freight, receiving $144,252, an average of about 72.6 cents a ton, or less than 2½ cents a ton mile. The income of operation of a mile of road was $1,774.

The company added 7 locomotives during the year and now has 12 in service; 22 cars to the passenger service, making 50 in use; 74 box cars and 40 flats to the freight department, making 318 in freight service. It uses in company work 1 caboose, 1 officer car, 19 gravel cars. The total cars owned by the company are 395.

THE YONKERS STRIKE SETTLED

The strike in Yonkers, N. Y., of the employes of the street railways in that city has been settled. The old motormen and conductors have returned to work on the condition that their grievances would be settled by the railway officials within a reasonable time. The railway officials made it a condition that before anything was done, the employes must return to work and also that under no circumstances would the union be recognized. To this the striking employes consented, and regular service on the lines was resumed on Tuesday, Oct. 29. During the particularly trying period of the past week, Waddell & Mahon, labor trouble specialists, of New York, handled the situation in Yonkers. This firm had 200 of their best men on the scene and operated the cars as far as it was possible to do so. On account of the political situation in the city of Yonkers, however, no support from the police department or the city authorities was forthcoming. Tracks were torn up in front and behind the cars, barrels of pitch and tar were placed upon the tracks and set on fire in order to stop the operation of cars. When the authorities of the city realized that the company was determined to operate its cars at all hazards, they decided to support the company, and conferences were held with the railway and city officials, the result of which was that a settlement of the strike was made. The company, however, gained what it was contending for, viz., non-recognition of the union and the right to treat with its employes independently of the union after the employes had returned to work.

PROPOSED LINES OUT OF NEW YORK PURCHASED BY NEW YORK, NEW HAVEN & HARTFORD RAILROAD

The acquirement by the New York, New Haven & Hartford Railroad of the Milbrook Company, a holding concern which controls the New York, Westchester & Boston and the New York & Port Chester Railway Companies and their affiliated concerns, was announced Tuesday, Oct. 29, by Oakleigh Thorne, president of the Trust Company of America. Mr. Thorne and Marsden J. Perry, president of the Union Trust Company, of Providence, and a director in the Trust Company of America, owned the control of the Milbrook Company, which was organized recently as the holding company. Mr. Thorne said that negotiations between the Milbrook Company and the New York, New Haven & Hartford had been pending for some time. The New York, Westchester & Boston Railway Company is capitalized at $20,000,000 authorized, and $19,000,000 outstanding. The par value of the stock is $100. The bonded debt of the company is an issue of $15,000,000 first gold fives, due Oct. 1, 1954, subject to call in 1909. The Knickerbocker Trust Company is trustee for the company.

In December, 1906, the New York & Portchester was acquired, and the latter company was allowed by the Railway Commissioners to issue a mortgage for $20,000,000 and to increase its stock to the same amount. The financial status of the Westchester Company in October, 1906, was that $11,000,000 of the stock—substantially all that had been issued—was deposited with the voting trustees, this amount including $10,000,000 guaranteeing the contract. While all the underwriting for the $15,000,000 of Westchester bonds had been taken, only about $4,500,000 was paid in, of which $1,077,000 had been spent in construction on that part of the road within New York City limits and $1,600,000 in Westchester County.

Details obtained at New Haven of the sale of the Milbrook Company to the New York, New Haven & Hartford Road make it appear that the transfer was arranged a number of months ago, and has been in the hands of a committee consisting of four of the New Haven directors. The property was paid for nearly a year ago, and, therefore, involves the creation of no new obligations on the part of the New Haven. The New Haven, it is said, intends to undertake the building of the system as soon as the conditions of the money market allow, and it is called for by public convenience. Northward, the proposed system will extend to New Rochelle, Westchester, Mount Vernon and White Plains. It will connect with the Harlem River & Port Chester Road, which is owned by the New Haven, at West Farms, and southward its most immediate connection will be with the subway at 177th Street.

THE CLEVELAND SITUATION

On application of T. H. Hogsett and H. J. Crawford, the Circuit Court, on Wednesday, issued a restraining order, good until Tuesday of this week, preventing the Forest City Railway Company from using the tracks of the Cleveland Electric Railway Company on Bridge Avenue in order to operate its cars over this route to the Public Square. Judges Winch and Henry asserted that they felt themselves disqualified to hear the suit, but that they could do no less than preserve the present status quo until Tuesday, when they would endeavor to have a court present, made up from other circuits in the state. Attorneys for the Forest City Railway Company endeavored in every way to prevent the order from being put into effect, but the court said that the delay to the company would be immaterial. Judge U. L. Marvin dissented from the action taken.

The mayoralty campaign is waxing warm as the time for election draws near. The greatest fight against Mayor Johnson is being made on the allegation that he is advocating the zone system, because he favors a settlement of the street railway controversy upon a 3-cent basis within the city regardless of the effect it may have upon the people of the suburban towns. When forced to discuss this point, he declares that he is not in favor of that system, but that he wants the settlement made between the company and the city and that the fare in the suburbs will not be changed, unless it is found possible to reduce them. If this can be done with a sufficient revenue merely to cover expenses, he says he will insist upon that course. So far he has fought shy of talking of the costly improvements that the company has included in its offer of seven tickets for a quarter, although a subway is needed and rapid transit lines must be built if the city continues to grow and spread over more space, as it has done in the past. Congressman Burton holds to his plan of settlement, and says that he is satisfied that the companies will accept it, and that a settlement may be made within a very short time, although he has had no assurance from the Cleveland Electric to this effect.

The Cleveland Electric Railway Company refused to send representatives to the meeting of the Council committees on ordinances and street railways, called a few days ago to decide upon terms on which the Forest City Railway Company might use the tracks of the old company in the so-called free territory. President Andrews sent a letter to the committees stating that he did not consider the ordinance under which they were acting as valid until the decision of the court before which it is now in question has been received, and, therefore, did not think it necessary to have representatives present. The committee adjourned without taking any action.

In reply to an accusation of the *Press* that the Cleveland Electric has spent large amounts of money in an effort to retain its franchises, President Andrews issued an open letter stating that the money referred to had been spent in defending the company in its rights. Had the city authorities been less zealous in their endeavors to organize competing companies and had the company not been put to the expense of preventing the confiscation of its property to other interests, the money spent thus would have gone for extensions and betterments, and the people would have benefited by it, he says. Further, the letter states that the company has at all times been willing to surrender its legal rights and make a new contract to operate at the lowest fare that would return a reasonable profit on the actual value of the system. He also repeated the statement that the company was willing to leave the rate of fare to arbitration, as was offered at the meetings of the City Council months ago.

Judge Lawrence refused to stop the operation of the cars of the Low-Fare Railway Company on East Fourteenth Street when his decision on that point was rendered a few days ago. Instead, he said, the question would be before the Circuit Court in a few days and he would preserve the status quo on that point, as he did not want to issue an order that would render congestion at the Public Square greater at this time than it would otherwise be.

The suit of Peter Witt, city clerk, against the Cleveland Electric to prevent the expenditure of money for publicity has been on hearing the entire week before a notary, who is taking evidence. The suit seems to have resolved itself into an attempt to prove that the company and the Republican central committee have been purchasing the space of several newspapers printed in foreign languages for campaign purposes. Mayor Johnson uses some of this matter in his speeches, and the Cleveland *Press* makes use of much of it in endeavoring to substantiate charges it has made against the company and the candidates on the Republican ticket.

In an exhaustive report of the affairs of the Municipal Traction Company, made by Haskins & Sells, expert public accountants, at the instance of Charles A. Otis, it is shown that $34,515.45 has been lost in operation within the past six months. This examination was dated as of June 30 of this year, as the books and papers since that time are not in shape to bring the figures down to a later date. The report states that much difficulty was encountered in getting at some of the facts, as items that should have appeared on the books were not to be found and papers that were necessary in making a proper examination were not furnished to the accountants. From the manner in which the business is transacted and the peculiar condition of the stock account, it would seem that the company is really a company only in name.

From the figures shown on the company's books Haskins & Sells have prepared the following balance sheet:

GENERAL BALANCE SHEET, PER BOOKS, JUNE 30, 1907.

ASSETS.

Capital stock of the Forest City Railway Company 10 shares par value $100 each		$ 900.00
Current assets:		
Cash in hand and on deposit	$ 4,155.72	
The Forest City Railway Company Current account	1,504.91	
Total		5,660.63
Total assets		$ 6,560.63
Profit and Loss—deficit		5,499.46
Total		$12,060.09

LIABILITIES.

Current liabilities:		
Accounts payable—including amount reserved for unrecorded bills for coal	$10,375.57	
Outstanding tickets	1,684.52	
Total		$12.060.09
Total liabilities		$12,060.09

With the exception of a monthly entry covering fuel consumed, the books only show cash receipts and disbursements. An examination of the minutes, and conversation with the various officers of the company, disclosed the fact that there were assets and liabilities which did not appear on the books, and Haskins & Sells, after determining what these were and making the various adjustments which they found to be necessary, prepared the following general balance sheet:

GENERAL BALANCE SHEET, AS ADJUSTED, JUNE 30, 1907.

ASSETS.

Subscribers to capital stock—Unpaid subscriptions		$ 9,000.00
Capital stock of The Forest City Railway Company, 10 shares, par value $100 each		900.00
Working assets:		
Prepaid car licenses—unexpired proportion	$134.19	
Rent of land and buildings payable in advance—unexpired proportion	420.97	
Total		555.16
Current assets—Cash in hand and on deposit		4,415.48
Total assets		$14,870.64
Profit and Loss—deficit		34,515.45
Total		$49,386.09

LIABILITIES.

Capital stock—100 shares, par value $100 each		$10,000.00
Current liabilities:		
Accounts payable	$10,366.54	

The Forest City Railway Company—Current account	8,766.45	
The Forest City Railway Company—Rental account	150.00	
Outstanding tickets	1,684.52	
Hired power—accrued	2,524.17	
Viaduct track rental—accrued	172.33	
Water rent—accrued	200.00	
Tax on earnings—accrued	661.14	
City and county taxes—accrued	1,953.24	
Corporation franchise tax of the Forest City Railway Company—accrued	916.63	
Total		$27,395.02
Reserves:		
For fire insurance	$1,100.00	
For claims for damages	1,391.07	
For depreciation of track, electric Line and buildings	9,500.00	
Total		11,991.07
Total liabilities		$49,386.09

From the figures shown on the company's books, the following statement of income and profit and loss was prepared:

STATEMENT OF INCOME AND PROFIT AND LOSS—PER BOOKS—FOR THE PERIOD FROM NOV. 1, 1906, TO JUNE 30, 1907.

Car earnings—Passengers		$75,541.44
Operating expenses		53,649.63
Profit from operation		$21,891.81
Taxes—Car licenses		230.00
Profit from operation after deducting taxes		$21,661.81
Other income:		
Dividend on stock held by W. B. Colver, trustee	$110.16	
Profit on labor	351.67	
Total		461.83
Gross profit		$22,123.64
Deduction from income—"Dividends" (Rent of Leased Lines)		27,923.10
Profit and loss—Deficit June 30, 1907		$ 5,499.46

AN IMPORTANT OPERATING AGREEMENT AT BOSTON

An interesting agreement for the joint use of tracks has just been formalized between the Boston Elevated Railway Company, operating the surface and the elevated lines within the limits of Boston, and the Boston & Northern Street Railway Company, which controls two or three lines built into the Boston Company's territory before the Boston companies were consolidated.

The Boston & Northern Company controls by lease the tracks of the old Boston & Revere Electric Street Railway, which form a double-track line through a sparsely populated district, largely over open marsh land on private right of way or in the reserved space of the boulevard leading to Revere Beach. The line skirts the shore, with one end joining the regular beach lines of the Boston & Northern in the thickly settled part of the Revere Beach Reservation and the other forming a dead end in an outlying, but well-settled, section of East Boston, known as Orient Heights. The line within the Boston boundary, at Orient Heights, is the only part in the midst of any population except the short section at the beach end.

Within a short distance of the Boston & Northern tracks in Orient Heights is the terminus of the Bennington Street line of the Boston Elevated Company, which runs into the East Boston Tunnel and so to Scollay Square. It is over this route that the Orient Heights people prefer to travel, but since the Boston & Northern Company operated in their section they have been obliged to pay two fares, one to each company, or else to walk to the Boston Company's tracks. The matter was taken to the city government and to the Railroad Commissioners, and after considerable discussion the companies concluded it was best for the Boston & Northern Company practically to abandon that part of its line lying within the limits of Boston to the Boston Company, after which the Boston Company should build a connection between its Bennington Street line and the other company's tracks, and thenceforth operate its Bennington Street cars over the Boston & Northern tracks as far as the Boston boundary line. This was approved Oct. 25, by the Railroad Commission, and will now give the Orient Heights population a five-cent fare without change of cars directly into the East Boston Tunnel. That is, they ride to and from all other parts of Boston on the same basis as the people of suburbs where no outside company owns tracks, except that all persons riding on street cars in the East Boston Tunnel have to pay a one-cent toll to the city.

A similar situation has developed in Malden and Chelsea, thickly settled suburban cities where the service is partly by Boston Elevated and partly by the Boston & Northern; and the local demand is already strong to have the Boston Company take over the outside company's trackage so far as these cities are concerned and deal with it as if it were all in Boston Elevated Company's territory. Attempts have been made to get the Railroad Commission to recommend this course, as they did in the West Roxbury & Roslindale case; but the commission, so far, has held aloof on account of the fact that the cities now struggling against the mixed control are outside the city limits of Boston, and therefore not so manifestly entitled to the five-cent fare.

Secondary results of this Orient Heights agreement are that the companies will run their cars to connect at the Boston boundary line, affording a direct route from Scollay Square, Boston, to Revere Beach, on payment of two fares, and they will arrange their summer schedules "so as to develop and adequately accommodate the traffic to and from Revere Beach." This may mean "through" cars in time of beach crowds.

THE WESTINGHOUSE RECEIVERSHIP

The developments of the past week indicate more fully the real conditions surrounding the appointment of receivers for the Westinghouse Electric & Manufacturing Company, the Westinghouse Machine Company, and the Nernst Lamp Company than were available when the last issue of this paper went to press. Investigations made by the receivers show very clearly that the cause of the trouble was not a falling off in business, but was brought about by the state of the money market, making it expedient for those interested to ask for the appointment of receivers. The unusual number of orders requiring large outlays for material and a constant drain of the payroll, without any immediate returns, because of the long time required before completion and payment, at a time of unusual financial stringency, created the difficulty. Such orders for machinery covered work which must extend over a period of months and sometimes years before realization on investment, and therefore required borrowed capital. It was the great stringency of the money market which prevented the renewal of the customary sources of ready money, and therefore made necessary prompt action to conserve the interests of the stockholders, creditors and all concerned. That the action was wise and timely is the consensus of opinion of the most conservative financial men in the country. There is no question that the various properties will be returned to the stockholders unimpaired in value as soon as the money market regains its equilibrium.

The splendid organizations of the different companies will be preserved to receive and execute orders with the same satisfaction to the customer as heretofore. There has not been even a momentary pause in the operations and orders are being filled with dispatch. So much confidence is felt in the men appointed as receivers for the several companies affected that the future success of these interests promises to be as marked as in the past. It is the understanding that no change in the general policy for the conduct of the business is contemplated. The attitude and ability of the receivers appointed is such that great confidence is felt everywhere that in a comparatively short time they will be warranted in restoring to Mr. Westinghouse and his copartners the properties which stand as a monument to the genius of the man whose name they bear.

AFFAIRS IN CHICAGO

Everybody interested in Union Traction properties has been summoned to appear in Judge Grosscup's court Thursday, Oct. 29, and show cause why the new plan of reorganization then to be presented should not be approved. The notices for the meeting sent out read:

"To whom it may concern: The undersigned will, on Oct. 31, at 2 p. m., in the room of the United States Circuit Court, hear all persons on the proposed plan of reorganization as now amended and promulgated by the Chicago Railways Company, pursuant to the ordinance of the City Council of Chicago, passed Feb. 11, 1907.

"Peter S. Grosscup,
"John C. Gray, *Arbitrators.*"

The idea is to try to gain the consent of all bondholders, the thing which the United States Court of Appeals in overruling Judge Grosscup's former order said was essential. In the meantime, the other banks acting as trustees for bonds are scheduled to file foreclosure suits, so if an agreement is reached the property can be transferred to the railways company on foreclosure sale.

Julien T. Davies before leaving Chicago told Judge Grosscup that the Guaranty Trust Company's position in the traction suit would not change, even if the City Council refused a further extension of time for accepting the ordinance, unless the money accruing to bonds in interest were spent on rehabilitation. Grosscup told Mr. Davies that he could experiment with a sale of the property to ascertain whether he could get the value of the liens, but doubted whether it would be possible to force a sale without the consent of all the mortgages.

NEW ORLEANS RAILWAY & LIGHT COMPANY'S EARNINGS

The income account of the New Orleans Railway & Light Company, including leased and controlled companies, for the month of September and for nine months, ending Sept. 30, shows as follows:

September.	1906.	1907.
Gross earnings	$441,807	$466,160
Operating expenses	239,823	268,142
Net earnings	$201,983	$198,018
Fixed charges	157,463	165,664
Net income	$ 44,520	$ 32,354
Other deductions	2,892	3,919
Surplus	$ 41,627	$ 28,434

For Nine Months.	1906	1907.
Gross earnings, all sources	$4,218,184	$4,456,560
Operating expenses	2,296,807	2,414,090
Net earnings	$1,921,376	$2,042,470
Fixed charges	1,376,999	1,483,462
Net income	$544,377	$559,008
Other deductions	24,849	29,157
Surplus	$519,527	$529,851

NEW CATALOGUE

The Stuart-Howland Company, of Boston, has just issued its illustrated catalogue of electrical supplies No. 3, which is one of the most voluminous as well as one of the most complete books of its kind which has ever reached this office. The apparatus is classified alphabetically and is very fully illustrated by outlines or small sketches of the apparatus listed. The book contains 784 pages and is handsomely bound in cloth.

Thirty patrolmen have been detailed to ascertain the cause of the congestion of cars in the Public Square, Cleveland, during the evening rush. It is said they will make a close inspection of the operation of both companies. While doing this they will also ascertain whether the companies have provided jacks for each car and other equipment with which the city has said they shall be provided.

UNITED STATES PATENTS ISSUED OCTOBER 22, 1907

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

868,648. Semaphore Signal; Fred B. Corey, Schenectady, N. Y. App. filed March 27, 1907. A motor-driven semaphore in which the motor itself acts as a brake to arrest the movement of the arm and means to prevent the backward rotation of the motor.

868,651. Insulated Metal Cross-Tie; Alva C. Dinkey, Pittsburg, Pa. App. filed Dec. 31, 1906. A metallic tie having an insulating plate on its top, a metallic bearing plate resting on the insulating plate and secured to the tie, the rail being secured thereto by means of bushed rivets.

868,664. Process of Making Rail-Bonds; Albert B. Herrick, Ridgewood, N. J. App. filed May 5, 1904. Consists in forming the bond strands into the desired shape upon a suitable pattern, and then fitting solder strips to said structure over the portions of the same that are to be utilized for the terminals of the bond.

868,736. Submarine Amusement Device; Dixon E. Washington, Chicago, Ill. App. filed March 25, 1907. Embodies the principles of the diving bell.

868,751. Electrical Connector; Frederick H. Ayer, Chicago Heights, Ill. App. filed Feb. 23, 1907. The bond wire is three-sided in cross-section, each side being formed on an arc described from the intersection of the other two sides.

868,777. Braking Apparatus; Patrick H. Griffin, Buffalo, N. Y. App. filed Jan. 28, 1907. The inner side of the wheel has a ring to which the brake shoe is applied instead of to the tread of the wheel.

868,780.—Trolley Wheel Guard; Charles Harkness, Providence, R. I. App. filed Feb. 16, 1905. A pair of guard plates loosely mounted upon the axle of the trolley wheel and having convex rollers at their extremities.

868,781. Electric Switch; Chester S. Hill, Williamsport, Pa. App. filed July 16, 1906. A specially shaped magnet carried by the car in close proximity to the ground, actuates, when energized, certain circuit-closing devices in the roadbed.

868,845. Street Car Fender; Charles O. Conner, Heppner, Ore. App. filed March 13, 1907. Details of construction.

868,864. Electric Controlling System; Ray P. Jackson, Wilkinsburg, Pa. App. filed Nov. 23, 1904. Means for preventing a circuit-breaker from closing after it has been caused to open by an overload on the motors, until after the reversing switch has been moved to its "off" position.

868,889. Trolley Operating Valve; Robert H. Rogers, Schenectady, N. Y. App. filed Nov. 17, 1905. Pneumatic apparatus for controlling trolley or third-rail collector shoes.

868,908. Railway Car Brake; Seth A. Crone, New York, N. Y. App. filed Nov. 26, 1906. A brake shoe head comprising a forged metal face plate in one integral piece and a back composed of two pieces riveted to the face plate and forming at their meeting portions suitable jaws or flanges for connection with the brake beams.

868,910. Railway Car Brake; Seth A. Crone, New York, N. Y. App. filed July 24, 1907. The brake head is so constructed that it may be temporarily applied to the wheel in the case of breakage or loss of the brake shoe.

868,911. Electric Railway System; John L. Crouse, New York, N. Y. App. filed Dec. 29, 1904. Relates to systems employing both trolley and third-rail conductors at different points. Covers electrical means for controlling the respective shoes or collectors.

868,929. Electric Control System; Ray P. Jackson, Wilkinsburg, Pa. App. filed April 3, 1905. Means for retaining the reversing switch in closed-circuit position after it has been moved to that position, until after the circuit breaker is opened.

868,949. Emergency Railway Brake; William Taylor, Youngstown, Ohio, and Hosea Napay, Pittsburg, Pa. App. filed Jan. 15, 1907. A main vertically movable brake beam carrying top brake shoes at its ends, a pair of supplemental brake bars each carrying a side thrust brake shoe, and a common operating device for the brake beam and brake bars.

868,993. Means for Resetting Automatic Controlling Devices for Vehicles or Trains; Frank E. Kinsman, Plainfield, N. J. App. filed Jan 29, 1906. A train embodying a fluid-pressure brake system and made up of power-operated vehicles each of which has thereon the following cooperative elements: A valve in the said brake system, an automatic trip controlling the valve

and movable from one position to another, and a fluid-pressure system including a cylinder and a resetting piston for resetting the trip—said cooperative elements on each vehicle being independent of the others.

869,009. Automatic Railway Switch Adjuster; Owen Morkert, Perry Township, Tippecanoe County, Indiana. App. filed May 27, 1907. Details of mechanical apparatus for automatically opening or closing a railway switch by means of a coil spring.

869,027. Electric Railroad; William G. Spiegel, New York, N. Y. App. filed July 17, 1906. Relates particularly to means for avoiding sparking in a sectionally energized third-rail thrown into circuit in advance of the train and disconnected after the passage of the train.

869,034. Car Replacer; Eugene C. Waldorf, Buffalo, N. Y. App. filed March 11, 1907. Adjustable guide-plate designed to be pivoted at one end upon the receiving platform of the replacer and immediately above the central rib, so as to permit of the adjustment of its opposite end to the right or left of the center as occasion may require.

869,070. Combined Railroad Tie and Clamp; Clark P. Dey, Keystone, Wash. App. filed Feb. 18, 1907. A hollow tie formed of sheet metal the edges of which overlap at the upper portion, a rail clamp carried by the tie and a fastening member securing the rail clamp to the tie and passing through the said overlapping edges of the sheet material.

869,083. Amusement Device; Harry C. Hebig, Closter, N. J. App. filed July 26, 1907. A passenger-carrying platform embracing a metallic globe which is universally movable, and anti-friction bearings between the platform and globe. Has a ziz-zag inclined runway.

869,122. Car Seat; Hubert Witte, St. Louis, Mo. App. filed April 20, 1906. Details of construction of a revolving car seat.

869,178. Railroad Tie; Samuel S. Harper, Philadelphia, Pa. App. filed March 16, 1907. A railway tie formed of concrete with an internal hollow metallic strengthening member, the concrete within the strengthening member being cored out through part of the length of the tie and solid below the rails.

869,183. Car Fender; Henry C. Jordan, Portland, Ore. App. filed March 4, 1907. Details of construction.

869,196. Railway Signal; Robert D. Peters, Knox, Ind. App. filed July 25, 1905. Details of construction of an electrically operated semaphore signal having a semaphore arm directly connected to the motor shaft which has stops limiting its movement to a quarter of a revolution.

PERSONAL MENTION

MR. JOHN W. CROX has resigned as general superintendent of the Morris County Traction Company, of Morristown, N. J.

MR. R. R. SMITH, general manager of the Evansville & Southern Indiana Traction Company, of Evansville, Ind., has resigned to become connected with the Louisville Railway Company.

MR. GEORGE S. RICE has resigned as chief engineer of the Public Utilities Commission of the first district of New York, his resignation to take effect Dec. 1, but will continue in the service of the commission as assistant engineer in charge of construction work. Mr. H. B. Seaman is his successor as chief engineer.

MR. GEORGE H. CHURCH has resigned as superintendent of the Middletown Street Railway, of Middletown, Conn., and also of the Berlin and Meriden lines, to become connected with Mr. L. Suzio, of Meriden, a general contractor, who has several important street railway contracts. Mr. Church will be succeeded by Mr. F. A. Hewitt, of the Eastern Pennsylvania Railways Company, of Pottsville, Pa.

MR. CHARLES A. COOLIDGE has been appointed general superintendent of the Oregon Electric Railway Company's interurban electric line between Portland and Salem, with headquarters in the Corbett Building, at Portland. Mr. C. D. Phillips, now chief dispatcher of the Peoria Terminal Company, at Peoria, Ill., has been appointed chief dispatcher of the company. Mr. Coolidge, who is to be superintendent of the line, has been general manager of the Astoria Electric Company's light plants and railway lines in this city during the past eight years.

MR. GEORGE CAYWOOD, who has been appointed chief engineer and superintendent of power stations of the Twin City Rapid Transit Company, to succeed Mr. D. W. Dozier, whose resignation from the company was announced in the STREET RAILWAY JOURNAL of Oct. 26, has been connected with the Allis-Chalmers Company for the past ten years, during which time he has had charge of the installation of a number of the most important plants contracted for by that company. Among the work with which Mr. Caywood has been connected has been the installation of plants for the Northwestern Elevated Railroad Company, of Chicago; the Cincinnati Gas & Electric Company, of Cincinnati, Ohio; the Toledo Railway & Light Company, of Toledo, Ohio, and the Union Light & Power Company, of St. Louis, Mo. Mr. Caywood entered upon his duties Nov. 1.

MR. J. L. ADAMS, general manager of the central division, Mr. A. W. Jordan, assistant general passenger and freight agent, and Mr. George Bush, chief clerk to Mr. D. G. Edwards, vice-president of the Ohio Electric Railway, in charge of traffic, have all resigned from the company. Mr. Adams came to the Schoepf lines from the Hartford, Manchester & Rockville Railroad, in Connecticut, about a year and a half ago. Mr. Jordan was formerly in charge of the traffic department of the old Columbus, London & Springfield lines when they were in the hands of receivers and Mr. Theodore Stebbins was general manager. He accepted service under the Schoepf management and for many months previous to the appointment of the present general passenger and freight agent managed the traffic department of all the Schoepf lines in Ohio, as acting general passenger and freight agent. The jurisdiction of Mr. W. A. Gibbs, general manager of the eastern division, will be extended over the central division until next spring. This will necessitate the moving of Mr. Gibbs' headquarters from Newark to Columbus in order that he may be in touch with both divisions.

MR. RICHARD T. LAFFIN, vice-president and general manager of the Manila Electric Railroad & Light Company, has resigned, having completed the task of establishing the operating organization of this property, and the management is now assumed by Mr. C. B. Graves, who has been Mr. Laffin's assistant since the property was placed in operation three years ago, officiating as manager of the lighting and power department. Mr. Laffin is still interested financially in the Manila properties, and resigns to take the management of another group of public utility properties in which J. G. White & Company, Inc., are largely interested. It is considered by Mr. Laffin and J. G. White & Company, operating managers of the Manila Electric Railroad & Light Company, that Mr. Graves is well qualified to continue the successful administration and maintain the policies inaugurated by Mr. Laffin, which have made the Manila company so successful. Mr. Graves has extended experience in the management of electrical properties in the tropics. At one time, before becoming connected with the Manila Electric Railroad & Light Company, he was electrical engineer and assistant manager of the extensive properties of the Sao Paulo Tramway, Light & Power Company, Soa Paulo, Brazil.

MR. H. S. SEAMAN, who, as noted elsewhere in this issue, has been appointed chief engineer of the Public Service Commission of the first district of New York to succeed Mr. Geo. S. Rice, resigned, is a native of New York and graduated from Swarthmore College, Pennsylvania, in 1881. He spent a year doing engineering work for the Erie Railroad Company, after which he entered the employ of the Edgemore Bridge Company. A year later he became associated with the engineering force of the Kings County Elevated Railway Company, a subsidiary concern of the Brooklyn Rapid Transit Company. Following this he was connected with the bridge department of the Pennsylvania Railroad Company, and afterward was assistant engineer of the firm of Wilson Brothers, of Philadelphia. Later Mr. Seaman returned to the Erie Railroad and had much to do with the construction of new bridges along that line between New York and Buffalo. For a while following this he was a construction superintendent for the New York, New Haven & Hartford Railroad Company, and at the time the New York subway was built he was employed as an engineer by the contractor for the Fourth Avenue section. He is now a consulting engineer in the Bridge Department of New York and will remain in that position until Dec. 1. He is a member of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the Engineers' Club, the American Institute of Mining Engineers, and the Brooklyn Engineers' Club.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement, "American Street Railway Investments" which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. ‡ Including Rapid Railway system, Sandwich, Windsor & Amherstburg Railway, and Detroit, Monroe & Toledo Short Line Railway.

Company.	Period.	Total Gross Earnings.	Operating Expenses.	Net Earnings.	Deductions From Income.	Net Income. Amount Available for Dividends.
AKRON, O. Northern Ohio Tr. & Light Co.	1m., Sept. '07	185,341	96,174	89,168	43,279	45,889
	1 " " '06	163,290	87,967	75,323	40,597	34,726
	9 " " '07	1,459,784	832,588	627,197	383,160	244,037
	9 " " '06	1,293,354	765,173	528,181	361,599	166,582
CHAMPAIGN ILL. Illinois Traction Co.	1m., Sept. '07	344,966	*187,938	157,028	.....	.....
	1 " " '06	266,844	*140,070	126,774	.....	.....
	9 " " '07	2,722,483	*1,534,073	1,188,409	.....	.....
	9 " " '06	2,163,308	*1,193,276	970,032	.....	.....
CHARLESTON, S. C. Charleston Consolidated Ry., Gas and Elec. Co.	1m., Aug. '07	64,437	40,400	24,037	13,517	10,520
	1 " " '06	56,290	36,147	20,143	13,017	7,126
	6 " " '07	367,378	226,067	141,311	81,100	60,211
	6 " " '06	328,504	198,855	129,649	77,950	51,699
CHICAGO, ILL. Aurora Elgin & Chicago Ry. Co.	1m., Aug. '07	150,597	73,463	77,134	26,986	50,148
	1 " " '06	131,434	62,657	68,778	24,939	43,838
	1 " Sept. '07	139,194	72,335	66,859	24,654	42,205
	1 " " '06	125,851	63,289	62,562	24,772	37,790
	3 " " '07	442,043	220,706	221,337	79,150	142,188
	3 " " '06	393,083	190,917	202,166	74,651	127,515
Chicago & Milwaukee Elec. R. R. Co.	1m., Sept. '07	111,117	42,791	68 326	.....	.....
	1 " " '06	97,156	39,865	57,291	.....	.....
	9 " " '07	785,401	325,437	459,964	.....	.....
	9 " " '06	633,542	252,759	380,784	.....	.....
CLEVELAND, O. Cleveland, Painesville & Eastern R.R. Co.	1m., Aug. '07	53,125	*16,585	18,540	6,796	11,744
	1 " " '06	31,797	*13,749	17,958	7,108	10,850
	8 " " '07	192,712	*100,954	91,758	56,868	34,890
	8 " " '06	178,225	*95,626	82,599	55,422	27,177
Cleveland, S. W. & Columbus Ry. Co.	1m., Sept. '07	75,993	40,493	35,500	.....	.....
	1 " " '06	64,371	33,490	30,881	.....	.....
	9 " " '07	568,891	326,780	242,112	.....	.....
	9 " " '06	482,635	272,789	209 846	.....	.....
COLUMBUS, GA. Columbus Elec. Co.	1m., Aug. '07	31,955	*19,368	12,587	10,511	2,076
	1 " " '06	25,002	*13,584	11,417	8,762	2,655
	12 " " 07	347,908	*200 950	146,958	115,643	31,315
DALLAS, TEX. Dallas Elec. Corp'n	1m , Aug. '07	93,404	*67,040	26,364	19,259	7,105
	1 " " '06	84,527	*56,042	28,485	15,250	13 235
	12 " " '07	1,079,196	*804,407	274 789	206,295	68,494
	12 " " '06	1,009,862	*633,716	376,147	182,987	193,159
DETROIT, MICH. Detroit, Jackson & Chicago Ry.	1m., Sept. '07	39,694	*32,511	7,183	16,575	†9,392
	8 " " '07	284,743	*224,680	60,063	123,225	†63,162
‡Detroit United Ry. Co.	1m., Sept. '07	630,411	*390,152	240,259	116,389	123,870
	1 " " '06	596,237	*349,545	246,692	107,519	139.173
	9 " " '07	5,111,875	*3,116,802	1,995,073	1,028,939	966,134
	9 " " '06	4,595,685	*2,714,808	1,880,877	924,576	956 301
DULUTH, MINN. Duluth St. Ry. Co.	1m., Sept. '07	74,398	35,439	38,959	17,922	21,037
	1 " " '06	67,763	35,198	32,565	17,860	14,705
	9 " " '07	625,672	309,624	316,048	159,808	156,241
	9 " " '06	570,470	297,926	272,544	158,645	113,898
E. LIVERPOOL, O. East Liverpool Tr. & Lt. Co.	1m., July, '07	37,978	19,439	18,539	11,607	6,931
	1 " Aug. '07	37,439	18,688	18,751	11,722	7,028
E. ST. LOUIS, ILL. East St. Louis & Suburban Co.	1m., Aug. '07	192,844	96,714	96,130	.....	.....
	1 " " '06	167,350	83,961	83,389	.....	.....
	8 " " '07	1,376,762	737,532	639,230	.....	.....
	8 " " '06	1,237,183	620,208	616,975	.....	.....
EL PASO, TEX. El Paso Cos.	1m., Aug. '07	42,131	*33,185	8,946	5,260	3,686
	1 " " '06	32,048	*24,501	7,547	4,084	3,463
	12 " " '07	465,224	*357,769	107,455	55,568	51,887
	12 " " '06	349,202	*237,271	111,931	45,903	66,028
FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co.	1m., Aug. '07	125,118	70,047	55,071	.....	.....
	1 " " '06	105,691	63,119	42,571	.....	.....
	8 " " '07	811,890	487,028	324,862	.....	.....
	8 " " '06	698,650	431,496	267,154	.....	.....
FT. WORTH, TEX. Northern Texas Tr. Co.	1m., Aug. '07	97.930	*57,597	40,333	11,330	29,003
	1 " " '06	79,066	*54,731	24,335	9,942	14,393
	12 " " '07	1,001,144	*616,389	384,755	124,468	260,287
	12 " " '06	777,442	*485,207	292,235	119,283	172,952
GALVESTON, TEX. Galveston-Houston Elec. Co.	1m., Aug. '07	99,467	*56,144	43,323	13,426	29,897
	1 " " '06	83,586	*49,195	34,391	11,958	22,432
	12 " " '07	1,010,543	*632,857	377,687	148,121	229,565
	12 " " '06	865,994	*541,737	324,257	148,006	176,250
HOUGHTON, MICH. Houghton County St. Ry. Co.	1m., Aug. '07	25,337	*13,332	12,006	3,976	8,030
	1 " " '06	25,694	*12,512	13,183	3,912	9,271
	12 " " '07	246,392	*152,174	94,219	47,295	46,924
	12 " " '06	217,630	*143,927	73,702	46,303	27,399
HUDSON, N. Y. Albany & Hudson R. R. Co.	2m., Aug. '07	85,788	53,134	32,654	18,083	14,571
	2 " " '06	81,700	55,597	26,103	17,583	8,520
KANSAS CITY, MO. Kansas City Ry. & Lt. Co.	1m., Aug. '07	523,641	263,230	260,411	155,906	104,505
	1 " " '06	470,579	230,576	240,002	143,864	96,138
	3 " " '07	1,552,902	810,017	742,885	463,734	279,151
	3 " " '06	1,398,342	709,240	689,102	429,350	259,751
LEXINGTON, KY. Lexington & Interurban Rys. Co.	1m., Aug. '07	59,085	32,917	26,169	.....	.....
	1 " " '06	51,547	31,223	20,324	.....	.....
	8 " " '07	361,588	235,188	126,400	.....	.....
	8 " " '06	333,135	225,367	107,768	.....	.....
MILWAUKEE, WIS. Milwaukee Elec. Ry. & Lt. Co.	1m., Sept. '07	345,728	171,388	174,339	104,073	70,266
	1 " " '06	320,156	143,373	176,783	94,050	82,733
	9 " " '07	2,890,838	1,449,335	1,441,503	880,947	560,556
	9 " " '06	2,622,839	1,280,410	1,342,429	791,918	550,511
Milwaukee Lt., Ht. & Tr. Co.	1m., Sept. '07	93,180	36,720	56,461	59,447	†2,987
	1 " " '06	80,706	27,482	53,224	31,410	21,814
	9 " " '07	635,760	267,447	368,313	390,121	†21,808
	9 " " '06	535,664	205,282	330,381	239,244	†91,137
MINNEAPOLIS, MINN. Twin City R. T. Co.	1m., Aug. '07	558,227	260,782	297,444	115,142	182,303
	1 " " '06	605,728	263,624	342,104	114,758	227,346
	8 " " '07	3,978,826	1,929,161	2,049,666	921,600	1,128,066
	8 " " '06	3,683,286	1,714,124	1,969,162	889,394	1,079,768
MONTREAL, CAN. Montreal St. Ry. Co.	1m., Aug. '07	329,755	184,844	144,911	67,208	77,703
	1 " " '06	300,278	158,415	141,863	59,430	82,433
	11 " " '07	3,164,399	1,946,389	1,218,010	524,555	693,455
	11 " " '06	2,794,948	1,686,679	1,108,179	434,240	673,93
NEWBURGH, N. Y. Orange Co. Tr. Co.	3m., Sept. '07	60,961	31,630	29,331	9,120	20,211
	3 " " '06	37,922	29,504	8,418	8,061	357
NEW ORLEANS New Orleans Ry. & Lt. Co.	1m., Sept. '07	441,807	239,823	201,984	160,356	41,628
	1 " " '06	466,161	268,142	198,019	169,584	28,435
	9 " " '07	4,218,185	2,296,808	1,921,377	1,401,849	519,528
	9 " " '06	4,456,561	2,414,090	2,042,471	1,512,620	529,851
NORFOLK, VA. Norfolk & Portsmouth Tr. Co.	1m., Aug. '07	307,488	171,544	135,944	.....	.....
	1 " " '06	162,623	105,231	57,392	.....	.....
	8 " " '07	1,681,686	1,038,747	642,939	.....	.....
	8 " " '06	1,120,196	738,923	381,273	.....	.....
PHILADELPHIA American Rys. Co.	1m., Sept. '07	270,058	.....	.....	.....	.....
	1 " " '06	258,097	.....	.....	.....	.....
	3 " " '07	866,217	.....	.....	.....	.....
	3 " " '06	808,538	.....	.....	.....	.....
PLYMOUTH, MASS. Brockton & Plymouth St. Ry. Co.	1m., Aug. '07	17,327	*9,704	7,623	1,786	5,837
	1 " " '06	17,383	*6,950	10,433	1,844	8,589
	12 " " '07	118,337	*79,132	39,206	21,516	17,690
	12 " " '06	107,642	*70,763	36,880	21,731	15,149
ROCHESTER, N. Y. Rochester Ry. Co.	3m., Sept. '07	741,464	422,128	319,336	107,392	211,944
	3 " " '06	648,613	386,861	261,752	107,389	154,363
	9 " " '07	1,954,859	1,166,168	788,691	359,826	428,865
	9 " " '06	1,690,757	1,008,581	682,176	300,896	381,280
ST. LOUIS, MO. United Railways Co. of St. Louis	1m., Sept. '07	930,606	*588,883	341,723	232,404	109,319
	1 " " '06	884,121	*530,915	353,206	231,802	121,404
	9 " " '07	8,116,337	*5,299,016	2,817,321	2,083,731	733,590
	9 " " '06	7,632,958	*4,785,673	2,847,285	2,086,147	761,138
SAVANNAH, GA. Savannah Electric Co.	1m., Aug. '07	54,417	*37,798	16,619	12,250	4,369
	1 " " '06	59,333	*33,424	25,909	11,537	14,372
TACOMA, WASH. Puget Sound El. Ry. Co.	1m., Aug. '07	165,079	102,734	62,345	33,664	28,681
	1 " " '06	142,603	86,203	56,400	26,240	30,160

Street Railway Journal

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Distribution Copper

That great care is necessary in planning the feeder system for an electric railway is well recognized, yet many operators fail to realize that as much or more care should be taken to see that the distribution copper in use continues to give the greatest possible operating economy. In planning the power distribution system for a new road the distances from power supply, location of grades, weight of car equipment, headway of cars, schedule speed and frequency of stops are all taken into consideration by the engineer. While an attempt is generally made to provide for the future to some extent, the designing engineer cannot always accurately forecast conditions as they develop later. The cost of copper also, in many cases, holds the feeder system down to the actual requirements of the present. Consider, moreover, that of the six factors named above as entering into the requirements, only the first two, distance from station and location of grades, remain unchanged, usually, for any length of time. Very few roads continue in operation long with the schedule factors constant. Headway, speed and stops are frequently altered to meet new conditions, and as these changes are made, others relating to the size and weight of the car equipment become necessary.

If such changes result in a great increase in the current required, and consequently in the voltage drop on any particular section, then, of course, the subject of copper is taken up, and enough is added to bring the mimimum voltages up to that allowable in the particular case.

The effect of such changes in schedule, etc., as do not immediately result in emphatically bad operating conditions are not as a rule sufficiently studied. As a consequence, after the railway has been in operation for some years, the copper system is likely to become remarkably inefficient, even though the interest on its first cost was once carefully compared with the cost of the distribution losses, as they existed with conditions prevailing at the time it was installed. This state of inefficiency usually comes about gradually, as the number of cars, size of equipments, schedule speed or number of stops slowly increases, or the routing of cars is changed. This may result in steady calls for the distribution copper to carry more and more load, until the losses, increasing so gradually as not to be particularly remarked, become so great that their cost would not only pay good interest on the cost of sufficient additional copper, but yield a handsome profit if it were installed. On the other hand, although occurring more infrequently, changes in operating conditions may have been in the opposite direction, leaving one or more particular circuits with more copper in service than the requirements justify. Often such conditions may be bettered, not by an actual removal of copper from one pole line or circuit to another, but by a judicial interlinking of circuits through tie lines, with circuit breakers and fuses if considered advisable or necessary.

Accurate feeder maps, showing diagrammatically the voltage drop per 100 amps. at every point on the system, are a great help in keeping the distribution system in a state of efficiency. These maps and feeder-loss charts should be studied carefully from time to time as the schedules, etc., are changed, and such study will not fail to reveal changes—oftentimes inexpensive—which will better operating conditions and save operating expenses. In a city system where circuits are divided by section insulators a switch, bridging the insulator through a circuit breaker, may or may not be

advisable—the loss chart will indicate. An additional feeder tap may reduce the voltage drop several per cent on a certain grade; its absence might not be noticed in ordinary operation, but the chart will show that the tap, costing perhaps three dollars, will save ten or twenty dollars per year. Such a chart, kept up to date through the careful checking of installation work on it, will stop the haphazard methods of tapping feeders to the trolley which exist on some roads, largely because of the ignorance of linemen, by bringing feeder-tap locations sharply before the eyes of "one who knows"—but does not always know the conditions which exist.

Too often, when additional feeder copper is required, it is bought and installed without sufficient care being taken with regard to its design in connection with copper already in use. The consolidation of roads also often results in very inefficient use of copper—more often when the load of both is transferred to one power station, but also when both stations continue to operate. Such bad conditions, and others possible but too numerous to attempt to mention, will be prevented or revealed, and the remedy, suggested by complete feeder maps and distribution-loss charts, properly considered with relation to existing and proposed schedules and operating conditions.

The benefits derived from a continual careful watch of the distribution system in connection with the work it has to perform, and the inefficiency resulting from a neglect of these matters, is but additional evidence that good engineering is essential in good operation as well as in good construction.

System and Organization in the Car Maintenance Department

Too many master mechanics are prone to keep themselves down among details rather than to study the work of the shop in a broad way and then to take such steps as may be necessary to secure its systematic conduct. In the very smallest shops where the master mechanic or foreman has probably only half a dozen men under him, there are not enough problems of this kind to demand all the time of one man, and the master mechanic must perforce get into the actual work. But in a shop employing a dozen or more men it is very doubtful if costs are lessened or work expedited when the master mechanic puts on the overalls, gets under a car and stays there with the men several hours at a time. The repairs on that one car may be completed in a shorter time, but work on other cars and in general is likely to be delayed because of the lack of systematic thinking and planning for the future. When a man puts a considerable portion of his time upon the fit of a single bearing, the adjustment of a brush-holder spring or some other as minute detail, everything else is driven out of his brain. A master mechanic who does do this is giving the company a lower grade of work than that for which he is paid, and which is expected of him. If he stays in details because no one else about the shop is able to do the work properly, he is to an extent a failure, otherwise he would get the proper kind of men for the work. This is one of the duties of his position.

There is great need of broad perspective in the shop notwithstanding the fact that some master mechanics may not see the necessity for it. There are so many and varied operations in the maintenance of equipment that the introduction of a system sometimes seems impossible. But it has been proven time and again that almost every kind of work can be systematized, and results show that the introduction of system, usually lessens confusion, reduces costs and enables work to be gotten out faster.

System for a shop might be defined as an organization of the men and of the work such that the latter will go on just the same in the absence as in the presence of a head. Such an organization requires that every man shall have certain duties to perform and that in the absence of one man another shall take up his work. Further than this, work of a constantly recurring kind shall always be taken care of in the same way. Conditions quite different from this are present in some shops, however.

When a man finishes one job he does nothing until given other work by his superior. When a disabled car comes into the shop every one of the half-dozen or more men who are told to drop other work must be told specifically what they are to do on the disabled car, and further, they must be instructed at every move. No one has specific charge of any one thing with the results that no one can be held definitely responsible for defective work.

Where such conditions prevail it often seems impossible to introduce system and it is impossible to a man who cannot or does not lift himself above details. Often the farther one can get away from the actual work the better the condition of the mind to view it in its entirety, to lose sight of details and to formulate plans for its organization. This probably accounts for the fact that frequently when a large railway system falls into the hands of a financier who never in his life was concerned with the actual details of operation, it is reorganized and systematized to an extent that the old railway management would have considered impossible.

A master mechanic, or other department head as well, who will get completely away from details at frequent intervals, and will view his department in its entirety from a distance, will have some chance of seeing his work and that of his associates from the right perspective. The chances are then that he will see some places where the organization can be improved. He can follow this by taking such steps as are necessary to secure proper order and system in his department, and is certain to be rewarded for his care and trouble by fewer worries and lessened costs in the future, together with that satisfaction which invariably accompanies quicker and more efficient performance.

Some Questions of Overload

There is a healthy tendency to work on standard specifications in electrical machinery and in a general way there have been established, thanks to the efforts of the various societies, rather definite rules of action. The greatest present variations in practice seem to be in the matter of permissible overloads on generators and motors, and in spite of standard rules the subject seems to be rather imperfectly understood. An overload means, or ought to mean, a load that reduces the factor of safety in operative conditions below a conservative value. It may imply overheating in dangerous degree or liability to sparking of a serious character if the machine in question has a commutator. In

any event it is passing beyond the limits of safe continuous operation for one reason or another. Now when, as sometimes happens, a manufacturer guarantees a machine to work continuously at say 25 per cent over its rating, it is pertinent to inquire what he really means. He may imply simply that the generator which he has sold for 1000 kw is really a 1250 kw machine which he has undervalued for purposes of competition, although this hypothesis is improbable. It is far more likely that he believes the insulation is good enough to stand the extra heating in spite of ordinary practice. Every machine may have as many ratings as there are temperatures to be considered, but all ratings above a certain point certainly cut down the factors of safety. The point of maximum heating is the general danger point and no certain means has yet been provided for estimating the temperature at this unknown maximum point.

If the 25 per cent overload does not imply dangerous heating it may imply bad regulation, which is fortunately less serious and more easily detected. The purchaser should in any event know exactly why the 1000-kw generator was not considered as of 1250 kw instead of being regarded as capable of 25 per cent continuous overload Temporary overload for a given time up to a certain temperature is another matter, and the user can form his own judgment as to the safety of applying it. But permanent overload is a misnomer and deserves investigation. There is a good deal of misconception about the importance of overload capacity anyhow. In a modern station there is seldom need of working much above the conservative rating save for short intervals, and a station which regularly calls for a large overload capacity on its machines is either being carelessly operated or is sinfully underpowered. It is not uncommon to see a railway plant staggering along for years with a steady overload and wailing for public sympathy when it is caught short of power. Operation under such conditions is simply taking unwarrantable chances from a mistaken idea of economy. It is no difficult matter to keep a little ahead of the demand for power and in the long run it is cheaper to keep a spare machine than to stand the increased depreciation of generators which are kept just at the edge of burning out. It is true that traffic grows sometimes at a surprising rate, but a man without imagination enough to look ahead even a single year, erring if must be on the side of safety, has no call to be in the railway business. Railway operation depends only in small measure on the mere costs at the generating station, and a few failures of power damage the receipts all out of proportion to the cost of proper precautions. If we heard more about underload efficiency and less about continuous overloads, superintendents of motive power would breathe easier and breakdowns would be fewer.

Recent Transformer Improvements

The high efficiencies obtained in late years in the operation of large transformers have given rise to an impression that very little improvement is to be expected in transformer design. This is doubtless true as far as efficiency is concerned, but from the standpoints of reduced cost of production, closer regulation and decreased weight per kilowatt, together with cooler operation under load, much remains to be accomplished. Perhaps the most striking advance in transformer design during the past two years has been that due to the production of special alloyed steel of low watts loss. In a paper on "Modern Lighting Transformers," at the recent meeting of the Canadian Electrical Association, G. P. Cole emphasized this point by comparing in a curve the losses in a special alloyed steel with those in a "normal" transformer steel at 60 cycles. The same considerations of course apply to the power transformers used in railway work. The watts loss per pound was 3.9 against 2.1 at a magnetic density of 25,000 lines per square inch; at 50,000 lines the loss was 12.8 against 6.6; and at 60,000 it was 17.7 watts against 9, all in favor of the alloyed steel at a ratio of nearly two to one.

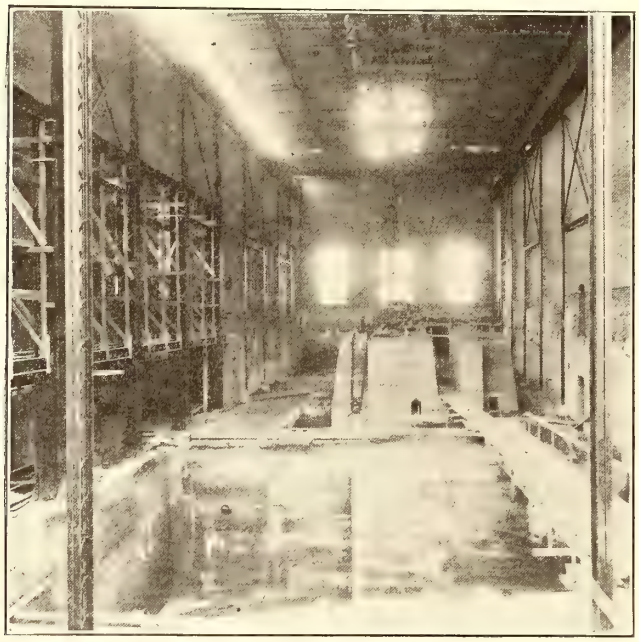
With a lower watts loss in the iron a higher density for the same core loss can be used. This reduces the number of turns in the coils, giving a shorter copper circuit and hence a smaller copper loss. A reduction in the number of turns also enables a greater cross section of copper to be used, improving the regulation, and to some extent the efficiency. The reduction of the number of turns also tends to improve the regulation because in the formula for the reactance voltage of a transformer, the numerator contains the number of primary turns squared.

The question of the aging of iron is not the bugbear it was a few years ago. The results of recent tests show that aging is not apt to result unless the core plates are clamped too tightly and the hysteresis losses allowed to carry the temperature above 80 degs. C. In connection with the disposal of heat the recent practice of impregnating coils with a special compound possessed of high heat-emissive qualities, in comparison with the ordinary treatment with a solvent varnish, has been found to improve the cooling from 20 to 25 per cent. The ordinary cotton covering and fibrous material used in cooling wire and in winding coils sometimes carry 7 to 10 per cent. of moisture. In the usual method of dipping these coils in a cold varnish and afterwards drying the varnish under heat the moisture is sealed in the coil, thus tending to lower the dielectric strength of the wire and cause an ever-present danger of burnouts. The varnish penetrates but a few of the outside layers of the wire, leaving the inside layers of the coil without the reinforced insulation which the varnish is supposed to give the cotton covering. With vacuum-treated coils these conditions are reversed. The moisture is vaporized at a comparatively low temperature, and when withdrawn leaves the coil in the best condition for impregnation. The latter process cements the turns together, giving mechanical protection to them as well as good heat dissipation powers.

Very close regulation is, of course, not as esential in electric railway as in lighting service, but the frequent combination of lighting and power loads on a large scale makes good regulation more and more desirable. If the voltage can be held up with increase of load in railway service the schedules can be held more readily, and the operation of the whole system will be smoother. There is little doubt that the transformer will be an adjunct piece of railway apparatus for many years to come, and every improvement in its design and manufacture will be welcomed by the electric traction fraternity.

THE HOCHELAGA POWER STATION OF THE MONTREAL STREET RAILWAY COMPANY

The Montreal Street Railway Company is having erected at Notre Dame and St. Raymond Streets, in the east or Hochelaga district of Montreal, a direct-current reciprocating engine power plant. This station will serve not only as a considerable addition to the power system of the company, but will also be a valuable reserve should there be any failure of the water power transmission. It will help out the St. Denis and Shawinigan water-power sub-stations and eliminate the long feeder lines from the William Street steam station in the western end of city.



VIEW IN ENGINE ROOM, SHOWING CONCRETE FOUNDATIONS

THE STRUCTURE

The building as it now stands is large enough to house seven batteries of 1060-hp boilers, but the present installation consists of only five batteries. It will be seen from the plan, however, that the eventual capacity will be twelve batteries; that is, the final structure will consist of sixteen bays instead of ten as now. The power plant then will be 299 ft. 10 ins. long and 153 ft. 9 ins. wide. The present length is 189 ft. 5 ins.

The structure is fireproof throughout, consisting of steel framing and brick walls, except for a temporary wood frame metal covered partition on the end where the extension will be made. The exterior of the station is pressed brick, while buff brick is used in the engine room, except for an 8-ft. wainscoting of glazed white tile. All foundations are of concrete. The floors are built up of I-beams and reinforced concrete arches. The roof slabs are of cinder concrete covered with slate laid in asphalt and are pitched 1 in. to the foot. Two stacks are provided for in the plans, but only one is now erected. It is of radial brick, 13 ft. in diameter at the top, and extends 225 ft. above the boiler room floor. The foundation for this stack is 33 ft. deep.

The location is on an ancient creek bed and the soil is of a varied nature, consisting in some places of sand, in other places of hard blue clay, and then again of gravel and sand; at one or two places the nature of the soil is similar to quicksand. Considering this condition, it was deemed advisable to provide all the large foundations, such as those for the main building, columns, engine foundations, chimney foundations, etc., with steel re-inforcing rods, laid crosswise to bond concrete footings thoroughly, and hence tending to lessen the cracking of said footings owing to slight and uneven settlements. All the footings are of such an area that the maximum loads on the soil will not exceed 2½ tons per sq. ft., which, however, is exceeded somewhat in the chimney footings owing to the action of the wind.

The laying of the concrete for the wet wells was a difficult piece of work. The excavation for this work was carried practically 50 ft. below the street level and there was considerable trouble with water, as the soil at this depth is a fine sand mixed with gravel. The footing course of the wet wells was laid after a system of trenches had been provided to carry all water to a sump, the concrete being done in bags. No particular type of re-inforcing was adopted in these heavy walls, but enough steel was placed in them to take care of all the exterior pressures.



THE HOCHELAGA POWER STATION OF THE MONTREAL STREET RAILWAY COMPANY

The station has three floor levels; the engine and boiler-room floors are on the same level; the corresponding basements are 14 ft. and 15 ft. high, respectively, and the economizer floor, which is 34 ft. above the boiler room level. The engine room is provided with a 50-ton Niles electric traveling crane of 60 ft. span, containing a 10-ton auxiliary hoist.

COAL AND ASH HANDLING

Coal is brought in hopper bottom cars to the station on a track alongside the boiler room, is weighed on a track scale and then delivered through a hopper over the crusher pit. From the latter point the coal is taken by a B. & W. gravity bucket conveyor and delivered to the overhead bunkers in the aisle between the two banks of boilers. This bunker has a storage of 1400 tons, which means a three weeks' supply under present operating conditions. The inside dimensions of the coal bunkers are 22 ft. wide by 101 ft. long.

A heavy cast-iron coal valve is placed over each boiler immediately under coal bunker to control the coal supply to the spout of the stoker hopper. A steel plate cement-lined hopper capable of holding three days' ashes is provided under each boiler furnace. These hoppers are provided with cast-iron valves which are opened to drop the contents into side-dumping steel cars, which in turn discharge their contents into the ash hopper at the lower end of the conveyor whose return is in a trench in the basement floor.

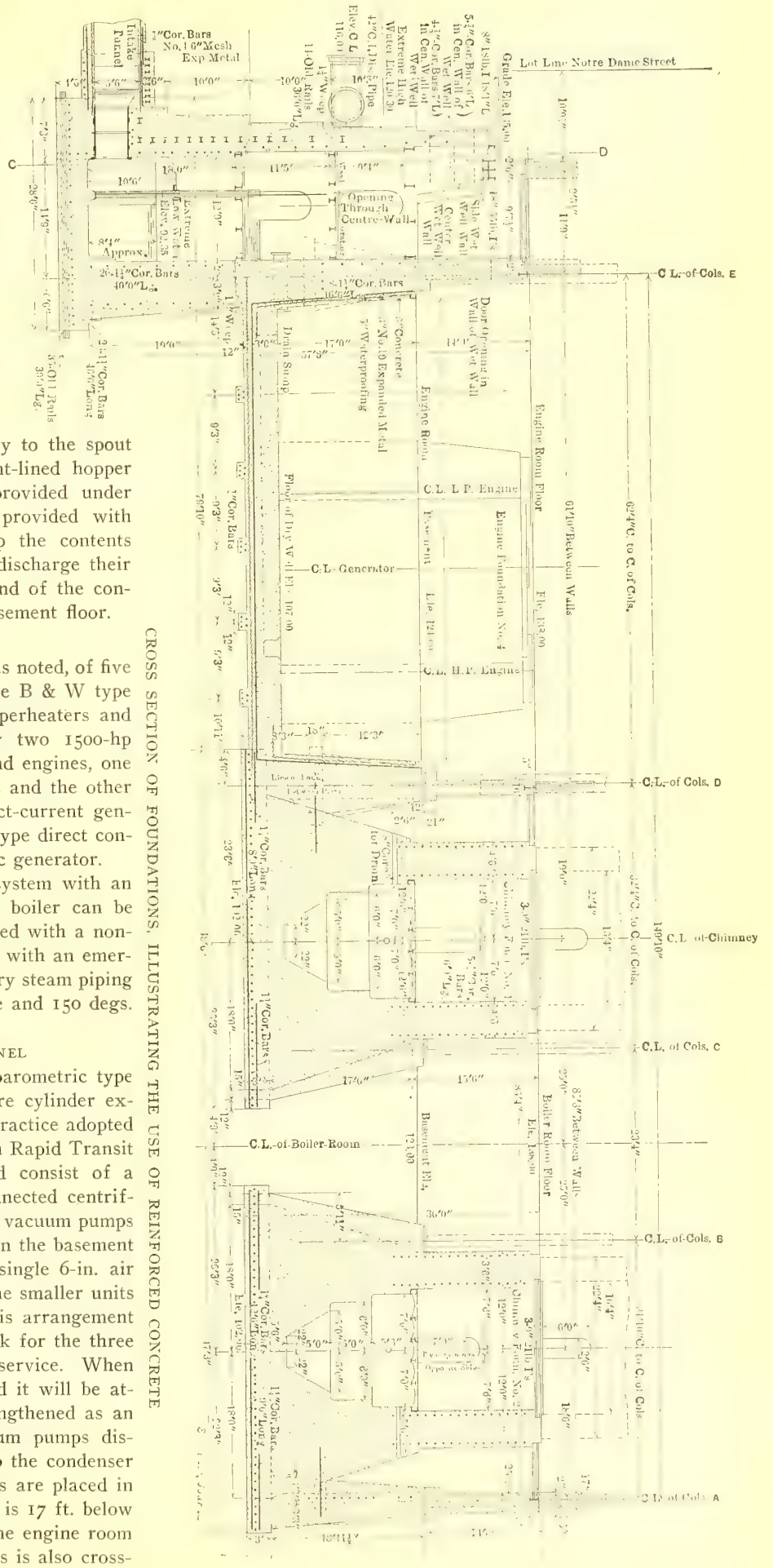
POWER EQUIPMENT

The steam generating equipment consists, as noted, of five 1060-hp water tube boilers. They are of the B & W type and are provided with the same maker's superheaters and chain grate stokers. These boilers supply two 1500-hp McIntosh & Seymour vertical cross-compound engines, one direct-connected to a 1000-kw Westinghouse and the other to a 1000-kw General Electric 550-volt direct-current generator, and one 3000-hp engine of the same type direct connected to a 2000-kw 550-volt General Electric generator.

The main steam piping is a single lead system with an equalizing header, so that steam from any boiler can be passed to any engine. Each boiler is provided with a non-return stop and check valve and each engine with an emergency stop valve. Both the main and auxiliary steam piping are capable of withstanding 250 lbs. pressure and 150 degs. superheat.

CONDENSERS AND DISCHARGE TUNNEL

The condensers are of the Worthington barometric type and are attached directly to the low-pressure cylinder exhaust openings of the engine, following the practice adopted in the Manhattan station of the Interborough Rapid Transit Company. The condensing outfits installed consist of a rotative dry vacuum pump and a direct-connected centrifugal circulating pump for each engine. The vacuum pumps are set alongside of the engine foundations on the basement floor which has a headroom of 14 ft. A single 6-in. air header receives the 4-in. connections from the smaller units and the 6-in. line from the larger one. This arrangement will permit two of the pumps to do the work for the three condensers, should the third pump be out of service. When the second large condensing unit is installed it will be attached to the same header which will be lengthened as an 8-in. diameter connection. The dry vacuum pumps discharge through short direct connections into the condenser discharge tunnel. All of the circulating sets are placed in the dry well or pump pit, the floor of which is 17 ft. below the engine room basement, or 31 ft. below the engine room floor. The piping for the circulating systems is also cross-connected.



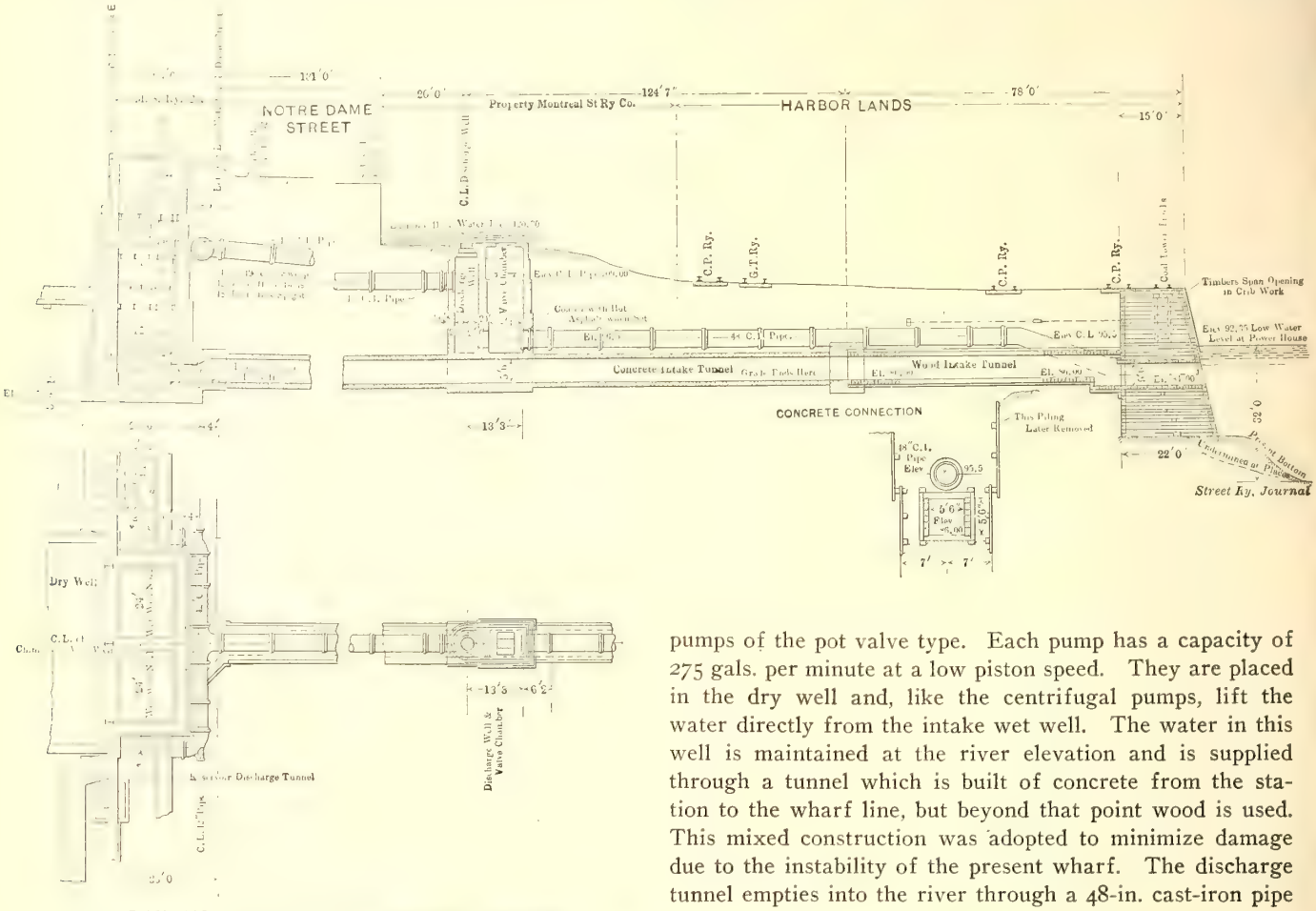
CROSS SECTION OF FOUNDATIONS, ILLUSTRATING THE USE OF REINFORCED CONCRETE

It was originally intended to divide the discharge tunnel, so that the water in the winter could be run some 75 ft. to the up-stream side of the intake tunnel and in the summer some 50 ft. on the down-stream side. For this reason a dividing chamber with valve was required, thus necessitating the concrete man-hole shown in the drawing.

made. The idea of having an up-stream discharge was to guard as much as possible against the action of frazile or anchor ice.

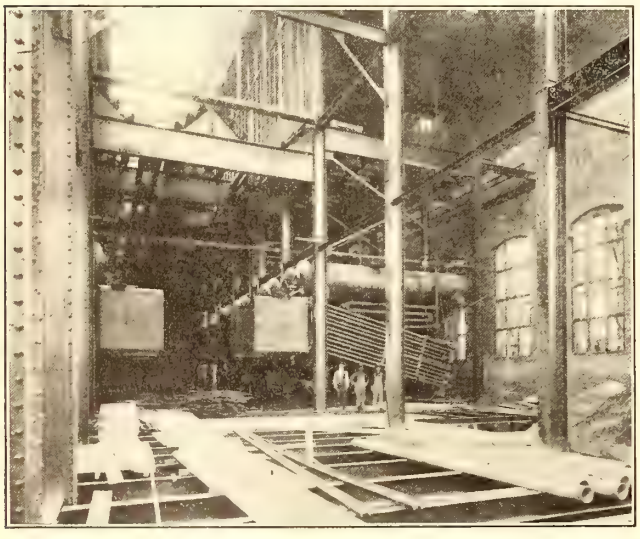
FEED WATER ARRANGEMENTS

The present feed-water pump installation consists of two 16-in. x 8½-in. x 18-in. duplex outside packed plunger

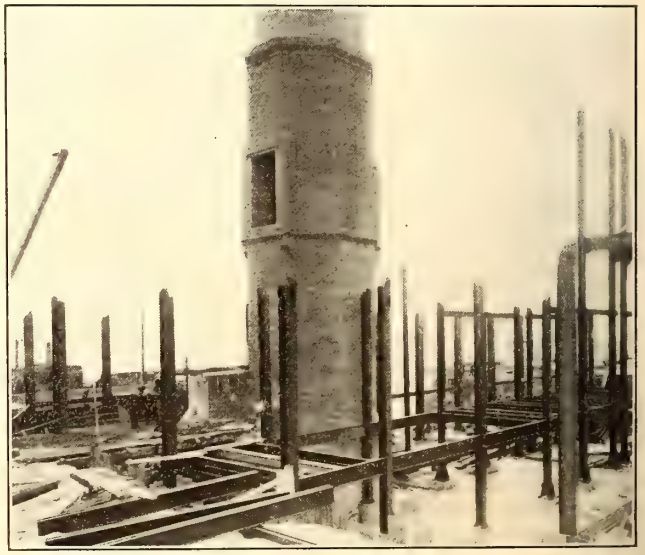


PART PLAN AND SECTION OF DISCHARGE TUNNEL

pumps of the pot valve type. Each pump has a capacity of 275 gals. per minute at a low piston speed. They are placed in the dry well and, like the centrifugal pumps, lift the water directly from the intake wet well. The water in this well is maintained at the river elevation and is supplied through a tunnel which is built of concrete from the station to the wharf line, but beyond that point wood is used. This mixed construction was adopted to minimize damage due to the instability of the present wharf. The discharge tunnel empties into the river through a 48-in. cast-iron pipe



VIEW IN THE BOILER ROOM DURING THE INSTALLATION PERIOD, SHOWING ALSO THE TYPE OF FLOOR SUPPORT



LOWER PART OF STACK

This scheme, however, was abandoned, owing to the fact that the Harbor Commissioners intended to build a new wharf next year, and so the discharge pipe was carried out straight and slightly turned down stream, in which position it will remain until the wharf improvement mentioned is

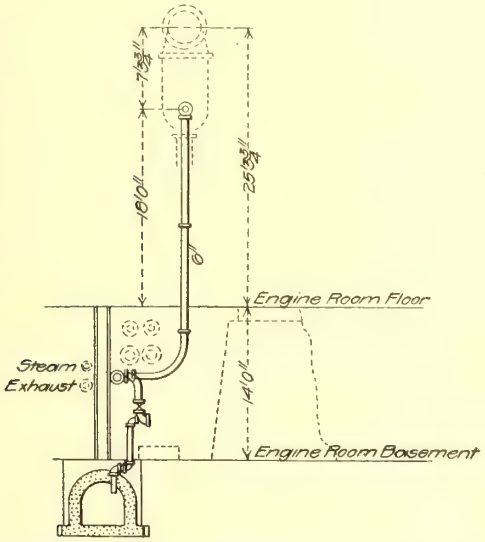
laid to pitch 7 per cent to the limit of the company's property. At the latter point the return drops 12.7 ft. into an intermediate discharge well and then proceeds to the river in two branches.

Each wet well has a pair of counterbalanced screens, so

when one is lifted for cleaning the other is in the water. The feed water heaters are of the Cochrane open type and of 4000-hp capacity each. They are located immediately over the feed pumps, so that the hot water is delivered to the feed pump under a good head and is fed to the boilers under pressure through economizers. The feed water heaters receive their water from taps taken off from the circulating water discharge pipes. They are also provided with an emergency connection for city supply. One float valve controls the feed to both heaters and a second controls the emergency connection, so if for any reason the regular supply from the condenser injection line fails the city water is brought in automatically.

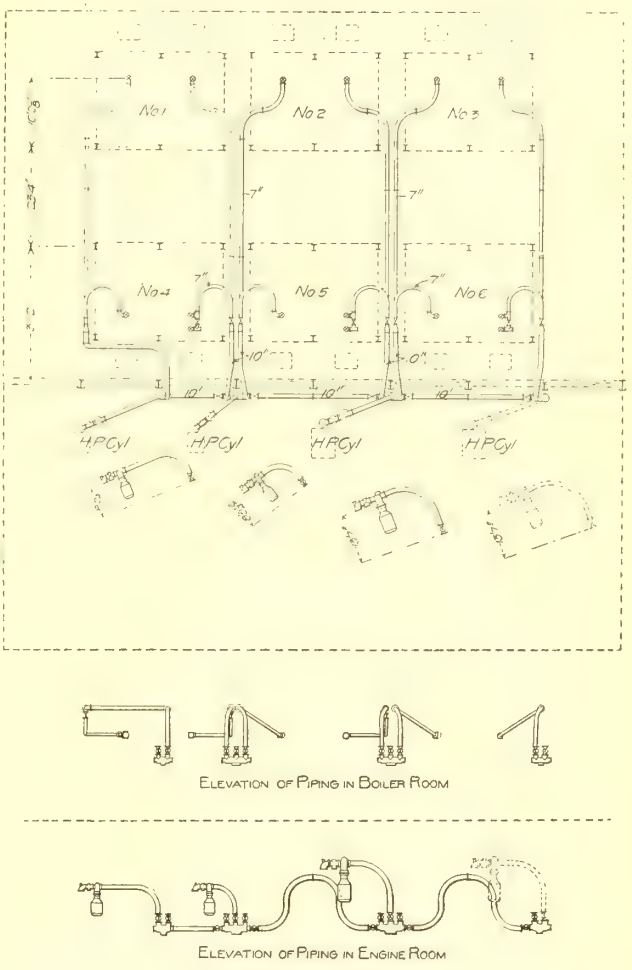
ECONOMIZERS

The present economizer installation consists of two 1200-



TYPICAL CROSS SECTION, SHOWING DISCHARGE OF DRY VACUUM PUMP INTO CONDENSER DISCHARGE TUNNEL

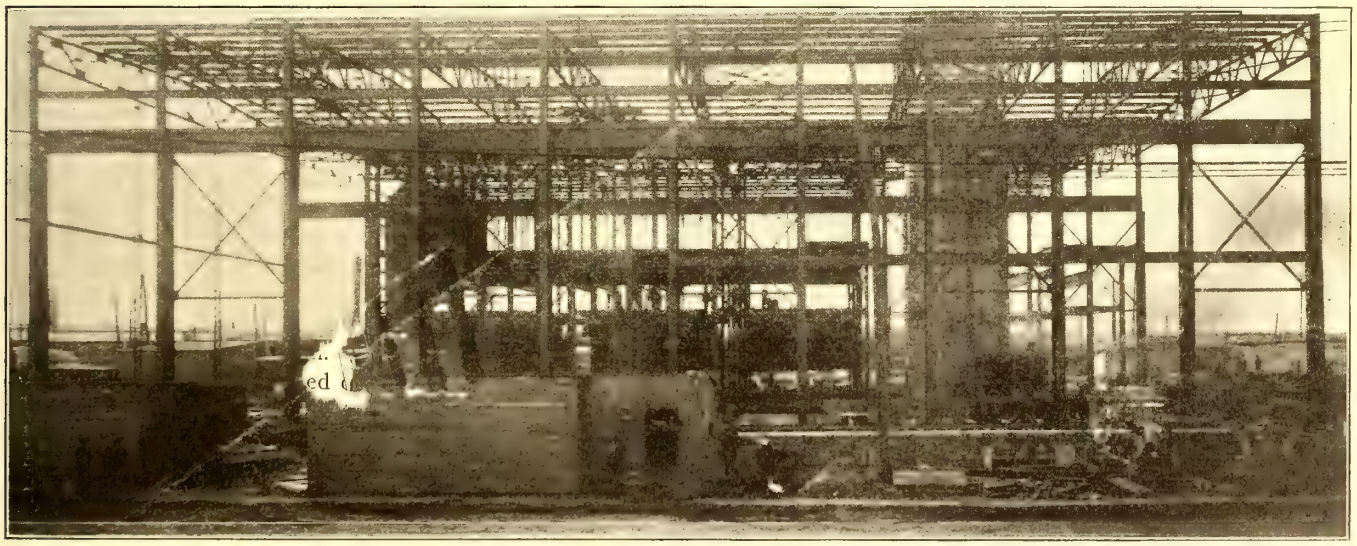
pipe Green economizers of the double section type with a center wall. One system is placed on the economizer floor immediately over one bank of three batteries and the other in the uptakes. The economizer scrapers are driven by vertical engines. Each bank of boilers is operated by one damper regulator.



PLAN AND ELEVATIONS OF THE MAIN STEAM PIPING

BLOW-OFF AND EXHAUST PIPING

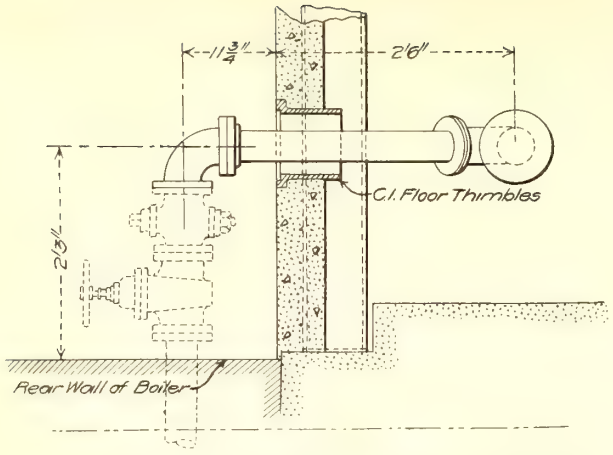
There are two 2½-in. blow-off connections for every boiler leading into a 3-in. blow-off main. This blow-off



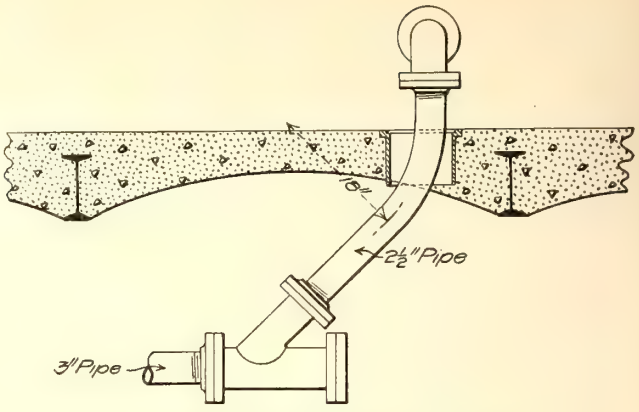
STEEL FRAMEWORK OF THE HOCHELAGA POWER STATION

likewise on the opposite side of the power house. The boilers and economizers are connected to the chimney with a steel flue, the draft being controlled by independent dampers

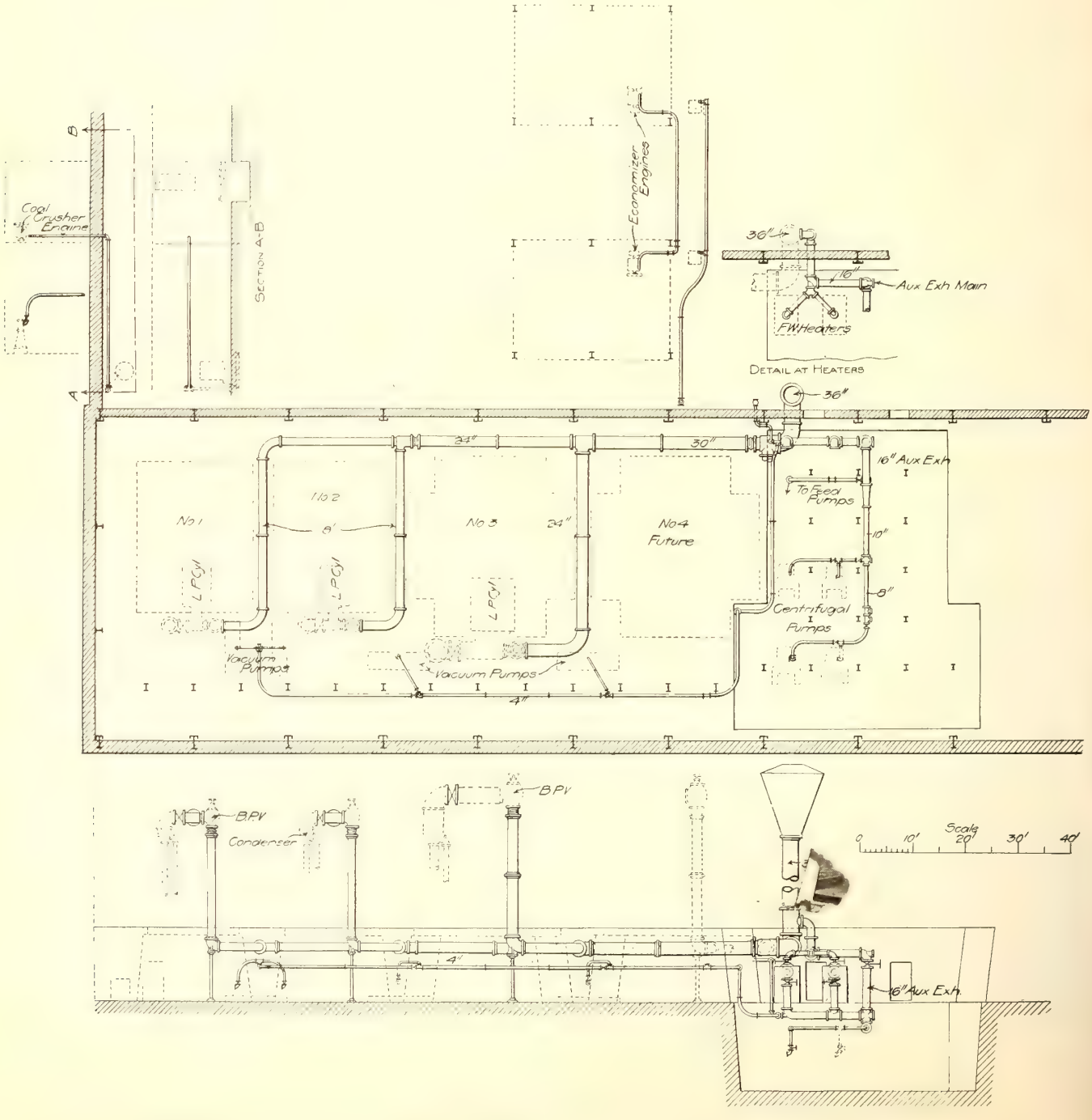
header is hung immediately below the boiler-room floor, and the branches to the boilers extend up through large thimble openings in the floor to allow for expansion and contraction.



ELEVATION OF BOILER BLOW-OFF CONNECTION



SECTION SHOWING BOILER BLOW-OFF CONNECTION



EXHAUST PIPING IN THE MONTREAL STREET RAILWAY COMPANY'S HOCHELAGA STATION

The details of this arrangement are presented in the section and elevation on page 946. Y-fittings are used throughout for this piping.

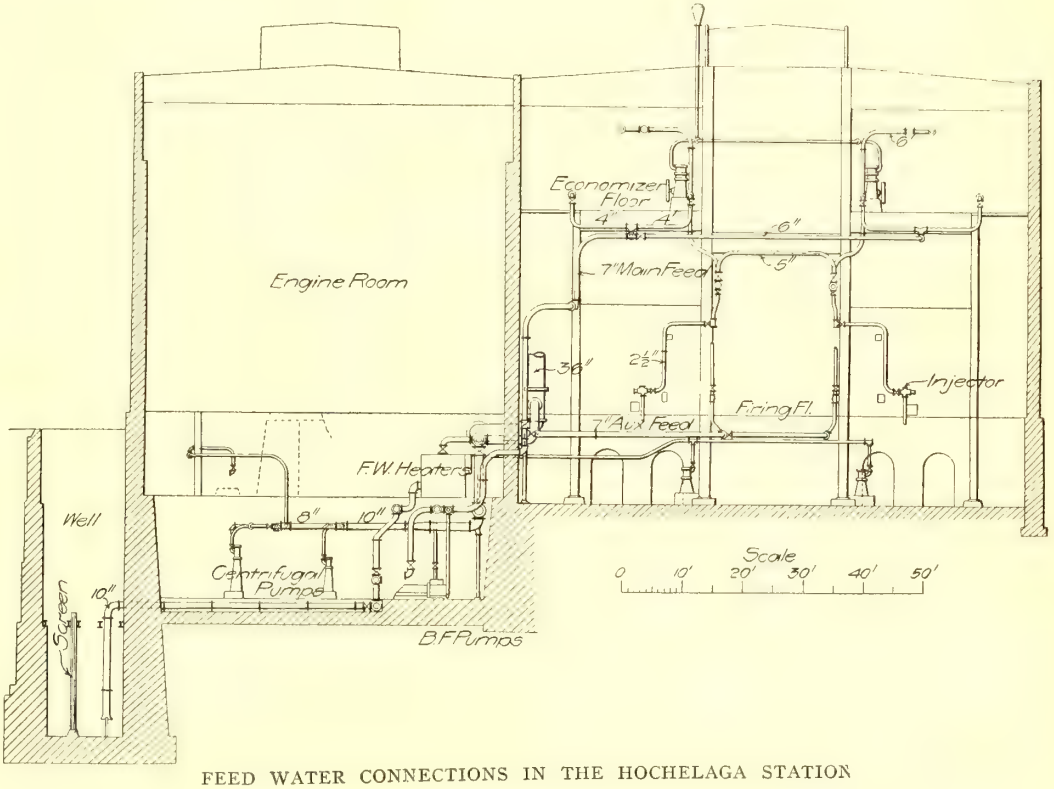
The exhaust steam from each unit to atmosphere passes through an automatic relief valve and thence through 18-in. and 24-in. pipes respectively to the free exhaust header in the basement, which leads to a 36-in. exhaust head about 16 ft. above the roof. Expansion is provided for by corrugated copper expansion joints of the bellows type. All of the material used for the exhaust piping is suitable for a working pressure of 100 lbs. per sqare inch. The plan of the exhaust piping is shown on page 946.

SWITCHBOARD

The switchboard is of blue Vermont marble panels and is mounted on a platform over the cable house in line with the main wall, as shown on the plan. Facing the board, and looking from right to left, the panels are as follows: 1000-kw generator; 1000-kw generator; 2000-kw generator; blank for future 2000-kw generator; blank for future booster; twelve feeder panels. Reference to the station plan will show that provision has been made for lengthening the switchboard in symmetry with the other future work.

DESIGN

The station was erected for the Montreal Street Railway Company by the Canadian White Company, Ltd., after the designs of the latter company's mechanical engineer, N. H. Rybitzki. Ralph D. Mershon, of New York and Montreal, was consulting engineer for the power equipment, switchboard and the rearranged feeder system.



FEED WATER CONNECTIONS IN THE HOCHELAGA STATION

UNION PACIFIC GASOLINE MOTOR CARS

The Union Pacific Railroad has issued a pamphlet descriptive of the thirteen gasoline motor cars constructed by it for service on its suburban lines. All of them are designed for passenger service and twenty-two additional cars are under construction. Car 1 was an experimental car 31 ft. in length, mounted on a single four-wheel truck, with wheels 42 ins. in diameter. The weight of the car was a trifle over 20 tons. It was turned out of the shops of the company at Omaha during March, 1905, and on Aug. 21, 1905, went into regular daily service between Kearney and Callaway.

Car 2 is an all-steel car mounted on two four-wheeled trucks. The two driving wheels are 42 ins. in diameter; the wheels on the trailer truck are 33 ins. in diameter. The car is 55 ft. long, with a seating capacity of fifty-seven, and the total weight is 56,000 lbs. Water from the cylinder jackets of the engine is used to heat the car in winter. Air brakes are employed and numerous tests at 20 m. p. h. have shown that the car can be stopped in 112 ft. to 115 ft. without inconvenience to the passengers. The car is driven by a 100-hp gasoline engine with six cylinders 8 ins. x 10 ins. of the upright type. Air is used for starting. The car made its initial trip Sept. 14, 1905, and since Oct. 6, 1905, has been in regular service on the line between Kearney and Callaway, making one round trip, or 113 miles, daily.

Car No. 3 is of the same general design as car No. 2, except that it has a baggage compartment. It is now on regular service on the line of the Southern Pacific Company, making a round trip daily between Houston and Galveston.

Car No. 4 is of the same general design and description as car No. 3 and is now in regular service between Kearney and Callaway in conjunction with car No. 2. Cars 5 and 6 are similar in general design to car No. 2; the former is in use on the regular branch line between Loop City and St. Paul, the latter between Leavenworth and Lawrence, Kan. The latter car draws a trailer. Car No. 7 is 55 ft. long and has side entrances and round window sash. Its weight is 58,000 lbs. It is now in service on the Erie Railroad.

The body and trucks of car No. 8 are similar in design to those of car No. 7. It is equipped with a 200-hp motor with 10-in. x 12-in. cylinders. The engine is directly connected to the axle but gears are used in starting. The car weighs 61,000 lbs., but this weight could be reduced to 55,000 lbs. in subsequent cars. It was put in service between Lincoln and Beatrice, Neb., in September, 1906, and is making a round trip daily. Twenty-two cars of this design are now being constructed in the Omaha shops. Car No. 9 is similar in design to cars 2 to 6, but is equipped with a 100-hp engine of special make. Cars 10 to 15 have been placed in service in Denver and have 200-hp motors.

REPORT ON RAIL CORRUGATION, PRESENTED AT THE ELEVENTH ANNUAL MEETING OF THE GERMAN STREET AND INTERURBAN RAILWAY ASSOCIATION

That rail corrugation continues to be a live topic among German electric street railways is apparent from the report on this subject presented by the track committee of the German Street and Interurban Railway Association (Verein Deutscher Strassenbahn und Kleinbahn Verwaltungen) at the eleventh annual meeting of the association held in Mannheim, Germany, Sept. 4, 5 and 6, 1907. The early part of the report describes the well-known features of the phenomenon familiar to readers of the Street Railway Journal. From the data thus collected the committee concludes that corrugation is not unique to electric railways, its greater prominence in recent times being due rather to heavier wheel pressure, harder braking and other factors increasing the strain on the track.

It is of great interest to learn that the results of two independent German investigations mentioned in this report fail to show the slightest evidence for ascribing corrugation to anything that might occur during the rolling process, thus strikingly confirming the experiments made in this country by George L. Fowler and described by him in the Street Railway Journal for Oct. 5, 1907.

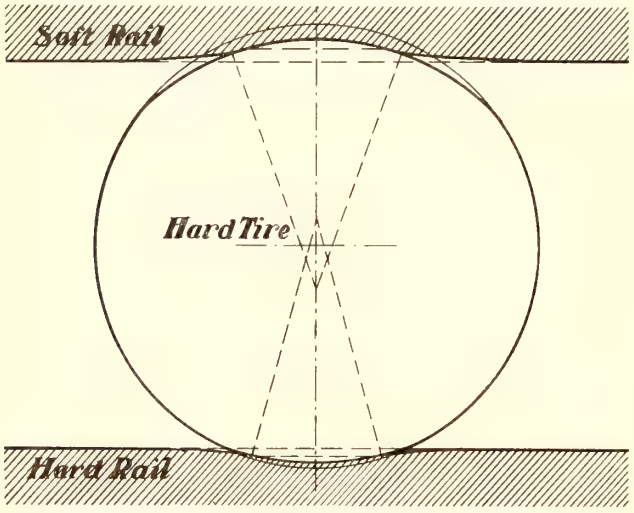


FIG. 1.—EFFECT OF HARD WHEEL ON HARD AND SOFT RAIL

To be sure, no material is absolutely homogeneous, and it is natural to expect that differences in structure will show up when corrugation occurs, but this does not necessarily imply that these differences are the cause of this appearance.

On examining the corrugations it is found that the material in the head of the rail and the depressions caused by the corrugations are disposed toward the groove rather than the outer side of the rail, hence the committee concludes that the corrugations are formed only when the action of the wheels is such as to cause a displacement of the rail material. Changes of this kind cannot occur, however, unless the wheel pressures are greater than the elastic limit of the rail. This does not mean that every individual wheel pressure need exceed the elastic limit of the rail, but that after the wheel has passed the particles do not return to exactly their original position. The sum of these small displacement increments results in corrugation. It is noted that this process of accretion is as gradual as the development of the effects of corrugation.

Without considering for the moment the absolute tension values of the track and wheel materials, it is possible to study experimentally this action of the wheel on the rail. Both are of elastic material and hence are not in contact at only one point in a line perpendicular to the rail, but in a plane whose area depends partly on the load and the compression resulting from the elasticity of the material and partly on the shape of the bodies in contact. If it be assumed for the sake of simplicity that the surface of the rail head is level, the molecular distortion of the rail produced by the pressure of the wheel tire will be greater than the actual depression of the wheel, because the molecules of the wheel spread more easily than those of the rail. Usually the wheel and rail, when both are of steel, are of fairly equal hardness, although more recently railway companies have been using hardened tires.

To show this effect graphically, a disc of hard but elastic rubber, Fig. 1, was made to represent the wheel, and two like sized square bars of rubber, one softer than and the other as hard as the wheel, were made to represent the rails. The disc was placed between the bars and then all three pieces were subjected to a uniform pressure between a plate glass disc and a wood disc applied in the direction of a selected diameter of the rubber disc. Fig. 2 is derived from the redrawn photograph shown in Fig. 1. From these experiments the following points are deduced.

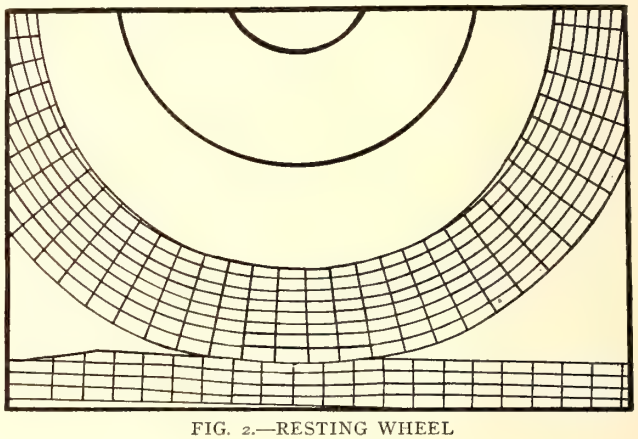


FIG. 2.—RESTING WHEEL

In both cases the flattening of the disc is less than the corresponding depression in the rail head. These elastic changes in form are not confined to the contact surfaces but spread beyond, especially in the softer rail. A longitudinal section taken through the contact surfaces shows on each side a curve which may be considered a circular arc, both of practically equal radius but greater than the radius of the wheel. Further, the wheel causes a deeper depression in the soft rail than in the hard one, and consequently the contact area and strains are greater in the soft rail, but the pressure per unit area is less. Referring again to Fig. 2, it will be noted that several lines were drawn both on the wheel and rail to show the amount of distortion that takes place. In this case the wheel is at rest and the contact surfaces and strains are symmetrically distributed on each side of a perpendicular line drawn through the axle.

The conditions, however, are very different once the wheel is in motion, even though this experiment does not permit an application of all the forces that occur in a wheel on the car. In the latter case the wheels, which themselves are somewhat elastic, are rigidly fastened to axles also possessing elasticity, and besides this, one pair of wheels receives the torque of the motor direct while

the others are trailers. The experiment, therefore, must be confined to a pure rolling motion combined with minor sliding movements.

Let it be supposed that the wheel, shown in Figs. 1 and 2, moves toward the right, as indicated by the arrow (see Fig. 3). Now if its movement is for an infinitely small period, an infinitesimal turning movement of the entire wheel about the point *A* may be substituted for the rolling motion. It then becomes clear at once that all points on the circumference to the left of *A* must have an upward movement and all points on the right a downward movement. One set of points, therefore, is adding load and the other losing load in proportion to the distance from *A*. From this it follows that the pressure resultants of the rail surfaces no longer will be at *A*, as in the case when the wheel is at rest, but they will pass through a point on the right which can also be obtained by finding the resultants of the wheel pressure and the horizontal force driving the car forward. It is easy to find the approximate course of the curve in this instance through the knowledge gained through a study of the longitudinal section of the contact surfaces shown in Fig. 2. It must form part of a parabolic curve of such type that *c* is the largest and *b* the

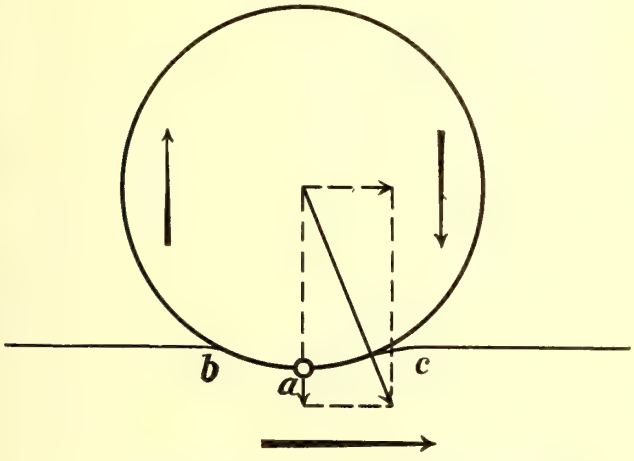


FIG. 3.—DIAGRAM OF WHEEL AND RAIL RESULTANTS

smallest radius of curvature, which almost corresponds with the radius of the wheel.

To secure experimental verification of the foregoing, the model wheel was turned and instantaneously photographed. The result, which is shown in enlarged form in Fig. 4, proves what has been said about the shape of the curve of contact. The same form is shown by the longitudinal section of actual corrugations.

Besides the pure rolling movement the average car wheel also slides occasionally, notably during the period of maximum braking, when the kinetic energy of the car pushes it forward. In this case there is no longer any difficulty in conceiving the appearance of the contact curve. Owing to the horizontal reaction of the rail material a pressure is produced on the front half of the wheel tire which is grasping the rail so much as to tend to flatten it. The curve, therefore, corresponds to the one for the stationary wheel, except that the branch on the right has greater radii of curvature, hence in general it resembles the rolling wheel. This is confirmed by Fig. 5, which shows even better than Fig. 4 that the material in the rail head is pushed forward by the wheel which strongly compresses it and forces the material to rise upward.

Of course between the curves given there is a series of variations differing in accordance to the relative proportion of rolling and sliding, but in general all of these curves are similar.

For the sake of simplicity only the longitudinal distortion has been considered, but naturally the gripping depth of the wheel depends also on the width of the contact surfaces, for the smaller the one factor the higher must be the other. The impression made by the wheel on the rail head is elastic and changes its position with the wheel.

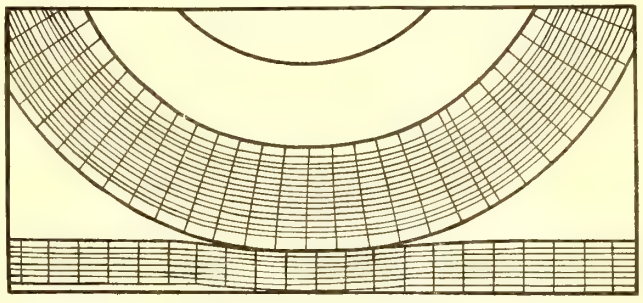


FIG. 4.—ROLLING WHEEL

Hence the rolling of a wheel over a rail originates on the head a progressive wave movement, or, in other words, molecular vibrations are generated both transversely and longitudinally. The first can last but a brief time, for even at hollow spots in the rail the wheel load tends to crush such spots and thus break up transverse movements, while the longitudinal movements continue for a long period as can easily be learned by placing one's hand on the rail after a car has passed. These longitudinal vibrations are the cause of the noise made by cars on both tangent and curved track.

Although this musical side of the theory of rolling friction is of little interest here, the vibrations which cause the noise must be considered and have already been referred to elsewhere. Those mentioned previously, however, were intended to relate to causes independent of the mutual action of the metals in contact. Both result in the same reactions in the rail and it is hard to keep them apart. It appears, however, that in some cases these disturbances from diverse causes are superimposed and at other times counteract each other.

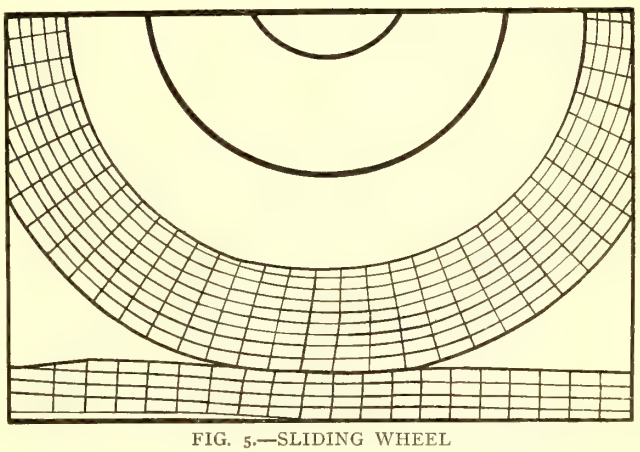


FIG. 5.—SLIDING WHEEL

In this connection it may be said that the kind of motive power and the equipment required by it cause certain oscillations which may have some influence in forming corrugations, but they cannot be the fundamental cause. The corrugations do not result directly from the vibrations, but from the stresses in the rail set up by them Just as transverse and longitudinal waves cannot appear independently, pressure and tensile stresses cannot be con-

sidered by themselves alone, no matter how accustomed we may be to treat them separately. Figs. 1 to 5 show very well that appreciable tensile stresses appear also in the rail head beside those caused by the pressure, and hence both cause deformation.

The tensile stresses are increased by rolling friction due to the moving of the wheel over the rail. With a rolling wheel there is a tendency to push the rail particles in a direction opposite to the wheel movement, and there is a similar tendency when the wheel is braked. Hence it is easy to conceive how valleys would be formed between these crests. Now in reality the wheel really never has a pure rolling motion because there is always a certain amount of sliding. Such sliding is not necessarily due to braking alone, but may arise from other causes, such as the unequal diameters of wheels on the same axle, unsymmetrical wheel tires and rail heads, a torsional twisting of the wheels owing to their unsymmetrical drive from one side, the changing resistance of the rails which are never in a true plane, and the unequal distances traveled by opposite wheels on the same axle, as is the case on all curves.

Hence, as a rule, this additional strain in the rail must be produced in a direction the same as, or opposite to, that of the wheel movement. If the conditions are such that the sum of the tensile stresses (whose direction naturally must not only be supposed to be parallel to the rail, but also normal to it) approaches the elastic limit of the rail structure or exceeds it, a permanent lengthening of certain fibers of the rail material must result. The material flows away equally on each side, is pushed forward by the wheel and at the same time compressed. The compression will continue until the producing force, which varies in amount on account of the axle torsion, is no longer large enough to cause further compression. The result of this compression is the formation of a gradually higher corrugation crest, from which the movement is repeated and further corrugations generated. Their length and depth must remain within the limits set by the wheel diameter and the differences of material in relation to the acting forces, which we may conceive as consisting of the weight on the wheel and the force driving the vehicle forward.

So aside from all differences in the rail material, which in themselves are sufficient to cause variations in wave length and depth, the latter will be fixed principally by the forces mentioned. It is clear that in operating with single cars the corrugations in general will appear as short waves, but on the other hand will increase in length with the increase in the kinetic energy applied per individual wheel because where there are many wheels, as in a train, the particles are pushed ahead much faster than they can return to their original position. Now as the kinetic energy of a braked train constantly decreases, the corrugations so caused will show this fact by their unequal wave length, the first corrugations being the longest and the later ones decreasing gradually, in correspondence with the diminution of braking effort applied. It remains to be seen, however, whether the wave lengths decrease in exactly the same ratio.

Thoroughly to understand the events which take place, it is necessary to compare again the movement of the elastic waves of the particles of the rail head in the case of a pure rolling wheel and a pure sliding wheel. It should be understood, however, that in operation we must deal with pairs of wheels connected by elastic axles subject to torsion, a condition which of course cannot be carried out in the disc experiment. In the first case the distance covered on the rail corresponds exactly to the sum of wheel perimeters, and the wave can always run backward without hindrance. With a sliding wheel, however, matters are entirely different, for the waves cannot return without opposition, owing to the steady resistance due to sliding friction at the contact area. But as the wave must go back eventually, the compression caused by the wheel pressure must be so great as to overcome even the resistance due to friction. Once this value is reached the compression wave moves backward as suddenly as a loosened spring, an action which is followed by the other waves until the car or train has come to a stop. Every action of this kind is accompanied by a shock easily perceptible on the car, the wheels of which are braked so hard as to be unable to turn. As the kinetic energy of the car is gradually diminished by braking, the compression and consequently the shock is diminished. From this it is seen that according to the circumstances under which braking occurs there must be considerable tension in the material of the rail head, from which there can be no doubt that, aside from harder wheel tires, the prime cause of corrugation arises from the sliding or braking of the wheels.

The prominence of corrugations on flat curves is now clear without further evidence, for on them there is a sliding of the wheels even without braking. This effect increases with the speed because the rail molecules cannot adjust themselves to the change quickly enough. The frequency of the corrugations will be greater first on the outer rail and then perhaps on the inner rail—possibly in most cases on the side less loaded, where the wheels take the lead and thus prevent sliding. Hence it happens that the smooth rolling on one rail produces no corrugation, while the other, with its combination of rolling and sliding, is corrugated. In Hamburg corrugation occurs mostly on the outer rail of curves between 150 and 300 meters radius.

Nothing has been said regarding the braking streaks produced in the rail when the wheel slides, yet these markings would appear suitable guides to the molecular effect produced. It may therefore be of interest to say something in regard to them. On the spots where the braking of the cars usually occurs there are, as a rule, one or more clearly defined streaks which indicate the direction of braking and apparently mark out the places of maximum pressure between the contact surfaces. Less attention, however, appears to have been given to the fact that along these lines, though sometimes isolated, there will be found occasionally short streaks whose length and intervals correspond with those of the corrugations. They are about 3 mm (⅛ in.) wide and 5 to 10 mm (0.2 to 0.4 in.) long. Sometimes they appear as single dotted lines, but at other times will be found in groups similar to the corrugation. They appear in exactly the same way on rails which have remained free from corrugation, but which lie opposite rails thus affected. From this it would appear as if they had the same origin as corrugation or else that the opposite corrugated rail had produced on the unaffected rail an effect similar to braking. Coupling this observation with the fact that these streaks are variable, we must conclude that they are caused by the braked wheels, in which also the after-push of the trailer or unbraked wheels against the motor-driven wheels may be considered a braking action. Only in one case dotted braking streaks were observed which had a width of 3 mm and an average

interval of 48.33 mm (1.90 ins.). These dotted braking streaks also must show the places of highest pressure. They are intermittent because, as already noted, the elastic waves arising when the wheel is braked are not continuous, but recoil like a spring. In such places, where a large number occur in a series, a cross section is given of the waves under tension from which conclusion regarding their length may be drawn.

In considering this explanation it may seem ridiculous at first to assert that the same wheel pressure should cause corrugations in one place and none in another, but it must be remembered that it is not the loads alone that cause corrugation, but principally the conditions already considered. It may, therefore, be of use to mention a similar phenomenon where familiarity prevents us from seeing anything paradoxical.

For instance, when in a lathe or drill a dull tool works with a given pressure and then is replaced by a sharper tool, but which has the same hardness as the material worked, it is known that no cutting will result. To secure such an effect it is essential that the tool steel should be harder and at the same time sharp or pointed, for the main thing is that it must penetrate into the material just as in any case the wear of two impinging surfaces can take place only when the molecules of one fit into interstices in the other. A wheel running on a rail, especially when it is very hard and is braked, is comparable with tool steel except that being round the least possible amount of work will be done.

No important differences can be found in the hardness of the rails at the corrugated places by tests made with steel balls. Differences in hardness could occur only where the corrugations are not fully developed. Once developed there must be a balance between the material and the external forces, from which an equal hardness would result throughout the surface of the rail head. A deepening of the valley in a fully corrugated rail is conceivable only in cases caused by hammering or falling of the wheels, which occasionally occur and may, for convenience, be termed secondary corrugations. In general, however, when the final state of corrugation is reached, the wheel cannot cause further strains exceeding the elastic limit, but is more likely to wear down the corrugations in proportion to the increase in speed.

In conclusion it may be said definitely that corrugations are caused when the surface on the rail material is acted upon by the wheels under such conditions that the tensions created in it reach a value approximating or equaling the elastic limit of the rail material. This condition can occur under the following circumstances:

(1) When the wheel tire is harder than the rail head.

(2) Through sliding wheels caused by quick intensive braking, by too sudden application of power in starting, by slipping in curves, by an unsymmetrical drive which transmits the torque unequally between the pair of wheels on the same axle, unequal diameters of wheels on the same axle, undesirable sections of tire and rail head, unequally worn wheel tires, inequalities in hardness of the rail head, etc.

(3) Through any favorable combination of the foregoing, even when any single cause would not be sufficient to effect corrugation; through further combinations with vibrations, increased speeds, increased wheel pressure and too small contact surface between the wheel and the rail on account of undesirable cross sections.

The same results are reached in the following manner: Since the corrugations have appeared only within a fairly definite period or else were previously unknown, they must have been due to novel factors in operation within that period. That this is so appears from the following list of new factors in electric railway operation:

(1) The physical changes in rails and wheels, but especially the relatively great increase in hardness of the latter.

(2) Introduction of power braking and consequent higher braking effort.

(3) Increase in pressure on the rail per wheel, particularly of the part not flexibly supported.

(4) Increase of speed.

A practical demonstration may be given with regard to the physical changes in wheels and rails. Electric railway service in Hamburg was commenced about 1894, but at first the old wheel tires which were as hard as the rails (tensile strength of 60-65 kg. per sq. mm). No corrugation occurred. In 1896 harder wheel tires (92 kg. per sq. mm) were introduced and corrugations appeared as rapidly as the new wheels were introduced. Not only did they occur on the new rails, but also on old ones which through years of service had never shown this phenomenon before. In one instance a change from steam railroad operation with soft tire wheels to electric service with hard tire wheels on one of the old lines quickly produced corrugation.

PANTOGRAPH COLLECTOR FOR HIGH SPEED ELECTRIC RAILWAYS

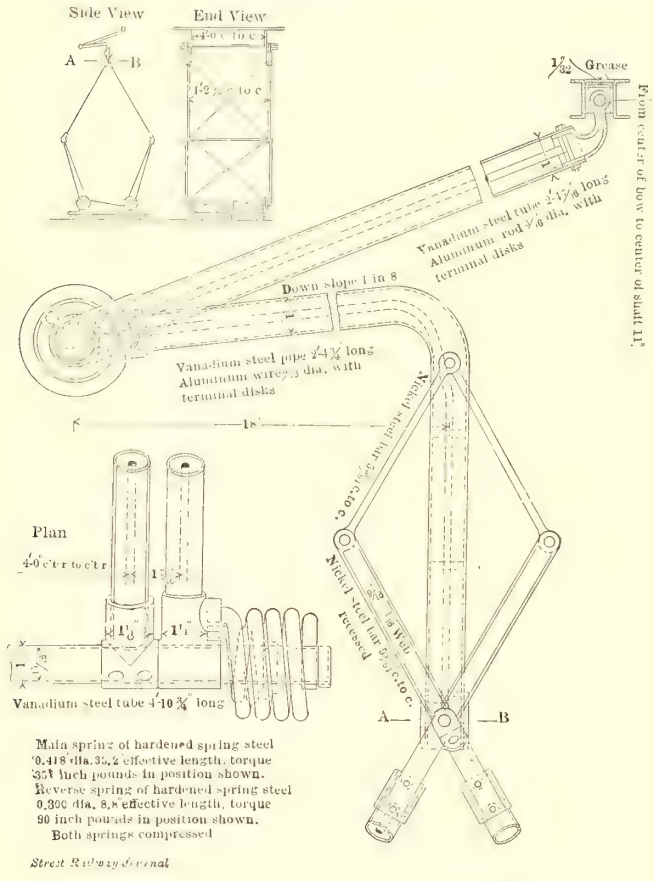
BY JOSEPH MAYER.

The contact wire which forms the track for the sliding bow used on high speed single-phase railways is suspended either at short or long intervals. In the former case the weight of one-half span of contact wire is generally much less than the upward pressure of the sliding bow and is called the contact pressure. The wire is therefore bent up by the bow beyond the supports. In the latter case the wire of one half span weighs more than the amount of the contact pressure. It is lifted by the bow from its normal sag, but to a position still below the horizontal between the two supports. In both cases the bow moves along vertical curves. At high speeds this produces a considerable amount of centrifugal force which, according to its up or down direction, increases or reduces the contact pressure. The increase should not be so large as to produce dangerous bending strains in the wire; the reduction should not be so large as to cause separation of the bow from the wire and consequent sparking.

The centrifugal force of the bow and its supporting frame is proportioned to the weights of the parts which move in curves and to the square of their speed, and is inversely proportional to the radii of curvature of their motion. It is therefore evident that it is large in bows, having a heavy supporting frame which has to follow exactly the motion of the bow where the latter moves along curves of short radius. Such bows are impracticable at high speeds. Various methods have been employed for obtaining a reduction of the centrifugal force; all have this in common that springs are introduced between the contact point and the heavier parts of the frame. The bow itself may be made of spring steel so that only the parts near the contact point closely follow the motion of the latter. One difficulty with this design is the low conductivity of spring steel and the large cross section required with the largest currents supplied to electric locomotives, but it may be practicable with the moderate currents needed with very

high voltage. This spring bow may be carried on an ordinary diamond frame or on two long trolley poles, or it may be supported by means of additional springs inserted between it and the heavier parts of one of the various forms of frames.

The design here illustrated and invented by the author of this article uses an aluminum bow carried by light tubular radial arms which by swinging around a shaft give the



DETAIL OF PANTOGRAPH COLLECTOR

bow an adequate range of vertical motion independent of the heavy frame below. The springs are between the shaft and the frame. The wind pressure on the bow and arms, due to a strong head wind and high train speed, turns the radial arms down if they point backward and up if they point forward. In the first case the remaining range of downward, in the later that of upward, motion is decreased. To reduce the effect of the wind pressure on the position of the arms reverse springs are introduced. The arms are firmly bolted to the shaft and are pressed up against the wire by the main springs, which are under compression and are attached to the shaft and the bent tubes carrying it. The reverse springs are only active during the upper part of the range of motion of the arms. They are so attached that they push the arms down and cease to act after a certain position is reached. They are also under compression and have the same stiffness as the main springs, they are smaller because exposed to less strain. Any change in the torque transmitted to the springs by the radial arms results in only half as much turning of them within the range of action of the reverse springs as outside of it. This halves the reduction in the range of easy motion of the bow caused by the wind pressure. The frame below the radial arms must, in this design, produce during its uniform upward motion a contact pressure of 15 lbs. and one of not over 19 lbs. during its uniform downward motion.

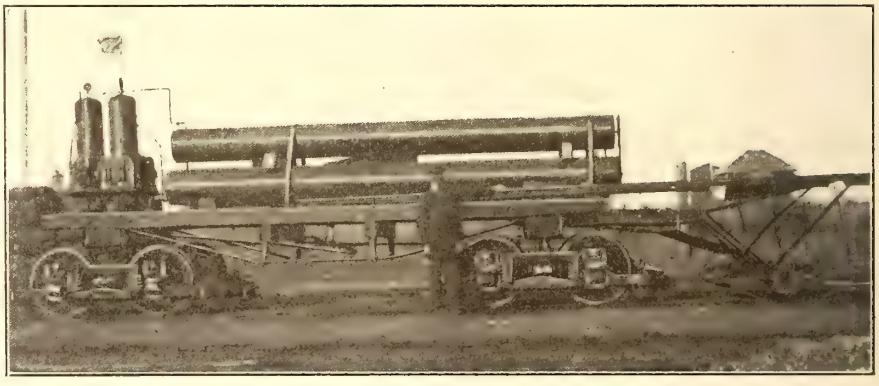
When the direction of motion of the sliding bow, along a wire hung with long spans and considerable deflection is changed at a suspender, from an upward to a downward slope, only the light bow and the radial arms quickly turn down, the compression in the main springs and consequently the contact pressure rapidly increase by a calculated safe amount. The heavy frame at first continues to move up, but with a retarded motion; it soon comes to a stop and begins to move down with an accelerated motion. The radial arms then turn up again, the contact pressure decreases and the downward motion of the frame is gradually stopped; it then begins to move up again. After a few oscillations the swinging of the radial arms ceases by the friction, the frame falling and rising then together with the bow. With the design here shown the contact pressure is not materially affected by the wind pressure or by the forward or backward direction of the radial arms. The needed length of the radial arms depends on the kind of suspension of the contact wire, on the size of wire and on the train speed.

The illustration shows a bow calculated for a 600-B and S-gage wire hung by the saddle suspension with 220 ft. spans and 4 ft. maximum vertical deflection, with a maximum train speed of 50 m. p. h. By using smaller deflections of the wire with 200 ft. spans and shorter sliding bows speeds of 80 m. p. h. can be provided for.

A WEED BURNER

BY C. L. GREER

The Northern Texas Traction Company operates an interurban line thirty-five miles in length between Fort Worth and Dallas, in the State of Texas. Much of the country traversed has a heavy growth of weeds and grass, necessitating the expenditure of considerable labor to keep the track clean. For almost the entire distance the track and right of way is covered by a grass, known locally as "Johnson grass." This grass is very tenacious and is kept down



SIDE VIEW OF WEED BURNER

only with great difficulty. As the roadbed is of crushed rock for most of the distance it was practically impossible to remove the weeds by cutting them off at the surface of the earth. After vainly trying other methods of overcoming the trouble the company constructed the weed burner shown in the accompanying engravings. The burner is mounted on a flat car and is slowly run over the track, while the flames from the burners destroy the vegetation below. The oil for the burners is common crude fuel oil.

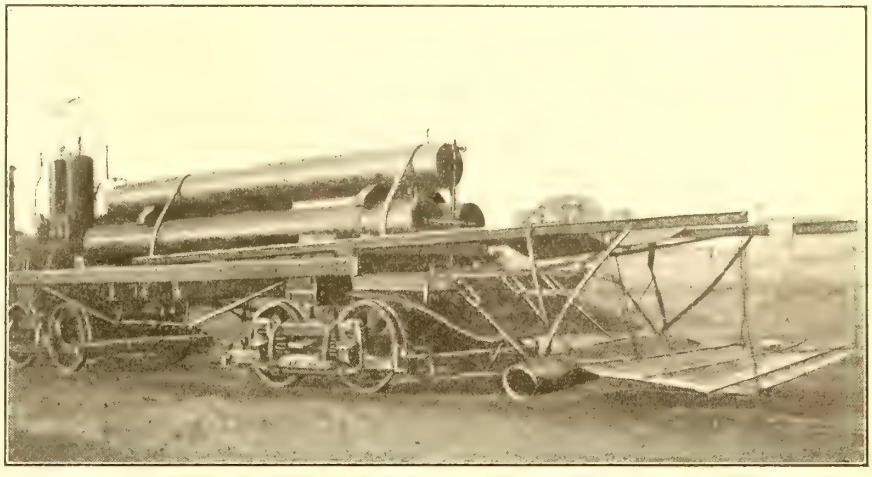
The outfit consists of a motor-driven air compressor, two air reservoirs, three oil reservoirs and four burners, together with the necessary valves and fittings. There are two air pipes, one to put pressure on the oil in the oil reservoirs and the other to furnish a jet of air to break the oil into a spray at the burners.

It will be noticed from the plan, Fig. 2, that the oil pipe from each oil reservoir is tapped into a pipe from the air reservoir, and this pipe is lead to a header from which the burners are fed with oil. It will also be noticed that the air for spraying the oil is brought to the burners in pipes which pass at their lower ends inside the oil pipes and terminate at the burners. The flame from the burners is directed downward and outward by the shield and split pipe shown. The latter is carried just above and at right angles to the track. It is a section of 10-in. pipe containing on one side holes to receive the burners and on the other side a 6-in. slot reaching its entire length, or nearly so. It is through this slot that the flames from the burners pass to the track below. Just above the burners is a large sheet iron shield which holds the heat and flame down to the track and prevents any serious disturbance of its position by the wind. On top of each oil reservoir is a small release valve to remove pressure from the oil while the outfit is not in use. The air compressor has an automatic governor which cuts out the motor when the desired air pressure is attained and cuts it in again when the pressure falls below a certain value. The current for the compressor motor is supplied through a wire from the motor car.

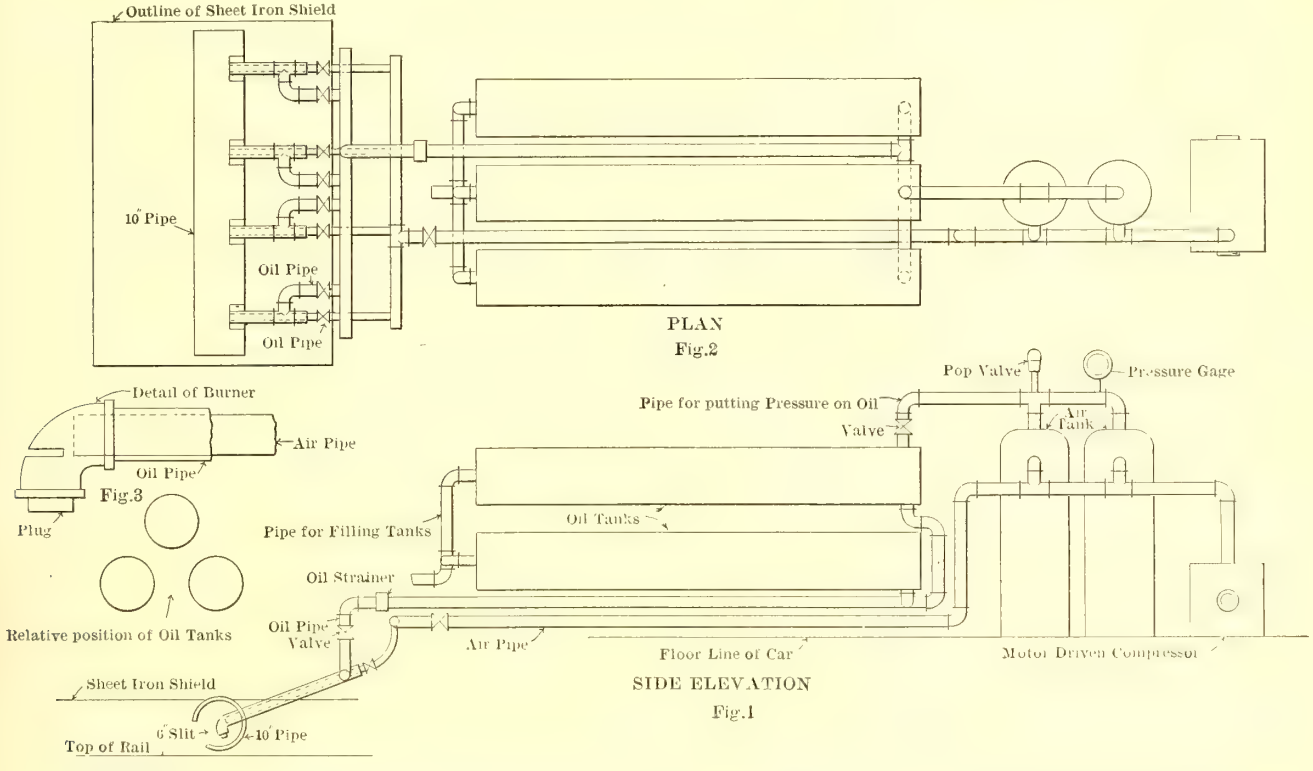
Fig. 1 shows a side elevation of the outfit; Fig. 2 shows a plan or top view, and Fig. 3 shows a detail drawing of the burner, which is made of a common ell with a hack saw slit in it and one end plugged up.

These drawings do not represent the exact arrangement of the device, but show enough of its main features to enable others to construct such a machine.

This device has been effective in clearing the track of weeds and grass and has saved a large amount of labor. The oil reservoirs used are some formerly employed by the company for storing air on their cars, and the compressor was taken from an air brake outfit. Barrels of water or fire extinguishers are carried on the car to put out a fire should the ties ignite or should the fire get from the right of way on to neighboring ground.



PART END VIEW OF WEED BURNER

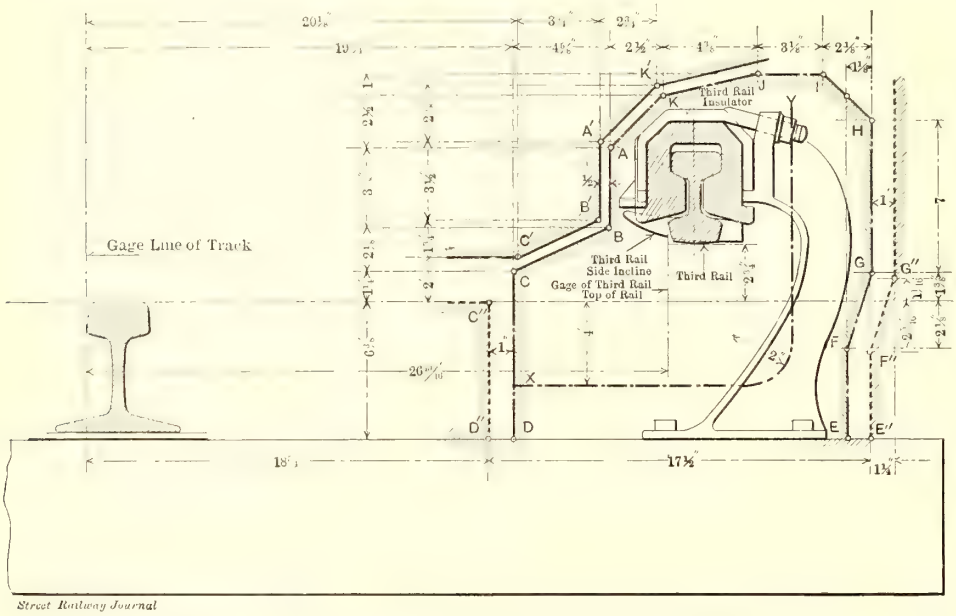


SIDE ELEVATION, PLAN AND DETAILS OF WEED BURNER USED BY THE NORTHERN TEXAS TRACTION COMPANY

The device was designed by G. H. Clifford superintendent; E. L. White, chief engineer, and Theodore Taylor, master mechanic of the interurban division of the Northern Texas Traction Company.

STANDARD LOCATION FOR THIRD-RAIL WORKING CONDUCTORS

As stated last week the committee on standard location for third-rail working conductors of the American Railway Association made a report Oct. 30. The committee consists of W. G. Besler (chairman), vice-president and general manager, Central Railroad of New Jersey; D. D. Carothers, chief engineer, Baltimore & Ohio Railroad; J. F. Deems, general superintendent of motive power, rolling stock and machinery, New York Central lines; Theo. N. Ely, chief of motive power, Pennsylvania Railroad; Geo. Gibbs, chief engineer of electric traction, Long Island Railroad; J. M. Graham, vice-president, Erie Railroad; W. Renshaw, superintendent of machinery, Illinois Central Railroad; W. J. Wilgus, vice-president, New York Central & Hudson River Railroad. The report follows:



NEW YORK CENTRAL, UNDER CONTACT, THIRD-RAIL TYPE (THIRD-RAIL INSULATORS SPACED 11 FT., CENTER TO CENTER)

REPORT

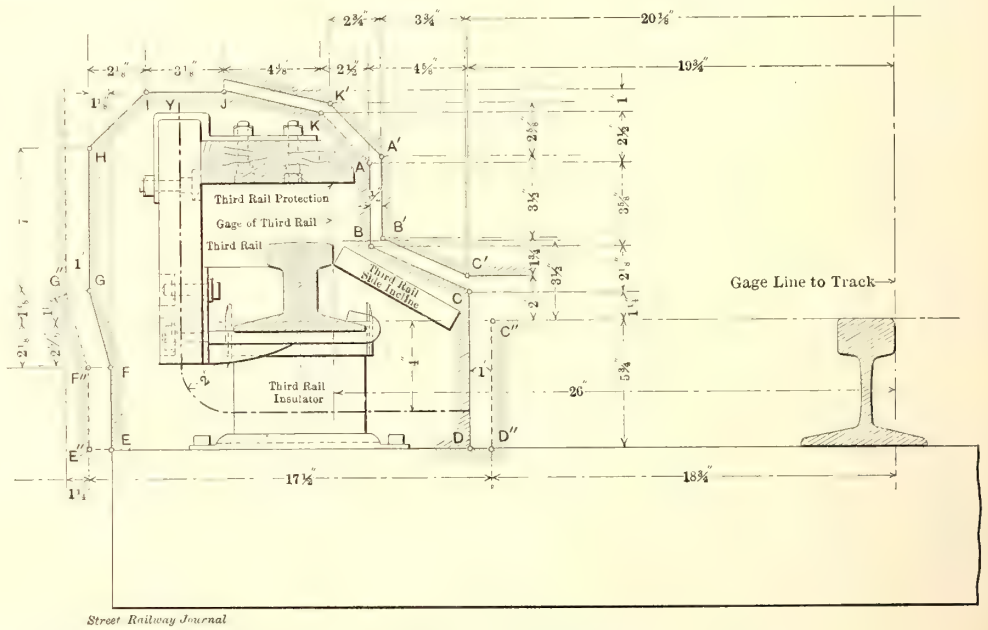
A committee of the association has been appointed to establish a standard location for third-rail working conductors on electrically operated railways for the purpose of facilitating interchange of equipment, electric or otherwise, between different roads.

As the third-rail must be located adjacent to the track rails, the question of interference with existing permanent way structures and with existing rolling stock becomes of importance, and in order that the committee may establish a location for the third-rail which will interfere least with existing equipment, this circular of inquiry has been prepared, and prompt and full reply from members is requested.

A diagram is herewith submitted showing the two types of existing third-rail construction in most extensive use, *i. e.*, the "Top Contact" type, as used by the Pennsylvania Railroad, the Long Island Railroad and others, and the "Under Contact" type, as used by the New York Central & Hudson River Railroad and others.

The line A-B-C-D-E-F-G-H-I-J-K shown thereon is the limiting line for third-rail structure, and is determined by the composite sections of the different types. In preparing this outline, allowance has been made for the variations which will necessarily occur in the alignment with respect to the gage line of the track and in the elevation with respect to the top of the track rail. These variations occur, due to the wear of the rail head and to the fact that the rail may be deflected from weight of passing equipment, between those ties which support the third-rail, without equal deflection of the latter. Another cause for variations is the wear which takes place in the tie, lowering the track rail without a corresponding lowering of the third-rail. It should therefore be understood that the line A-B-C-D-E-F-G-H-I-J-K is the line beyond which the third-rail structure shall in no case extend, all variations in the third-rail with respect to the base line (top of rail and gage of track) being included.

The line K'-A'-B'-C', the limiting line for rolling stock, has been plotted by allowing ½ in. working clearance between this line and the limiting line of third-rail structure, and it is considered that rolling equipment should under no conditions of wear or distortion due to broken springs, etc., extend beyond this line.



LONG ISLAND RAILROAD, TOP CONTACT, THIRD-RAIL TYPE (THIRD-RAIL INSULATORS SPACED 10 FT., CENTER TO CENTER)

As the third-rail contact shoe is carried on the truck, which has usually a very short wheel base, the distance from the end of the shoe to the gage line of the track is not ap-

preciably affected by curvature of the track, and it is therefore not possible to place the third-rail structure at an appreciably greater distance from the gage line of the track on curves than on tangent track. It should therefore be understood that the line K'-A'-B'-C' is the limiting line for rolling equipment on curved as well as tangent track. Allowance in equipment clearance, however, should be made for curved track, depending on the degree of track curvature and the distance between truck centers of the cars, and, to cover yard conditions, the offset of rolling equipment should be figured on curves as sharp as 20 degs.

In making this allowance, the side throw of car body as a whole, due to truck bolster end movement, should be added to the total of the horizontal variations, given in the table below, and the effect determined upon clearances of such portions of equipment as steps, truss rods, hoppers, tool boxes, etc. This end movement of bolsters may be taken as 2⅝ ins. for passenger, and ⅜ in. for freight equipment. It should also be noted that the third-rail may be placed on either the inside or the outside of the curve.

HORIZONTAL VARIATIONS IN ROLLING EQUIPMENT SHOULD BE ALLOWED AS FOLLOWS:

Wear of axle, collars and boxes	9-16 inch.
End play of brasses	1-8 inch.
End wear on brasses	1-4 inch.
Wear on wheel flange	3-8 inch.
Clearance between new flange and rail	3-16 inch.
Constructional variations	1 inch.
Total	2 1-2 inches.

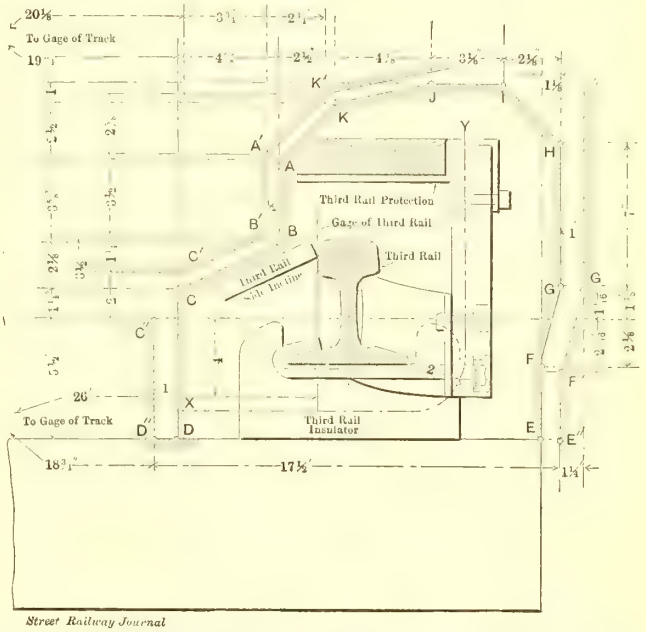
VERTICAL VARIATIONS IN ROLLING EQUIPMENT SHOULD BE ALLOWED AS FOLLOWS.

	Passenger.	Freight.
Wear of journals and brasses	3-4 inch.	3-4 inch.
Radial wear on wheels. (Passenger, steel tires; freight, cast iron tires)	1 1-4 inches.	1-4 inch.
Compression of springs	4 1-4 inches.	1 3-8 inches.
Sagging at center of car	1 inch.	1 inch.
Constructional variations	1 inch.	1 inch.
Total	8 1-4 inches.	4 3-8 inches.

The line C"-D"-E"-F"-G" represents what is considered the desirable clearance line for continuous permanent way structures. This has been determined by allowing a working clearance of one inch between it and the limiting line of third-rail structures, and applies particularly to such permanent way structures as station platforms and bridge girders. As the station platforms are usually supported independently of the ties, and the third-rail structure is supported by the ties, and as the ties are occasionally shifted with respect to the platforms, the considerable clearance shown is deemed necessary. All variations in the permanent way structures, due to variations in dimensions, warping, or deflection of material, should be allowed for, and the results should not encroach beyond the line of C"-D"-E"-F"-G", the clearance of one inch net being allowed for the possible subsequent shifting of the track as a whole.

The line XY is the allowable clearance line for non-continuous permanent way structures, such as bridge gussets or other structures which are not continuous for length greater than the distance between the third-rail ties or between the brackets supporting the third-rail protection. In other words, it is a line to which the permanent way may project, provided it comes between the third-rail supports and between the third-rail protection brackets.

You are requested to analyze your clearance diagrams and send detail information of the cases where your rolling equipment or your permanent way interferes with the suggested clearance lines, together with a statement of how difficult it would be to make changes which would prevent such interference. A form of reply is given herewith. The committee will be glad to receive any suggestions that you may see fit to make for the purpose of aiding its work.



WEST JERSEY & SEASHORE RAILROAD, TOP CONTACT, THIRD RAIL TYPE (THIRD-RAIL INSULATORS SPACED 8 FT., CENTER TO CENTER)

1. Does your rolling equipment interfere with the suggested clearance lines?
2. If so, what part of your equipment?
3. Please give details.
4. Will it be difficult to make the changes necessary to prevent such interference?
5. Please answer for both general and electric equipment.
6. Does your permanent way interfere with the suggested clearance line?
7. If so, in what particular?
8. Please give details.
9. Will it be difficult to make the changes necessary to prevent such interference?
10. Is any portion of your line operated electrically?

Remarks—

PUBLICATION OF INTERURBAN OPERATING RULES RECOMMENDED BY THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

The Central Electric Railway Association, through its committee on rules, has published as a neat 4-in. x 6-in. forty-page pamphlet, the "Standard Code of Rules for Interurban Railways," submitted at the meeting of the association held in Columbus, Ohio, on Sept. 26, 1907. Owing to the fact that these rules are classified differently from those adopted at the Kingston meeting of the Street Railway Association of the State of New York on Sept. 21, 1907, it is not practicable to compare them. It is worth noting, however, that they differ in quite a number of respects from the New York rules, having been prepared to meet the conditions peculiar to the majority of interurban systems in Indiana and Ohio. These rules, as stated in the convention report, are not binding upon the members of the association in any way, but are offered simply as a set of regulations which the different companies can modify to meet individual needs. The chairman of the committee is F. D. Carpenter, general manager of the Western Ohio Railway Company, of Lima, Ohio.

CORRESPONDENCE

RAIL CORRUGATION

Philadelphia, Oct. 30, 1907.

Editors Street Railway Journal:

In your "Convention Report-1," of recent date, in quoting my remarks on "Rail Corrugations," it appears that they may leave a vague idea, and in some respects may cause an erroneous conclusion. Therefore, I thought it well to write this in order to establish the correct thought that it was desired to convey.

The idea advanced was, that corrugations were caused by the elongation of the upper surface of the metal of the rail under traffic or rolling action of the wheels. That such elongation does take place is an established fact. This can be seen in all old tracks which appear in the streets in vertical and horizontal curves; the length of the curves being the length of the rail in both planes. The horizontal curves have their rise at the middle of the rail, the joints being outward of the track, forming a wide gage at these joints. When an old track is taken up, the loose rails are distinctly and permanently curved. How could these curves be explained otherwise than by the elongation of the upper surface under the rolling action of the tread of the wheel and the friction of the flanges against the gage surface of the rail? The expansion of the exposed portion of the metal, due to the variation in temperature, could have very little, if any, influence upon this—for it works in both directions, and therefore has a compensatory effect.

In order to understand this rolling action that causes the elongation, it can readily be assumed that the weight or pressure of the wheels produces an indentation in the surface of the rails. This indentation is moved along causing the upper layer of the metal to flow in the direction of the traffic. When the movement of the wheels is slow it permits the metal to assume its original position on account of its elasticity. But when this movement is rapid, the stresses produced by this flow of the surface of the metal, results either in curving of the rail (elongation of the surface), when the rail is on a loose foundation; or in case of a solid foundation, which permits of no such distortion, it results in gradually pressing or rolling the surface metal until a maximum compression is reached when the metal is formed into a hump, over which the wheels roll over and begin their action again; thus forming elevations and depressions at regular intervals—corrugations.

In assuming a cause, in explanation of a phenomenon, such an assumption may only then be dignified a theory, when, if not all, at least most of the known facts relative to such a phenomenon may be explained by this theory. And it appears to me that by careful analysis it will be found that by assuming the above theory as the cause for corrugations, all the varying, peculiar and seemingly contradictory manifestations of corrugations can be readily explained by it.

From the quotation it may further appear that there was an advocacy of a dirt foundation for track construction. This is entirely contrary to what it was desired to assert. In order to explain under what conditions corrugations cannot occur it was assumed, and this is quite evident, that cars run on two parallel lines of rails loosely placed on the surface of the earth, and without being held down in any way, will never cause any corrugations. But in a question of track construction there are so many important and paramount considerations which must govern the decision, that the trouble of corrugations is but secondary. Economy in the permanency of road-bed and paving, to avoid the ruinous expense on the maintenance of track, paving and rolling stock, the life of rail and joints, etc., is of so much vaster importance that the question of possible occurrence of corrugations (while the latter may be a contributing cause), can influence the decision but slightly; aside from the fact that in paved streets loose tracks of such construction as mentioned above, and where corrugations cannot occur, is out of the question, as it cannot be built. Therefore, there can be but one conclusion, that a firm and permanent foundation, with the rail held on it as firmly as it is possible to attain in practice, and an ideal one, upon which rails may be renewed without the disturbance of the foundation, such as concrete, is the only practical and economical construction that can be advocated for paved streets, and especially so on busily traveled streets. Corrugations will or may occur, but after one thorough, or possibly two filings, they will never become a cause of annoyance again; for the upper and gage surface textures will be compressed into such hardness that the wheel will not produce further indentations.

One other point is necessary of correction: for the words "systematic investigation" should be substituted "scientific investigation," which was stated, and is probably a transcription error. Systematic investigations have been made, such as could be accomplished under conditions that already exist. But in order to make a scientific investigation, conditions must be created especially for such an investigation, as it was mentioned in the discussion. Of course, the expense may be such that only a large association such as the American Street & Interurban Railway Association can afford to undertake.

C. B. Voynow.

MEETING OF THE ELECTRICAL INSTITUTE ON NOV. 8 TO DISCUSS ELECTRIC LOCOMOTIVES

The American Institute of Electrical Engineers has set aside Friday evening, Nov. 8, to a paper on the comparative performance of steam and electric locomotives, by Albert H. Armstrong, of the Railway Engineering Department of the General Electric Company. Mr. Armstrong's paper treats of steam and electric locomotives with particular reference to the operating expense as affected by their different characteristics. Among those scheduled to take part in the discussion are Cary T. Hutchinson, consulting engineer, New York; Frank J. Sprague, consulting engineer, New York; W. J. Wilgus, vice-president N. Y. C. & H. R. R. R. Co., New York; N. W. Storer, electrical engineer, Westinghouse Electric & Manufacturing Company, Pittsburg, Pa.; George R. Henderson, mechanical engineer, New York; L. B. Stillwell, consulting engineer, New York; J. G. Muhlfeld, superintendent of motive power, Baltimore & Ohio Railroad, Baltimore; B. F. Wood, electrical engineer, Pennsylvania Railroad, Altoona, Pa. An extended report of the meeting together with Mr. Armstrong's paper will be published in the next issue of the Street Railway Journal.

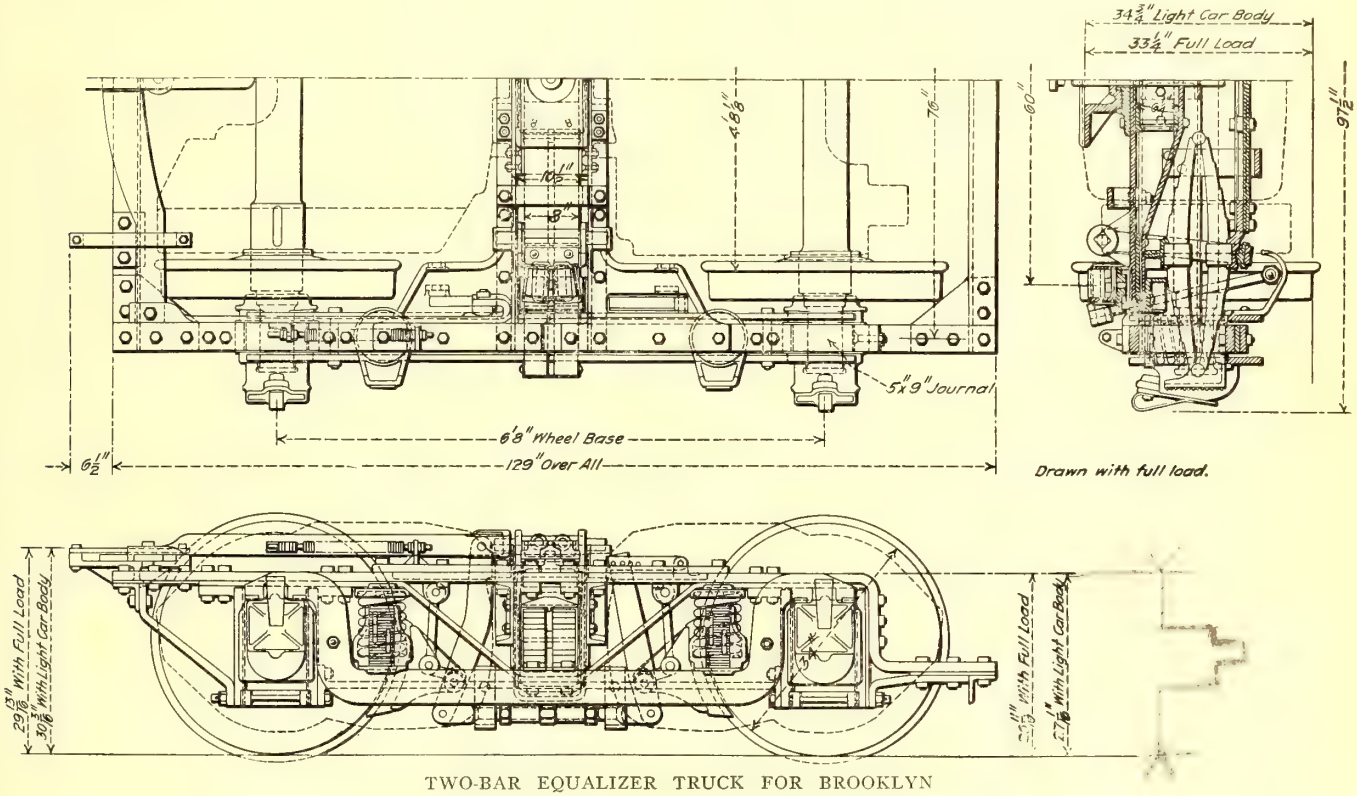
NEXT CENTRAL ELECTRIC MEETING

The next meeting of the Central Electric Railway Association, which was scheduled for Nov. 21, will probably be postponed until Nov. 25 or Nov. 28.

TWO-BAR EQUALIZER TRUCK FOR TRANSIT DEVELOPMENT COMPANY

The accompanying drawing shows one of the 101 motor trucks now being built by the American Locomotive Company for the Transit Development Company, which purchases the rolling stock for the Brooklyn Rapid Transit System. These trucks are to be used under the 1907-type of semi-convertible elevated motor cars, and are for delivery during October and November.

The general design was prepared by the builder in consultation with the company's engineers and embodies all of the features of the American Locomotive Company's standard interurban truck. At the same time the details include many of the Brooklyn Rapid Transit patterns. A careful study of the engraving will show the distinguishing features of the design. The more prominent of these are the cast-steel transom gussets which tie the side frames and transoms and embrace in the one casting swing-link bearings, brake hanger brackets or lugs and brake release-spring brackets. This feature of the design eliminates a number of small castings, bolts and rivets, which are generally used when each of the foregoing parts are separate details. The general dimensions, clearances, etc., are made to conform to the requirements of the cars. It will be noted that this necessitated the dropping of one end of the top frames to clear the car body platforms.



TWO-BAR EQUALIZER TRUCK FOR BROOKLYN

The general dimensions and specifications are as follows:

Type, 2-bar equalizer and swinging bolster.
Gage of track, 4 ft. 8½ ins.
Wheel base, 6 ft. 8 ins.
Total length, 10 ft. 9 ins.
Transverse centers of frames, 6 ft. 4 ins.
Height top of rail to top of car body center plate, 34¾ ins.
Load at center plate, 28,500 lbs.
Wheels, 34 in. dia.
Axles, 6½ ins. dia.
Journals, 5 ins. x 9 ins.
Boxes, Symington.
Springs (under bolster), double elliptic.
Springs (on equalizers), double coil.
Weight without motors, wheels or axles, about 6500 lbs.
Weight complete with motors, about 12,000 lbs.

THE STRENGTH OF STRUCTURAL TIMBER

Recent tests by the Forest Service of loblolly, longleaf and Norway pines, tamarack, Douglas fir and western hemlock show longleaf pine to be the strongest and stiffest of the timbers, with Douglas fir a close second; while western hemlock, loblolly pine, tamarack, and Norway pine follow in the order given. Fortunately, Douglas fir and western hemlock, of which there are comparatively large supplies, have high structural merit, as has also loblolly pine, the chief tree upon which the southern lumber companies are depending for future crops. Much of the information hitherto available concerning the strength of timber has been secured from tests of small pieces without defects. This cannot safely be assumed to hold good for large-sized timbers as found on the market, since these commonly contain such defects as checks, knots, cross grain, etc. The location of the defects varies the extent to which they lessen its strength; and the proportion of heart and sap wood, and the state of seasoning, must also be considered. Circular 115 of the Forest Service, just issued, which gives the results of tests conducted during the past four years, will be mailed upon application to The Forester, Forest Service, Washington, D. C.

Both city and interurban cars of the Mahoning & Shenango Railway are being equipped with Schoen steel tire wheels. New wheels are 34 ins. in diameter and they will be worn down to 29 ins., when it is expected to turn them and equip them with steel tires. For high-speed service ⅞-in. flanges are employed. On low-speed work a ⅝-in. flange is used. The flanges are turned in the shop to suit the service.

BALTIMORE COMPANY MAKES RECORD HANDLING "OLD HOME" TRAFFIC

An "Old Home" celebration was held in Baltimore beginning Oct. 13, and extending to Saturday, Oct. 19. Like similar events of its kind, it resulted in a large attendance at the special entertainment features of people from even remote parts of the country.

Various estimates have been made of the number of people participating, but they are all speculative, with the exception of the returns of traffic of the United Railways & Electric Company, which reports having carried more than 3,000,000 passengers, a figure which does furnish a basis for estimating the number of visitors. Naturally the entertainments arranged imposed extra obligations upon the company, and made it necessary, temporarily, to modify the operation of cars to suit the requirements of the occasion. In many cases service was entirely abandoned on certain routes for short periods, while on others cars were operated over only a part of the line. In addition special plans had to be made for meeting the exigencies of the situation in the evening, when celebrations were held, continuing till a late hour, and throwing the burden of transporting all the celebrants within a very short period. Briefly, the events may be summarized as follows: Sunday, German Singing Society Concert at Druid Hill Park; Monday, baseball parade; Tuesday, military parade and bombardment of Fort McHenry; Wednesday, fraternal orders parade; Thursday, municipal parade, municipal pageant, regatta; Friday, carnival parade.

The instructions to the employes included all assignments at points along the different lines, and full details as to the operation of the lines, including the routes, the increasing of service and all arrangements affecting the operation of cars. The complete schedule of events for the week was also made readily available for consultation. Despite the obligations imposed upon the company a record was made for handling traffic that evoked favorable editorial comment from all the newspapers, and resulted in a letter of commendation from Mayor Mahool to President House of the company, as follows:

"My Dear Mr. House: It is doubtful if anybody in Baltimore has been more severely tried than has the United Railways & Electric Company during the past week. Your corporation and our admirable police force have been the main sufferers during this week of enjoyment. With such immense throngs frequenting the streets as has marked the past seven days, it is a matter of great wonder to me how your corporation succeeded in handling the people half so well as it did. Really, I hardly see how anybody but a chronic grumbler could complain at the car service.

"I know about as well as anybody in Baltimore how difficult was your problem. That is why I watched the service so closely myself and also made special inquiry all along the line. Be it said of your corporation that almost everybody is commending the United Railways Company for its general efficiency. Of course, nobody expected car service in the midst of crowds like that to be as regular and as comfortable as it is under normal conditions, and yet, as a matter of fact, I found that it was comparatively easy to secure transportation and to secure it under satisfactory comforts when all the surrounding conditions are properly taken into consideration.

"I want to publicly thank you for the extraordinary labor on the part of yourself and all members of your corporation, in thus serving the comfort of our people. I feel very appreciative myself and I feel satisfied that every Baltimorean and that every visitor approves these views. Very truly yours,

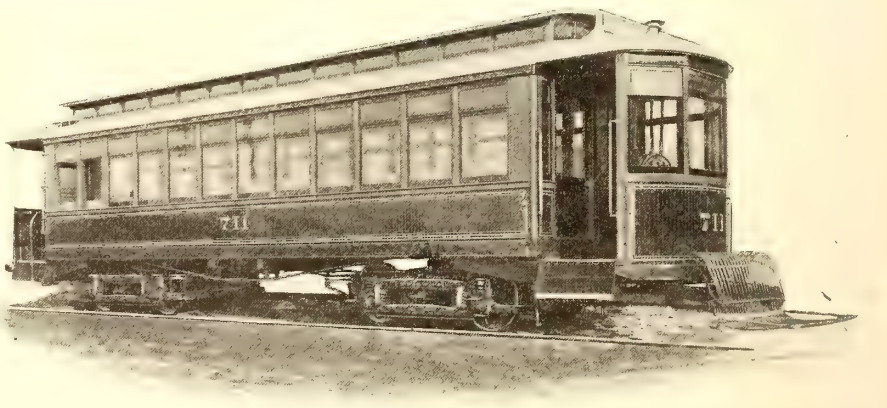
J. Barry Mahool, Mayor.

OVERCOMING MOTOR LEAD TROUBLES ON DOUBLE TRUCK CARS

Troubles with motor leads on double-truck cars are being obviated on the Mahoning & Shenango Railway by bringing all four leads up over the top of the motor and cleating them over the shell with a four-wirewood cleat held by bolts screwing into the shell. The leads are then brought up with an S bend to the car body at the bolster, and are secured to the car body by two four-wire wood cleats, placed one on each side of the connectors. These cleats also serve to hold in place the short sections of circular loom with which the connectors are covered. No tape is employed. An additional four-wire cleat, which might be termed a floating cleat, is bolted over the wires as they make the S bend. This cleat and the wires as well are held away from the bolster by a small wire attached to the motor-shell.

THIRTY-FIVE NEW CARS FOR OMAHA

The Omaha & Council Bluffs Street Railway Company has considerably added to its rolling stock of late to the extent of 35 closed cars built by the American Car Company. Thirty of these cars—28 ft. in length—have longitudinal seats, as they are for local service, and as much standing room as possible is allowed for. The 34-ft. cars, which will run between Omaha, Benson, Florence, Dundee and Council Bluffs, have the transverse seats in the center with longitudinal seats at the rear occupying the space of two windows. The distinctive, if not unusual, feature of both lots of cars is the method employed of handling the passengers. The cars run in one direction only and the door at the front end is placed to one side so that passengers on entering and leaving will not interfere with the motorman, who has a compartment to himself which extends from the car body to the corner vestibule post. The platforms at the rear are of the familiar "Detroit" type, which solves the problem of how best to handle a number of passengers at the same time. Since only the large car is shown in the engraving, the dimensions of that type are given. They are as follows: Length over end panels, 34 ft.; over crown pieces, 45 ft.; width over sills including sheathing, 8 ft. 3 in.; height from floor to ceiling, 8 ft. 4¼ ins.; from track to under side of sills, 9 ft. 7¾ ins.; size of side sills, 2¾ ins. x 7¾ ins.; end sills, 4½ ins. x 7¾ ins.; sill plates, 8 ins. x ⅝ in. These cars are mounted on No. 27-El trucks with 6-ft. wheel base.



ONE OF THE LATEST OMAHA CARS, READY FOR SERVICE

LEGAL DEPARTMENT*

INTOXICATED PASSENGERS

A railroad company is not obliged to accept as a passenger a person who is so intoxicated as not to be able to take care of himself or as to be dangerous to fellow passengers. If an intoxicated person does, however, gain entrance to a car, the duty arises of protecting other passengers from injury through his acts. Thus, in a recent case in the Supreme Court of Alabama (Montgomery Traction Co. vs. Whatley, 44 So., 538) it was held that where a street car passenger was so intoxicated as to be unable to stand, and his condition was known to the conductor, the latter was negligent so as to charge his employer with liability in permitting the drunken man to walk up and down the aisle when the car was in motion, with the result of falling upon and injuring a fellow passenger. Such liability has been carried quite far, as, for instance, in the recent decision of the Court of Appeals of Georgia in Grimsley vs. Atlantic Coast Line R.R. (57 S. E., 943), wherein it was held that whether, in the exercise of the extraordinary care required, the servants of a carrier should have apprehended that an intoxicated passenger, who was armed with a pistol and who had been shooting it while on the train, would jump from the train at a station and fire the pistol into the coach, injuring another passenger, is a question to be decided by the jury, and not by the court on demurrer.

Although, as above stated, access may be refused, a certain duty is imposed upon the carrier to protect the intoxicated person himself, if once aboard a car or other vehicle, from danger arising through his condition; and this, notwithstanding voluntary intoxication is not a defense for criminal acts, and an intoxicated condition may always be taken into consideration as one of the circumstances to show contributory negligence. Thus, in Doherty vs. California Navigation, etc., Co. (91 Pac., 419) in the Court of Appeal of California, it was held that where the captain of a steamship discovered a passenger lying in a drunken and helpless condition on the floor, and, with knowledge of his helplessness, lifted him to his feet and left him without any support, whereupon he fell and broke his arm, the captain did not exercise the full degree of care required by rendering assistance sufficient in the case of a sober man, but was bound to exercise such care as he could to avoid an accident in the situation presented to him. The court said in part:

"For an injury resulting from prior or concurrent negligence contributed he could not recover, but if the defendants with knowledge of the plaintiff's danger in the performance of the duty owed by them could have prevented the injury, they were bound to do so, and their breach of duty would be the legal cause of the injury, unless at the time of the injury the plaintiff by the exercise of due care could have avoided it. If the plaintiff could not have prevented the injury to himself and the defendants could by the care the situation required of them, they are liable if they did not, although the plaintiff's inability resulted from his prior negligence or intoxication."

ORDINANCES, CHARTERS, FRANCHISES, ETC.

ALABAMA.—Nuisance—Public Nuisance—Injunction—Special Damage.

Where a railroad constructed and operated its track on the alley of a city, without authority of law, and built a fence and gate across it, thus inclosing one end of the alley and cutting off entirely the communication of owners of lots abutting on the alley through the alley with another street, it constitutes a general nuisance, which the lot owners were entitled to enjoin, their damage being distinct from that of the public generally.—(Birmingham Ry., Light & Power Co. vs. Moran et al., 44 S. Rep., 152.)

ILLINOIS.—Street Railroads—What Constitute—Use of Streets—Connection with Commercial Railroad.

Where an electric railway company was chartered under the general railway act, and, by its charter, was authorized to operate between two cities and transport passengers, mail, express and other matter, it was a commercial railroad, and not a street railroad.

A city ordinance authorized the construction and operation of a street railway in the streets of the city, and a subsequent ordinance also authorized the operation of a street car line or street railway therein. Hurd's Rev. St. 1905, c. 114, § 44, provides that railroad companies shall have power to make such contracts with each other for leasing or running their roads or any part thereof as shall be necessary to effect the object of the act. Section 45 provides that railroad companies shall have the right of connecting with each other. A railroad chartered under the general railway act, and engaged in operating an interurban electric railway for the conveyance of passengers, mail, express and other matter, not having the right to come within the city limits, contracted with plaintiff company, which was the assignee of both grants of authority from the city operating therein a street railway, whereby plaintiff company agreed to carry all passengers, and so far as it was able to do so, under municipal and statutory regulations, express, mail, or other matter from the connecting point at the city limits to points along its line within the city, and vice versa. Under the agreement, the interurban cars were leased to plaintiff company and were to run upon its tracks and the interurban employees were to be deemed the employees of plaintiff company while in the city limits. Held, that plaintiff company did not by virtue of the ordinances and sections 44 and 45 obtain the right to authorize the interurban company to use plaintiff's tracks over which to operate its cars without permission from the city, and that being the effect of the contract, it was entered into without right and did not confer any authority on the interurban company to bring its cars within the city limits.—(City of Aurora et al. vs. Elgin, A. & S. Traction Co. et al., 81 N. E. Rep., 544.)

INDIANA.—Eminent Domain—Street Railroads—Interurban Railroads—Compensation to Property Owners—Injuries to Abutting Property—Rights of Property Owners.

The operation by a corporation, organized under the statute providing for the incorporation of street railway companies, of interurban cars on streets of a city with its permission, for the carriage of passengers, express and light freight, is not an additional servitude on the streets, and abutting owners are not entitled to compensation therefor.

An owner of property abutting on a street on which interurban cars are operated may prosecute an action for special damages resulting from the improper operation of the cars, notwithstanding a sale of the property pending the action, and notwithstanding an injunction to restrain the wrong complained of is sought, and may recover the damages sustained up to the time of the bringing of the action.

A street railway company operating on a city street, for the carriage of freight and passengers, interurban trains of three cars, each 60 feet in length, at a rate of 20 to 30 miles an hour, thereby rendering the use of the street dangerous, and thereby causing the house of an abutting owner 60 feet from the track to shake so as to cause the plastering and ceilings and the pictures on the walls to fall, and to disturb the comfort of the owner and his family occupying the house, is liable to the abutting owner for the special damages sustained; the operation of its cars in such a manner by a street railway being unlawful and unjustifiable.—(Kinsey vs. Union Traction Co. et al., 81 N. E. Rep., 922.)

INDIANA.—Eminent Domain—Persons Entitled to Take—Necessity of Legislative Authority—Lessees of Railroads—Street Railways—Street Railroads—Transmission Lines—Public Use—Construction of Legislative Act—Proceedings—Sufficiency of Description in Complaint—Statutes—Subjects and Title—Acts Relating to One or More Subjects—Nuisances—Transmission of Electricity.

A lessee of a railroad cannot condemn lands for a use appurtenant to a way of the lessor, unless expressly so authorized by statute.

Acts 1903, pp. 92, 94, c. 36, conferring the power of eminent domain, provides that any street railroad company having constructed or acquired any street railroad or interurban street

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railroad shall, in addition to the rights already given by law to street railroad companies, possess the power to receive, acquire and take, by special proceedings hereinafter provided, lands and other property necessary for the construction of lines for transmission of electricity. Held, that it conferred the power upon lessees of street and interurban railroads.

Under the express provisions of Acts 1903, pp. 92, 94, c. 36, a street or interurban railroad company has the power to condemn land for a transmission line which may be on its line of road, or elsewhere, as the company may desire.

Where the Legislature has authorized the taking of lands for the use declared in a complaint in condemnation proceedings, the court will not decline to acknowledge it a public use, merely because of an incidental private advantage, unless it is manifest that the proposed use does not imply a right in the general public to its enjoyment.

Acts 1905, p. 60, c. 48, provides that, where a right of way is sought, the complaint in condemnation proceedings must state the location, general route, width and termini thereof, and a specific description of each piece of land to be taken. A complainant averred that the defendant owned a quarter section particularly described, and that plaintiff desired to construct its transmission line on and over said tract by replacing 24 poles 115 feet apart across the land from the west side to the east side thereof, which poles were to be placed within 6½ feet of the fence on the north side of the right of way of a certain railroad through the land on a strip of land 6½ feet wide running in a diagonal manner through the quarter section on the north side of and parallel with and immediately adjoining the railroad right of way, as then located through the land; the amount of land actually occupied by the poles being not to exceed 40 square feet. Held, that the description was sufficient.

Const. art. 4, § 19, provides that "every act shall embrace but one subject and matters properly connected therewith, which subject shall be expressed in the title." The title of an act was "An act to amend sections one (1), four (4) and five (5) of an act, entitled 'An act concerning street railroad companies, granting additional rights and powers therein specified and matters relating thereto, and declaring an emergency.' . . ." It embraced the general subject of street railroad companies, and gave power to acquire ground for the construction of lines for the transmission of electricity for light, heat and power. Held not to violate the constitutional provision.

The transmission of electricity at a high voltage over a right of way, being authorized by law, is not a nuisance per se.—(Mull vs. Indianapolis & C. Traction Co., 81 N. E. Rep., 657.)

MINNESOTA.—Street Railroads—Corporate Powers—Extent—Who May Question—Advertising in Cars.

The publisher of a weekly newspaper, containing, among other things, advertisements, sought to enjoin a street railway company from placing advertisements on the upper inside parts of its cars, because, as a result, that company diverted a large and lucrative business, which otherwise he might have been able to secure. It is held that this was not sufficient to entitle plaintiff to litigate the question whether the acts of the defendant were ultra vires or not.—(Burns vs. St. Paul City Ry. Co., 112 N. W. Rep., 412.)

NEW YORK.—Carriers—Street Railroads—Transfers—Construction.

Railroad Law, Laws 1890, p. 1114, c. 565, § 104, as amended by Laws 1892, p. 1382, c. 676, requiring every street railway company contracting with another company for the use of their respective roads to carry passengers for one fare between points on the railroads embraced in the contract where the passenger desires to make one continuous trip, relates to companies that have entered into contracts with other companies to insure a continuous passage from a point on one road to a point on the other road embraced in the contract, and does not apply to a company running short service and long service cars over its own line.

A street railroad must transport for a single fare a passenger whose fare is accepted on any car to any point on its line reached by cars running in that direction, regardless of whether or not the car boarded is a short service or a long service car.—(Baron vs. New York City Ry. Co., 105 N. Y. Sup., 258.)

NEW YORK.—Eminent Domain—Street Railroads—Change to Elevated Road—Statutes—Title—Subject—Construction.

If a street railroad has as against an abutting landowner a prescriptive right only, it cannot change from the surface to an elevated structure without compensating him for the added interference with his easement of light, air and access.

The title of Laws 1855, p. 854, c. 475, reciting in detail its purpose to be the widening and extension of an avenue and the ratification of an agreement between a railroad company, a city, and another providing for the cession of railroad lands to the city in exchange for an exclusive right to occupy a strip in such avenue, was not violative of Const. 1846, art 3, § 16, as embracing more than one subject, the agreement being an essential part of the scheme of improvement.

Statutes authorizing the taking of land may not be extended by implication, and no greater right is acquired than is necessary to satisfy the purpose of the statute.

Though an abutting landowner was not bound by a tripartite agreement between a city, a street railroad company and its lessor, whereby railroad lands were ceded to the city, and the company acquired an exclusive right to use a strip of land in an avenue to be improved, the owner was bound by proceedings taken pursuant to an act, providing that the improvement should be made, and the proceedings of the commissioners under the act should be subject and in conformity to the terms of the agreement.

Where a perpetual right to the exclusive use of a strip in an avenue for railroad purposes was acquired by condemnation proceedings many years ago, it must be assumed that the damages awarded an abutting landowner included the value of the premises actually taken and the damages resulting to the residue, including those to be sustained by reason of the use to which the portion taken was to be put, and such damages could not be lessened by the fact that there might be a possibility of a reverter, and hence, when the company was compelled by the Legislature to elevate its tracks, it took no property of such abutting landowner's remote grantee, since the former award must be presumed to have included the damage resulting from the change.—(Leffmann vs. Long Island R. Co., 105 N. Y. Sup., 487.)

NEW YORK.—Licenses—Rights in Real Estate—Revocation.

An instrument under seal, executed by one owning the fee to the center of a street and premises abutting thereon, which recites that an elevated railway company is operating its road in front of the premises, and which declares that the owner consents thereto and that he discharges the company from all demands for compensation arising therefrom, is a license only, and is revoked by his conveyance of the premises to another, who may enjoin the company from maintaining and operating the road in front of the premises.—(Smyth vs. Brooklyn Union Elevated R. Co. et al., 105 N. Y. Sup., 602.)

PENNSYLVANIA.—Street Railroads—Right to Use Street—Condition of Grant—Forfeiture of Franchise.

A city gave by ordinance a street railway company the right to use a particular street, reserving the right to grant to any other railway company rights in the same street. The mayor required the railway company, in consideration of the ordinance, to agree to arbitrate any dispute with another company to which the right to the street might be granted. Held, the company could not allege that the agreement for arbitration, not being a part of the ordinance, was not binding on it.

Where an ordinance giving a street railway company the right to use a street contained no clause of forfeiture, an agreement of the company with the mayor, at the time of signing the ordinance, to arbitrate any difficulty with another street railway company seeking to use the street, did not give the city the right to the street might be granted. Held, the company unable to agree with the second arbitrator in the choice of a third.

Where a city gave a railway company by ordinance permission to use a street in question, with a provision therein reserving the right to another company to use the same street, the city cannot maintain a bill in equity to compel the first company to permit the second company to use the street, the party aggrieved in such case being the second company.—(Chester City vs. Union Ry. Co. of Chester et al., 66 Atl. Rep., 1107.)

TEXAS.—Street Railroads—Equipment—Regulations—Statutes—Validity.

Act April 3, 1903, providing that each street car shall be equipped during the winter months with a vestibule to protect the motorman, is within the police power of the State, and is valid.—(Beaumont Traction Co. vs. State, 103 S. W. Rep., 238.)

WISCONSIN.—Eminent Domain—Statutory Provisions—Interurban Railroads—Railroads—Interurban Roads—Articles

of Incorporation—Statement of Business—Designation of Termini of Road—Conflicting Locations—Rights by Prior Location.

Rev. St. 1878, § 1820, authorized the formation of corporations for general commercial railroad purposes, and section 1862 the formation of street railway corporations, with the right to accept franchises from municipal corporations to operate their cars on city streets. Section 1863 authorized street railway corporations to extend their railways to adjoining towns, and for such purpose to use the highways of the town upon consent of the proper authorities. Laws 1880, p. 255, c. 221, in amendment of section 1863, added an additional clause authorizing the formation of corporations for the purpose of constructing and operating street railways in any village or town or to extend from any village or town to, into, or through any other, and running cars propelled by animals for the carriage of either passengers or freight. Laws 1891, p. 915, c. 387, struck out the word "street" before "railways," and inserted "or other power" after the word "animals," and, as amended, section 1863 was inserted in Rev. St. 1898, where it appears as section 1863. Laws 1897, p. 290, c. 175 (St. 1898, § 1863a), confers the power of eminent domain on any street or electric railroad corporation. Held, that Rev. St. 1878, § 1863, amended by Laws 1880, p. 255, c. 221, and by Laws 1891, p. 515, c. 387, now all embodied in St. 1898, § 1863, and St. 1898, § 1862, being the same as Rev. St. 1878, § 1862, authorized the formation of two distinct classes of railroad corporations other than the commercial steam railroad, one being the municipal street railroad and the other the electric interurban, and such electric interurban railroads, as well as street railroads, being empowered under St. 1898, § 1863a, to exercise the right of eminent domain.

St. 1898, § 1863, authorizes the formation of corporations for the purpose of building and operating railways in any village or town, or to extend from any village or town to, into, or through any other village or town. Section 1772 requires the articles of incorporation of any corporation to state its business or purpose. Held that, to incorporate as an interurban railway corporation under section 1863, it was not a prerequisite that the articles of incorporation designate the termini of the road, but articles of incorporation, stating that the purpose of the corporation was to construct and operate street railways in a city named and elsewhere in the state, and to extend its lines into or through any village or town, sufficiently stated its business or purpose to entitle it to incorporate as an interurban railway under that section.

Petitioner, an interurban railroad corporation, began its survey over a certain route in 1903, but did not complete the same until May, 1905, and the line was not adopted by its board of directors until January, 1906. The parties who later organized defendant interurban corporation completed their survey over the same line in November, 1905, and staked the same out. Defendant was incorporated in October, 1905, and the work already begun progressed without interruption. Money was paid in by the stockholders, and resolutions were adopted by the directors authorizing the officers to contract with one of the parties who had organized defendant for the acquirement of all necessary additional right of way and franchises, and appropriating money to pay for right of way already secured, and on account of additional right of way to be secured, etc. Acting upon such resolutions, assignments of the option contracts already procured were secured to defendant, and further contracts were obtained, so that, before the time of the resolution adopting the route by petitioner, defendant owned option contracts covering eight out of nine miles of the disputed right of way, together with the necessary franchises. Held, that the acts of defendant constituted a complete location of the route prior to the time of the adoption of the route by petitioner by resolution in January, 1906, and hence, that being the decisive corporate act by which location of the route was made by petitioner, defendant's right to the route was prior to petitioner's.

That defendant corporation adopted surveys already made by other parties did not affect its rights.

It was not essential to the location of the route by defendant corporation that it secure deeds of the right of way or binding contracts for its purchase.—(In re Milwaukee Light, Heat & Traction Co. Milwaukee Light, Heat & Traction Co. vs. Milwaukee Northern Ry. Co., 112 N. W. Rep., 663.)

LIABILITY FOR NEGLIGENCE.

DELAWARE.—Street Railroads—Persons on Street—Injuries—Negligence—Burden of Proof—Use of Streets—Contributory Negligence—Proximate Cause—Voluntary Intoxication—Damages—Personal Injuries—Measure of Damages.

1. In an action for injuries to plaintiff, while lawfully using a street, by a collision with one of defendant's street cars, the burden was on plaintiff to prove that his injuries resulted from defendant's negligence, as alleged, which negligence could not be presumed.

2. Where plaintiff was injured in a collision with a street car as he was assisting in loading a van with furniture in the street in front of his residence, the rights of plaintiff and the owners of the street car to use the street were reciprocal; each being bound to use due care not to infringe the rights of the other.

3. Where a street car approached a point where plaintiff was loading a van with furniture in the street, it was the duty of the motorman to sound the gong, ring the bell, slow up, or stop the car in the presence of danger to plaintiff, according to what was reasonably demanded by all surrounding circumstances to prevent injuring him.

4. Where plaintiff, in an action for injuries received in collision with a street car, was negligent, and such negligence contributed to the injury, plaintiff could not recover, though the railroad company was also negligent; but if, notwithstanding plaintiff's negligence, the railroad company could have prevented the accident by the use of ordinary care, plaintiff's negligence was no defense.

5. If plaintiff suddenly moved from a position of safety to a position of danger on or near defendant's street car track, so that it was impossible for the motorman to stop the approaching car before collision, defendant was not liable for plaintiff's resulting injury.

6. In an action for injuries to plaintiff by being struck by a street car, plaintiff's voluntary intoxication, if it caused him to omit to take reasonable care for his safety, might be considered in determining whether plaintiff was negligent.

7. In an action for injuries to plaintiff in collision with a street car, the measure of plaintiff's damage was such sum as would compensate him for his injuries, including loss of time and wages, and pain and suffering, past and future, resulting from the accident, and also for any future impairment of ability to earn a living.—(Heinel vs. People's Ry. Co., 67 Atl. Rep., 173.)

DELAWARE.—Carriers—Passengers—Duty of Carrier—Defective Appliances—Injury to Passengers—Proximate Cause—Damages—Personal Injuries—Measure.

1. A common carrier of passengers is bound to provide safe cars, keep them in good repair, and do all things reasonably necessary to secure safe transportation of passengers from place to place and their safe departure from the cars after reaching their destination.

2. A street railway company, as a common carrier of passengers, while not an insurer of a passenger's safety, is required to exercise the highest degree of care and diligence reasonably practicable.

3. Where plaintiff, a passenger on a street car, claimed that she was injured while attempting to alight because of the defective condition of a step of the car, she was bound to show that she was injured while in the exercise of due care, and that the defective step was the proximate cause of her injury.

4. A street car passenger was entitled to assume that the platform, steps, or running boards of a street care were reasonably safe for her to use in alighting from the cars, unless she knew, or by the exercise of ordinary care could have known, that they were defective.

5. In an action for injuries to a passenger, the measure of damages was such a sum as would reasonably compensate her for injuries she sustained, including pain and suffering, and all disabilities that had resulted therefrom.—(Smithers vs. Wilmington City Ry. Co., 67 Atl. Rep., 167.)

DELAWARE.—Negligence—Question for Court and Jury—Street Railroads—Injuries to Traveler—Contributory Negligence—Evidence—Custom—Pleading.

1. In an action for injuries, it is for the court to say whether there is any evidence from which negligence or contributory negligence can be reasonably and legitimately inferred; but it is for the jury to say whether, from the evidence adduced, when submitted to them, any negligence, and whose, ought to be inferred.

2. In an action for injuries to the driver of a coach in a funeral procession, caused by a collision with a street railway car, evidence held to require submission of the question of

defendant's negligence and of plaintiff's contributory negligence to the jury.

3. In an action for injuries to the driver of a coach in a funeral procession, caused by a collision with a street car, evidence that for a long time prior thereto it had been the custom of the operators of street cars as a matter of privilege to permit funeral processions to pass without a break in the line, and that plaintiff, with knowledge of such custom, relied thereon at the time he crossed the track in front of the car, was admissible, though not pleaded.

4. In an action for injuries to the driver of a coach in a funeral procession by a collision with a street car, evidence as to the condition of travel on the street for two hours, including the time of the accident, was admissible, though not pleaded.—(Wilmington City Ry. Co. vs. White, 66 Atl. Rep., 1009.)

DELAWARE.—Carriers—Street Railroads—Protection of Passengers—Care Required—Obligation of Passengers—Negligence—Reasonable Care—Passengers—Injuries—Actions—Declaration—Proof—Presumptions—Burden of Proof—Damages—Personal Injuries—Measure of Damages.

1. A street railway company, in letting its passengers on and off its cars, must stop its cars at the usual stopping places and wait a reasonable time for passengers to get on or off.

2. A carrier, though held to strict care in the safe transportation of passengers, is not an insurer of their safety, and is only responsible for its own negligence in causing injury to a passenger.

3. Passengers must act with prudence and use the means provided for transportation with reasonable care, and if a passenger's negligent act contributes to an injury he cannot recover.

4. It is the duty of a street car passenger, before alighting from a car, to see that it has stopped and that he may alight safely, and to exercise reasonable care in alighting.

5. Reasonable care is such care as a person of ordinary prudence would take under similar circumstances to avoid accidents, in view of the risks incurred.

6. A passenger, suing a carrier for injuries, must show by preponderance of the evidence that the negligence causing the accident was the negligence described in the declaration.

7. The negligence of a carrier is not presumed from proof of an accident resulting in an injury to a passenger.

8. A passenger, suing a carrier for injuries received through the negligence of the carrier, has the burden of proving negligence.

9. The verdict in favor of plaintiff in a personal injury action should be for such an amount as will reasonably compensate him for the injury sustained, including therein pain and suffering and all disability that may result therefrom.—(Reiss vs. Wilmington City Ry. Co., 67 Atl. Rep., 153.)

ILLINOIS.—Trial—Instructions—Applicability to Pleadings—Damages — Evidence — Remoteness—Appeal—Evidence—Prejudice—Trial—Reception of Testimony—Motion to Strike — Witnesses — Cross-Examination—Scope—Discretion — Appeal—Evidence—Prejudice—Experts—Cross-Examination—Damages—Evidence—Results of Injury—Relevancy.

1. Where, in an action for injuries to a street car passenger, the first count of the declaration charged that defendant caused its cars to be "suddenly and violently started," but the second count alleged that defendant "carelessly and negligently caused the car to be started and moved," a request to charge that the burden was not on defendant to show how plaintiff came to fall, and, if the preponderance of the testimony did not show that she fell by reason of the car being "suddenly and violently started," she could not recover, was properly refused, as eliminating the cause of action alleged in the second count.

2. In an action for injuries to a female street car passenger on July 4, 1902, evidence that she was delivered of a still-born child in January, 1903, and had a miscarriage in June, 1905, claimed to have resulted from the accident, was admissible as bearing on the nature and extent of the injuries; the court having instructed that plaintiff could not recover anything because of the loss of the child or by reason of her miscarriage, but only for personal injuries which she suffered as the result of the negligence charged.

3. In an action for injuries to a female passenger, one of plaintiff's physicians testified that in his judgment the accident caused plaintiff to give birth to a still-born child and also caused a subsequent miscarriage, which answer was stricken at defendant's instance as invading the province of the jury. Held, that there was no reversible error in the subsequent admission of evidence of several physicians that the accident pleaded "could or might" have caused the still-birth of the child and the miscarriage.

4. In an action for injuries, a physician testified that his examination of plaintiff showed that the entire right side up to the wrist was less sensitive to the touch than the left side; whereas, the sensation in the palm of the right hand was greater than in the left. At the close of his evidence, the witness stated that it was difficult to testify as to such matters without telling anything the patient said, because the physician depended so much on the patient's statement, whereupon, on motion, the testimony was stricken. Held, that the court did not err in permitting the jury to hear the testimony until it developed that it was incompetent, because based on plaintiff's statement.

5. Where, in an action for injuries to a street car passenger, one of defendant's investigators testified in its behalf, the scope of cross-examination with reference to the work he had done for defendant in other cases was largely within the trial court's discretion.

6. Defendant was not prejudiced by the exclusion of a question, where all the material parts thereof were subsequently asked and answered.

7. An expert may be cross-examined as to the basis of his opinion, and as to whether the authorities do not lay down a different doctrine.

8. Where, in an action for injuries to a female passenger, it was claimed that the accident caused her to be subsequently delivered of a still-born child, evidence as to the child's weight and whether it was well developed at birth was material, as bearing on the question whether the accident caused it to be still born.—(Chicago Union Traction Company vs. Ertrachter, 81 N. E. Rep., 816.)

INDIANA.—Street Railroads—Collision with Pedestrian—Actions—Complaint—Operation—Injuries to Pedestrian—Contributory Negligence—Proximate Cause.

1. A complaint, in an action against a street railway company for injuries to a pedestrian struck by a car at a crossing, which alleges that the company ran its car after dark without a headlight, that no signal was given as the car approached the crossing, that the car ran at a dangerous speed, and that it negligently ran the car against the pedestrian, injuring him, when liberally construed, as required by Burns' Ann. St. 1901, Section 379, sufficiently charges negligence as against a demurrer or a motion to make more definite and certain.

2. Since under Burns' Ann. St. 1901, Section 359, requiring all defenses except the general denial to be specially pleaded, the burden of establishing contributory negligence is on defendant, a general verdict in favor of plaintiff, in an action against a street railway company for injuries to a pedestrian struck by a car at a crossing, is a finding of freedom from contributory negligence.

3. Where, in an action against a street railway company for injuries to a pedestrian struck by a car at a crossing, it appeared that a wagon passing in front of the pedestrian immediately before the car struck him prevented him from hearing the noise made by the running of the car, and that no signal of the approach of the car was given, the conduct of the pedestrian in walking on the track, if negligent, was not the proximate cause of the injury.

4. Where a motorman in charge of a car could have seen a pedestrian on the street crossing in time, by the exercise of ordinary care, to have prevented an injury to him, it was his duty to do so, regardless of whether the pedestrian negligently came on the crossing.—(Grass vs. Ft. Wayne & W. V. Traction Co., 81 N. E. Rep., 514.)

INDIANA.—Master and Servant—Injury to Servant—Action—Pleading—Fellow Servant's Negligence—Master's Liability—Evidence—Res Gestæ—Admissibility.

1. Where, in an action for injury to a servant, several acts of negligence are sufficiently alleged, recovery will be justified on proof of injury resulting from one or more negligent acts.

2. Where, through overwork and loss of sleep, a motorman failed to observe a rule requiring him to keep 100 feet behind a preceding car, and collided with it, injuring plaintiff, the motorman thereof, the company may not interpose his noncompliance with the rule as a fellow servant's negligence, barring plaintiff's recovery.

3. Where a street car superintendent placed a motorman on

a car about 10 o'clock a. m., and about 4:30 o'clock p. m. the motorman caused a collision, resulting in plaintiff's injury, and the cars were run four miles to another point, where the superintendent came up while employees were stating how the accident occurred, his declaration that he should have known better than to put the motorman on the car was inadmissible as part of the res gestæ.—(Ft. Wayne & Wabash Valley Traction Co. vs. Crosbie, 81 N. E. Rep., 474.)

IOWA.—Negligence — Instructions — Concurrent Negligence—Instructions—Street Railroads—Operation of Cars—Collision with Hack—Action.

1. In an action for injuries in a collision between a coach and a street car, an instruction that if the jury found the owners of the coach and the street railway company were jointly negligent, and were also separately negligent, and that the joint and concurrent negligence brought about the accident and injury, plaintiff could recover, was objectionable, for failure to define what would authorize a finding of negligence either joint or separate.

2. Where, in an action for injuries to a passenger in a coach in collision with a street car, plaintiff charged that both owner of the coach and the street car company were jointly and concurrently negligent, but averred different and specific acts of negligence against each, an instruction that if defendants were jointly negligent and also separately negligent, and the joint and concurrent negligence caused the injury, plaintiff could recover, was erroneous as against the street car company, for failure to present the specific negligence charged against it to the jury, and for failure to define and limit the railroad company's duty in the premises.

3. Where, in an action for injuries to a passenger in a hack by a collision between the hack and a street car, the only negligence of the street car company, if any, was in failing to make a timely stop of the car, and the motorman testified that he used the emergency stop, instead of the brake, an instruction that, if the motorman could have seen the team on the track in a dangerous position, it was his duty to use all the appliances at his command to prevent the collision, and, if he did not do so, the jury might find him negligent, was objectionable, for failure to confine the jury's attention to the question whether in the exercise of reasonable care the car in question could not have been stopped soon enough to have avoided the accident.—(Ramsey vs. Cedar Rapids & M. C. Ry. Co., et al., 112 N. W. Rep., 798.)

KENTUCKY.—Master and Servant—Injury to Servant—Action—Evidence—Similar Facts—Other Injuries from Same Cause—Duty to Provide Safe Place to Work—Duty of Servant to Inspect.

1. In an action against a street railway company for injuries caused to a conductor by coming in contact with a pole at the side of the track, it was error to exclude evidence of a former conductor that his attention had been called to the proximity of the poles to the track by reason of his clothing coming in contact with one of them, and that another conductor had been hit by a pole at the same place at which plaintiff was struck while collecting fares on the running board, since it was competent to show that the poles were too near the track to be safe for the conductor in using the running board in collecting fares.

2. It was the duty of a street car company to furnish its employee with a reasonably safe place to work, and he is not precluded from recovering for an injury caused by a pole in dangerous proximity to the track, unless he had notice of it or it was patent to persons of his experience and understanding.

3. Where it is not in the line of a servant's duty, he is not required to make an inspection of his place of work to discover the defects and dangers incident thereto.—(Finley vs. Louisville Ry. Co., 103 S. W. Rep., 343.)

KENTUCKY.—Carriers—Street Railroads—Negligence—Evidence—Instructions.

1. Where, in an action against a street railway company for injuries to a passenger in consequence of an unhitched horse in the street becoming frightened and running into the car, the evidence of plaintiff showed that the horse was frightened before the car reached it, and that the motorman did not check the speed of the car, and the evidence of the company showed that the car was barely moving at the time it got opposite the horse, and that the motorman, as soon as the horse showed signs of fright, shut off the current, put on the brakes, and that just as the car got opposite the horse it suddenly wheeled in the direction of the car, an instruction that the company was required to exercise the utmost care for the safety of the passengers, and if the motorman, by the exercise of the utmost care, could not prevent a collision and injury, a verdict should be rendered for the company, properly submitted the issues.—(Wynn vs. Paducha City Ry., 102 S. W. Rep., 824.)

KENTUCKY.—Carriers—Injury to Passenger in Alighting—Negligence of Conductor.

Where, on a dark night, the conductor of an electric car twice announced a station, and then opened the door and went onto the platform, and a passenger, ignorant, though exercising ordinary care, of the fact that the car was still moving, the current having been turned off at the top of a grade and the movement of the car being so smooth that a person would not notice it, followed him onto the platform, passed by him down the steps, and was injured in attempting to alight, the carrier is liable; the conductor having failed to warn her, though he knew her danger, or by the exercise of ordinary care should have known it, and he being bound to know, under the circumstances, that she followed him for the purpose of alighting.—(Blue Grass Traction Co. vs. Skilman, 102 S. W. Rep., 809.)

MASSACHUSETTS.—Street Railroads—Injury to Child on Track—Contributory Negligence—Question for Jury—Gross Negligence—Question for Jury.

1. In an action for the death of a child killed by a street car, whether the child was guilty of contributory negligence in attempting to cross the track held, under the evidence, to be a question for the jury.

2. In an action for the death of a child killed by a street car, whether the motorman was guilty of gross negligence in operating the car held, under the evidence, to be a question for the jury.—(Beale vs. Old Colony St. Ry. Co., 81 N. E. Rep., 868.)

MASSACHUSETTS.—Carriers—Street Railroads—Injuries to Passengers—Negligence—Questions for Jury—Care Required—Evidence—Racks—Custom.

1. Plaintiff was a passenger on an ordinary street car, having seats running lengthwise on each side. As she was leaving the car, she stumbled over a bag which another passenger had placed on the floor, and fell, receiving the injuries complained of. The bag did not obstruct the free passage of plaintiff from the car, and did not render the passageway dangerous to a person exercising due care. Held, that the conductor was not negligent as a matter of law in suffering the bag to be placed and to remain on the floor.

2. In an action for injuries to a street car passenger by falling over another passenger's bag, deposited in the aisle, the court properly refused to charge that the carrier was bound to use the highest possible degree of care and caution to keep the aisles, entrances, and exits of its cars free from obstructions, and to exercise toward plaintiff the utmost care and diligence in providing against those injuries which could be averted by human foresight; the carrier only being bound to exercise the highest degree of care consistent with the practical operation of its business.

3. In an action for injuries to a street car passenger by falling over another passenger's bag placed in the aisle, evidence that it was not customary to have racks for baggage or parcels in street cars, and that it was the custom to allow passengers to put hand baggage and dress-suit cases on the floor, was admissible as bearing on the question whether defendant exercised due care in the premises.—(Pitcher vs. Old Colony St. Ry. Co., 81 N. E. Rep., 876.)

MASSACHUSETTS.—Carriers—Injuries to Passengers—Negligence—Question for Jury—Instructions—Negligence—Violation of Rules—Evidence—Conclusion of Witness.

1. In an action against a street railway company for injuries to a passenger thrown from a car while passing a curve, the question of negligence in running the car at an excessive rate of speed held for the jury.

2. An instruction, in an action against a street railway company for injuries to a passenger thrown from a car running at an excessive rate of speed over a sharp curve, that it was not sufficient to show that the car was going at such speed as to make it probable that there would be a lurch, nor sufficient to show that there was an unusual lurch of the car sufficient to throw a passenger off, but that it must be shown that the speed was so unusual that the servants in charge thereof ought to have realized that the car was likely to lurch more violently

than incident to the ordinary operation of cars on curves, was properly refused; the question of negligence being whether the servants were running the car at a rate of speed which, under the circumstances, involved unnecessary dangers.

3. A violation by employees in charge of a car of the rule limiting the speed of cars while running over curves in the track is a circumstance to be considered in passing on their negligence.

4. To maintain an action against a street railway company for injuries to a passenger thrown from a car while running over a curve in the track, it must appear that the lurch of the car which threw the passenger off was more than is ordinarily to be expected, and that it was due to a defect in the car or track, or a negligent rate of speed, or some other cause for which the company is responsible.

5. A statement of the conductor in charge of a car that, while running over a curve in the track, the car did not lurch more than any of the single-track cars would do, is admissible as a statement of the result of his observation, though it involves his opinion.—(Partelow vs. Newton & B. St. Ry. Co., 81 N. E. Rep., 894.)

MASSACHUSETTS.—Master and Servant—Injuries to Servant—Duty of Master—Fellow Servants—Incompetency—Evidence—Knowledge of Master of Incompetency of Servant—Evidence—Sufficiency—Question for Jury—Instructions—Trial—Requests—Necessity.

1. An employer by the contract of employment impliedly undertakes to provide the employees with suitable appliances and a safe place in which to work and to use reasonable diligence in employing competent fellow servants.

2. Where a servant originally competent becomes during the service incompetent, and the incompetency is known, or in the exercise of reasonable diligence should have been discovered, and the employment is continued, the master's liability is the same as if he had knowingly or negligently hired an incompetent servant.

3. In an action by an employee for injuries caused by the incompetency of a fellow servant, single instances of incompetency of the fellow servant are inadmissible; but his general reputation as a person deficient in skill in performance of his duties is admissible.

4. The knowledge of the assistant superintendent of a street railway company, charged with the duty of supervising the operation of cars, that a motorman was incompetent and would not be able to run a car properly, which knowledge was communicated to the superintendent, must be imputed to the company.

5. An employee, seeking to recover for injuries sustained in consequence of the incompetency of a fellow servant retained by the employer with knowledge of the facts, must not only prove prior incompetency of the fellow servant, of which the employer could have had knowledge, as well as the retention by the employer of an incompetent servant, but also that the accident resulting in the injury complained of was occasioned by such incompetency.

6. In an action by a street car conductor for injuries received in consequence of the incompetency of the motorman operating the car, evidence examined, and held to justify a finding that the accident was due to the motorman's lack of ordinary skill.

7. An employee, seeking to recover from his employer for personal injuries, who introduces testimony from which a single ground of negligence on the part of the employer may be found, is under no obligation to go further.

8. In an action by a street car conductor for injuries sustained in consequence of the incompetency of the motorman in charge of the car, evidence examined, and held, that the question whether the conductor assumed the risk arising from the incompetency of the motorman was for the jury.

9. An instruction, in an action by a street car conductor for injuries caused by the incompetency of the motorman, that the motorman was required to exercise the degree of care called for under the circumstances, and if there had been only one passenger, the conductor, the duty imposed would have been reasonable care with reference to the circumstances, while with reference to passengers the motorman was called on to exercise the highest degree of care consistent with the performance of his duties, was not erroneous, as leading the jury to believe that the conductor was to be considered a passenger, requiring the company to exercise the highest degree of diligence.

10. Where, in an action by a street car conductor for injuries caused by incompetency of the motorman, the company deemed that a charge might have led the jury to consider that the question was one involving the motorman's due care, rather than that of his incompetency, it was the duty of the company to ask for more specific instructions.—(Cooney vs. Commonwealth Ave. St. Ry. Co., 81 N. E. Rep., 905.)

MICHIGAN.—Master and Servant—Injury to Servant—Negligence—Employment of Incompetent Fellow Servant—Evidence—Instructions—Evidence—Admissibility.

1. Where, in an action against a street railway company for injuries to a conductor, struck by a car operated by a motorman on an adjacent track, the only ground of recovery was based on the incompetency of the motorman, of which the company had notice, it was error to instruct the jury that they might consider other claims of negligence in determining whether the company retained in its employ an incompetent motorman.

2. In an action against a street railway company for injuries to a conductor struck by a car operated by a motorman on an adjacent track, the books kept by the company containing records of conductors and motormen, including the motorman in question, were admissible not only to show notice to the company of his record, but also as prima facie evidence of any facts stated therein.—(Trend vs. Detroit United Ry., 112 N. W. Rep., 977.)

MISSOURI.—Trial—Reception of Evidence—Motion to Strike—Necessity—Appeal—Harmless Error—Admission of Evidence.

1. In an action against a street car company for damages caused by a collision, the admission, over objection, of a city ordinance limiting the speed of street cars, which had been repealed unbeknown to the court, was not error, where counsel objected to its admission because he thought it had been repealed, but did not, after such fact was ascertained, move to exclude it from the consideration of the jury.

2. The admission of the ordinance was not prejudicial error, where the cause was not submitted to the jury on the question of negligence in running the cars at a rate of speed prohibited by ordinance.—(Weir et al. vs. Metropolitan St. Ry. Co., 103 S. W. Rep., 583.)

MISSOURI.—Street Railroads—Persons on Track—Death—Contributory Negligence.

1. Plaintiff's intestate, who was engaged in improving a street on which double street car tracks were laid, with knowledge that cars were passing over the track every few minutes, took a position on the east-bound track with his back toward the west, and continued in this employment, without turning his face to the west or giving any attention to the approach of cars, until he was struck by an east-bound car. Held that, in the absence of any claim that the motorman's act in striking intestate was wilful or wanton, or that he was running his car at an excessive rate of speed, intestate's negligence directly contributed to his injury and precluded a recovery.—(Brockschmidt vs. St. Louis & M. R. R. Co., 103 S. W. Rep., 964.)

MISSOURI.—Carriers—Injuries to Passenger—Petition—Sufficiency—Damages—Evidence—Health of Injured Person—Injuries to Person—Excessive Damages.

1. In an action against a carrier for injuries to a passenger, an allegation that defendant, while operating its car at a rapid rate of speed, suddenly and without warning stopped it so as to cause a violent and sudden shock sufficient to throw plaintiff against the car and onto the street, stated a prima facie case of negligence.

2. In an action for injuries to a married woman, her testimony that her family consisted of herself, husband, and five children, and that she took care of the house and family prior to the accident, but had not been able to do so since, was properly admitted for the purpose of showing that she was a healthy woman before her injuries and thereafter incapacitated.

3. Where plaintiff, who was a strong, healthy woman prior to her injuries, capable of taking care of a numerous household, was rendered weak and incapable of labor, had her nose broken, and became a nervous wreck, with her mind weakened, and her sight impaired, and was otherwise injured, a verdict of $4,500 was not excessive.—(Latimer et al. vs. Metropolitan St. Ry. Co., 103 S. W. Rep., 1102.)

MISSOURI.—Carriers—Street Railways—Injuries to Passenger — Evidence — Instructions — Evidence—Verdict—Evidence.

1. Proof that, while plaintiff was a passenger on one of defendant street railway's cars, it collided with another car on the same track, whereby plaintiff was injured, made out a prima facie case of negligence on defendant's part.

2. In an action against a street railway for injuries received by plaintiff in a collision, an instruction that, if plaintiff received his injuries as the result of some occurrence which careful men in the situation of defendant's agents would not have reasonably anticipated, then such occurrence is what, in law, is termed an "accident," and defendant was not liable, was misleading; an accident being something unexpected and unavoidable.

3. In an action against a street railway for injuries received by plaintiff in a collision between the car on which he was a passenger and another car, evidence examined, and held sufficient to show that a break in an air brake was caused by the collision and was not the cause thereof.

4. In an action against a street railway for injuries received by plaintiff in a collision between the car in which he was a passenger and another car, a verdict for defendant held against the weight of the evidence.—(Hunt vs. Metropolitan St. Ry. Co., 103 S. W. Rep., 1088.)

MISSOURI.—Death—Action for—Measure of Recovery—Statutory Provisions—Instructions.

1. Where, in an action against a street railway for wrongful death resulting from the negligence of defendant's servants, the allegations of the petition, other than the amount sued for, which was $4,500, brought the case within the purview of Rev. St. 1899, Section 2864, providing that for every such death defendant shall forfeit and pay $5,000, an instruction authorizing the jury, in case they found for plaintiff, to assess the damages at $4,500, was error; it being necessary to demand in the petition the full amount provided by the statute.—(Gormley et al. vs. St. Louis Transit Co., 103 S. W. Rep., 1147.)

MISSOURI.—Street Railroads—Collision with Vehicle—Contributory Negligence—Driver of Vehicle—Actions for Injuries—Sufficiency of Evidence.

1. It is not the duty of a teamster's helper to see that the teamster acts prudently, in the absence of knowledge or reason to believe that he is not a careful driver or prudent man. Hence he is not guilty of contributory negligence, where he is injured on account of a street car running into the wagon in which he was riding while the teamster was driving.

2. In an action for personal injuries caused by a street car running into the wagon in which plaintiff was riding, evidence considered, and held sufficient to sustain a verdict for plaintiff on the theory that the motorman was negligent—(Agnew vs. Metropolitan St. Ry. Co., 102 S. W. Rep., 1041.)

MISSOURI.—Evidence—Opinion—Evidence—Physical Condition—Damages—Physical Injury—Question for Jury—Trial—Instructions—Applicability to Pleadings.

1. In an action for injuries caused by being thrown from a street car, a physician, when asked in what condition he found the injured party the next day, stated: "I found him pretty badly shook up and bruised up. * * * He was suffering in the hip and back, and generally shook up. * * * " Held, that the statement that the person was suffering in the hip and back was not incompetent as being based on hearsay or mere opinion.

2. In an action for injuries caused by being thrown from a street car, evidence that plaintiff's suffering from rheumatism was occasioned by the injury examined, and held sufficient to go to the jury on the question of damages.

3. Where, in an action for personal injuries, the petition did not allege that the injured person was suffering from rheumatism prior to the injury, but alleged that he became afflicted with it as a result of the injury, and evidence that he had suffered with it prior to the injury was introduced without objection that it was not proper under the petition, it was not error for the court to instruct the jury to a continuation of that affliction.—(Detrich vs. Metropolitan St. Ry. Co., 102 S. W. Rep., 1044.)

MISSOURI.—Trial—Issues—Question for Jury.

Where, in an action for injuries to a passenger as she was attempting to alight from a street car, plaintiff's evidence that the car was suddenly started as she was attempting to alight, after it had come to a full stop, was corroborated by the physical facts, whether she was injured in the manner claimed or in attempting to alight in an improper manner before the car had come to a stop, as defendant claimed, and as testified by seven eyewitnesses of unimpeached veracity, though not necessarily free from bias, was for the jury.—(Pickens vs. Metropolitan St. Ry. Co., 103 S. W. Rep., 124.)

MISSOURI.—Street Railroads—Leases—operation by Lessee—Liability of Lessor—Same—Collisions—Contributory Negligence—Question for Jury—Negligence—Injuries Avoidable Notwithstanding Contributory Negligence—Trial—Demurrer to Evidence—Effect—Collision with Vehicle—Question for Jury—Evidence—Instructions.

1. Where a street railway company, pursuant to legislative authority, leased its railway to another company which agreed to pay rent and to operate the railway, the former company was not liable for damages sustained in a collision between a vehicle and a car operated by the latter company.

2. A driver of a team and wagon, who looked and listened for a car prior to going on a street car track, and who neither saw nor heard a car, was not negligent as a matter of law for not looking for a car within a minute thereafter while driving 470 ft. along the track.

3. A street railway company is liable for injuries sustained by a collision between a vehicle and a car, where the employees in charge of the car by the exercise of ordinary care could have avoided the accident, notwithstanding the negligence of the driver in the first instance in placing himself in a situation of peril.

4. A demurrer to the evidence by operation of law admits the facts proved.

5. In an action against a street railway company for injuries caused by a collision between a vehicle and a car, evidence examined, and held that the question of the negligence of the employees in charge of the car in failing to exercise ordinary care to avoid the accident on the discovery of the peril of the driver was for the jury.

6. Where, in an action against a street railway company for injuries caused by a collision between a vehicle and a car, there was no evidence authorizing an inference that the negligence of the driver of the vehicle contributed to the injury after the employees in charge of the car either saw or by the exercise of ordinary care could have seen his perilous situation, instructions that if the motorman in charge of the car saw or by the exercise of ordinary care could have seen the vehicle on the track and in a position of peril in time to have avoided the collision by the exercise of ordinary care, and he nevertheless negligently permitted the car to run against the vehicle, the verdict should be for plaintiff, was not erroneous for failing to require the jury to find that plaintiff was exercising ordinary care after going on the track and before the collision.—(Bensiek vs. St. Louis Transit Co. et al., 102 S. W. Rep., 587.)

MISSOURI. — Carriers — Injury to Passenger — Proximate Cause of Injury—Trial—Instructions—Necessity of Requests.

1. Where a street car conductor, in passing from a trailer to the grip car, neglected to hook into its place a chain, which performed the office of a gate between the trailer and grip car, and a passenger who was standing on the platform of the trailer, on a sudden jerk of the car, was thrown forward so that he fell through the open place where the chain should have been, whereby he was injured, the absence of the chain, and not the jerk of the car, was the proximate cause of the injury.

2. Failure to instruct on the issue of negligenc, such issue not being embraced in the instructions asked by counsel, amounted to mere non-direction, not constituting error.—(Hooper vs. Metropolitan St. Ry. Co., 102 S. W. Rep., 58.)

MISSOURI. — Evidence — Admissions — Competency — Appeal — Review — Admission of Evidence — Objection Not Raised on Motion for New Trial—Exceptions Not Reserved—Witnesses—Examination by Court—Disclosure of Opinion as to Veracity—Carriers—Street Railways—Stops—Binding Effect Upon Passengers—Damages—Personal Injury—Deafness Caused by Nervous Shock—Trial—Instructions—Necessity for Request.

1. Plaintiff, in an action for injury received by the premature starting of a street car while she was alighting at a point between cross streets, admitted on cross-examination that the had stated in a deposition that the car did not stop at all, but

explained that she was confused and misunderstood; that she meant the car did not stop at the last street passed before she got off, for which she had signaled a stop. Held, that it was improper to exclude the notary's testimony that plaintiff stated several times in her deposition that the car was not stopped at all.

2. Defendant's exception to the admission of evidence is not reviewable, where the admission of incompetent or irrelevant evidence was not stated as a ground for new trial; a ground that the verdict "is against the law" being insufficient to comprehend an erroneous ruling on the admission of evidence.

3. Defendant cannot base error on questions asked a witness, where no exceptions were taken thereto, though objections were made; and it makes no difference that defendant might have prejudiced its case before the jury had it stated the reasons for the objection and excepted to the court's action.

4. Though a trial judge may question a witness, his examination should be guarded so as not to give even a hint of his opinion as to the witness's veracity, or any impression he may have as to the merits of the case.

5. If a conductor stops a car in violation of a company's rule prohibiting stops between cross-streets at a passenger's request to allow her to alight, and while she is alighting the car starts, causing her injury, the rule affords no defense, for the conductor is the company's vice principal for the time, and the company is liable for his acts in negligently starting the car.

6. Plaintiff's deafness, resulting from a nervous shock received when injured, is a proper element of damages.

7. If plaintiff's deafness, resulting from a nervous shock received when injured, was not a proper element of damages, where the court instructed that on a verdict for her she was entitled to compensation for such injury as she received and for such pain of body and mind as she suffered as a direct result of the injury, if defendant desired to have the element of deafness eliminated from the estimate of damage, it should have asked an instruction to that effect.—(Dreyfus vs. St. Louis & S. Ry. Co., 102 S. W. Rep., 53.)

MISSOURI.—Carriers—Street Railways—Injury to Passenger—Pleading—Stopping Places—Opportunity to Alight—Sufficiency—Appeal—Review—Harmless Error—Trial—Instructions—Issues Not Sustained by Proof—Objections to Questions—Scope—Unresponsive Answers.

1. In an action for injury to a passenger while alighting from a street car, plaintiff's omission to plead that the car stopped at a regular station did not restrict proof to a stop at a point other than a regular stopping place.

2. Where one in charge of a street car knows a passenger is alighting, the duty to him is the same whether the stop is made at a regular stopping place or not.

3. A street car conductor has no right to assume because the car has been stopped for a time reasonably sufficient to enable passengers to alight that they have alighted, but is charged with the duty to see that no one is in the act of alighting when the car starts.

4. In an action for injury to a street car passenger while olighting, any error in an instruction in including in the hypothesis upon which she could recover the fact that the car was started before she had "a reasonably sufficient time to leave said car" was against her, and harmless to defendant.

5. In an action for personal injury, it was not error against defendant to instruct on contributory negligence, though there was no evidence tending to show plaintiff's negligence, where defendant pleaded contributory negligence and did not attempt to withdraw that issue.

6. An objection to a question merely advises the court that the propriety of the question and of a responsive answer thereto is put in issue, and does not reach unresponsive statements included in the answer, which may only be put in issue by motion to strike out.—(Murphy vs. Metropolitan St. Ry. Co., 102 S. W. Rep., 64.)

MISSOURI.—Carriers—Injury to Passenger—Question for Jury.

In an action by a passenger for personal injuries sustained in striking his foot against certain pieces of iron on the platform, on account of a jerk of the train while he was getting on the car, where there was no evidence that the pieces of iron were deposited, or permitted to be deposited, on the platform by defendant's employees, it was error to submit that question to the jury in an instruction.—(Price vs. St. Louis Transit Co., 102 S. W. Rep., 626.)

MISSOURI.—Carriers—Care to Protect Passengers—Negligence—Presumptions—Pleadings—Evidence—Instructions Protection of Passengers—Care Required.

1. Operators of a street car in the discharge of their duty to a person boarding it to become a passenger should either hold it at rest until the passenger has been given a reasonable time in which to seat himself, or, when there is no vacant seat, to reach a place where he may support himself while standing, or, if they start the car before the passenger has reached a place of safety, the start must be gradual to avoid the danger of throwing him down.

2. Operators of a street car who make a sudden start of the car of sufficient violence to injure a passenger proceeding with reasonable care to reach a place of security are presumptively negligent, and the presumption becomes conclusive unless it is shown that the manner of starting the car was unavoidable in the exercise of the highest degree of care.

3. Where, in an action against a street railway company, the petition charges, and the evidence of plaintiff shows, that she was thrown by a sudden and violent start of the car made when she was stepping onto the foot board to become a passenger, and the evidence of the company showed that the car did not stop and plaintiff made no attempt to board it, and the jury were told that a recovery could be had on no other ground than that plaintiff was thrown from the foot board before she had time to secure her footing, an instruction authorizing a recovery if the car was suddenly started without allowing plaintiff a reasonable time to board it and become seated thereon was not objectionable as charging, as a matter of law, that it was the duty of the company to hold the car stationary until plaintiff had been given a reasonable time in which to seat herself.

4. Where an open car with a foot board along each side of it for use of passengers in boarding it stopped at a regular stopping place for the reception of passengers, it was the duty of the conductor, before giving a signal to start, to look to see that no one was in a position to be injured should the same be started, and he had no right to assume from the fact that the car had been stationary a time reasonably sufficient to transact the business at that point that no one would be endangered by starting it.—(Miller vs. Metropolitan St. Ry. Co., 102 S. W. Rep., 592.)

MISSOURI.—Street Railroads—Injuries to Travelers—Collision with Fire Truck—Negligence—Question for Jury—Contributory Negligence—Negligence—Imputed Negligence—Driver of Vehicle—Street Railroads—Collision of Vehicles—Issues and Proof—Damages—Excessiveness—Injuries.

1. Where, in an action for injuries to a fireman in a collision between a hook and ladder truck and defendant's street car, there was evidence that the speed of the car was much too high to prevent a timely stop of the car after danger to the truck became apparent, and that with any proper use of the appliances at the motorman's command, after the peril arising from the truck could have been discovered, the car might have been stopped, such facts were sufficient to require submission of the issue of defendant's negligence to the jury.

2. Plaintiff, while returning from a fire on a fire truck, was injured in a collision between his truck and an approaching street car. Plaintiff was not driving, and only saw the car when 50 ft. away by looking over the top of the truck, after which he attempted unsuccessfully to get away. Held that it was not incumbent on plaintiff to keep a vigilant watch for cars, and that he was not negligent as matter of law.

3. Where plaintiff, a fireman, was riding as a passenger on a fire truck which was being driven home from a fire, and plaintiff had no control over the driver of the truck, the latter's negligence was not imputable to him.

4. Where a petition in an action for injuries to a fireman in a collision between a street car and a fire truck charged that the motorman was negligent in running the car at a speed in excess of the rate fixed by a city ordinance so as to be dangerous to persons lawfully using the street, a finding of negligence because the speed of the car exceeded the ordinance limit, and in consequence of such high speed the car collided with the truck, was within the scope of the petition.

5. Plaintiff, a fireman, was injured in a collision between his fire truck and a street car. He was under treatment four or five months, and was more or less disabled. His right leg was broken, his left foot crushed so as to interfere with his move-

ments, and he received a head wound and bruises on his thigh. He also expended $215 for attendance. Held that a verdict allowing plaintiff $4,000 was not excessive.—(Burleigh vs. St. Louis Transit Co., 102 S. W. Rep., 621.)

NEW YORK.—Damages—Personal Injury—Loss of Profits.

In an action for personal injury, plaintiff could not recover for loss of profits in a lunch business; it not appearing that it required any particular skill to manage it, that he had any particular skill in serving food, or that the business could not have been continued by the employment of help until he could supervise it, but the testimony should have been confined to the value of his individual services.—(Weir vs. Union Ry. Co. of New York City, 81 N. E. Rep., 168.)

NEW YORK.—Appeal—Review—Evidence — Presumptions — Trial—Questions for Jury.

1. Where the complaint was dismissed on plaintiff's evidence alone, the testimony is entitled on appeal, not only to belief, but to all favorable inferences that can reasonably be drawn therefrom.

2. In an action for personal injuries caused by starting a car from which plaintiff was alighting, where plaintiff established prima facie that he was free from contributory negligence and that the defendant was negligent in starting the car as it did, it was error to dismiss the complaint.—(Klein vs. New York City Ry. Co., 103 N. Y. Sup., 751.)

NEW YORK.—Carriers—Injuries to Passengers—Street Railroads—Evidence.

Where, in an action for injuries to a street car passenger, the only evidence that defendant operated the cars on the line on which plaintiff was injured was a transfer slip bearing defendant's name, which transfer slip defendant's superintendent testified was issued by another railroad company, and not by defendant, plaintiff was not entitled to recover.—(Dista vs. Westchester Electric R. Co., 103, N. Y. Sup., 738.)

NEW YORK.—Carriers—Injuries to Passengers—Proof of Negligence.

In an action for injuries to a passenger on a street car, where it was shown that the car, while being driven rapidly on a curve, left the track, whereupon plaintiff was thrown from the platform into the street, receiving the injuries complained of, it was error to dismiss the complaint for failure of proof of defendant's negligence.—(Ludinsky vs. Dry Dock, E. B. & B. R. Co., 103 N. Y. Sup., 711.)

NEW YORK.—Carriers—Passengers—Actions for Injuries—Questions for Jury.

1. In an action for injury to a passenger on a street car, due to the starting of the car before she had reached a place of safety, it was not essential to plead or prove the manner in which the car was started, and failure to prove an allegation that the car started with a jerk was not fatal to the action.

2. Where it was shown that plaintiff, a woman 77 years old, after taking a street car, was thrown, without stumbling, but purely by the motion of the car in starting before she could reach a place of safety, to the floor, and injured, the question of the negligence of defendant's servants in so operating the car was properly for the jury.—(Morrow vs. Brooklyn Heights R. Co., 103 N .Y. Sup., 998.)

NORTH CAROLINA. — Carriers — Negligence — Injuries to Passenger—Evidence—Burden of Proof—Instructions.

1. In an action against a street railway for injuries received by a passenger from a derailment of defendant's car, evidence that other cars ran off the track at the place of the derailment was inadmissible, without proof that the track was in the same condition as at the time when the accident in question occurred.

2. In an action against a street railway for injuries to a passenger from derailment of defendant's car, an instruction that proof of the derailment raised a presumption of negligence on defendant's part, with a further instruction that if there was negligence, and such negligence was the proximate cause of the injury, plaintiff was entitled to recover, was proper.

3. In an action against a street railway for injuries to a passenger from a derailment of defendant's car, an instruction that, if the jury found from the evidence that such derailment was the result of a mere accident or the motion of the power ordinarily incident to cars while running at an allowed rate of speed, then defendant would not be guilty of negligence, put on defendant the burden of showing that the derailment was accidental, and was not open to plaintiff's exception.—(Overcash vs. Charlotte Electric Ry., Light & Power Co., 57 S. E. Rep., 377.)

PENNSYLVANIA.—Street Railways—Injury to Pedestrian—Contributory Negligence.

Where a person attempted to cross defendants's street car tracks, and was struck by a car which he intended to take, and he could have taken but one or two steps from the time he entered on the line of the track until the car caught him in the space between the rails, he was guilty of contributory negligence barring recovery.—(Crooks vs. Pittsburg Railways Company, 66 Atl. Rep., 142.)

RHODE ISLAND. — Damages — Evidence — Admissibility — Grounds — Direct Consequences — Physical Suffering — Trial—Waiver of Right to Object to Introduction—Proceedings for Assessment—Instructions—Mitigation.

1. In an action for personal injuries, where plaintiff alleged injury to the internal organs and specific notice that pelvic injury was claimed was given to defendant's surgeon, and immediately reported to its counsel, evidence of pelvic injury was properly admitted.

2. In an action for personal injuries received by being thrown from a street car, an injury to the shoulder was a proper element of damages, whether caused directly by the fall or by the ligating of the arm after the fracture was reduced, since it was a natural result of the accident.

3. Where, in an action for personal injuries, the question of the permanence of the injury was the subject of extended cross-examination, the defendant, thereby waived any valid objection to the introduction of the life tables by plaintiff.

4. In an action for personal injuries, the court properly instructed that the plaintiff must do all that a reasonable person would do to reduce her injuries, and, if she has failed or refuses to do this, defendant would not be liable for the increase of injury, due to her negligence, but, if she puts herself into the hands of the physicians and follows their advice, defendant would be liable even though the physicians lack in skill or err in judgment.—(O'Donnell vs. Rhode Island Company, 66 Atl. Rep., 578.)

RHODE ISLAND.—Carriers—Injuries to Passengers—Negligence—Res Ipsa Loquitur—Question for Jury—Damages—Personal Injuries—Nature and Extent of Injuries—Evidence Expert Witnesses—Opinion Evidence—Admissibility—Appeal—Harmless Error—Overruling Improper Questions Asked a Witness—Physical Suffering Caused by Fright—Trial—Instructions—Refusal to Give Instructions Embodied in Those Given—Injuries to Child—Expenses Incurred.

1. Proof of a collision between two street cars operated by the same company injuring a passenger on one of them raises a presumption of negligence of the company, placing the burden of proving freedom from negligence on it.

2. Where, in an action by a street car passenger for injuries in collision with another car, the passenger proved the collision and injuries, and the company gave evidence in explanation of the collision, the question whether the presumption of negligence was overcome by the company's evidence was for the jury.

3. Where, in an action for personal injuries, the evidence of the nature and extent of the suffering of the person injured, and whether the suffering was a result of the accident, or was due to her previous physical conditions, was conflicting, the question whether the person injured was injured as a result of the accident complained of was for the jury.

4. In a personal injury action, a question asked a physician, based on his observation of the person injured as to the time of her ultimate recovery, is properly allowed.

5. Where a physician, in a personal injury action, in response to a question calling for his opinion as to the time of the ultimate recovery of the person injured, stated that he could not tell, the error, if any, in admitting the question was harmless.

6. While recovery cannot be had for mere fright caused by negligence of another, yet where fright is followed by physical ills, or gives rise to nervous disturbances and those in turn to physical troubles, an action will lie.

7. Instructions are properly refused where they are sufficiently covered by the charge as given.

8. A parent suing for injuries to a minor child may recover the expenses incurred in nursing the child which are in excess of the ordinary services the parent is bound to render to a minor child.—(Simone vs. Rhode Island Company, 66 Atl. Rep., 202.)

FINANCIAL INTELLIGENCE

Wall Street, Nov. 6, 1907.

The Money Market

The developments in the money market during the past week have been decidedly mixed. Following the suspension of several trust companies and state banking institutions a fortnight ago, heroic efforts have been made by the leading bankers and financiers to bring about a restoration of confidence, and while they have been partly successful in their undertaking, still the situation as a whole cannot be said to be at all encouraging. The heavy liquidation in the securities markets greatly reduced the demand for money for stock market purposes, but at the same time it was practically impossible for borrowers to obtain needed requirements except by paying unusually large premiums. As a matter of fact, the banks and trust companies have been absolutely out of the money market, leaving the demands of borrowers to be supplied by pools and by individuals who were willing to put out their funds on stock collateral. Money on call loaned as high as 100 per cent, and as low as 3 per cent, the average rate for the week being about 50 per cent. It was absolutely impossible to negotiate loans for fixed periods, and borrowers, as a rule, withdrew their bids, fully realizing the impossibility of securing accommodations. For the first time since 1893 the Clearing House Association was compelled to issue Clearing House certificates to enable certain institutions to settle their daily balances. This action by the New York banks was followed by similar action in Boston and many Western cities. For the first time since 1893 currency in this city was quoted at a premium, the rate at times ruling as high as 2½ @ 3 per cent per $100. In many instances comparatively small concerns were compelled to pay their employes in checks, so great was the scarcity of bills of small denominations. A feature of the week has been the complete demoralization in the foreign exchange markets, bankers at times finding it impossible to sell bills at any reasonable price. Prime demand sterling bills have sold as low as 4.82 and cables at 4.83 @ 4.83½. At the low level our bankers were able to negotiate successfully for gold in Europe, and notwithstanding a subsequent sharp advance in sterling to the highest rates of the year, gold continues to be engaged for import to this side. Within the past ten days approximately $37,300,000 gold has been engaged in London, and in well-informed quarters it is believed that fully $50,000,000 will be secured on this movement. The demand for gold in New York has already alarmed financiers at London and Berlin, the result being an advance in the Bank of England rate of 1½ per cent to 6 per cent, while the Imperial Bank of Germany has advanced its rate to 6 per cent in order to keep their supplies of gold intact. Unless further advances in the discount rate are made, local bankers are confident that they will be able to draw additional amounts of gold from the other side. One gratifying development of the week has been the announcement that the Bank of France was perfectly willing to part with some of its gold in order to relieve the money stringency at this center.

The bank statement, which was withheld until after business hours on last Saturday, made a most remarkable showing: Loans increased $60,741,600, to $1,148,452,600, and deposits increased $28,014,900, to $1,051,786,900. This shows an excess of loans over deposits of about $96,500,000. The cash holdings of the banks decreased $30,601,800, and as the reserve required was $7,003,725 larger than in the preceding week, the deficit was increased by $37,605,525, making the total deficit $38,838,825 under lawful requirements. In the corresponding week of last year there was a surplus of $3,049,775, and in 1905 the surplus was $2,354,475.

The Stock Market

Wall Street during the week just ended passed through a stress of developments that have exceeded in importance everything ever before recorded in its history. The one great factor that dominated all business in the financial districts was the most acute money famine the country has ever known. With the start of the week the scarcity of money was so intense that banks were forced to issue Clearing House certificates in order to settle daily balances of their accounts with each other. This is the fifth time such an action was taken by the Clearing House banks, but at no time was the action so universally followed wherever there are banking institutions in all parts of the United States. In fact, banking operations were forced to such a point that legal holidays by the governors of many of the Western States in order to prevent financial institutions there from being forced actually to suspend business. For many days it was impossible to obtain cash for checks in Nevada, California, Oregon and Washington, but the same impossibility to draw currency from the banks prevailed even in New York City, and not even enough cash could be obtained in the banking institutions in this city to meet payrolls of employes. The full story of the money famine will, perhaps, never be told. Money in the latter part of last week sold at a higher premium than in 1893, and the market situation developed into a condition where it was useless for holders of stocks to sell their securities, as they would only change their position as stockholders to that of creditors at banks. Because of this the stock market operations have for many days been restricted to forced liquidation due to the curtailment of loans by the banks on the one hand, and to investment buying of stocks on the other. The Stock Exchange is now, and has been for some time, no longer a speculative field. It is simply a place where the actual holders of securities who are forced to sell find the market in actual cash buyers. To a great extent this buying has been in fractional lots, but the number of fractional lots traded in has not been reflected in the printed reports of the Exchange. This fractional lot business has been long ago reduced to a system. Certain houses have assumed the position of supplying the fractional lot demand, and these houses buy in hundred or thousand-share lots and then split the certificates received as needed to meet the requirements of the scattered buyers. On Monday there was buying of a different character. All Sunday and until 5 o'clock on last Monday morning a number of the highest financiers in New York City were held in conference. The course of the market on Monday indicated that this conference had been productive of great results, although at the opening on that day the air was full of stories of impending panic and extreme disaster, and prices in the first few minutes showed serious losses from those of the preceding Saturday, and it was soon demonstrated that a buying power had been developed, and steadily until the close the supply of stocks was absorbed, always at continually advancing prices. The buying itself created a belief that the financial interests represented at the meeting had joined hands, and Wall Street gossip had it that an important pool had been formed to support the market and prevent any further movement to lower prices. There was also a general understanding that seemed to be confirmed during the day that the Tennessee Coal & Iron stock, the carrying of which is supposed to have been a burden on some of the financial institutions, had been taken over on private terms by the United States Steel Corporation. Without any such agreement and without the need of assistance from any bankers' pool, there was ample reason for the sudden development of strength in the market. From the time that the necessities of the financial situation had impressed themselves upon bankers here and in Europe there has been a constant accumulation of gold on the other side of the Atlantic for shipment to this city to relieve the bank's needs. Already importations of gold amounting to $37,300,000 have been arranged for, almost one-quarter of which left England a week ago to arrive in time to be available for the payment of all stocks bought on Monday, the Election Day interval just giving buyers a lapse of one day between the purchase of the stock and the time for which it would have to be paid. This in itself must be regarded as one of the chief incentives for the upward movement on Monday without the necessity of any secret banking agreement.

The traction issues have moved in sympathy with the general market. Third Avenue stock and bonds were particularly weak, the first named selling at 20, by far the lowest price on record, while the 4-per cent. bonds sold below 40. The declines in these issues followed the announcement that the stock will be defaulted on Jan. 1.

Philadelphia

The developments in the general financial markets at New York and all of the principal centers were reflected in the local securities market during the past week, and naturally the traction issues suffered accordingly. At no time was the volume of business heavy, and all things considered, price fluctuations were moderate. Philadelphia Rapid Transit was the active feature of the week, several thousand shares of which changed hands at from 17 to 16. Union Traction declined in sympathy with B. R. T., the price yielding from 47 to 45½, but later it recovered to 46. Philadelphia Traction was the weakest issue of the group, the stock sustaining a net loss of 2 points to 83. Consolidated Traction of New Jersey, after selling at 55, advanced to 56½, but subsequently there was a reaction of 1¼ points to 55¼. Philadelphia Company common sold at 34½ and at 34, and the preferred at 37. American Railways lost a point to 45, and Fairmont Park Transportation sold at 9.

Baltimore

Trading in the Baltimore traction issues was fairly active and prices showed very little change from those prevailing at the close of last week. In the early dealings there was rather heavy selling of United Railway 4s, which carried the price from 79¾ to 79, but at the low figure good buying developed and resulted in a recovery to 79½. The income bonds sold at 43, and the refunding 5 per cent bonds at 67¼ to 68. The common stock was fairly active at 8⅞ @ 9. Baltimore City Passenger 5s sold at 102, Washington City & Suburban 5s at 97, and Lexington Street Railway 5s at 96.

Other Traction Securities

The market for traction stocks at Boston was comparatively quiet, and while prices displayed more or less irregularity, the net changes were generally confined to the fractions. Boston Elevated held steady at 120. West End common sold at 80 and the preferred at 98 @ 97¾. Massachusetts Electric sold at 9⅞ @ 10, and the preferred, after an early decline to 37, advanced sharply to 39. Boston & Worcester preferred sold at 60. There were no important developments in the Chicago traction situation during the past week and none are expected until the money and financial markets assume normal conditions. Trading in the local traction issues has been extremely light, and price changes were unimportant.

Trading on the Cleveland Stock Exchange has reflected the conditions that prevail over the country to some extent. Cleveland Electric reached 40 and several blocks of stock were sold at 40 and 41. Northern Ohio Traction & Light changed hands at 19½ and 19¾, a low figure for that security. For future delivery several large blocks of Cleveland Electric were taken at 42 and 43. The result of the election will have everything to do with the future of this stock and will perhaps have its effect on the stocks of companies in other cities where the street railway question has been made a political issue. Aurora, Elgin & Chicago preferred varied between 69 and 70, while Washington, Baltimore & Annapolis Pooling certificates were quoted at 10.

Security Quotations.

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Oct. 30.	Nov. 6.
American Railways	—	—
Boston Elevated	a124	a120
Brooklyn Rapid Transit	37⅛	32½
Chicago City	150	150
International Traction (common)	a47	a45
International Traction (preferred) 4s	a60	a59¼
Cleveland Electric	—	40¼
Consolidated Traction of New Jersey	54	55½
Detroit United	36	32½
Interborough-Metropolitan	5½	5¼
Interborough-Metropolitan (preferred)	15⅛	16½
International Traction (common)	a47	a45
International Traction (preferred) 4s	a60	a59¼
Manhattan Railway	111	105
Massachusetts Elec. Cos. (common)	a10	10¼
Massachusetts Elec. Cos. (preferred)	37	39½
Metropolitan Elevated, Chicago (common)	21	21
Metropolitan Elevated, Chicago (preferred)	50	50
Metropolitan Street	a35	29
North American	51½	44
North Jersey Street Railway	40	40
Philadelphia Company (common)	36	33½
Philadelphia Rapid Transit	16¼	16
Philadelphia Traction	85½	85
Public Service Corporation certificates	53	54
Public Service Corporation 5 per cent notes	89	90
South Side Elevated (Chicago)	69	69
Third Avenue	25	19½
Twin City, Minneapolis (common)	83¾	73
Union Traction (Philadelphia)	46½	46¼

a Asked.

The *Iron Age* says: It is amazing how swiftly the iron trade is adjusting itself to the conditions created by the happenings in the money markets. Plants are shutting down right and left, or are reducing their output. A large number of furnaces have shut down or are about to do so; coke ovens and steel plants have been stopped partially or wholly and the rolling mills are reducing their output. During the week there have been a number of conferences among makers in different lines looking toward harmony of action in meeting the sudden contingencies which have arisen. The copper market has developed considerable action, the large producers reporting a heavy demand both from domestic and foreign consumers. The demand from the latter source is still heavy, the exports of copper metal for the month of October being the second largest on record. Prices are quoted higher at 14¼ @ 14½c. for Lake and 14 @ 14½c. for electrolytic.

"L" TRAFFIC IN CHICAGO

Each of the three Chicago elevated railroads reporting its traffic for October showed an improvement over last year, as well as the preceding month of this year. In percentage of gain the South Side Company led with more than 35 per cent. The Northwestern Company made an unusually good exhibit with a daily average of 108,806, the best of any month in the history of the road. The same was true of the Metropolitan and South Side Companies, except the record made by the latter during the Chicago City Railway strike. The elevated properties are doing unusually well, and the price of their securities fails to reflect the good business which the roads are enjoying. The figures follow:

	1907	1906	Increase	Per Cent
SOUTH SIDE ELEVATED				
January	92,411	92,406	5	0.00
February	96,094	95,077	1,017	0.00
March	100,226	95,466	4,760	4.98
April	103,152	95,756	7,306	2.72
May	109,880	91,759	12,721	13.03
June	115,686	101,770	19,986	13.67
July	111,933	92,796	19,187	20.39
August	113,847	88,539	25,308	28.58
September	118,256	89,749	28,507	31.74
October	126,670	93,577	33,093	35.36
METROPOLITAN ELEVATED				
January	150,165	129,720	20,445	15.76
February	154,444	135,570	18,874	13.91
March	154,790	138,169	16,621	12.02
April	156,275	137,477	18,798	13.67
May	151,423	136,735	14,688	10.72
June	148,518	133,974	14,544	10.85
July	135,779	123,370	12,409	10.37
August	136,517	123,512	13,005	10.52
September	140,979	126,975	14,004	11.02
October	157,080	142,671	14,409	10.09
NORTHWESTERN ELEVATED				
January	88,632	81,204	7,428	9.15
February	88,435	83,572	4,863	5.81
March	89,344	85,154	4,190	4.92
April	99,134	84,244	5,800	6.99
May	94,204	81,748	12,456	15.24
June	99,051	80,165	18,886	23.56
July	91,542	73,308	18,234	24.87
August	93,174	73,170	19,998	27.32
September	97,447	77,508	19,939	25.72
October	108,806	88,344	20,462	23.16

REPORT OF MONTREAL STREET RAILWAY FOR THE YEAR

The Montreal Street Railway Company's full pamphlet report for the year ended Sept. 30, 1907, shows, as follows:

	1907	1906
Gross receipts	$3,503,643	$3,100,487
Operating expenses	2,104,653	1,850,720
Net earnings	$1,398,990	$1,249,767
Received from Park & Island Railway	55,101	.....
Total net	$1,454,091	$1,249,767
Fixed charges	585,250	546,064
Surplus	$868,841	$703,703
Dividends and insurance fund	793,100	700,000
Surplus	$75,741	$3,703

The general balance sheet as of Sept. 30, 1907, compares as follows:

ASSETS

	1907	1906
Road construction and equipment	$9,425,754	$8,392,547
Stores	421,177	347,311
Real estate and buildings	2,086,086	1,973,810
Accounts received	111,832	70,607
Park & Island Railway advertising	250,619	215,664
Montreal Terminal advertising	41,137	.....
Cash	309,886	40,202
Fire insurance fund	370,153	266,000
Stocks and bonds of other companies	3,200,906	1,572,399
Total	$16,217,555	$12,878,540

Capital stock	$8,829,590	$7,000,000
Bonds	2,566,368	2,509,368
Bank of Montreal loan	500,000	1,483,975
Accounts and wages payable	190,972	396,354
Accrued interest	50,002	34,568
Accrued tax	224,489	187,235
Employees' securities	16,377	15,371
Unclaimed dividends	1,957	1,957
Unclaimed tickets	44,357	37,874
Bills payable	1,010,030	.....
Suspense account	204,620	163,007
Dividends payable	213,000	175,000
Fire insurance fund	381,451	341,245
Contingent account	11,637	7,817
Surplus	2,365,792	524,770
Total	$16,217,555	$12,878,540

Included in the Montreal Street Railway's report is the report of the Montreal Park & Island Railway Company, owned by the Montreal Street Railway Company. The income account for the year ended Aug. 30, 1907, compares as follows:

	1907	1906
Gross receipts	$262,814	$218,604
Operating expenses	180,931	155,142
Net earnings	$81,883	$63,462
Counting for renewals	26,714	50,000
Net Inc.	$55,169	$13,462
Charges and C. pf	125,018	121,488
Deficit	$69,849	$108,026

Montreal Park & Island Railway's general balance sheet as of Aug. 31, 1907, compares as follows:

ASSETS

	1907	1906
Cost of road and equipment	$2,328,197	$2,264,468
Office change fund	2,000	2,000
Accounts receivable	1,438	2,048
Profit and loss	862,926	793,077
Contingent account	.....	9,218
Total	$3,194,560	$3,070,810

LIABILITIES

	1907	1906
Preferred stock	$315,000	$315,000
Common stock	720,900	720,900
Bonds	1,025,000	1,025,000
Mortgages	.....	500
Unredeemed tickets	11,780	10,007
Suspense account	25,609	19,981
Contingent account	9,687	.....
Montreal Street Railway Company's loan	204,272	209,277
Accrued interest on bonds	700,581	607,314
Cumulative dividend on preferred stock	181,731	162,831
Total	$3,194,560	$3,070,810

President L. J. Forget says, in part, as follows:

In the city proper few extensions have been made, as the city has not seen fit to grant any new routes, notwithstanding that this company has persistently urged the Council to consider the question of granting new routes in order to meet the growing requirements of the public. This attitude is to be regretted, as the company has been, and is, anxious to keep well ahead of the requirements, in order that the public may get the best possible satisfaction from its car service. The directors intend to continue to press this matter upon the Council, in the hope that they will soon realize the importance of considering and dealing with a question of such public importance.

The Montreal Park & Island Railway Company has, during the past year, shown satisfactory results.

In the past years the Montreal Park & Island Railway has been a charge on the Montreal Street Railway; but this year the company has shown improved earnings and was enabled to pay to the street railway company the sum of $55,101, on account of interest, and the directors believe that the returns from this investment will continue to increase.

The company has entered into a franchise with the Notre Dame de Grace for the extension of its system through the municipality, extending over a period of fifty years.

The company has secured a right of way from the present terminus of the Back River route to a point outside the village of St. Vincent de Paul on the south shore of the river.

During the past year additional right of way was purchased on the Cartierville line, in order to permit the continuing of the double tracking of this division.

The Montreal Terminal Railway purchase was completed on the first of July, and the directors anticipate that this property will become a valuable asset to the shareholders in the future.

A STATEMENT REGARDING PENNSYLVANIA'S NEW YORK PLANS

Vice-President Samuel Rea of the Pennsylvania Railroad Company authorizes the following statement:

"It was originally intended by the Pennsylvania Railroad to change from steam to electric locomotives near the Hackensack portal of the New York tunnels, and the alignment of track from Harrison to this portal was made accordingly. It having been decided, however, to change locomotives at Harrison, this short section of track is being improved by reducing the curvature at a very moderate expenditure. The report that this revision of line is due to an engineering mistake, and involves a million-dollar expenditure, is incorrect and grossly exaggerated."

OHIO ELECTRIC RAILWAY ORGANIZES

The organization of the Ohio Electric Railway Company, of Cincinnati, has been completed by the election of the following officers: W. Kelsey Schoepf, president; Norman McD. Crawford, vice-president; F. A. Healy, secretary-treasurer. The directors are: W. Kelsey Schoepf, Norman McD. Crawford, F. A. Healy, D. G. Edwards, J. B. Foraker, Jr., and Dana Stevens, all of Cincinnati; J. Levering Jones, of Philadelphia, and Hugh J. McGowan, of Indianapolis.

D. G. Edwards, vice-president in charge of traffic, presented his resignation, giving as his reasons that the duties of the office were becoming too heavy when taken in connection with his other work, and that he was forced to be absent from home too much of the time. Mr. Edwards was made president of the Lima & Toledo Traction Company, the Indiana, Columbus & Eastern and the Columbus, Newark & Zanesville, all companies forming a part of the larger system. In addition he will act in an advisory capacity to the traffic department. No one has been selected to fill the vacancy, and the duties will be performed by others for the present.

As previously announced in the Street Railway Journal, J. L. Adams, general manager of the Central Division; A. W. Jordan, assistant general passenger and freight agent, and George Bush, chief clerk in the office of D. G. Edwards, have also resigned. W. A. Gibbs, in charge of the Eastern Division, will also have charge of the Central Division in the future, with headquarters at Columbus. These resignations are due to the change brought about by the retirement of Mr. Edwards from the traffic department, it is said.

This company has a large amount of construction work under way, and will make one of the large Western systems. Working in conjunction with the McGowan roads of Indiana, the two systems will effectually cover the two states and will be in a position to do an extensive business. The headquarters of the Ohio Electric Railway Company will remain in Cincinnati, and the business will be directed by President Schoepf.

THE SITUATION IN NEW YORK

The quarterly dividend of 1½ per cent on the stock of the Third Avenue Railroad, guaranteed under the lease by the Metropolitan Street Railway Company, payable Oct. 31, was not met because of the order given the receivers by Judge Lacombe in the United States Circuit Court on Oct. 8. In issuing his order directing the receivers to default on the quarterly dividend, paid as rental, Judge Lacombe called attention particularly to that clause in the Third Avenue lease which prevents stockholders of the Third Avenue from repossessing their property within six months after any default. Judge Lacombe declared that by that time "sufficient information can be gathered and made public by the receivers as to give such enlightenment as to the whole situation as will enable the court to deal understandingly with all questions as to these items of rent and mortgage interest."

According to the *Wall Street Journal,* the Third Avenue situation is complicated by the fact that the property not only is leased for 999 years to the Metropolitan, but that the Metropolitan Street Railway and the New York City Railway, together, according to latest figures obtainable, control $7,880,000, or 49.3 per cent, of Third Avenue's entire $15,995,800 outstanding stock, while the public holds $8,115,800, or 50.7 per cent. Furthermore, the earnings of the Third Avenue property from the time it was leased by the Metropolitan have been far from sufficient to meet the dividend paid as rental by the Metropolitan. No report of earnings of the Third Avenue alone has been published since 1904. The report for the last full year was that ended June 30, 1903, and showed a surplus after charges of only $44,527. This meant practically nothing earned for the stock. The outstanding $36,943,000 4 per cent bonds of the company, put out a few weeks after the road was leased to the Metropolitan, require such large interest charges as to leave little for the stock.

FURTHER TROLLEY FREIGHT DEVELOPMENT IN MASSACHUSETTS

The general movement of Massachusetts electric railway companies to secure freight and express rights was marked last week by new action by the Old Colony Street Railway Company in the Fall River case. The company now takes the whole matter to the Railroad Commissioners, over the heads of the local authorities. This is a move that would not have been possible previous to the passage of the so-called "missing link" freight law for electric railways, by this year's Legislature (Chap. 402, Acts of Mass.). But under this new law, if the local authorities refuse a grant or fail to act on it within sixty days, the company may appeal to the Railroad Commissioners, who then have it in their discretion to grant the rights through the particular community if it appears to them that the latter is standing in the way of a service that will be "of public necessity and convenience." On Nov. 3, 1905, the company tried to get these rights unsuccessfully. It put in a second petition on Jan. 1, 1906, under Chapter 441 of Mass. Acts and Resolves of 1904. On Sept. 10, 1906, the mayor and aldermen granted the desired rights, but attached a number of conditions, such as limitation of the service to five years, special rights of the city with reference to termination of franchises, etc. The Railroad Commissioners would not approve the grant with conditions which it regarded as extraneous to the contemplated service, and action was suspended.

Meanwhile, the Old Colony Company secured rights in practically all the other large cities of southeastern Massachusetts and began running cars. Last summer it secured the passage of the new law; then on Aug. 3 of this year filed a new petition with the Fall River authorities. They failed to act, and the sixty days' limitation expired this month. West of Boston, the Middlesex & Boston Street Railway (a part of the Boston Suburban system) has secured rights from the local authorities in Natick which it wants the Railroad Commission to approve. Conditions attached by the local authorities raise a question whether the Board will acquiesce without some modification. They include provision that the franchise may be revoked for violation; regulation of the service by the selectmen as approved by Railroad Commission; that the company shall receive and deliver matter at points or stations approved by the town; that the cars shall carry only matter usual to express companies in closed cars; that the freight cars shall not be run between 11 p. m. and 5 a. m., nor on Sundays, excepting through baggage cars from connecting lines for personal baggage of passengers; and that the speed shall not be greater than that of passenger cars, as regulated from time to time.

The Berkshire Street Railway Company, operated by New Haven Railroad interests in the Pittsfield district, takes another step in electric railway freight development by asking approval of rights granted in Cheshire.

END OF CHICAGO TRACTION DIFFICULTIES IN SIGHT

There is every promise of a speedy settlement of the troubles of the Chicago Union Traction Company. A new reorganization plan, drawn up to take the place of the one objected to by the bondholders and which a few months ago was held by the United States Supreme Court to work an injustice to the present holders of the first mortgage bonds, has been agreed to by all concerned. The new plan differs from the old one by providing that the money for the rehabilitation shall not constitute a mortgage on the property until title has been perfected by the Chicago Railways Company. The company is required to perfect its title by Feb. 11, 1910, three years from the date of the ordinance.

According to the new plan, the money to rehabilitate the properties and pay off the floating debt so that the system can be taken out of the receivers' hands is to be raised by two syndicates. One, to be called the rehabilitation syndicate," will furnish $12,000,000 in the purchase of first mortgage 5 per cent bonds at a price which the board of directors of the Chicago Railways Company may determine. This money is to be used for the improvement of the properties.

The other, the "organization syndicate," will float $5,000,000 of "collateral notes" drawing interest at 6 per cent and redeemable at the option of the syndicate after three years. This money, or as much of it as needed, is to be used to pay off:

Receiver's certificates aggregating	$1,072,000
Car trust obligations	760,000
Real estate mortgages	1,969,000
Legal expenses, including all costs of the receivership and charges connected with the transfer of the properties to the Chicago Railways Company	1,969,000

The $12,000,000 is not intended to mark the limit of cash to be spent in improvement work. It is figured it is all that can be spent in two years and after that more money can be obtained. The amount is limited to the demands of the board of supervising engineers under the ordinance.

In addition to these first mortgage securities to raise the ready cash the Chicago Railways Company is to issue $37,500,000 of second mortgage bonds to take up existing bonds of the companies comprising the Union Traction Company and stock of the two underlying companies.

When the new plan was first made public it was subjected to an attack by Attorney Jacob Newman, representing holders of part of the floating indebtedness, which aggregates $4,400,000. He made the point that his clients were not sufficiently secured and contended that the earnings belonged to the creditors until their claim was satisfied, and that dividends not be paid to the stockholders first. At a subsequent conference it was agreed that instead of getting 8 per cent dividends, if earned, on their stocks, holders of the Union Traction and North and West stocks will get 4 per cent a year until one-half the floating indebtedness is paid; then the dividends are to be increased to 5 per cent until the remaining half is paid.

To take up the floating debts, amounting to about $4,400,000, in judgments, promissory notes and receivers' certificates of indebtedness, "series C" bonds will be issued, to be retired by means of a sinking fund. Provisions for the disposition of the sinking fund were also made by the arbitrators and agreed to by the lawyers.

A new order of possession will probably be entered by Judge Grosscup granting to the Chicago Railways Company the right to operate for twenty years the lines under the newly approved plan. The company will accept the traction settlement ordinance and the receivership will be continued indefinitely by this program.

In view of the probable termination of all difficulties, the people of Chicago are looking forward to through car routes between the North and South Side and universal transfers provided for in the franchise ordinances. Twenty-one through routes are planned. However, before many of them can be adopted considerable new track will have to be constructed.

MASSACHUSETTS HALF-FARE LAW LEGAL

The case of the Interstate Consolidated Railway vs. the State of Massachusetts, involving the constitutionality of the Massachusetts statute requiring street railway companies to sell tickets to school children at half-rates, was decided by the Supreme Court of the United States in accord with the State's contentions. The opinion was handed down Nov. 4 by Justice Holmes and upheld the law. The case originated in the town of Attleboro. The decision raised the interesting point as to whether a charter for a corporation involving a contract based upon an unconstitutional law is binding, and the majority of the court in effect held that such may be the case. In announcing the court's decision, Justice Holmes said that the court had reached the conclusion that inasmuch as the law was enforced when the charter was granted it was binding regardless of the law's validity. As for himself, however, he considered the law to be in pursuance of the state police power, and was willing to sustain it on that ground. He also stated that Justice Harlan believed it necessary that the law should be constitutional.

SOUTHERN PACIFIC IMPROVEMENTS

Pending the report of its engineers on the electrification of its lines across the Sierra Mountains, referred to at length in the Street Railway Journal for Aug. 31, 1907, the Southern Pacific is carrying out improvements, the effect of which on transcontinental traffic will be immediate. Twenty-four sidings between Roseville and Truckee are being lengthened, so that after this month trains of forty-five instead of thirty cars can be sent across the mountains to Ogden. Adding 700 ft. to twenty-four sidings of a railroad built upon mountain ledges was an enormously difficult and expensive undertaking. One-half the sidings are in the 46 miles of snow-sheds which enclose the road between Blue Canyon and Truckee. The extension of the snow-sheds alone required 7,000,000 ft. of lumber. At Summit an entirely new track, 3100 ft. in length, was put in to avoid the congestion which has blocked traffic at this point. In addition to the siding extension, the Southern Pacific is laying a double track between Truckee and Winsted, and between Elvas and Loomis. This work is almost completed, and with the vast terminal improvements being carried out at Roseville, will double the capacity of the Harriman lines in this territory. In the new Roseville classification yard, the natural distributing points for transcontinental coastwise and transcontinental traffic, the last of 50 miles of track is being laid. The receiving, classification and departure tracks comprise 27 miles, the remainder being storage, repairs and industry spurs. Work is also being rapidly pushed on additional round-house facilities and repair shops at Roseville.

PREPARING PUBLIC SENTIMENT FOR HIGHER FARES

There are indications that some of the street railway interests in Massachusetts are taking steps to prepare public sentiment for an increase in fares on the country lines. For two years or thereabout proceedings before the Railroad Commission have been noted from time to time, whereof the net result has been to allow the companies to get a larger return for country service through the curtailment of transfer privileges or the reduction of fare limits. The more notable instances of this kind have had to do with sections of the Boston & Northern and Old Colony street railways, the systems covering the large territories north and south of Boston, respectively.

Recently the management of the Blue Hill Street Railway has caused to be sent out for publication in local newspapers along its line, through Milton, Canton and Sharon from the Boston Elevated Railway terminus at Mattepan, items calling attention to the low return on the average country line of street railway, of which the Blue Hill is one. The first item was as follows:

"A street railway expert says: Practically every class of commodity which the public is buying to-day, outside of street railway and telephone services, and in a few isolated cases, gas and electricity, has been advanced in the past three years. The street railways either by charter or custom are held to the five-cent rate. And yet the advance in the cost of operation has affected street railways precisely as much as it has manufacturing concerns. There can be no question but that if the present tendency toward increased cost continues, the street railway companies of the country will be obliged in time to seek relief in higher rates.

"The city traction systems which serve a densely populated area can probably manage to make a living profit on the five-cent rate; but the long country lines in sparsely settled districts have already felt the pinch and are apparently destined to feel it even more severely. The city lines get a liberal percentage of profitable short-haul business, but the riding in the suburban and country districts is for the long haul.

"It is certainly a suggestive fact that forty-six Massachusetts street railways in the 1906 fiscal year, operating nearly 750 miles of track, showed a combined surplus after fixed charges of less than $125,000. That was in 1906, one of the best trolley years in recent street railway history. It is probable that during the year which ended September 30 last many of these forty-six roads have shown a considerable loss after charges, so that the combination of forty-six will show a deficit instead of a small surplus."

In the weekly papers of a week or two later, the same interests secured the publication of the following, dealing directly with their local situation:

"The report of the Blue Hill Street Railway Company for the fiscal year ending September 30, 1907, shows that the company operated at an absolute loss of $7,040.32. Ever since the company started business it has lost money, this loss aggregating $55,622.07. To carry on its operation the company has been compelled to borrow extensively, and at the present time has ont notes for $185,000. All this means that the company is carrying its patrons at less than the actual cost, and the stockholders are steadily losing money. What the outcome will be is very difficult to foresee, but it is hoped that a satisfactory solution may be reached without curtailing the present service. The road has been of great convenience and benefit to the citizens of Canton and Stoughton, and any financial disaster to it would be very unfortunate for those towns."

That there is any intention of abandoning any part of the service over the Blue Hill trackage seems unlikely, inasmuch as this is a Stone & Webster property, and was some time ago named in a public hearing as one of the several local lines in the territory between Boston and Providence, which the firm plans to connect with the proposed Boston & Providence Interurban Electric Railroad, for which the certificate of public exigency is shortly expected to issue from the office of the Railroad Commission—the first to be approved under the "interurban law" passed in 1906.

INTERURBAN ROADS INCLUDED

The Indiana Supreme Court has decided that the word "railroad" used in the law relating to subsidies includes interurban roads, and that the act of 1903 declaring that a large body of legislation concerning railroads "shall be extended to and held to include every kind of street railroad or interurban street railroad by whatever power its vehicles are to be or are transported," is constitutional. Accordingly, the court held that the grant of a $25,000 subsidy voted by the taxpayers of Wayne Township, Kosciusko County, to the Winona Interurban Railway Company, was valid, and that the Circuit Court judge properly refused to enjoin the county officials from placing the tax on the duplicate for collection.

It was insisted that the act did not have a constitutional enacting clause, and that it was an amendatory act which failed to recite the acts amended. The court held that the enacting clause is there, and that this act was supplementary only by the way of giving an interpretation to the word "railroad," and, therefore, not governed by the rules which apply when the Legislature undertakes to amend a statute. Judge Hadly, who wrote the opinion, called attention to the fact that the term "railroad" never did have any connection with the use of steam power, as the first railroad law particularly mentioned railroads operated "by steam, animal or any mechanical power."

This decision has been patiently waited for by promoters of interurban lines in Indiana. The question was raised that the law relating to the voting of a subsidy tax in aid of a railroad did include an electric road. For this reason some townships refused to vote a subsidy and other petitions were held up by county commissioners pending the decision of the Supreme Court. It is said that a number of projected roads will now be built, because the people want them and will vote the necessary subsidy assistance.

CONSOLIDATED COMPANY ANNOUNCES OPERATING CHANGES

Following close upon the announcement of the substitution of a system of through trolley tickets in place of the old system of repeated payments on all trolley lines controlled by the Consolidated Railway Company in Connecticut and Rhode Island, the statement is now made by officials of the company that early steps are to be taken for the adoption of a standard trolley signboard of the most improved type, indicating the destination of cars. The new style of sign it is stated will be transparent both by night and by day, its purpose being to do away with any confusion which may have arisen in the past, and to make clear to passengers the destination of all cars. The new sign will be placed on both ends and both sides of cars. Experiments looking forward to the selection of the most satisfactory model of sign have been in progress for some time, and the style selected will, it is stated, be made standard throughout. It is believed by officials that it will result in much greater convenience and the doing away with any complaints about poorly lighted or illegible car signs.

MAYOR JOHNSON RE-ELECTED—CLEVELAND COMPANY WITHDRAWS LOW-FARE TICKETS

Mayor Tom L. Johnson was, on Nov. 6, re-elected for the fourth time as Mayor of Cleveland in a hard-fought battle in which the Republican ticket was headed by Congressman Theodore E. Burton, chairman of the House Committee on Rivers and Harbors. The official count on 130 of 244 precincts gives Johnson 23,990; Burton, 20,434. The present ratio if maintained would give Johnson a majority of over 8000.

Readers of the STREET RAILWAY JOURNAL are familiar with the campaign in Cleveland through the accounts that have appeared in this paper from week to week dealing with the street railway situation and the attitude assumed by the candidates on the street railway franchise question, the main issue of the campaign. The closing week of the campaign developed into a series of accusations and denials. It was clearly shown, however, that the franchises given the new companies have proved to be of such a character that they are not bound to give the people a three-cent fare. Neither are they tied down to universal transfers, or any transfers, unless the company's income will produce 6 per cent. on the capital stock of the companies.

By most people the re-election of Mayor Johnson is taken to mean that there will be a continuation of the street railway fight, and that it will be harder than ever before. The Cleveland Electric withdrew its seven-for-a-quarter tickets as soon as it was known that Mr. Johnson was elected and took down the advertising in the cars appealing to the people to favor its offer. The opinion prevails that the new companies can do nothing with the West Side, even if they secure the right to build lines; in fact, it would seem that no company could get money now to build roads.

Along the line of advancing Mayor Johnson's interests just before the election, the City Council, acting under his advice, passed five of the seven ordinances that were presented recently, giving the low-fare companies the right to use the tracks of the Cleveland Electric in so-called free territory. They become operative within ten days after their passage, and give the Forest City Railway Company the right to operate around the Public Square and on Ontario Street, which passes through the square. From this point its cars may run over the Superior, Euclid and Prospect Street lines of the old company to East Ninth Street and on the latter for a sufficient distance to connect these streets, so that it will have facilities for handling its cars in the central part of the city. The Euclid grant extends to East Fourteenth Street, where the "graveyard" line reaches Euclid. On the West Side the Forest City is given the right to operate on Lorain Avenue from West Twenty-Fifth Street to West Seventy-Third Street; also over the Abbey Avenue bridge to West Fourteenth Street, to Kenilworth Avenue, across the Central viaduct to Central Avenue and then to Eagle Avenue, where connection is again made with the lines about the Erie Street cemetery. These grants were made on the full Democratic vote in the Council, all the Republicans voting in opposition to them.

Last week the Cleveland Electric Railway refused to allow Peter Witt, city clerk and owner of one share of the capital stock of the company, to continue his investigation of the books, although his experts had been engaged in this line for several weeks past. President Andrews said that the investigation was being made for political purposes and that the material secured thus was being handed over to certain newspapers for use against the company. For this reason he thought that Witt was not exercising the right of a stockholder, but was merely securing ammunition, as far as possible, to aid Mayor Johnson in his campaign.

Witt appealed to Judge Chapman to enforce an order of court allowing him to continue the investigation, but the court refused. The matter was then taken to the circuit court and Judge Marvin, sitting alone, said that the case would have to go over to Nov. 8, and that he would hold matters where they are until a full court could hear the case. This was disappointing in the last days of the campaign, as Witt had been very busy not only with this, but in taking evidence in an attempt to show that the Cleveland Electric had been using money for purposes for which it should not have been spent—that is, in advertising, printing a paper of its own, paying for the consents on certain streets and other things along the same lines.

RAILROAD ACCIDENTS IN INDIANA—BULLETINS TO BE ISSUED BY RAILROAD COMMISSIONERS

The Indiana State Railroad Commission is giving especial attention to the prevention of accidents on steam and electric railroads. According to the first quarterly bulletin issued by the commission, during July, August and September 99 people were killed and 365 injured on steam railroads and 8 killed and 34 injured on electric roads in Indiana. The commissioners say, "unquestionably a large proportion of these accidents were preventable, and there are many reasons why they should be prevented." However, in many instances the railroads are not at fault, as the bulletin shows that thirty-six of the killed—or one-third of the total—were trespassers on the railroad tracks, or trains, and so were twenty-two of the injured. The property loss amounted to $42,863.76.

In line with its intention to investigate all serious accidents, the commission will in the future issue quarterly bulletins discussing serious railroad accidents. The bulletins will be compiled from the reports sent in by the roads in Indiana supplemented by reports from the inspectors sent out by the commission, and these reports will be used in connection with the investigation of accidents. The purpose is to ascertain what steps should be taken to prevent a repetition of accidents within the state.

In the first bulletin the commissioners say it is apparently impossible to prevent people from using railroad tracks for foot paths, and of course they do so at their peril. It is a form of recklessness to which Americans are prone, but it is inexcusable recklessness in a person defective in sight or hearing, or those otherwise handicaped in ability to get out of the way of approaching trains. The bulletin states that recklessness and carelessness are found among railroad or train men, also. Over one-fourth of the number killed, lost their lives in collisions, and seldom do collisions occur without fault of some railroad employee. The commission very sensibly calls attention to some common forms of these faults such as neglect of the proper signals for highway crossings, careless reading of train orders, and permitting loungers to loaf in telegraph offices and signal stations. It notes also that 114 brakemen were killed and 23 injured while coupling cars—a hazard which is expected to be removed by automatic couplers. These casualties were in part due to carelessness of the men and in part to defect in safety appliances. The commission's inspectors found seven interurban and eighty-seven steam line cars defective in respect to safety appliances and other defects. Only six casualties were reported from defective tools and appliances.

All of this information will be used in the investigation of accidents which will be taken up in a short time. All train men implicated will be summoned and an attempt will be made to find out who was responsible in each case, and what was the cause of the accident.

AMERICAN MUSEUM OF SAFETY DEVICES

Word has just been received that the International Jury in the section of Social Economy at the International Book, Paper and Publicity Exposition, which closed in Paris last month, made an award of the grand prix to the American Museum of Safety Devices and Industrial Hygiene. A diploma of honor, the second highest award, was made to Charles Kirchhoff and T. C. Martin, respectively chairman and vice-chairman of the museum's advisory council, also to Dr. L. L. Seaman and Rudolph Lens for their active interest in promoting the work of the museum.

The museum is now occupying the entire fifth floor at 231 to 241 West Thirty-Ninth Street, New York City, and all inquiries for space, exhibits and other information should be sent to Dr. W. H. Tolman, director of the museum.

INSTITUTE LIBRARY TO BE OPEN EVENINGS

Announcement is made by the committee having supervision of the library of the American Institute of Electrical Engineers, the library of the American Society of Mechanical Engineers, and the library of the American Institute of Mining Engineers, that the library rooms will be open evenings until 9 o'clock on all week days beginning in the near future, on a date to be announced shortly. The date when this plan will go into effect will probably be about December 1st, or a little earlier. As most of our readers know, these libraries are located on the 13th floor of the new Engineering Societies Building, New York.

REORGANIZED EXTENSION COURSES IN MECHANICAL ENGINEERING AT BROOKLYN POLYTECHNIC

The Polytechnic Institute of Brooklyn starting this year with the reorganized department of Mechanical Engineering in charge of Prof. William D. Ennis, is offering enlarged courses of extension work through its evening classes. These classes began with purely lecture courses about three years ago, and have developed into valuable adjuncts to the regular college work. They offer to the student employed during the day opportunities for study or review of elementary and advanced mathematics, besides practical courses on engineering subjects.

During the past summer the mechanical laboratories of the institute have been greatly enlarged and large expenditures made for new equipment, which now includes two steam engines with high-pressure boiler, one gas engine, one gasoline engine, one 100,000-lb. testing machine, one small testing machine, pumps, meters, etc., besides the usual small equipment for field and laboratory testing. Laboratory courses are offered to evening students, involving the use of portions of this apparatus, and the training of the student in the precise measurements of engineering. A thorough course in machine design is also to be given under the direction of Prof. F. De R. Furman; this will be open to men who have completed the equivalent of one year's work in mechanical drawing, and is intended to fit such men for positions as detail draftsmen. This course, in common with others offered, will be practical in its nature rather than mathematical. It is given on Fridays at 7:30 p. m.

The courses in heating and ventilating, by Prof. Taggart, given on the same day and hour, are planned to train men in the practical design of the commercial forms of direct and indirect heating systems.

On Wednesdays at 7:30 p. m. there is to be given a thorough course in mill engineering by Prof. Ennis. This will cover the problems met with in the arrangement of buildings, tracks and yards for large industrial works and especial discussion of the various elements entering into their engineering equipment. Attention is to be given particularly to the practical design of such features as crane installations, automatic sprinkler equipment, apparatus for generating and utilizing compressed air and hydraulic operative machines. The general principles covering the economical design of mill buildings will be discussed and exemplified, and the broad relations of engineering equipment to factory organization will be analyzed.

The major course of the series will be that on power-plant design, given by Prof. Ennis, on Thursday evenings. This will start with a consideration of the power house as a manufacturing plant, its location with regard to the raw material and the market, the choice of site and standard types of buildings. The various items of equipment will then be discussed, their performance analyzed and their relations to the general problems of design investigated. The object of the course is to fit engineers for actual practice in the design and construction of steam or gas power generating plants. The mathematical knowledge required for admission is elementary only, the subject being one that permits of thorough treatment without an extended use of higher algebra or calculus.

The evening work at the Polytechnic Institute is largely pursued by men who are candidates for a degree. A certain amount of credit is allowed, based upon the courses taken during the evening, and the student has the encouragement of working toward the same definite end as the usual day students.

SOME RECENT INSTALLATIONS OF GAS ENGINES

The saving in fuel effected by use of the gas engine as a prime mover has long been fully realized by power users of this country, yet little progress has been made except in the natural gas district, chiefly, perhaps, because of a doubt as to the reliability of engines of this type. The performance of the engines already installed by one of the prominent gas engine manufacturers, the Allis-Chalmers Company, will prove of interest.

The first gas engine of these manufacturers to be put in constant service was a tandem engine of 1000 hp maximum capacity direct connected to a d.c. generator made by the same company and of 500-kw rated capacity. This unit is installed at the Milwaukee works of the Illinois Steel Company. Although it was the first gas engine built by this company, it started successfully and has been in continuous day and night operation ever since, only shutting down with the mill on Sunday. As would be expected of an engine installed at a rolling mill, the load varies greatly in character and is subject to wide fluctuations. Another unit of 600 hp, direct connected to a 350-kw Allis-Chalmers d.c. generator, has been for some time in service at the works of the Trenton Iron Company, Trenton, N. J. This engine is supplied with gas from producers furnished by the R. D. Wood Company, and has also been in continuous service ever since it was started, on loads ranging from full-rated capacity to 50 per cent overload. A 2000-hp Allis-Chalmers engine direct connected to a 1000-kw generator has been for some time in operation on blast-furnace gas at the plant of the National Tube Company at McKeesport, Pa. This engine is the first of several units which the manufacturers are installing at the same plant. Two units, duplicates of the unit at McKeesport are just going into service at the power house of the Milwaukee Northern Railway Company at Port Washington, Wis. This is an interurban line, with the City of Milwaukee as its southern terminal, operated exclusively by gas power. The generators are 1000-kw Allis-Chalmers, 3-phase, 25-cycle alternators, and the gas is supplied by producers.

A duplicate of the Trenton engine, using natural gas, has also been recently put in service at the Kokomo plant of the Pittsburg Plate Glass Company. This is the first of a number of units which Allis-Chalmers Company is building for that service. Two units of 4000 hp each, direct connected to 2000-kw alternators will very shortly be put in operation at the South Works of the Illinois Steel Company, South Chicago, Ill. These engines operate with blast-furnace gas, and the design, in all respects, duplicates that of the engines already in service. Another 4000-hp unit is now in the course of erection at one of the Carnegie plants in the Pittsburg district, this unit being the first of seven 4000-hp units, which are being installed at the rate of one every thirty days in the same power house.

The new mills of the Indiana Steel Company at Gary are also to be equipped by gas engines and the Allis-Chalmers Company is now under contract to supply seventeen Allis-Chalmers gas engines of 4000 hp each. Fifteen of these are direct connected to 25-cycle, 3-phase alternators, which will operate in parallel and supply current to more distant portions of the mill; two to direct-current generators supplying current for portions of the plant immediately adjacent to the power house. The company is also building eight blowing engines with the same sized gas cylinders as the electrical units for the same plant, making twenty-five engines, or a total of 100,000 hp, which the manufacturers are supplying for this power house alone. It will require approximately 1000 carloads to complete the shipment of these engines. The electrical power house, in which will be installed the seventeen electrical units, is 1000 ft. long and 105 ft. wide.

NEW PUBLICATIONS

ELECTRIC RAILWAYS, by James R. Cravath and Harris C. Trow, Chicago. American School of Correspondence, Chicago. 153 pages. Illust. Price $1.

POWER STATIONS AND TRANSMISSION, by George C. Shaad, Chicago. American School of Correspondence, Chicago. 155 pages. Illust. Price $1.

These books form a part of the series of manuals descriptive of approved practice in the subjects of which they treat, issued by the American School of Correspondence, and supply the demand for a short, comprehensive and clearly expressed description of the main engineering principles of the topics treated. In the book on electric railways the title page indicates that the first section was written by Mr. Cravath and the second by Mr. Trow. The book is up to date and well illustrated. Professor Shaad's book is in two sections, one devoted to power stations and the other to power transmission. The latter contains a careful discussion of the method of calculating transmission losses.

ELECTRIC RAILWAYS, VOL. II, ENGINEERING PRELIMINARIES AND DIRECT-CURRENT SUB-STATIONS. By Sidney W. Ashe, New York: D. Van Nostrand & Company, 1907. 282 pages. Illustrated. Price, $2.50.

The previous volume of this series, written by Messrs. Ashe and Keiley, related to rolling stock, and the thorough treatment accorded this subject has been duplicated in the book just issued. In the first chapter the author discusses quite briefly statistics of rides per capita and other commercial considerations relating to traffic. He then takes up the question of motor capacity and its application to schedules and load diagrams. These sections are followed by discussions of power-station location, substation design and operation, the converter, the transformer, insulating oils and auxiliary power-station apparatus.

MASSACHUSETTS ELECTRIC EARNINGS FOR SEPTEMBER AND THE YEAR

The Massachusetts Electric Company's statement for the quarter ended Sept. 30, 1907, compares as follows:

	1907	1906
Gross receipts	$2,595,586	$1,573,001
Operating expenses	1,314,437	1,391,312
Net earnings	$1,281,149	$1,181,689
Charges and taxes	406,680	376,643
Surplus	$874,469	$805,046

As the fiscal year ends Sept. 30, the following forecast of the annual report has been made:

	1907	1906
Gross receipts	$7,761,062	$7,520,537
Operating expenses	5,003,204	4,847,046
Net earnings	$2,757,858	$2,673,491
Fixed charges	1,702,622	1,594,502
Balance	$1,055,236	$1,078,989
Reserve for winter expenses	.....	38,802
Surplus	$1,055,236	$1,040,187

TWIN CITY RAPID TRANSIT EARNINGS FOR QUARTER AND NINE MONTHS

Twin City's report for September and nine months compares as follows:

	1907	1906
Gross receipts	$561,446	$534,151
Operating expenses	251,276	236,926
Net earnings	$310,170	$297,225
Charges, taxes and preferred dividend	115,142	114,758
Surplus	$195,028	$182,467
Nine months' gross receipts	4,540,272	4,217,437
Operating expenses	2,180,436	1,951,050
Net earnings	$2,359,836	$2,266,387
Charges, taxes and preferred dividend	1,036,741	1,004,152
Surplus	$1,323,095	$1,262,235

RESUMING THE TRANSIT INQUIRY IN NEW YORK

The general investigation by the Public Service Commission of traction affairs in New York will not be taken up again until Monday of next week, or possibly Tuesday. According to the present plans, the broad subject of vehicular traffic in Manhattan, with its relations to congestion on the surface lines, will furnish the material for the investigators. Herbert D. Mason was busy Wednesday examining patrolmen from the police traffic squad to get their ideas on this subject. Mr. Mason gathered from them that the chief reason the truckmen stuck to Broadway and other congested north-and-south streets was that in winter side streets were not cleaned so they could get through them. Broadway would be free from snow, while cross streets and some of the less important north-and-south streets would not be. Therefore, a truckman would stay on Broadway all the way uptown rather than take any chance about getting back to it after he had left it once. That habit, acquired in winter, accounted largely for the truck traffic on these congested streets in summer. These facts and others will be brought out at the hearings, the views of the railroad men and merchants and business men obtained, and the commission will endeavor to formulate the result into some sort of a recommendation to the Board of Aldermen, perhaps, for legislation on the subject.

A hearing was held before Commissioner Bassett on an order to the Brooklyn Rapid Transit Company to show cause why a superintendent of terminals should not be employed to have supervision over all the bridge traffic.

ST. LOUIS COMPANY OPENS CLUB HOUSE

The United Railways Company, of St. Louis, has opened its new club house. The club house is the old Fowler mansion remodeled and is located at Grand and Park Avenues, and is for the use of the 2800 employes of the company. The grounds extend from Park to Vista Avenues on Grand, and will be fitted up for baseball, football and other outdoor sports. The interior of the house has been made into a handsome theater, equipped with a good stage, asbestos curtain, scenery and all the needed equipment for producing plays. In the house a fine gymnasium has been constructed and also reception rooms and other conveniences.

General Manager Robert McCulloch, of the company, has announced the company's willingness to place on sale $30,000 worth of street car tickets in payment for which will be accepted personal or corporation checks. The tickets are good for one fare and are issued in strips of five. Capt. McCulloch has suggested that business houses may find it advantageous partly to pay the salaries of employes in street car tickets during the money stringency.

PERSONAL MENTION

MR. E. V. POPE has resigned as general manager of the Alabama City, Gadsden & Attalla Railway Company, of Gadsden, Ala.

MR. JOHN F. REARDON has been appointed successor to Mr. H. C. Barrow as superintendent of the Lehigh Valley Transit Company, of Allentown, Pa.

MR. R. R. RAY, formerly superintendent and claim agent of the Southern Michigan Railway, has accepted the position of claim agent of the South Chicago City Railway.

MR. JAMES WOODS, the retiring superintendent of the Springfield Traction Company, of Springfield, Mo., has been presented with a gold watch by the employees of the company as a token of esteem. Mr. Woods will engage in the coal business at Champaign.

MR. WILLIAM S. GORSUCH, of the electrical engineering department of the New York Central and Hudson River Railroad Company, has been selected by the authorities of the Y. M. C. A., of New York, to conduct its evening course in electricity. This course extends over two years, the first is devoted to the principles of electrical engineering and the second to their practical application.

MR. FLETCHER M. DURBIN has resigned as assistant superintendent of the Indianapolis Traction & Terminal Company, of Indianapolis, Ind., to accept of the position of general manager of the Evansville City Railway and the Evansville & Southern Indiana Interurban Company. Mr. Durbin succeeds Mr. R. R. Smith, who, as previously announced in the STREET RAILWAY JOURNAL, has become connected with the Louisville Railway Company.

MR. THOMAS E. MITTEN, president of the Chicago City Railway Company, has been elected vice-president of the International Railway Company, of Buffalo. Mr. Mitten succeeds Mr. Arthur N. Robinson, a New York capitalist, who has large holdings and represents others. The position is an inactive one and was formerly held by Mr. Daniel S. Lamont. Mr. Mitten was formerly general manager of the International Company. At the time the Buffalo system changed control, Mr. Mitten went to Chicago.

MR. JOHN L. MATSON, formerly general manager of the Muncie & Portland Traction Company, Portland, Ind., has assumed the duties of resident manager of the South Chicago City Railway and the Hammond, Whiting & East Chicago Electric Railway. Previous to his connection with the Muncie & Portland system Mr. Matson held the position of superintendent of motive power and machinery of the Chicago & Milwaukee Electric Railway, and previous to that the position of superintendent of motive power of the Indiana Union Traction Company.

MR. F. W. COEN, for some years secretary and treasurer of the Lake Shore Electric Railway Company, has been chosen general manager, to succeed the late Mr. F. J. Stout. Mr. Coen has proved himself an electric railway man of ability and is well fitted for the new position, which he is to assume at once. He will retain the office of treasurer of the company. Mr. John Witt has been chosen as secretary and assistant treasurer. Mr. Coen will make his headquarters at Norwalk, where the office of the general manager has been located for some time.

MR. EDWARD E. POTTER, superintendent of the Union Street Railway Company and the Dartmouth & Westport Street Railway Company, who, as announced in the STREET RAILWAY JOURNAL of Oct. 19, had been granted leave of absence from the companies to travel in the West, has accepted the position of assistant manager of the Seattle Electric & Power Company, a Stone & Webster property. Before leaving for the West, Mr. Potter was tendered a dinner at the Hotel Algonquin by fellow-members of the New England Street Railway Association and the Massachusetts Street Railway Association. Among those present were Mr. C. H. Page, manager of the Springfield Street Railway, who acted as toastmaster; Mr. Robert S. Goff, general manager of the Old Colony and Boston & Northern Street Railways; Mr. C. S. Sargeant, vice-president, Boston Elevated Railway; Mr. D. Dana Bartlett, auditor Old Colony and Boston & Northern Street Railways; Mr. Frederick S. Swift, of Boston; Mr. M. C. Brush, vice-president and general manager, Newton Street Railway; Mr. H. H. Crapo, president of the Union Street Railway Company, New Bedford, and Mr. Charles C. Peirce, of the General Electric Company.

MR. EDWARD M. WHARFF has been appointed electrical engineer of the Syracuse, Lake Shore & Northern Railroad, of Syracuse, N. Y., in charge of the power station, car house and cars, and overhead work. Mr. Wharff graduated from Syracuse University, being a member of College of Liberal Arts class of 1903, and subsequently graduated from Q. C. Smith College of Applied Science, class of 1906. Since graduation he has been connected with the Rochester, Syracuse & Eastern Railroad. Mr. Wharff says the Syracuse, Lake Shore & Northern Railroad is to make marked changes in both power supply and cars. Within a short time it will begin to use Niagara Falls power, purchased from the Niagara, Lockport & Ontario Power Company, and later will place in use new high-speed interurban cars equipped for operation by both direct current and single-phase alternating current.

MR. EDWIN J. WILCOXEN, general superintendent of the Rochester Railway Company, of Rochester, N. Y., died in Rochester Monday, Nov. 4, following an operation for appendicitis. Mr. Wilcoxen was a young man, only thirty-six years of age, and had been connected with the Rochester Railway Company and its subsidiaries since 1900. He was born at Seneca Falls, N. Y., April 27, 1871, and after attending the public schools in Seneca Falls, entered Mynderse Academy. He then pursued a special business course. In 1888 he entered the employ of the Buffalo, Rochester & Pittsburg Railway Company, acting as mileage clerk. One year later he advanced to the car service department, with headquarters at Bradford, Pa., and subsequently became connected with the general superintendent's office at Bradford. In 1891 he became record clerk of the Wagner Palace Car Company at the Buffalo works, and the next year he was made secretary to the assistant manager of the Wagner Company. In 1894 Mr. Wilcoxen was appointed to the important position of assistant superintendent of the New York State Reservation at Niagara Falls. He filled this position for two years, and was then appointed general passenger agent of the Waterloo, Seneca Falls & Cayuga Lake Railway Company. In May, 1900, he was appointed assistant superintendent of the Rochester & Sodus Bay Railway Company.

MR. C. L. DE MURALT, the well-known consulting engineer, has recently returned from a flying trip to Europe, where he made an examination of the Arlberg Tunnel under the Tyrolean Alps, which is shortly to be electrically equipped. Mr. Muralt has been appointed consulting engineer to the State Railways of Austria and the work to be done under his supervision is said to be the longest stretch of steam railroad electrically equipped in either Europe or in the United States, there being about 140 miles, exclusive of the tunnel. The tunnel is on the main line from Paris to Vienna and is 7 miles long, with steep grades from each mouth to the middle. When the plans developed by Mr. Muralt are carried out the speeds of trains passing over this line will have been increased 25 per cent and the capacity of the road 50 per cent. To accomplish this result three-phase locomotives will be used, capable of developing 3000 hp, or about three times as much as the New Haven locomotives use in the New York suburban service. The electric locomotives designed for the Arlberg Tunnel will be particularly adapted to this service, as when coasting down the grade out of the tunnel they will generate and return to the system about 60 per cent of the energy used to pull the train up the grade into the tunnel. Mr. Muralt, who has recently been appointed Professor of Electrical Engineering at the University of Michigan, has been granted a leave of absence from the university in order that he may supervise this work.

MR. JEFFERSON POLK, president of the Des Moines Street Railway Company, died at his home in Des Moines, Nov. 2, after a two weeks' illness. Mr. Polk was born in 1830 near Georgetown, Ky., and was graduated from Georgetown College. Deciding to fit himself for the practice of law he entered the law office of Mr. P. L. Cable, of Georgetown, subsequently for many years prominently identified with the Chicago & Rock Island Railroad. In 1855 he went to Des Moines and opened an office with Judge Casady. In 1857 he was admitted to the bar of Polk County, and in 1859 formed a partnership with Judge Casady and M. M. Crocker, afterwards General Crocker. In 1864, Mr. Crocker having gone into the army and Mr. Casady having retired, Mr. Polk formed a partnership with F. M. Hubbell, which continued for twenty-three years. In 1866 they financed the first street railway, which had been chartered by Dr. M. P. Turner, and in 1868 they sold their interest to the doctor. In 1871 Mr. Polk organized the Des Moines waterworks with a capital of $200,000, which soon after passed to Polk & Hubbell, and in 1880 to a joint stock company. In 1874 he gathered together the odds and ends of a project to build a railroad to Minnesota, changed the name of the company and built a narrow-gauge road to Ames. After completing the road he sold it to the Des Moines & Minnesota Railway Company. It is now the Northwestern. In 1881 he built a narrow-gauge road to Waukee and formed a syndicate which extended the road to Panora and Fonda, with a branch from Clive to Boone, and also built the road from Des Moines to Albia, now a branch of the Wabash; also the Des Moines Union Railway. In 1888 there had been chartered two or three street railway companies, and in 1889 Mr. Polk purchased the franchises of all the other companies in the city, consolidated the lines, electrified them, and laid the foundation for the present local Des Moines system. Having perfected the street railway system, Mr. Polk began to work out ideas for interurban roads, and with his son-in-law, Mr. George B. Hippee, and son, Mr. Harry Polk, organized the Inter-Urban Railway Company, which has built a road to Colfax, one to Woodward and Perry, and has projects in several other directions.

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Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1907 *to date,* 378,950 *copies, an average of* 8238 *copies per week.*

Incorrect Use of the Title Superintendent of Motive Power

On several systems having sub-shops in charge of men with the title "master mechanics," the master mechanic of the largest shop who is usually in authority over the superintendents of the sub-shops, is known as the superintendent of motive power. In giving this title steam road organization has been used as a pattern. The name is correct in steam railway service, because the official so designated has charge of the maintainence of the locomotives and really is the superintendent of motive power, but the title seems to be a misnomer when applied to the electric railway man in charge of the car equipment. On an electric railway system the "motive power" originates in the power house, and to the power house superintendent, it appears, rightfully belongs the title of "superintendent of motive power." The title for the man in charge of the cars its seems should be "superintendent of car equipment."

Erecting Overhead Motors in Shops

In the extension of the applications of individual motor drives in repair shops it often happens that a motor must be installed in an overhead position, either upon a platform hung from the ceiling or by being bolted inverted to convenient planks or stringers. The advantages of locating a motor for group driving well out of the way of the shop force and machine tools are obvious, but the ease with which motors can be installed at the floor level often leads to their being located in the latter position. As a matter of fact, it is not nearly as awkward a problem to install a motor overhead as is often supposed.

The use of a stout chain and balls is a great advantage in most cases of erecting motors overhead. It generally pays in erecting several motors to build a wooden horse or platform from 6 to 10 ft. in height on which the motor can be rested pending the final adjustment of its bolts in the overhead timbers, though if the motor is to stand upright on a suspended platform the chain and balls will usually be sufficient. A motor of 7.5 hp may easily weigh 1000 lbs., and a 15-hp motor of slow speed type 1500 lbs. The importance of amply strong supports is evident on its face. In some cases, where the shop is built in two or more stories, a hole about 2 ins. in diameter can be bored through the ceiling above the point where the motor is to be located; the chain can be dropped through this hole and the motor hoisted close to its final position without the use of the platform. Sometimes the tackle can be supported best from a horse on the floor above or a stout eye bolt can be pressed into service in the second floor ceiling, with a plate set into the floor as a check against pulling out.

When no upper floor is available to drop the chain through, it may be possible to screw an eye bolt into the stringer nearest the point of final motor support, and to hoist the motor from 7 to 10 ft. above the floor by a tackle depending from this bolt. The horse or movable platform can then be slipped under the motor, and the latter jacked into its proper place opposite the suspension bolt holes. Of course, when a shop is equipped with pneumatic or electric hoists, the erection of overhead motors can be much more easily done, but it will generally be found that some special rig will be needed in getting the motor exactly into the right place. The last few inches of vertical adjustment with a

weight too large for manual handling are the sticking points. In many cases motors are slowly jacked up from the floor, and in a busy shop with a high ceiling this takes a considerable time with possible inconvenience due to interruptions. For this reason the use of hoists and movable platforms is better practice when the conditions are favorable. When the motor is hoisted into close proximity with belts, shafting and other equipment, the use of a guiding rope to steer it clear of these obstructions is very important. A blow struck by a 1000-lb. motor moving, even though an inch or two, is capable of doing serious damage. Objections to the boring of holes in the floors can be largely overcome by plugging them afterwards. In shops with concrete or tile ceilings the jack must be pressed into service to supplement the hoist in most cases. Hap-hazard work in overhead erection brings the natural result of excessive vibration and power losses, to say nothing of the danger of accidents and throttling of production. Skilful planning to meet the conditions of each case is absolutely necessary for the best results.

The Twentieth Century Locomotive

The discussion of steam versus electric locomotives has been active of late and we have published not a few interesting contributions to the subject within the past three or four years. The chief difficulty in a proper consideration of the matter is the seeming impossibility of securing a judicial view point. The literature has been made up of briefs for plaintiff or defendant, very ingeniously constructed and full of telling arguments, yet not wholly convincing. In the nature of things this is the course of events to be expected, since there are practically no engineers who have acquired anything like adequate experience with both classes of motive power. For a full grasp of the problem much more is necessary than to consider it purely from the standpoint of design. Effective railway operation is not so much a matter of small economies in motive power as of infinite finesse in dealing with questions to which tractive efforts and critical speeds are entirely subsidiary. Bearing all this in mind our readers will nevertheless find Mr. Armstrong's Institute paper and the resulting discussion a highly interesting contribution to the subject. The former is particularly striking because the author carries the war into Africa and proceeds to attack the supremacy of the steam locomotive in the very territory that has seemed most its own—the haulage of heavy freight trains—although for the time considered in connection with mountain grades.

There is no doubt whatever, as a matter of theory and of practice as well, that it is possible to build an electric locomotive of bigger output at any and all speeds that it seems practicable to duplicate with steam power. The boiler is the weakest point of steam locomotives, especially when heavy continuous duty is concerned. In taking a "double header" up a steep mountain grade it will generally be the case that the two engines are not simultaneously at maximum duty but ensure a high average duty by relieving each other. With electric locomotives both engines could be pushed to their full power hour after hour without cessation and without exhausting the crews. Moreover, the electric locomotive is better adapted to overloads. We are not inclined to lay so much stress as Mr. Armstrong on the mere increase of speed up grade. While it is true that the economical speed of an electric locomotive may be fairly high, it is an open question from the standpoint not of dynamics but of the art of transportation, whether high speed up grades is worth the while in case of freight haulage. It might even be doubtful whether even were it decided to use electric locomotives the freight speeds should be raised, owing to the effect upon the power stations, especially in the otherwise favorable case of the transmission from water powers. The best conditions for the generation of electric power demand uniformity of load, which is precisely what the employment of gigantic motor units renders extremely difficult. On the other hand the ability of the electric locomotive to surmount formidable grades is a very strong point for electric traction, as in the existing state of railroading the latter form a sort of natural barrier that is the source of many inconveniences. They limit the schedule and hamper the dispatch of the long trains which are feasible elsewhere in the system.

Mr. Armstrong took absolutely the right position in pointing out that the really important gain from electrical equipment is not a saving in the cost of motive power on a particular division but an improvement in the general economy of transportation. Up to the present there have been very few data on the actual performance of electric locomotives in comparison with steam, but the discussion brought out some valuable statistics on this point from Messrs. Wilgus and Murray. These figures are very reassuring, especially when we consider the point so clearly elucidated by Dr. Steinmetz, that all experience with electric traction up to the present has been with the limitations imposed by methods of handling business and operating trains which belong peculiarly to steam service. For example, take the matter of schedules, terminals, and the requirement in the New York Central service that the electric locomotives must furnish steam for heating purposes. In the long run, as Dr. Steinmetz points out, the use of electric motive power will produce appropriate means of handling the traffic and meeting suitably the new requirements which will arise. The objections now raised against it are in no small measure due to the formation of habits directly determined by the use of steam locomotives. Certainly the change of motive power must imply new methods in transportation. This necessity may for a time impede electric traction but it is very unlikely to prove a permanent obstacle.

Schedules, Load Factor and the Cost of Power

The relation of load factor to efficiency is well known. An improvement in the load factor, or the relation between the average and the maximum loads, will result in a reduction of the all-day losses in the feeder system, as well as in an increase in the efficiency of boilers, engines and electrical machinery, besides oftentimes allowing a reduction to be made in the number of power station units operated, thus reducing labor costs, and still further reducing the cost of power as delivered to the motors.

The influence of schedules upon the power station load factor is also well known, but often not properly studied. The load factor of the station which furnishes power for a large number of cars is always better than the one serv-

ing fewer cars, this being true whether the train units are large, as in trunk line operation, elevated and subway work, or small, as in street railway practice with the smallest single-truck cars.

When but relatively few cars or trains are operated from a power station, the resulting low load factor influences the cost of power to a considerable degree, but both may sometimes be considerably bettered by slight changes in the schedule and operating rules of the road. After the operating engineer of the power station has brought his plant to the best possible operating efficiency, the application of some engineering ability to the arrangement of schedules and operating rules may still further cover the cost of power per car-mile and per kilowatt-hour in a manner which may be surprising to the management.

This subject may be studied to the best advantage on the type of interurban road which has become so common throughout the country. These roads are in many instances single track and operate cars weighing from twenty-five to forty tons on a regular hourly or half-hourly schedule, passing at fixed sidings every fifteen or thirty minutes. If, in addition to this handicap, the crews of both cars are expected to telephone the despatcher from every siding, the telephone wires are "red hot" at passing times, while the power station is cooling down. Immediately thereafter, the power station has all that it can care for, as the cars all start from the sidings at practically the same time, and if cars are on time these minimum followed by maximum peaks recur every fifteen minutes or half hour through the day. If one or two cars become late, this bad state of the schedule actually betters conditions at the power station, but only temporarily, as it is usually the case that sidings exist only at regular passing points, and these late cars must either make up their time or throw all cars on the run off time in one trip, so that the bad load factor is very soon restored at the station.

As the cost of power is a very considerable percentage of the total operating expenses, anything that may be done to benefit the load factor, which has such an influence on the cost of power, should be very carefully considered.

For the purpose of illustration, take the concrete case of a road 30 miles in length, operating eight cars on a thirty-minute headway, at a schedule of 15 m. p. h., the sidings, consequently, being located approximately 3¾ miles apart. With such a regular schedule, all cars are either at terminals or passing at sidings at regular fifteen-minute intervals. It might be possible, in this case, without detriment to the service, to increase the schedule speed of cars in one direction to 15.65 miles per hour, at the same time reducing the schedule speed of cars in the other direction to 14.4 miles per hour. This makes the running time, in one direction, 2 hours and 5 minutes, in the other direction, 1 hour and 55 minutes, a total of 4 hours for the round trip, the same as before. The passing time on sidings, however, has been changed. Before the change two cars left the terminals at the same time that all the others were due at sidings—two cars at each of Nos. 2, 4 and 6 sidings. Now, however, as a car leaves one terminal, the other cars are just approaching sidings; a minute and a quarter later two cars are passing at No. 2 siding; in 2½ minutes, two others are passing at No. 4 siding; in 3¾ minutes two at No. 6 siding; and a full 5 minutes later the remaining car leaves the other terminal. In this way the regular quarter-hourly minimum and maximum peaks at the power station have been flattened out, with practically no change noticeable to patrons of the road, with no change affecting the car equipment, unless the schedule was already too high for the equipment, and with no change in the location of sidings. If the despatcher has been called at each siding, as is the practice on some roads, his work has been spread over five minutes each quarter hour instead of receiving reports from all cars in rapid succession. If a good system of rules, printed train schedules and written train orders is in effect, however, it does not seem that it should be necessary to call the despatcher at every siding, and if this can be done away with, not only will the load factor be bettered on such roads, but these waits, so annoying to passengers, will be eliminated.

On single track roads, the over-ambitious motorman is very likely to leave sidings by rapid accelerations and crowding his motors to the limit, with the firm and steadfast resolution to make the next siding on time or know the reason why, only to be compelled to kill time during the next mile or two or on the siding, this still further crippling economy at the station, especially if practiced by a number of trainmen on a regular schedule. A careful watching of the motormen, and careful arrangements of the schedule, not only on a single track division along some such line as suggested above, but by interlacing schedules on different divisions and lay-over times at different terminals, will do much toward improving the load factor and reducing the cost of power, especially on the road which operates only a small number of train units.

Taking Care of Defective Parts of the Car Equipment

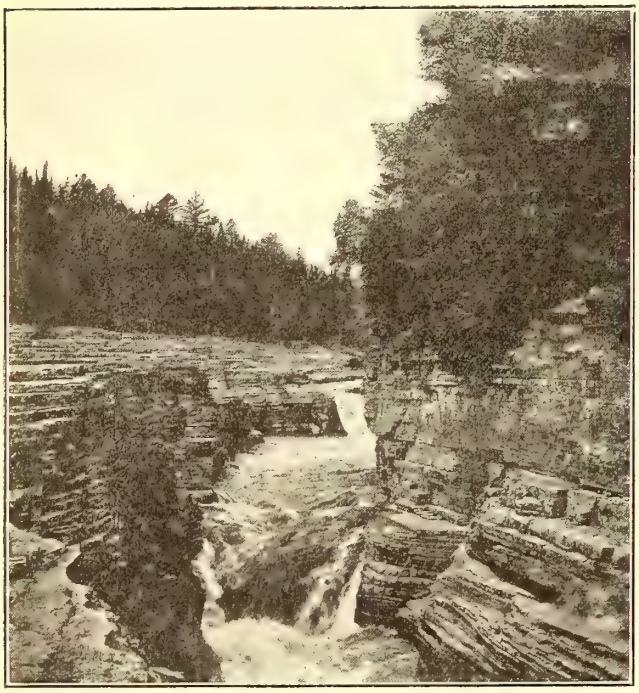
Judgment of several men may differ widely as to when a worn or defective piece of car apparatus has passed its period of usefulness and should be scrapped. Some shops recognizing this have adopted a plan of caring for defective apparatus, which saves a great deal of money.

A separate room in charge of one man is provided for the apparatus and all burned, broken or worn parts are sent directly to him. He passes judgment on each piece and consigns it to the junk pile, tears it apart and reserves the good pieces, or repairs it as he sees fit. Shelf compartments are provided for the separate parts of each kind of apparatus, and very frequently he is able to reclaim a device which would otherwise be thrown away because of the lack of one lug or coil or other part necessary for its further use. Parts repaired are marked o. k., and are usually kept in the repair department rather than turned over to the store room because of the likelihood of confusion in accounts in crediting and checking out. When in need of a circuit breaker, a controller cylinder, brush holder or other part a repair man must assure himself that what he wants is not in the repair department before being allowed to draw a new one out of the store room.

A similar plan could no doubt be adopted to great advantage in many shops and particularly on systems where there are several sub-shops. On such a system where the repairs of defective apparatus are not centralized one man may be in great need of small parts which may have been scrapped at another sub-shop.

THE MONTMORENCY DIVISION OF THE QUEBEC RAILWAY, LIGHT & POWER COMPANY

The Montmorency division of the Quebec Railway, Light & Power Company is a combined steam and electric line 25.2 miles long, extending from Quebec to St. Joachim and along the St. Lawrence River. The distance of 6.6 miles to Montmorency Falls is double-track and has a 30-minute service, while the section to Ste. Anne de Beaupré, 21 miles from Quebec, is operated on an hourly schedule. Dispatching is done by telegraph only. The Sunday time tables are arranged so that passengers can attend church services and return without loss of time. All freight is carried by steam trains, but the greater part of the pas-



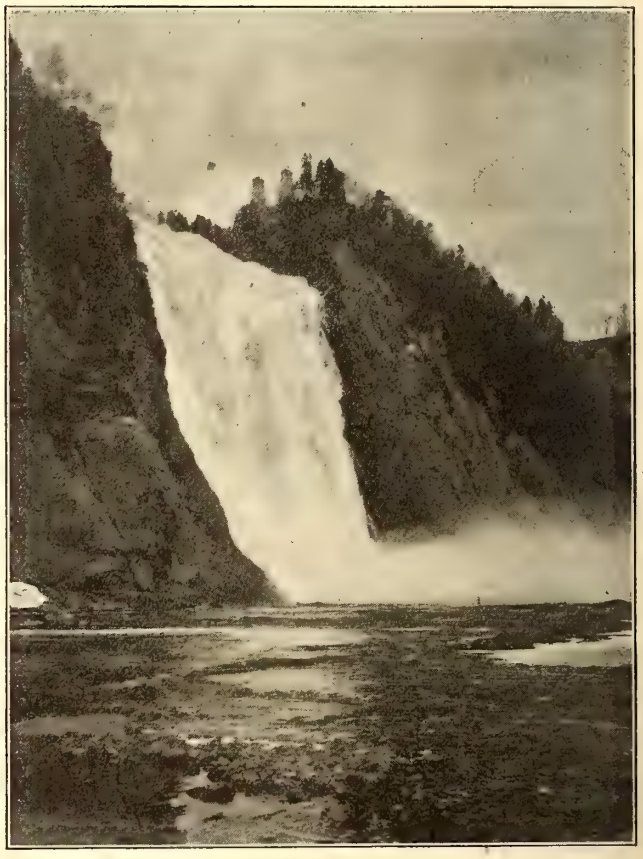
THE FAMOUS NATURAL STEPS OF THE MONTMORENCY RIVER

senger business is handled on electric cars either singly or in trains, as conditions demand. On Sundays, however, the heavy pilgrimage traffic to the shrine of Ste. Anne makes it necessary to operate a couple of long steam passenger trains in addition to excursion traffic originating on the connecting steam trunk lines. The Quebec terminus is within a block of the Canadian Pacific, Great Northern and Quebec and Lake St. John railroads, and is about ten minutes' walk from the ferries connecting with the Grand Trunk, Intercolonial and Quebec Central railroads. Passengers from the first two lines can go to Ste. Anne de Beaupré without changing cars, while those from the other lines find the cars waiting for them at the ferries.

PILGRIMAGE AND PARK TRAFFIC

Most of the traffic of the Montmorency line is due to the pilgrimages mentioned and to Montmorency Falls. The shrine of Ste. Anne is a genuine Mecca, for every year hundreds of thousands of Catholic devotees journey to it to view the fragment of Ste. Anne's arm. Many of these pilgrims are cripples seeking the miraculous aid of this noted relic, and, in fact, the church is filled with numerous crutches, eye-glasses and other physical aids left by visitors. Aside from its religious features, Ste. Anne de Beaupré attracts many others owing to its historical associations, for this section properly is called the Cradle of Canada. It was one of the first districts colonized by the French on their ascent of the St. Lawrence and the conservative spirit of their descendants has permitted the preservation of many old buildings and customs of interest to the tourist.

During the pilgrimages season of 1907, 126 excursions were handled between Quebec and Ste. Anne de Beaupré Of these 53 pilgrimages were from Quebec and adjacent parishes around the city. The others were divided as follows: Seven via Canadian Pacific Railway from the city of Montreal, seven from different places in the Province of Quebec, one each from Pembroke, Ont.; Winnipeg, Man.; two from Ottawa, Ont.; Rutland, Vt.; Sault Ste. Marie, Ont.; Detroit, Mich.; Duluth, Mich.; Kingston, Ont.; Albany, N. Y., and Alexandria, Ont. Via Grand Trunk Railway: One from Montreal City, five from different places in the Province of Quebec, and one each from Biddeford, Maine; Gananoque, Ont.; Kingston, Ont., and three from Lewiston, Maine. Via Quebec Central Railway: Ten from Providence of Quebec, one each from Meriden, Conn.; Woomsocket, Mass.; Pittsfield, Mass.; Oldtown, Maine; Salem, Mass., and two from Waterville, Maine. Via Intercolonial Railway: Five from Province of Quebec, one from Memramcook, N. B. Via Canadian Northern Quebec Railway: One from Province of Quebec. Via Quebec & Lake Saint John Railway: Six from Province of Quebec; and via Richelieu & Ontario



MONTMORENCY FALLS, AND PIERS OF DESTROYED SUSPENSION BRIDGE

Navigation Company: One from Cincinnati, Ohio, and one from Picton, Ont.

Fourteen outside pilgrimages numbered between 1000 and 2450 passengers, all others averaging 500 each. From the city of Quebec and vicinity there were eight pilgrimages numbering over 1000 passengers. Pilgrimages numbering over 1000 are handled in three sections, when coming from foreign railways, and consist of first-class coaches, parlor

and sleeping cars, one refreshment and café cars on each section. Pilgrims are in charge of the clergy.

The other important attraction on this line is Montmorency Falls, which on account of its great height, 274 ft., and size is a worthy rival of Niagara. Although the company utilizes the falls for its hydro-electric stations their beauty has been carefully preserved. Trains to Montmorency are run up a Y-connection from the main line, where passengers either climb the hill or take the elevator to the park grounds maintained by the company. From this park a few minutes' walk brings the visitor to the picturesque rocky ledges or natural steps of the Montmorency River before its plunge into the flats of the St. Lawrence River.

Montmorency is also of patriotic interest to Canadians, for it still possesses the Kent House, which was the residence of the Duke of Kent, father of the late Queen Victoria, during his stay in Quebec as commander-in-chief of the British army in Canada. The company has converted this structure into a very attractive hotel and banquet headquarters, without materially changing the original architecture. During the French and English war these grounds were occupied by the armies of Montcalm and Wolfe, and to this day entrenchments, old cannon and shot remain as memories of their struggles.

In addition to the natural features of the Kent House grounds, a very fine zoo is maintained by Holt, Renfrew & Company, Quebec furriers. Most of the animals are peculiar to northern America and in the case of the beavers, visitors can study them under natural conditions. There are also fine cricket, polo and baseball grounds for free use. The railway company maintains a rustic theater where vaudeville performances are given afternoons and evenings without charge except a 10-cent fee for reserved seats. Among other attractions are balloon ascensions in the summer and tobogganing in the winter. The management leases certain hunting and fishing districts which offer strong inducements to the sport-loving public. Visitors to



COMPANY HEADQUARTERS AND QUEBEC TERMINUS OF THE MONTMORENCY DIVISION

Ste. Anne de Beaupré are given the privilege of stopping at the Falls, either going or returning.

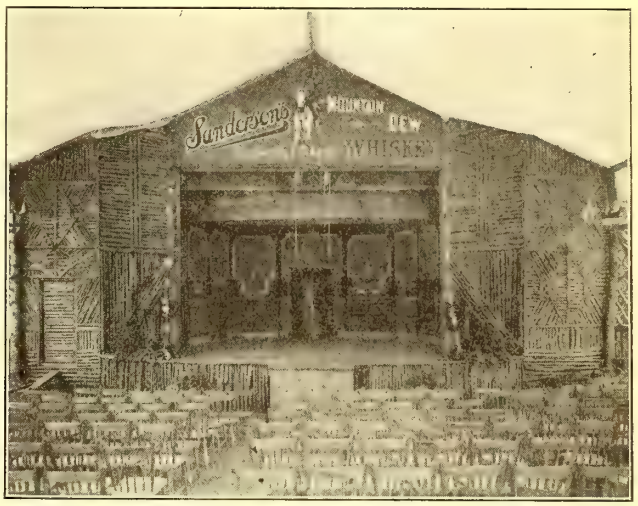
COMMUTER AND REGULAR TRAFFIC

Every effort is made to foster the growth of commuter business. The usual fare is about 2 cents per mile, but 50-ticket books are sold at a reduction from this figure and unused tickets are redeemed. An excess of 10 cents over the regular fare is charged on trains.

The company issues a circular every season giving the location and rates of the summer boarding houses and hotels on the line. For the encouragement of this summer commuter traffic the company undertakes the free transportation of household effects at the owner's risk, providing the owners produce commutation book tickets to the destination, and the goods are shipped in one lot. Laundry bags are carried free of charge in both directions when plainly addressed.



A WINTER VIEW OF THE INCLINE RAILWAY TO KENT HOUSE



RUSTIC THEATER IN KENT HOUSE PARK, MONTMORENCY FALLS

Personal baggage up to 150 lbs. is carried free on full-priced tickets and up to 75 lbs. on half-price tickets. Passengers are permitted to check bicycles and baby carriages free as baggage when without other baggage, if the value of the ticket bought is 40 cents or over one way or 60 cents both ways. In all other cases they are treated as freight weighing over 100 lbs. and are charged no less than 25 cents. Commercial travelers are allowed to have 300 lbs. of samples or personal apparel carried free on presenting the

proper credentials. Dogs accompanied by owners are carried on special tickets for 25 cents any distance in one direction and 50 cents in both directions. Dogs in crates or chained are billed as freight. Parcel rooms are maintained at Ste. Anne's and Quebec where baggage may be checked for the day at a cost of 5 cents per article.



STANDARD MOTOR CAR ON THE MONTMORENCY DIVISION

EXPRESS FREIGHT RECEIPT.

QUEBEC RAILWAY, LIGHT & POWER CO.
(MONTMORENCY DIVISION)

This Railway will not be responsible for any goods mis-sent unless they are consigned to some Station on the Railway, such Station being plainly stated.

Date 190

RECEIVED from

the undermentioned Property, in apparent good order, addressed to

to be sent by the said Railway, subject to the terms and conditions as stated above, and upon the other side.

ARTICLES	Weight	Charges	RECEIPT BY

EXPRESS FREIGHT RECEIPT

PASSENGER ROLLING STOCK

The electric rolling stock consists of eight motor cars and five trailers, seating sixty-two each. The five large motor cars, which seat 117 passengers, are fitted with four No. 56 Westinghouse motors each, while the other three, seating fifty-five passengers, are fitted with four 38-B motors each. The cars have a section for smokers and a baggage closet at the front. All are mounted on Taylor trucks and have Westinghouse air brakes.

The steam passenger equipment consists of five locomotives and twenty-two cars, seating 120 passengers each.

EXPRESS AND FREIGHT HANDLING

The company has always encouraged both express and freight business on the Montmorency division, and has met with success in both. The material is shipped as express freight or regular freight.

Express freight is understood to mean that all goods weighing less than 100 lbs. and offered for shipment will be carried on any regular steam passenger or electric train with all despatch possible. The shipper on delivering a package is given a receipt for the same embodying the following conditions on the back: Non-liability for any loss or damage to a receipted package exceeding $10 whether the trouble be caused by the railway or otherwise; non-liability for losses due to improper packing, breakage, leakage or stealing; refusal to carry fish, meat or other perishable articles except at the owner's risk; responsibility of shippers of dangerous articles for damage therefrom, unless the contents are plainly marked and special terms made by the railway for their carriage. No C. O. D. articles are accepted.

The express tariff, which is the same regardless of the distance the goods are carried, is as follows: 0 to 10 lbs., 5 cents; 11 to 20 lbs., 10 cents; 21 to 30 lbs., 15 cents; 31 to 50 lbs., 20 cents; 50 to 100 lbs., 25 cents. Articles over 100 lbs. are carried on the freight trains only.

An illustration shows the form used by the station agents

NOTE.—Agent will be particular to note the authority by which any deviation is made from Tariff Rates: otherwise the proper rate will be substituted, and the Agent held responsible for the deficiency

QUEBEC RAILWAY, LIGHT & POWER CO.
(MONTMORENCY DIVISION.) (No. Ex. 201

EXPRESS WAY-BILL OF FREIGHT FORWARDED 190

From BEAUPORT STATION. To

Train No.

SHIPPER	CONSIGNEE	No. Packages	DESCRIPTION OF ARTICLES	Weight	Paid	Advanced Charges	Our Charges	To Collect	Signature for Goods

EXPRESS WAYBILL OF FREIGHT FORWARDED

190

M

TO THE QUEBEC RAILWAY, LIGHT & POWER COMPANY, Dr.

For Transportation of *Our charges*

From *Advanced*

Shipped by *Total $*

Weight lbs.

Received payment for the Company.

Agent.

STATION AGENT'S RECEIPT FOR GOODS RECEIVED



KENT HOUSE AT MONTMORENCY FALLS, MAINTAINED AS A HOTEL AND RESTAURANT BY THE QUEBEC RAILWAY, LIGHT AND POWER COMPANY

in way-billing. This is made out in duplicate, one copy going to the motorman of the electric train or the baggageman of the steam trains. The agent retains his copy of the way-bill which is accounted for in the same way as regular freight. Agents receiving express freight issue immediately the receipt previously mentioned, and when the goods are delivered a receipt is taken on the agent's way-bill opposite the article for which the receipt is required. The way-bills received are accounted for like regular freight. Conductors on all regular trains are permitted to accept express freight for shipment at any station on the special form illustrated. The conductor sends a duplicate to the main office and turns the original over to the proper station agent.

The regular freight charges are in general governed by the Canadian freight classification, but special rates are given as shown in the following tables for building material, coal and wood:

SPECIAL CAR LOAD RATES.—TO AND FROM QUEBEC ONLY.

FROM OR TO QUEBEC	Miles from Quebec	MAXIMUM 40,000 lbs.			CORD WOOD Minimum 12 Cords		REMARKS
		Cement Stone Brick † Lime Sand	Lumber Timber Shingles Mill Refuse Laths Slab Wood Box Stuff Tanbark Ties	Coal all kinds	2½ feet per Cord	3 feet per Cord	
Limoilou Jonction.	½	$4 00	$5 00	$4 00	45	55	
*Mastaï	2	4 00	5 00	4 00	45	55	
Beauport	3	4 00	5 00	5 00	45	55	These rates do not apply to cut stone, pressed bricks, dressed or other valuable lumber, &c., which must be billed according to classification.
Montmorency Falls	7	5 00	6 00	6 00	45	55	
L'Ange-Gardien	10	5 00	6 00	7 00	45	55	
*Petit Pré	12	5 00	7 00	7 00	45	55	
*Lemoine	14	5 00	7 00	7 00	45	55	
Chateâu Richer	16	5 00	7 00	7 00	45	55	
*Rivière des Chiens	19	6 00	7 00	7 00	50	60	
Ste. Anne de Beaupré	21	6 00	7 00	7 00	50	60	
Beaupré	23	6 00	7 00	7 00	50	60	
St. Joachim	25	6 00	8 00	8 00	60	70	
*Cap Tourmente	30	7 00	8 00	10 00	60	70	

* Flag stations—Freight must be prepaid.
† Lime in barrels only.

SPECIAL LOCAL MILEAGE FREIGHT RATES FOR CAR LOADS.

FROM OR TO QUEBEC	MAXIMUM 40,000 lbs.			CORD WOOD Minimum 12 Cords		REMARKS
	Cement Stone Brick Brick † Lime Sand	Lumber Timber Shingles Mill Refuse Laths Slab Wood Box Stuff Tanbark	Coal all kinds	2½ feet per Cord	3 feet per Cord	
Not exceeding 2 miles	$4 00	$5 00	$4 00	45	55	These rates do not apply to cut stone, pressed bricks, dressed or other valuable lumber, which must be billed according to classification.
Over 2 and not over 3	4 00	5 00	5 00	45	55	
" 3 " 6	4 00	6 00	6 00	45	55	
" 6 " 8	5 00	6 00	6 00	45	55	
" 8 " 10	5 00	6 00	7 00	45	55	
" 12 " 14	5 00	7 00	7 00	45	55	
" 14 " 16	5 00	7 00	7 00	45	55	
" 16 " 24	6 00	7 00	7 00	66	70	
" 24 " 30	7 00	8 00	8 00	66	70	

† Lime in barrels only.

Milk from all stations is carried to Quebec for 8 cents per 100 lbs. and empty cans are returned free. Empty boxes, tins, barrels, bags, etc., which have served for transport of farm produce to Quebec from any station on which freight charges were paid to Quebec are also returned free. The minimum accepted for any freight shipments is 25 cents. The personal freight of employees is carried at half-prices and when they are obliged to change their residence at the order of the company their household effects are carried free. Agents do not deliver freight consigned to order without first obtaining the original bill of lading, properly endorsed to whose order the freight is consigned. When freight is not removed by the consignee after the expiration of 24 hours it is stored free for an additional period of 48 hours (exclusive of Sundays and legal holidays) after which time the charge for storage is as follows: First to fifth class, 2 cents per 100 lbs. per week or portion thereof; sixth to tenth class, 1 cent per 100 lbs.; minimum charge for any single consignment 10 cents. When freight is to be loaded by the consignor or unloaded by the consignee, not less than $1 per car a day or fraction thereo, for delay beyond 48 hours in loading or unloading is added to the rates.

The company has devised a considerable number of forms to keep track of the amounts and classes of freight business handled. One of the cuts illustrates the usual form of duplicate way-bill made out by station agents in collecting freight. The agents are required to send to the audit office weekly statements of freight traffic received, freight outstanding and freight forwarded, as derived from way-bills. The agents also send in monthly reports covering outstanding freight collected; number, kind, tonnage, ton-miles and revenue of carload shipments; a report covering the details of less than carload shipments, and balance sheets.

STATISTICS

For the year ended June 30, 1907, the company carried 1,235,260 passengers over the Montmorency line. During June, 1907, which may be considered a typical summer month, the earnings from passengers amounted to $14,-999.91, which was equal to the collection of $0.1026 per passenger mile.

The mileage records for typical winter and summer months compare as follows:

	Month Ending Jan. 31, 1907*
Passenger car mileage	4,147
Loaded freight	6,692
Empty	2,902
Foreign freight	3,210
Snow plow	425
Electric car	15,654

*No foreign passenger cars in winter.

	Month Ending June 30, 1907
Steam passenger car mileage	18,006
Loaded freight cars	8,013
Empties	3,529
Foreign passenger car mileage (from C. P. R)	5,094
Electric car mileage	29,591
Foreign freight mileage	1,814

The following table covers the earnings from all sources, passengers transported and tons of freight carried, since the opening of the line in 1889. From this it will be noted that the freight has almost doubled in three years and the passenger business has also steadily increased.

COMPARATIVE STATEMENT OF EARNINGS

From Aug. 10, 1889, to June 30, 1907. Railway in operation, Aug. 10, 1889.

Year ending June 30	Earnings	Passengers carried	Tons of freight
1889-90	$20,043	88,863	2,720
1890-91	36,163	167,960	17,853
1891-92	45,424	190,875	4,995
1892-93	52,144	219,697	6,544
1893-94	49,915	221,369	6,513
1894-95	48,835	217,764	9,419
1895-96	48,546	213,303	7,178
1896-97	50,919	203,916	11,546
1897-98	54,533	221,040	16,027
1898-99*	58,882	239,593	15,470
1899-1900	65,615	261,178	21,083
1900-01	92,049	537,938	24,492
1901-02	102,934	649,087	18,857
1902-03	121,951	797,941	24,753
1903-04	130,331	877,310	35,363
1904-05	139,730	947,070	44,813
1905-06	170,501	1,112,197	66,441
1906-07	185,493	1,235,260	84,897

*Operated by steam only up to September, 1899; then steam and electric.

The traffic and cost of operation for the year ending June 30, 1907, given below, show that the freight business, roughly speaking, constitutes about one-third of the regular passenger business.

STATEMENT OF TRAFFIC AND COST OF OPERATION FOR THE YEAR ENDED JUNE 30, 1907.

EARNINGS

Passenger fares	$129,647.78
Freight	39,585.03
Passenger elevator	10,330.05
Montmorency Falls Park	4,622.33
Mail	1,223.04
Parcel offices	85.55
Total	$185,493.78

THIS WAY-BILL TO BE MADE IN DUPLICATE AND ONE COPY TO BE SENT TO AUDIT OFFICE

QUEBEC RAILWAY, LIGHT AND POWER CO. No. 4050

(MONTMORENCY DIVISION.)

CONDUCTOR'S WAY-BILL OF FREIGHT FORWARDED *from* ..... *to* ..... *190*....

Initials of Car .....

No. of Car .....

NOTE.—Conductors in Way-Billing Freight will not enter the odd pounds—when the fraction is 5 or over, call it ten pounds; when it is under 6 call it 0.

Shipper	Consignee and Destination	No. Packages	Description of Articles	Weight	Rate	Net Frieght	Advanced	Total Collect

CONDUCTOR'S WAYBILL OF FREIGHT FORWARDED

COST OF OPERATION

Maintenance of way	$20,687.26
Maintenance of equipment	14,005.55
Conducting transportation	68,487.71
General expense	23,395.86
Elevator	3,721.42
Total	$130,297.80

The passenger earnings per mile of road were $4863.62; passenger earnings per train mile, $55.10; average number of passengers carried per train mile, 24.48; average receipts per passenger per mile, $0.0210; average income per passenger, $0.1040; and average income per passenger on Montmorency elevator, $0.0487.

NOTE.—Agent will be particular to note the authority by which any deviation is made from Tariff Rates; otherwise the proper rate will be substituted and the Agent held responsible for the deficiency.

QUEBEC RAILWAY, LIGHT & POWER CO. No.....

(MONTMORENCY DIVISION)

.....190....

WAY-BILL OF FREIGHT FORWARDED *from*.....*to*.....

Initials of Car.....

NOTE.—Agents in Way-Billing Freight will not enter the odd pounds—when the fraction is 5 or over, call it 10 pounds; when it is under 5 call it 0

No. of Car.....

Shippe:	Consignee and Destination	No. P'kgs.	Description of Articles	Weight	Rate	Net Freight	Unpaid	Adv. Charges	Prepaid	Total Coll ec

STATION AGENT'S WAYBILL OF FREIGHT FORWARDED

The freight department handled for the traffic year ended June 30, 1907, 84,897 tons; earned an average of $0.4662 per ton and $1319.50 per mile of road. The average receipts per ton per mile were $0.029. The number of carloads hauled was 5277.

The average daily number of trains handled in and out of the Quebec terminal is 76. During the last fiscal year 2237 trains were handled by steam and 25,503 by electricity. The mileage records are as follows: Steam locomotive mileage, 33,233; steam passenger cars, 109,084; motor cars, 256,510; electric trailers, 27,292; foreign passenger cars, 17,333; loaded freight cars, 83,230; empty freight cars, 35,762; foreign freight cars, 21,181; snowplows, 1554.

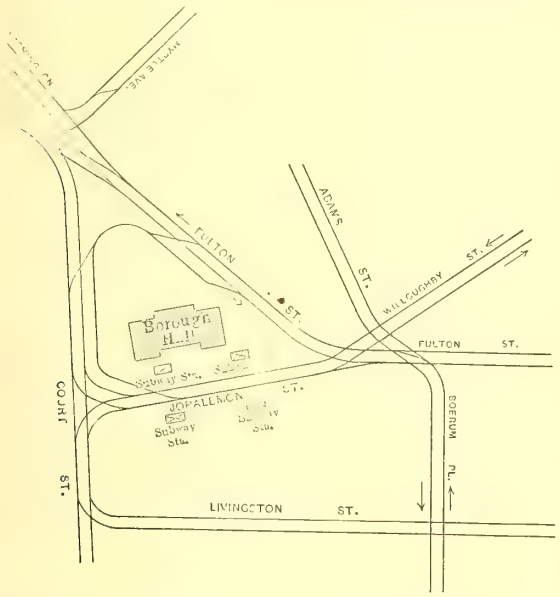
THE LIVINGSTON STREET RAILWAY IMPROVEMENT FOR RELIEVING BROOKLYN RUSH-HOUR TRAFFIC

In 1898 tracks were laid for the operation of trolley cars over the Brooklyn Bridge. Up to that time passengers on the surface lines desirous of getting into New York by crossing the bridge were obliged to transfer to special bridge cars and buy another ticket, which was sold for three cents singly or two tickets for five cents. As this fare was more than that charged by ferry, or two cents, the traffic from Brooklyn to New York was divided to a considerable extent between the ferries and the bridge. The inauguration of a through ride by surface cars for five cents, from any part of Brooklyn to the New York terminus of the bridge, effected a radical change in the distribution of traffic. Many of the lines of the Brooklyn Rapid Transit Company operated to Fulton Ferry were diverted from that route and run over the bridge to New York, where four terminal loops were laid on a level with the street for returning the cars to Brooklyn. At the time of the change the population of Brooklyn was 1,180,000, whereas figures just compiled for 1907 show the population to be 1,426,166. This is an increase of 21 per cent. in nine years. The effect of this change was not only to congest the routes leading to the bridge, but on account of the reduction in fare to attract so many new residents to Brooklyn as still further to increase the patronage of the lines reaching New York by the bridge route.

Unfortunately the number of streets leading to the bridge and suitable for street railway operation is limited. Moreover, Fulton Street, the main business street of Brooklyn, about 40 ft. wide from curb to curb, is the street through which most of the cars of the Brooklyn Rapid Transit Company were originally routed. Consequently congestion on Fulton Street between the Borough Hall and Flatbush Avenue has steadily increased. Meanwhile the company had been casting about for a solution of the problem of congestion on Fulton Street, but without success, as no streets were available to which to divert cars from Fulton Street that would not complicate matters by removing cars in some cases many blocks from their regular routes and increasing the burdens of the conductor and creating

operating problems, as other lines were already well loaded.

In 1904 the number of loops on the bridge was increased from four to eight, thus helping the movement of cars over the structure, which by this time was carrying sixteen lines of cars, of which six were operated on Fulton Street between Borough Hall and Flatbush Avenue, a distance of six-tenths of a mile. In addition to this, service was operated over this territory on the lines mentioned to Fulton Ferry, for the accommodation of the ferry traffic, and around the Borough Hall to accommodate the business establishments along Fulton Street, two of which employ



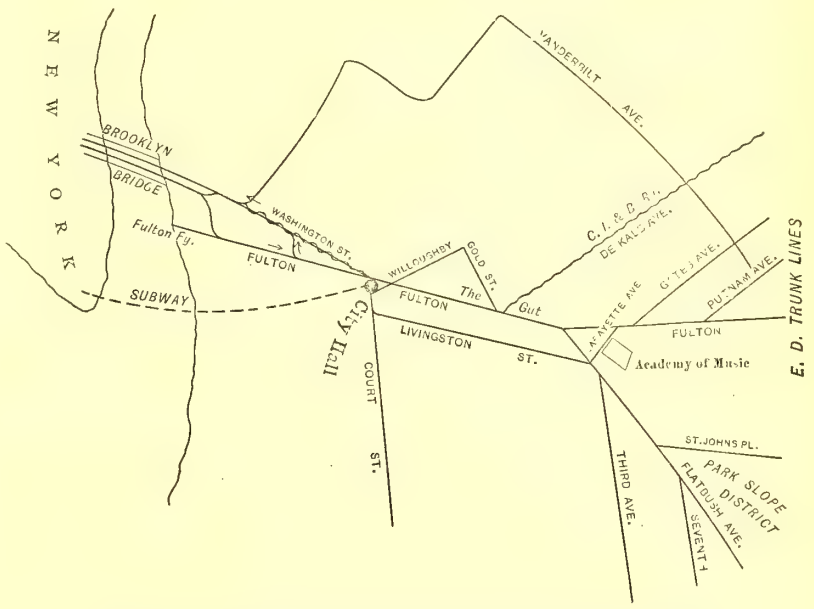
TRACK LAYOUT NEAR BOROUGH HALL, BROOKLYN

4000 people each. For stated periods during the morning and the evening rush, cars of such lines as Gates and Putnam avenues bound to and from New York were diverted from Fulton Street to lessen the congestion, but a return to the old operation had to be made in the case of the Gates Avenue line because of the confusion that resulted among the passengers who seemed never to learn that lower Fulton Street was avoided to facilitate the handling of traffic.

Paralleling Fulton Street between the Borough Hall and Flatbush Avenue, as the first street to the south, is Livingston Street, a narrow thoroughfare upon which back many of the large Fulton Street stores. The only solution of the problem seemed to be to place tracks on this street and thus parallel Fulton Street, or in other words double the ability to handle cars between the Borough Hall and Flatbush Avenue. To this end it was decided if possible to secure from the city the right to build a double track line on Livingston Street after the widening of that thoroughfare from 40 ft. to 80 ft. by the city as a public improvement had been accomplished. This right was secured by a special franchise in the name of the Nassau Electric Railway Company purchased from the city at auction, the terms of which were determined after many conferences between city, borough and railroad officers and a fixed compensation made for the use of this street. A line has just been built on Livingston Street, as shown in the accompanying diagram of the congested district in Brooklyn, extending from Court Street to Third Avenue. Thence the route is continued along Lafayette Avenue to Fulton Street, making parallel routes of Fulton and Livingston Street not more than 200 ft. apart. Over this route two lines have been run for several weeks in slight degree and a third was placed in operation Nov. 7, all of which will be almost completely operated hereafter. By this means it is expected that the time between the Borough Hall and Flatbush Avenue will be cut down from between ten and twelve minutes to seven or eight minutes.

The lines now traversing Fulton Street between the Borough Hall and Flatbush Avenue are Fulton Street, Gates Avenue, Putnam Avenue, Third Avenue, Flatbush Avenue, Flatbush-Seventh and St. Johns line. In addition the Coney Island & Brooklyn Railroad operates over Fulton Street between the Borough Hall and DeKalb Avenue, as shown in the map. Of these lines the Flatbush, Third Avenue and St. Johns lines will be permanently diverted to Livingston Street, and the Putnam Avenue and Halsey Street line, which has been partly diverted in the morning and evening rush hours, will be returned to its original route through lower Fulton Street. In this way about thirty Flatbush, twenty Third Avenue, and seventeen St. John's Avenue cars are being diverted an hour, while the advantage is gained of operating the Halsey Street line over its original route.

It was impossible to divert cars from Fulton Street to the north, as no street really parallels it. Willoughby Street, however, crosses Fulton at an angle of about 45 degs. above the Borough Hall, and in the case of "City Hall" cars of all the B. R. T. lines this was taken advantage of in the evening to run cars over the Gold Street tracks into Willoughby Street, looping the Borough Hall and returning to Fulton Street to accommodate Brooklyn retail stores. Willoughby Street, however, running as it does into Fulton Street at the angle mentioned, is several blocks from Fulton at Gold Street, which is below and opposite to Flatbush Avenue on the north side of Fulton



MAP SHOWING LINES FEEDING INTO FULTON STREET WHICH CAUSE CONGESTION

Street, and it thus had the disadvantage of introducing the element of uncertainty among the passengers and added to the complexity of the complicated crossing at Fulton, Willoughby and Adams Streets, the layout of which is shown in the accompanying map of the tracks near the Borough Hall.

In this connection it is of interest to refer to the map of the track layout in the vicinity of the Borough Hall. It will be noted that there is a very complicated crossing just above the Hall, where Adams and Willoughby Street cross Fulton. Over Adams Street cars also are operated to and from the bridge. Frequently more than 700 cars cross at this intersection in the rush, while more than 260 pass on Fulton Street in one direction, between Washington Street and the intersection of Adams, Willoughby and Fulton Streets. The company keeps a daily record of all cars passing the corner of Fulton Street and Court, and from this record the following table has been prepared, showing the lines and the number of cars for each half hour during the evening rush on Nov. 1, between 4:30 and 6:30 p. m.:

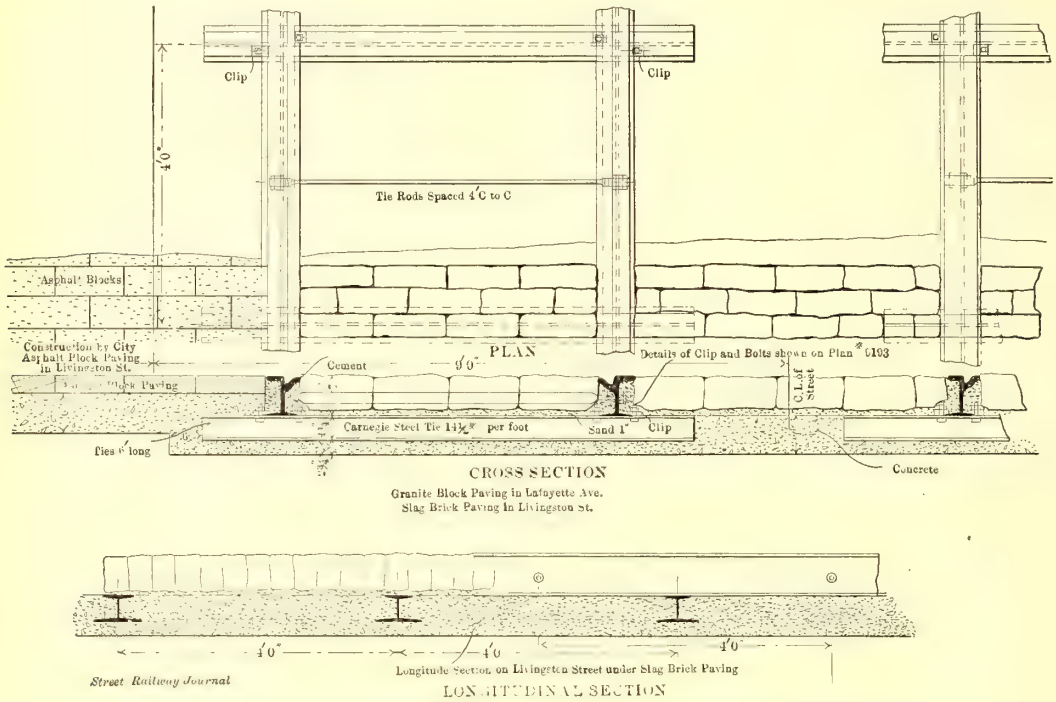
	Time			
Line	4:30-5	5-5:30	5:30-6	6-6:30
Fulton Street	15	18	20	22
Putnam Avenue	15	13	15	15
Gates Avenue	15	16	22	22
DeKalb Avenue	8	7	7	10
Myrtle Avenue	13	12	15	14
Court Street	13	12	13	14
Flatbush	13	15	18	17
Third Avenue	10	8	10	8
Flatbush-Seventh Avenue	8	10	9	9
St. John's	5	6	6	6
Union	6	5	6	7
Totals	121	122	141	144

From the record kept by the bridge commission of New York the following figures of round trips, by trolley car over the bridge by years since the inauguration of the service, has been compiled.

For the nine months ended Sept. 30, 1907, 1,062,661 trips have been made.

1898	1,119,348	1903	1,299,108
1899	1,379,815	1904	1,327,367
1900	1,348,864	1905	1,345,261
1901	1,398,071	1906	1,388,908
1902	1,275,522		

Two improvements under way are expected to have bearing on the problem of traffic in lower Fulton Street, however. They are the new subway extension under the East River from Manhattan running out Fulton Street to Flatbush and Atlantic Avenues and the new Manhattan bridge, under construction, which is the third to span the East River. The subway is expected soon to be opened to the public as far as the Borough Hall, but it will be at least five years before the bridge is completed. Just what effect the subway will have on traffic in Brooklyn it is impossible to foretell, but the company is planning to meet any change in operation that may be deemed necessary as a result of the subway.



STEEL TIE-TRACK CONSTRUCTION ON LIVINGSTON STREET, BROOKLYN.

An interesting feature in connection with the new Livingston Street line is the use for the first time in Brooklyn of steel ties. The service over the short route being heavy it was decided to install the ties, using a 7-in. Lorain rail, No. 393, and section 114. This is a grooved rail instead of a tram rail, and weighs 114 lbs. to the yard, which is very heavy considering that the rail is only 7 ins. high. Of the new line 3400 ft. are in Livingston Street and 800 ft. in Lafayette Avenue. Livingston street is paved with brick, but Lafayette Avenue is paved with granite. In Livingston Street, therefore, the concrete was brought up between the ties as shown in the cross-section of the track herewith. The ties were made by the Carnegie Steel Company. They are 6 ft. long and 4¼ ins. high and weigh 14½ lbs. per foot. The concrete bed on which they are laid is 2¾ ins. deep. The ties are spaced 4 ft. center to center. The tie rods are also spaced 4 ft. center to center.

FOUR-TRACK LINE IN CALIFORNIA

The Pacific Electric Company's four-track system, now in operation as far as Watts, is relieving congestion upon the southerly lines to a great extent. The Long Beach, San Pedro, Whittier and Santa Ana lines take that course out of Los Angeles. The local travel between Los Angeles, Watts, and intervening stations formerly delayed interurban passenger traffic to an annoying degree. With the operation of four tracks to Watts all difficulties have been overcome, and long distance cars are making their trips on schedule time.

COMPARATIVE PERFORMANCE OF STEAM AND ELECTRIC LOCOMOTIVES*

BY ALBERT H. ARMSTRONG

Among the many electrification projects now in course of construction, nearly all were inspired by such motives as cleanliness, smokelessness, convenience, etc., but few indeed have been considered strictly from the standpoint of direct financial benefits to be obtained. The improvements in and around New York City terminals, the various tunnel projects, such as the early Baltimore & Ohio installation, and later the Sarnia, Detroit River, and Cascade Tunnel projects—all are examples of steam road electrification in which there were distinct reasons for displacing steam as a motive power, but there are other sections of our steam lines where these same reasons do not apply with equal force, and benefits of a more far-reaching nature must be made evident before such electrifications can be considered as necessary or desirable. It is concerning these other sections of steam lines demanding other reasons for electrification that this paper is written, and the best means to be employed in getting a thorough grasp on the subject seems to lie in an investigation into the comparative inherent qualities of steam and electric locomotives.

Before considering the electric locomotive, much the simpler of the two, it is advisable to determine the general characteristics and limitations of the steam locomotive viewed from the standpoint of the electrical engineer, in order that the scope of the problem may be thoroughly understood and the lines of contrast be sharply drawn.

This preliminary study of the steam locomotive is made necessary by the fact that railroad practice to-day is essentially *steam* railroad practice and is hedged about by practices and methods of operation demanded by the use of the steam locomotive as a type of motive power. Viewed in the light of greatest benefits to be secured, the coming of the electric locomotive is not due to petty economies effected in coal consumption and cost of locomotive repairs. The use of water power, or of a cheaper grade of fuel than can be burned on a steam locomotive, will in many cases afford a means of reducing the fuel cost well below the present cost of high-grade coal required for successful locomotive operation; but in general the fuel item reduction does not in itself offer a sufficient saving to pay an adequate return on the large investment required for electrification. It is necessary, therefore, to look for more far-reaching benefits, and, not considering the reasons governing the introduction of the electric locomotives at terminals and in tunnels, we find in a comparison of the characteristics of the steam and electric locomotives a contrast so marked that it shows not only the superiority of the electric locomotive for general railway conditions, but it also suggests changes of a fundamental nature in present methods of operation now necessary with steam locomotives. And these benefits to be secured occur not only in the operation of passenger trains, but are felt to an even greater degree in the haulage of the heaviest freight trains, a field supposedly the exclusive domain of the steam locomotive.

The locomotive engine is distinct from the locomotive boiler, and when supplied with unlimited steam at constant pressure it has its own characteristics and maximum output both in tractive effort and horse-power. Engines are of two general types, simple and compound, the latter being introduced in orded to effect a saving in the large steam consumption inherent to non-condensing engine operation. The success of the compound locomotive is very much a matter of discussion among railroad men, but it seems to have found a permanent foothold upon easy-grade lines although its use is still open to serious question upon the heavy mountain-grade divisions. In general, the electric locomotive must compete with the compound steam locomotive on level divisions, and the simple engine on heavy grade divisions, although the Mallet compound has lately been introduced with some success in this latter class of work.

The general shape of the steam locomotive characteristic is given in Fig. 1, which shows the relation between the speed and tractive effort of a simple consolidation locomotive designed for heavy freight service. Owing to clearances it is seldom that a locomotive can work at more than

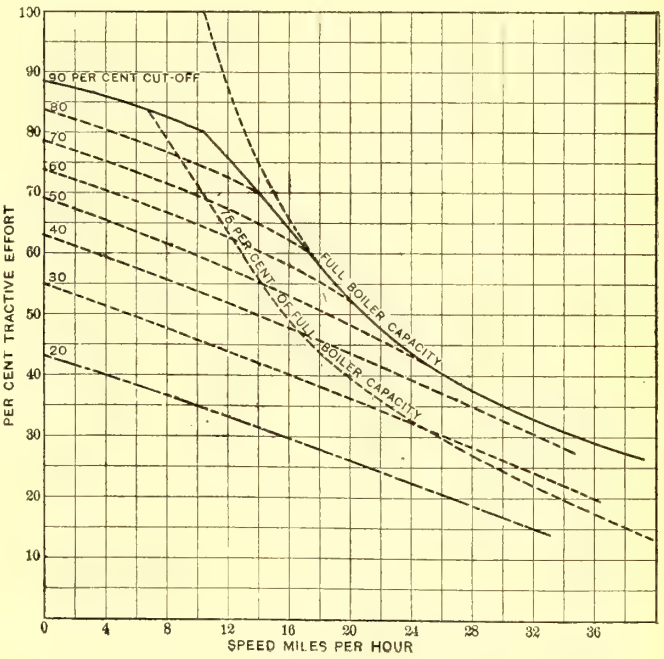


FIG. 1.—TYPICAL STEAM LOCOMOTIVE CHARACTERISTIC (SIMPLE)

90 per cent. of the theoretical full stroke, hence the maximum tractive effort at starting with lever in the corner will not be much greater than 88 per cent. of the theoretical tractive effort available with gage pressure in the cylinders. An inspection of Fig. 1 shows that the steam locomotive is limited as to maximum tractive effort by its engine design, and limited as to the speed at which this tractive effort is available by the capacity of the boiler to supply steam. Thus, assuming that the locomotive will give 88 per cent. of its theoretical tractive effort when starting, it is capable of providing but 80 per cent. tractive effort at a speed of 10.6 m. p. h. (with the constants of the particular locomotive chosen for illustration) at which the boiler is giving its full output. Hence higher speeds can only be reached with a less cut-off and a consequent reduction in mean effective pressure and tractive effort. Locomotive engines are generally designed to give their maximum tractive effort at 90 per cent. theoretical cut-off at a point corresponding to a coefficient of adhesion of approximately 22 per cent. of the weight upon the drivers; that is, at about slipping point of steam locomotives with good rail conditions. It is immediately evident, therefore, that the tonnage rating of the locomotive on ruling grade must be so proportioned that the maximum tractive effort called

*Abstract of paper presented at the meeting of the American Institute of Electrical Engineers, New York, Nov. 8, 1907.

for will be less than the available tractive effort of the locomotive in order to provide a small percentage, say 10 or 15 per cent., for possible starting under maximum grade and load conditions. In other words, as the steam locomotive is designed so that the maximum tractive effort is delivered at a point not greater than 22 per cent. of the weight upon the drivers, it is not possible to take advantage of possible abnormally good rail conditions (either natural or made abnormal by the use of sand) as the engine itself will fail to deliver any excess tractive effort thus made available with increased coefficient of adhesion.

On the other hand, the tractive effort of the electric locomotive is limited only by the adhesion between driving

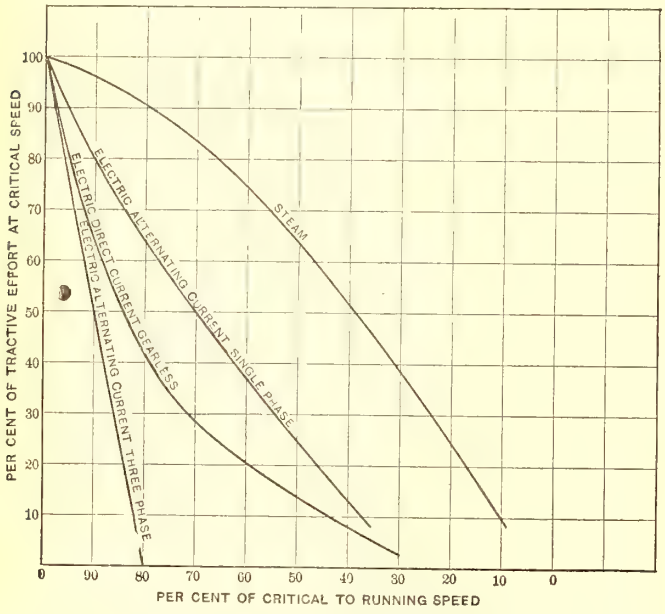


FIG. 2.—TYPICAL CHARACTERISTICS OF STEAM AND ELECTRIC LOCOMOTIVES

wheels and rail, and aside from some 15 per cent greater adhesion possible with the uniform tractive effort provided by the electric locomotive, it is possible with this type of motive power to take momentary advantage of abnormally good rail conditions or to derive full benefit from the use of sand; indeed, tests have been taken with electric locomotives showing as high as 35 per cent coefficient of adhesion between driving wheels and rail. This point is emphasized as with the greater tractive effort of the electric locomotive it becomes possible to give them a higher tonnage rating for the same weight upon the drivers than would be possible with steam locomotives operating over the same track profile.

There is a marked difference in the speed characteristics of the steam and electric locomotives, and indeed there is also a marked difference in the speed characteristics of different types of electric locomotives. Although this paper is not intended to enter into any discussion of the relative merits of different types of electric locomotives, there is so striking a difference in the several speed characteristics, each of which possess special advantages for certain operating conditions, that Fig. 2 has been prepared contrasting the characteristics of the steam locomotive and the direct-current gearless, alternating-current single-phase geared, and alternating-current three-phase geared electric locomotives. As all types of motive power share in common the fact of a certain critical speed beyond which full tractive effort cannot be maintained, the curves in Fig. 2 have been prepared on the basis of showing the relation between percentage of maximum tractive effort available at speeds higher than the critical speed, ordinates being tractive effort and abscissas percentage of critical speed to running speed.

A more familiar presentation is given in Fig. 3, showing a concrete case of a 22 in. x 30 in. steam locomotive of the simple type equipped with 57-in. drivers, contrasted with both an alternating-current geared and a direct-current gearless electric locomotive designed for the same tractive effort both maximum and running, but for a higher speed. The contrast of these different speed characteristics brings out sharply the small speed variation with different tractive efforts delivered by the electric locomotives, this small variation being even more marked in the case of the direct-current gearless than in the case of the alternating-current geared motor working at a lower iron saturation and thus affording a more sloping speed characteristic.

The steam locomotive chosen is typical of those in general use upon our mountain-grade divisions, the tonnage

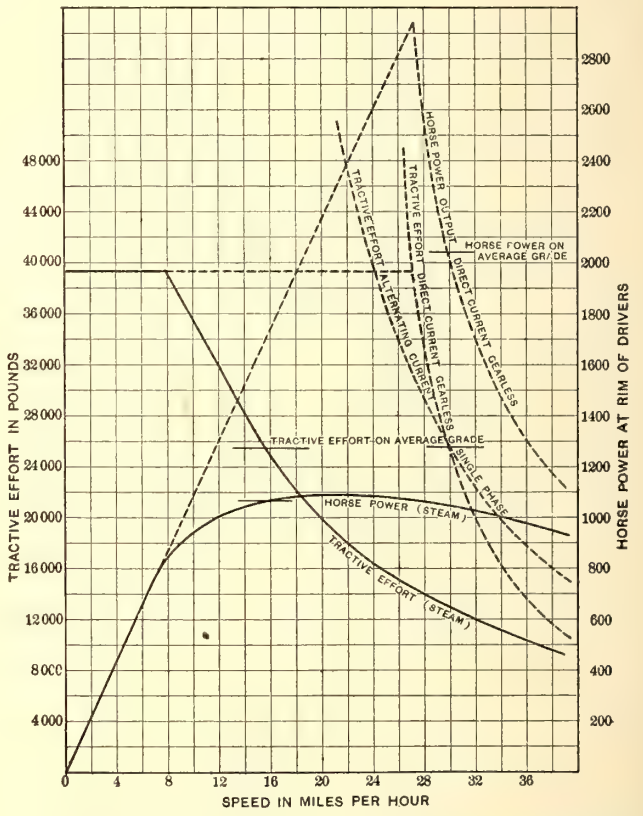


FIG. 3.—STEAM AND ELECTRIC LOCOMOTIVE CHARACTERISTICS

rating in operation of this particular locomotive being such as to call for a tractive effort of 25,600 lbs. on average grade and 33,200 lbs. on the maximum ruling grade occurring on a certain engine division, thus leaving a margin of 6,300 lbs. above the demands of maximum tonnage on maximum ruling grade for starting the train from rest.

The maximum speed available at the different tractive efforts is a matter of boiler capacity, condition of boiler, quality of coal, and efficiency of fireman. The first of these factors, the boiler capacity, can be controlled by properly proportioning the design of the boiler to engine capacity, but there are three other factors which the locomotive manufacturer cannot control and two of these factors constitute sufficient cause to warrant a considerable reduction in the theoretical rated capacity of the boiler. Thus, referring to Fig. 1, such a locomotive in prime condition carefully fired with the best coal (approximating 14,000 B. T. U.) should be able to deliver full tractive effort at

10.6 m. p. h., but in practice it has been found that the average condition of boilers and the average firing provided by the none too conscientious or diligent fireman, cuts the sustained boiler output down to not much greater than 75 per cent of its output under what must be considered exceptionally or momentary conditions. By sustained "output" is meant the output required while ascending the continuous up grades met with on our western mountain divisions. Though full boiler capacity may be attained for short periods, the average performance of all the locomotives on the division on the average up grade will show a marked reduction in capacity from the results obtained in a stationary test or single experimental test runs.

The locomotive characteristic in Fig. 3, has been prepared on the basis of 75 per cent. of the possible boiler capacity in the following manner:

General Constants of Simple Consolidation Locomotive.

Diameter of cylinders	22 ins.
Length of stroke	30 ins.
Diameter of drivers	57 ins.
Heating surface	3397 sq. ft.
Total weight of locomotive	103.5 tons
Weight on drivers	93 tons
Weight of tender	61.5 tons
Total weight locomotive and tender	165 tons

This particular locomotive has been chosen for illustration as it is the type in daily use on the mountain division of one of the largest Western roads.

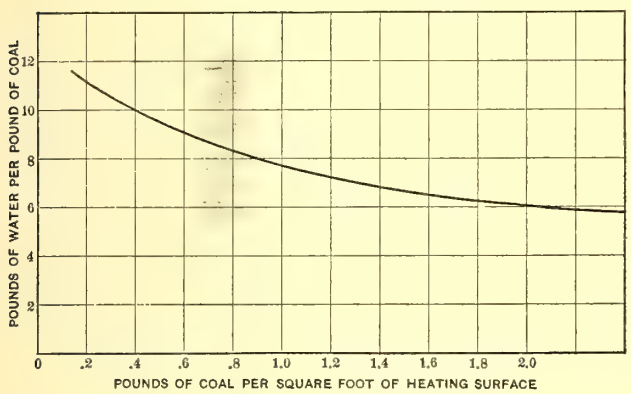


FIG. 4.—RATE OF EVAPORATION

Under the above conditions, the theoretical tractive effort is 49,500 lbs., of which 39,600 lbs. is available at 90 per cent cut-off. The contents of each cylinder is approximately 6.6 cu. ft. and with four cylinders of steam per revolution and with steam weighing 0.41 lbs. per cubic foot at 170 lbs. cylinder pressure, each revolution requires 10.85 lbs. steam. With 3397 sq. ft. of heating surface there is a possibility of evaporating 6 lbs. of water per pound of coal when burning 2 lbs. of coal per sq. ft. of heating surface, thus giving an available supply of 40,700 lbs. of steam per hour when working boilers in prime condition at the full output resulting from perfect firing with good quality of coal. In practice, however, the available steam for sustained output would not be greater than 75 per cent or 30,500 lbs. per hour, thus giving full tractive effort at 46.8 r. p. m. of the drivers corresponding to 7.93 m. p. h. on a 57-in. driver. The "critical speed" of the locomotive is therefore 7.93 m. p. h. when working at 75 per cent of full attainable boiler capacity, and the coal consumed under such circumstances will be 4,360 lbs. per hour, corresponding to 1.28 lbs. of coal burned per sq. ft. of heating surface, at which rate we would expect an evaporation of approximately 7 lbs. of water per pound of coal.

What might be termed the "performance capacity" of a steam locomotive may be worked out from the speed and tractive effort characteristics given in Fig. 3, using as a basis the 1000 ton-miles trailing load moved per hour on a level or any gradient selected. The prevalence of 2.2 per cent. ruling grade on many of our Western roads perhaps justifies the selection of that figure for demonstration purposes; and the coal consumed, crew wages, and maintenance charges, may all be worked out from the basis of continuous operation per 1000 ton-miles trailing load on 2.2 per cent grade, these results being shown in Fig. 5.

Certain assumptions are necessary and are as follows:

Cost of coal	$3 per 2000 lbs.
Engineer, wages per hour	$0.50
Fireman, wages per hour	0.35
Conductor, wages per hour	0.40
Three brakemen, wages per hour	0.90
Total crew	2.15

Average mileage per locomotive per year, 36,500.
Total maintenance, including round-house charges, $5,000.
Maintenance per locomotive mile actually run, 13.7 cents.
General locomotive constants are the same as previously given.

Having broadly outlined the performance characteristics of the simple consolidation engine frequently met with in heavy grade operation, it becomes necessary so to proportion the constants of the electric locomotive, assumed to replace it, as to gain the greatest benefit from the different inherent characteristics of the latter type of motive power.

Referring to Fig. 2, it is evident that with the small speed variation of the electric locomotive, and due to the fact that its motive power is separate from its unlimited source of power generation, it is possible to consider radical changes in the method of moving freight, more especially on mountain-grade divisions. It has become a partly accepted fact that the electric locomotive characteristic should be so proportioned as to enable it to operate trains at a high rate of speed on level track and at a much slower speed on grades, in fact conforming with present steam practice in this respect. The writer would again point out that steam railroading to-day is in reality steam locomotive practice in that the speed possibilities of different track divisions are restricted to a large extent by the limitations of the steam locomotive. In other words, the only reason why it is common practice to run at very low speeds on mountain-grade divisions instead of continuing the high speeds in vogue on more level portions, is because a steam locomotive cannot be built powerful enough to supply the heavy tractive effort required at any higher speeds than those now in vogue. Railway economies teach us that the lowest cost per 1000 ton-miles is obtained when operating the greatest train weight at the highest speeds, and J. J. Hill's well-known saying to the effect that "Expenses are per train-mile and receipts per ton-mile," is only partly true, as the time consumed in hauling the train one mile enters as a most vital factor.

Considered broadly, the one expense in train operation that is fundamental is the cost of fuel, this factor being influenced only by the economy of the fuel-burning plant. Other expenses, such as locomotive maintenance, crew wages, etc., are affected entirely by the method of operation, and no radical departure from present methods is to be looked for until the coming of a type of motive power which offers possibilities not equally enjoyed by the steam locomotive.

This point is further illustrated by reference to the operating sheet of one of our greatest Western roads using the simple consolidation locomotive previously described.

Speed Relations. Road "A" Mountain Division.

	Up Grade.	Down Grade.
Schedule speed.....	7.35 miles per hr.	12.5 miles per hr.
Av. speed while running.	12.1 miles per hr.	20.0 miles per hr.
Number stops per mile..	0.177	0.149

The average schedule speed of a number of trains, including all layovers due to the despatcher or failure of motive power, as obtaining on another mountain division of a different road, showed values as low as 6.7 m. p. h. up grade. In general it may be stated that the freight movement over mountain divisions is effected at very low schedule speeds, and the cause is evident from an inspection of the steam locomotive characteristic. Except for the fact that curves are usually of shorter radius on heavy grades than on levels, there is no reason for the slower speed of trains, provided a type of motive power is available that is capable of supplying great draw-bar pulls at high speeds. It is just this characteristic which the electric locomotive possesses to an almost unlimited extent, and such locomotives can be built which are even more powerful and operate at higher speed than can be utilized at present.

For example, the simple consolidation locomotive considered is capable of sustaining a tractive effort of 25,600 lbs. at a maximum speed of 15.4 m. p. h., and weighs

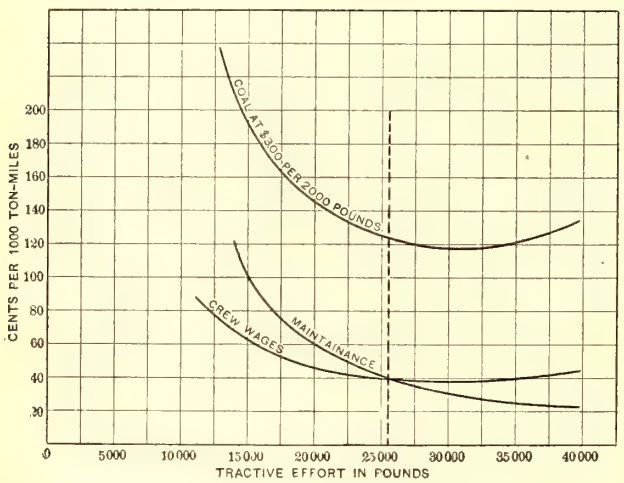


FIG. 5.—PERFORMANCE CAPACITY STEAM LOCOMOTIVE (SIMPLE), GRADE 2.2 PER CENT (UP)

165 tons with tender, while a single New York Central electric locomotive, of the 600 type is capable of delivering the same tractive effort at approximately 37 m. p. h., and the weight is only 100 tons. The Central locomotive is of course designed for moderate speed passenger service and could not be run continuously at such a large output, but it is cited only as an example of a well-known electric locomotive having an enormous horse power capacity, although in this respect it is but the forerunner of other electric locomotives having still greater outputs. Owing to the fact that such units may be run in groups of two or more and still be perfectly under the control of a single operator, the advantage of very large single units is somewhat modified, and the introduction of the electric locomotive may also introduce new ideas as to the size and construction of single hauling units.

The electric locomotive may be equipped with motors of several different types each having characteristics best qualifying it for certain classes of work. Fig. 6 and Fig. 7 illustrate the usual speed, torque, and efficiency curves of two typical motors, the direct-current gearless and the alternating-current single-phase geared type. The type of motor to be adopted is a matter requiring full local knowledge of the conditions obtaining in each individual instance before a proper selection can be made. All three of the available motors—direct-current, alternating-current single-phase, and alternating-current three-phase—possess the one needed characteristic of great output per pound and hence the arguments advanced for the substitution of the electric for the steam locomotive are general in character and do not apply strictly to locomotives equipped with any one type of motor to the exclusion of all others. As the direct-current gearless motor can be built in the largest sizes, is the best understood, and is in successful operation upon a very important division of one of the largest steam roads, it is here chosen as the equipment of a typical electric locomotive.

The large output, 840 hp for one hour and 400 hp continuous, shown in Fig. 6, illustrates what can be accomplished with this type of motor. The output of the complete locomotive is dependent upon the number of motors permitted with the construction adopted. Thus, such a four-motor equipment is capable of delivering a tractive

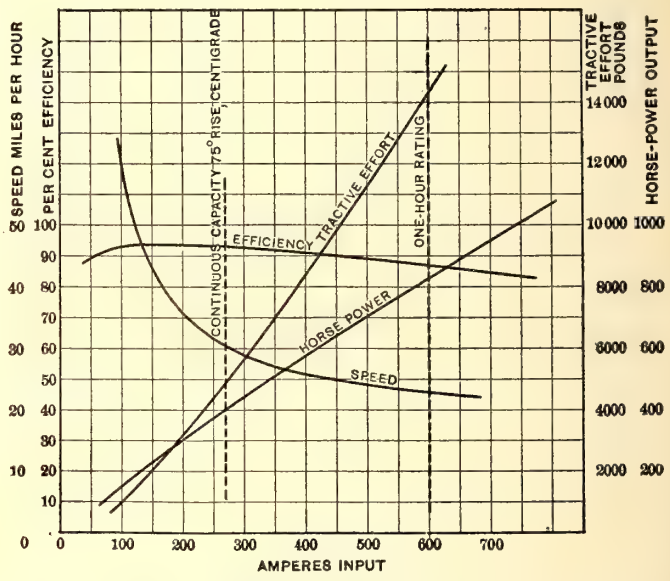


FIG. 6.—DIRECT-CURRENT GEARLESS MOTOR CHARACTERISTICS, 1200 VOLTS

effort of 56,800 lbs. at a speed of 23 m. p. h. approximate (depending upon the voltage) while the efficiency of conversion at this output would be 87 per cent, rising to a maximum of 93 per cent at higher speeds and lower tractive effort. Another form of construction, say one similar to that employed in the largest Mallet compound, would permit the use of two four-axle articulated trucks, providing an equipment of eight motors and an output of 113,600 lbs. at a speed of 23 m. p. h.

The same motors could readily be rewound to give the same tractive effort at considerably increased speeds if desired, without materially increasing the internal losses of conversion.

Returning to the direct comparison of the simple consolidation and electric locomotive, Fig. 3 was plotted on the basis of a speed of 30 m. p. h. for the electric and 15.4 m. p. h. for the steam locomotive, giving in each instance a tractive effort of 25,600 lbs. at the rim of the drivers. Though the electric locomotive could very readily be designed to give the same tractive effort at a higher speed, 30 m. p. h. was assumed as the highest speed permissible due to the alignment of the track on heavy grades.

To plot a performance capacity curve for the electric locomotive, certain further assumptions are necessary.

Type of equipment, direct-current gearless motors.
Weight of total locomotive.....125 tons
Weight on drivers.....100 tons
Engineer, wages per hour.....$0.50
Conductor, wages per hour..... 0.40
Three brakemen, wages per hour..... 0.90
Total wages of crew..... 1.80
Efficiency of transmission rail to bus-bar, 70 per cent.
Maintenance of locomotive, 5 cents per mile run.

The train crew is so divided as to permit the location of a brakeman in the engineer's operating cab.

The cost of electrical power must in this instance be most arbitrarily assumed, owing to the widely different cost of coal, possibility of water power, etc., obtaining in different localities. As the cost of coal for steam locomotives will also vary greatly as to price and quality, it has been assumed at $3 per 2000 lbs., and a cost for electric power of one-half cent per kw-hour is based upon using the same price and quality of coal. As it is further assumed that an entire engine division of say 150 miles is to be electrified, it gives promise of a 24-hour load-factor of 50 per cent and this figure has been taken. Approximating the

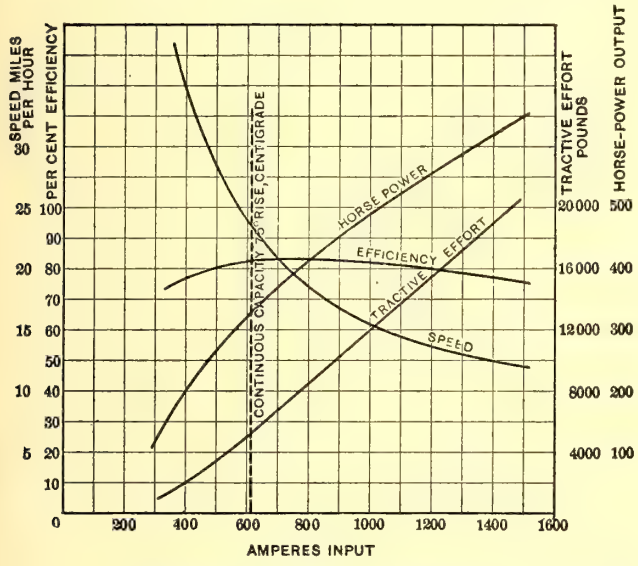


FIG. 7.—ALTERNATING-CURRENT SINGLE-PHASE MOTOR CHARACTERISTICS, 25 CYCLES, 375 VOLTS

first cost of installation of the generating station at $100 per kilowatt, and allowing 10 per cent per year for interest and other fixed charges, the cost of power is brought up to possibly $0.0075 per kw-hour at the station bus-bar. Other conditions obtaining will in a given instance modify the figures arrived at, but for purposes of demonstration $0.0075 is a conservative estimate, and such a figure is needed to compare the cost of power with the fuel item in steam-locomotive performance.

The effect of increased speed on cost of operation is clearly shown by comparing the performance capacity curves of the steam and electric locomotives, Figs. 5 and 9.

It will be observed that the reduction in the operating expenses is effected in the two items of crew wages and maintenance of locomotives, and that the cost of fuel remains practically unchanged. This is as it should be, as the cost of fuel in the case of steam locomotives or power with electric locomotives is the only fundamentally necessary expense in train movement. Overcoming train friction and raising a train up grade against gravity represents useful work performed, and this work is accomplished at an expenditure of approximately 4 lbs. of coal per hp-hour at the drivers with simple engines and 2.66 lbs. of coal per hp-hour at the drivers with electric locomotives, including all intervening losses between rail and generating station bus-bar. The speed at which this work is performed, therefore, does not affect the cost of fuel or power, it being assumed that the motive power for the various speeds is so proportioned as to operate at the point of greatest economy.

Thus with coal at $3 per 2000 lbs. in each case, the steam locomotive can generate a horse power at the drivers at an expenditure of $0.006 as against $0.0039 for fuel alone with the electric. The two figures are not directly comparable, as to the cost of fuel for steam locomotive operation must be added the extra cost of hauling, which on grade divisions may constitute a large percentage of its original cost; and the waste incident to handling and storing in many bunkers along the tracks. In addition, there is a considerable quantity of coal burned under the boilers of steam locomotives standing idle or coasting down grades, which will be shown later, may equal 10 per cent of the total consumption in main line freight movement and much more in the case of helpers and switching engines. If, therefore, coal be delivered at the engine division terminal at $3 per ton, the

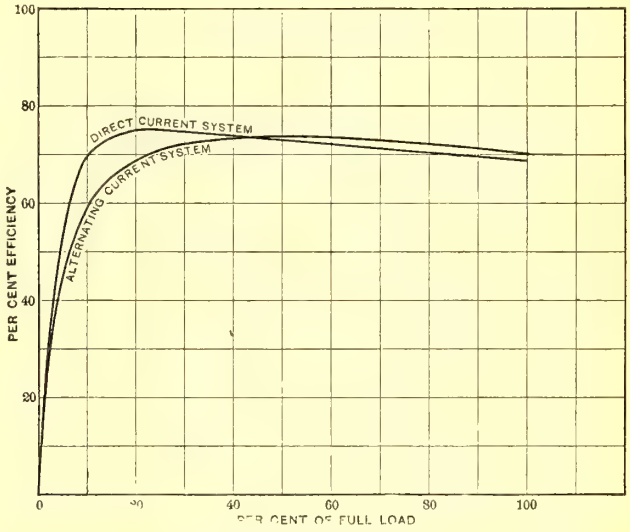


FIG. 8.—EFFICIENCY OF DISTRIBUTION GENERATOR TO RAIL

actual cost on the tender will be considerably in excess of this figure, and due allowance must also be made for the coal wasted, burned or otherwise, and not producing useful brake hp-hours at the rim of the drivers.

In the electric system also, besides the allowance made in distribution losses in arriving at 2.66 lbs. coal burned per hp-hour at the rim of the drivers, there will be an additional charge for labor and fixed expenses incident to power-house operation and first cost. The electric system, however, is not restricted to the use of high-grade fuel and coal of an inferior quality, and much lower cost, such as lignite, can be utilized, besides the large opportunities for cheap power presented by the water powers generally available on mountain divisions. A common cost of $3 per 2000 lbs. for coal is taken in this discussion; it is rather favorable than otherwise to steam locomotive operation, as coal can be dropped into the bin of a power house located at a division terminal at less expense than it can be hauled up a severe long grade and distributed in several pockets along the route.

It is evident that the cost of fuel or power, being fundamental, constitutes a fixed item in the total cost of operation while the other two items, crew wages and maintenance expenses, will be determined solely by the method of

operation and the excellence of motive power used. We have become so accustomed to consider that fuel, crew wages, and engine maintenance each constitute approximately 10 per cent of the total cost of operating a railway that we rather lose sight of the fact that two of these items are a theoretically needless expense and subject to considerable modification in practice with the adoption of another type of motive power possessing characteristics which will permit making radical changes in operating methods.

While the figures shown in Figs. 5 and 9 indicate a certain relation among the three items of fuel, crew, and maintenance expense, this is not the true relation obtaining in practical operation for the reason that the values given in the curves assume continuous operation up grade under the conditions outlined. Unfortunately, train crews must be paid full value per mile whether the mile be up grade or down, and with steam locomotives there is also a considerable loss in fuel resulting from engines standing or running

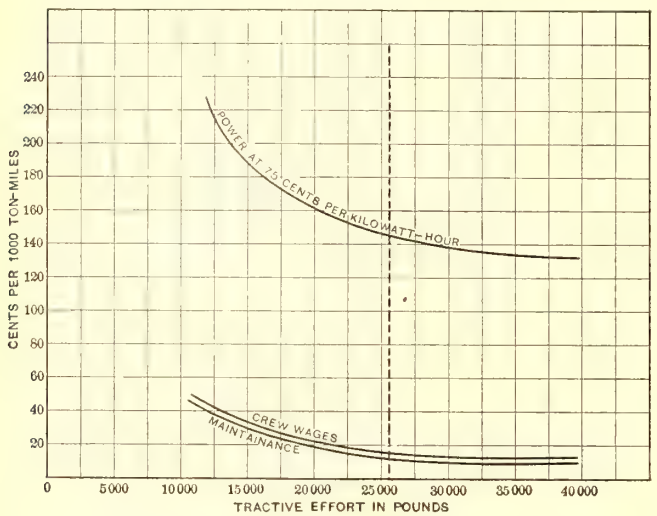


FIG. 9.—PERFORMANCE CAPACITY ELECTRIC LOCOMOTIVE (DIRECT-CURRENT GEARLESS) GRADE 2.2 PER CENT (UP)

light which must be also taken into account; hence it becomes necessary to modify the figures arrived at, and for this purpose certain references must be made to current railroad practice on mountain-grade divisions in order to arrive at the proper tonnage relations, schedule speeds, etc., obtaining in up-grade and down-grade operation.

Previous figures have been given showing that the schedule speed on several mountain divisions is approximately 50 per cent of the average running speed and this figure is assumed in the following statement of cost of operating 1000 ton-miles with steam locomotives, averaging the cost of up- and down-grade running. Owing to the higher schedule speed of electrically operated trains, resulting in fewer meeting points with the same tonnage handled, and due to the absence of forced stops to take on fuel and water, etc., it is assumed that with electric motive power the schedule speed may be 60 per cent of the running speed.

With the electric locomotive standing, or coasting down grade, there is no demand whatever made upon the generating station, and hence the only expense carried through these periods is that for train crew and a certain amount for maintenance. On the other hand, with the steam locomotive there is a considerable amount of fuel burned and water wasted when standing at sidings and when coasting. In the case of mountain railroading with its frequent and prolonged delays, this waste may reach considerable proportions.

The following results of a carefully conducted series of tests will illustrate this point. Two test locomotives and trains were operated over a mountain division under regular service conditions—steam and fuel consumption, duration of delays, etc., being carefully noted. The total work expended up grade was 5700 hp-hours at the rim of the drivers including allowance for 1.54 per cent average grade and seven pounds per ton track and curve friction. The total water evaporated on the trip divided by the total hp-hours gave a steam consumption of 36 lbs. per brake hp-hour at the rim of the drivers. Indicator cards taken upon the engine in question at all cut-offs up to 90 per cent showed that the greatest steam consumption did not exceed 32 lbs. per indicated hp-hour, or 35.5 lbs. per brake hp-hour, allowing 10 per cent internal engine friction. Values as

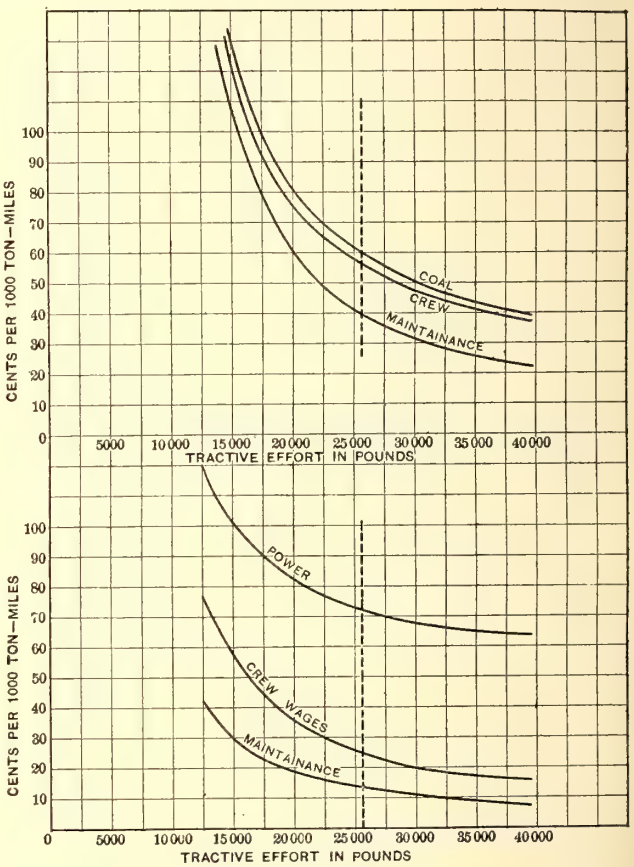


FIG. 10.—TRACTIVE EFFORT IN POUNDS. SERVICE CAPACITY STEAM AND ELECTRIC LOCOMOTIVES AVERAGE OF UP AND DOWN 2.2 PER CENT GRADE

low as 23 lbs. of steam per indicated hp-hour or 25.5 lbs. per brake hp-hour were recorded for the average cut-off of 40 to 50 per cent used throughout the run. A third and fourth series of tests conducted up the same grade gave similar results, except that the values were slightly higher than those quoted, showing that there was a considerable loss of water unaccounted for by indicator cards and useful work performed.

Operating down grade, it was necessary to accomplish 1110 hp-hours on account of the somewhat broken profile, and again the water consumption showed on two trips 57.7 lbs. of steam per brake hp-hour, and on two subsequent trips 66.5 lbs., values entirely unaccountable on the basis of useful work performed. During the runs up grade the trains were in motion but 66 per cent of the total elapsed time, and down grade the trains were in motion from 52 per cent down to 40 per cent of the total elapsed time. As these delays were frequent and undetermined, it was neces-

sary to maintain full steam pressure while waiting for the momentarily expected release from the block, hence the waste of fuel and water was considerable. Averaging this waste at 400 lbs. per hour, at which low rate of consumption the water evaporation would approximate 10 lbs. of water per pound of coal burned, or 4000 lbs. of water evaporated per hour, and reducing the total water consumption measured by the waste losses thus obtained, the steam consumption in eight different tests up and down grade ranged 34.7 lbs., 32.4 lbs., 28.1 lbs. and 25.3 lbs., etc., water per brake hp-hour. These values are fairly commensurate with results of indicator cards taken, and, with the type of engine used and under the operating conditions obtaining an allowance of 400 lbs. of coal stand-by losses per idle locomotive-hour seemed not too great a value to allow, and this figure has been taken in subsequent calculations.

Locomotive performance capacity curves may therefore be plotted which will show approximately the true relation

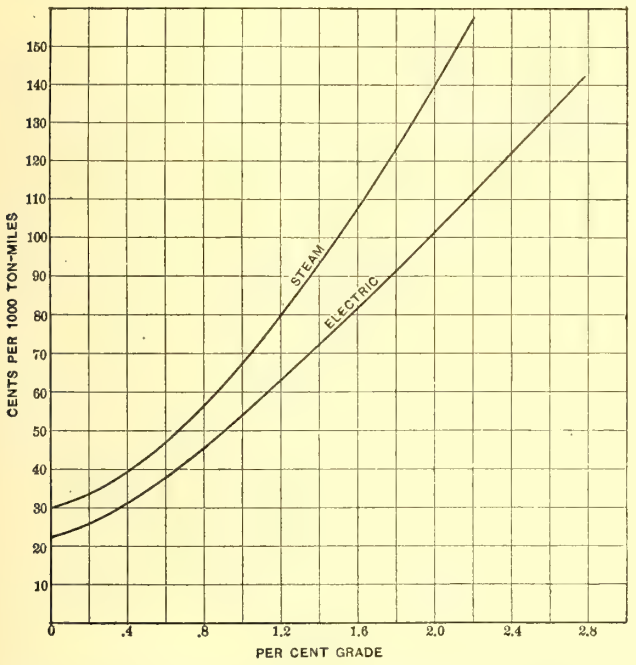


FIG. 11.—SERVICE CAPACITY OF STEAM AND ELECTRIC LOCOMOTIVES, AVERAGE BOTH DIRECTION AND ANY GRADIENT

between the several items of fuel, crew wages, and motive power maintenance, by adhering to the following assumptions:

Ratio schedule to running speed up-grade steam locomotive ..... 50 per cent
Ratio schedule to running speed electric locomotive..60 per cent
Schedule speed down-grade steam.....15 miles per hour
Schedule speed down-grade electric.....18 miles per hour
Cost of coal .....$3.00 per 2000 lbs.
Cost of electric power.....0.0075 per kw-hour
Efficiency of distribution.....70 per cent
Crew wages per hour steam.....$2.15
Crew wages per hour electric.....$1.80
Maintenance locomotive steam.....$0.137 per mile
Maintenance locomotive electric.....$0.05 per mile
Fuel waste per idle hour steam.....400 lbs.

An inspection of the performance curves shows that in practical operation the fuel expense approaches more nearly to the value of the other items considered, instead of being greatly in excess of them as indicated in the theoretical performance curves, Figs. 5 and 9, showing up-grade operation only. For operation on less grades than 2.2 per cent, all items are reduced and the total and subdivided comparative costs are given in the following table and in Fig. 11.

COMPARATIVE OPERATING EXPENSES PER 1000 TON-MILES STEAM (SIMPLE) AND ELECTRIC LOCOMOTIVES

AVERAGE OF UP AND DOWN GRADE OPERATION

Steam Locomotives

Grade	½%	1%	1½%	2%
Coal	$0.15	$0.25.5	$0.38	$0.53
Crew	.13.5	.24	.36	.50
Maintenance	.10.5	.17.8	.26	.36
Total	$0.39	$0.67.3	$1.00	$1.39

Electric Locomotives

Grade	½%	1%	1½%	2%
Power	$0.20	$0.35.5	$0.50.5	$0.66
Crew	.07.2	.12.2	.18	.24
Maintenance	.03.6	.06.2	.09.0	.11.9
Total	$0.30.8	$0.53.9	$0.77.5	$1.01.9

Saving effected by electric operation

Grade	½%	1%	1½%	2%
	$0.08.2	$0.13.4	$0.22.5	$0.37.1

A study of the above table is most instructive, as it shows that while the percentage saving with electric operation is approximately the same whatever the ruling grade, yet the actual money saving is much greater on the heaviest grades. As about the same investment must be made in each case for distribution system including third-rail or overhead trolley, sub-stations, etc., the inference must be drawn that heavy-grade divisions present a more attractive field for electrification than level sections when considered from the purely economic standpoint.

So far, the matter has been viewed from the standpoint of comparative operating expenses for a given tonnage moved. There is another argument for electrification which may in certain instances be of a much more controlling nature. Most of our mountain roads are single track and transcontinental tonnage has so increased as seriously to congest these mountain divisions. The heavy trains of the plains, weighing 2000 to 3000 tons, must be split up into units of about 1000 tons in order that the present steam engines, operating double and even triple, may haul them over the heaviest grades. The slow speed obtainable makes the number of trains on a mountain division large, the meeting points frequent, and hence, however good the despatching system employed, there will of necessity be a considerable amount of lost time introduced. Add to this the failures of motive power being worked to its limit, and there is reason for the claim that the tonnage capacity of the division will be greatly increased by the introduction of electrically hauled trains.

Lest the writer be accused of unfairness in selecting the simple engine for comparison, it is proper to touch upon the economies effected with the use of the compound locomotive and also by the introduction of such coal-saving devices as superheaters and feed-water heaters.

Reference to Fig. 13 shows a saving in water consumption per horse power of approximately 20 per cent with the compound locomotive, but in spite of this generally accepted saving the simple locomotive still rules the mountain division after repeated trials of the compound. Not being an ardent supporter of either type of locomotive, the writer leaves the battle of the simple and compound to their enthusiasts, commenting only upon the fact that, except in the case of the Mallet compound, the arguments for the compound are based upon fuel economy only.

The latest Mallet compound, weighing 413,000 lbs., is the largest steam locomotive yet built, and is of particular interest owing to the enormous boiler which such a construction permits. With a total heating surface of 5300 sq. ft. we should expect an evaporation of 63,600 lbs. of water for

a short period and possibly 48,000 lbs. water continuously. With a possible evaporation of 6 lbs. of water per pound of coal, this would necessitate the burning of 8000 lbs. of coal per hour, requiring the best efforts of two firemen if maintained for several hours. Assuming a steam consumption of 22 lbs. per brake hp-hour, such a locomotive should give a sustained output of 2180 hp. at the rim of the drivers, and this with a weight with tender of approximately 300 tons, or three times the weight of an electric locomotive of the New York Central 6000 type giving the same horse-power output.

The two locomotives are, of course, designed for entirely dissimilar classes of work; but it is not unfair to compare them on a horse-power basis, as it is the huge boiler of the Mallet that is remarkable, and upon this basis the selling price of the two machines is approximately the same.

The comparative cost of electric and steam locomotives is generally considered as very favorable to the steam units, but reversing the usual methods and comparing the cost of the electric with that of the steam locomotive or locomotives required to replace it, may reverse the relations. The electric locomotive requires no more than casual inspection, can be side-tracked indefinitely and still be ready for instant operation at full capacity, can run 24 hours without a stop, if necessary, and all these advantages and others offer a guarantee for a much greater annual mileage than is possible with its steam competitor. Then, too, compare the cost of a group of steam locomotives (no single unit could be designed to give the output) capable of delivering even 4000 hp continuously with a single electric unit of this output, and the difference in cost is not great. It may be stated broadly that for a given gross annual ton-mileage moved, the cost of steam locomotives may be even greater than the cost of the electric units replacing them.

The term "horse power" is perhaps not fully appreciated by the steam railway fraternity. When the statement is made that a certain electric locomotive is rated at so many horse-power output, it does not leave the impression it should. The horse-power output of a locomotive is a direct measure of its capacity to do work, and while the tractive effort available governs the tonnage of the trailing load, it is the product of the tractive effort times the speed at which

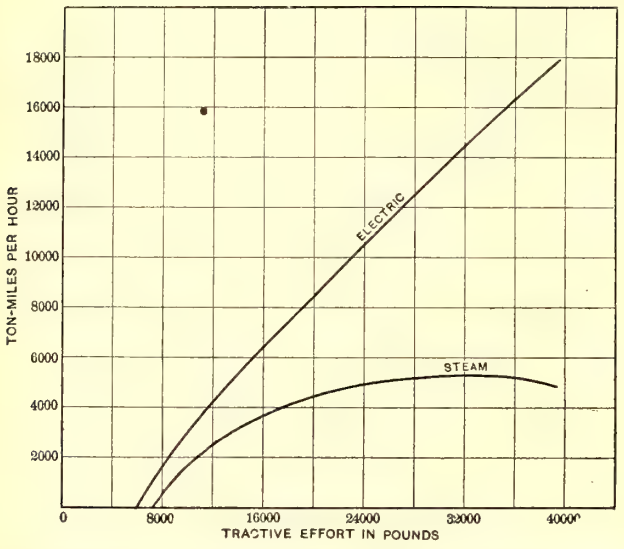


FIG. 12.—HOURLY TONNAGE CAPACITY OF STEAM AND ELECTRIC LOCOMOTIVES UP 2.2 PER CENT GRADIENT

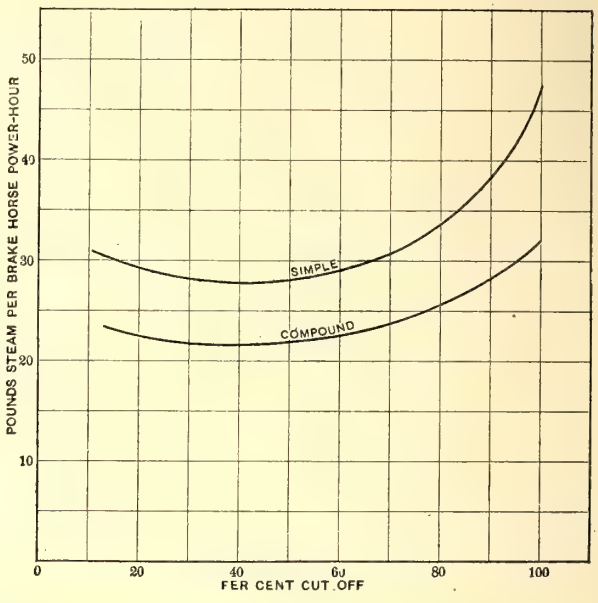


FIG. 13.—COMPARISON OF SIMPLE AND COMPOUND LOCOMOTIVES IN STEAM PER BRAKE HORSE-POWER

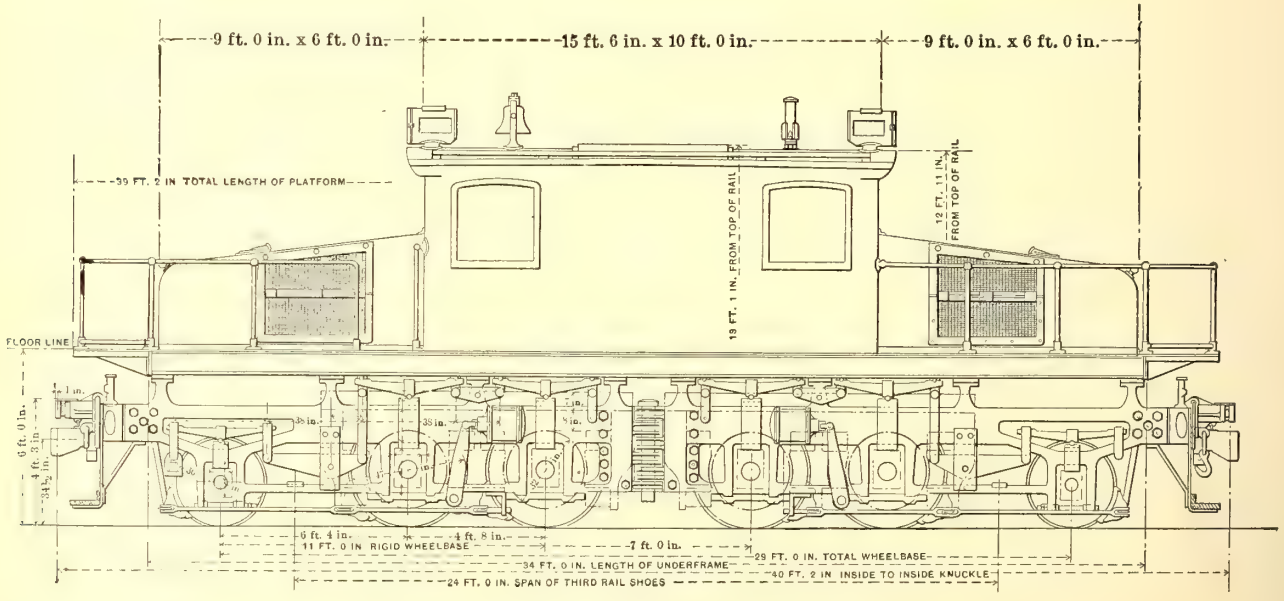


FIG. 14.—TYPICAL ELECTRIC FREIGHT LOCOMOTIVE 2-4-4-2 TYPE

it is available, or in other words, the horse-power output, that measures the hourly tonnage capacity of the locomotive upon which the crew expenses of the entire train depend. Hence the great claim for recognition of the electric locomotive lies in its great horse-power output, that is, its ability to carry full tractive effort or to slip its wheels at speeds two or three times greater than can be done with any steam locomotive yet built.

Superheating promises something in fuel economy, as does the introduction of feed-water heaters. Such improvements, together with the adoption of the four-cylinder locomotive, either compound or simple, must necessarily call for more expense to maintain and less reliability in operation. In fact, superheating in stationary boiler plants has given much trouble, and excessive superheating has not been a complete success even when used with turbines, with which superheating has given the best results. Judged from stationary engine practice, it seems fair to assume that the amount of superheat in locomotive practice must be moderate and result in small benefits to be secured.

The feed-water heater is also a coal-saving device and should prove to be worth its added complication as soon as it is commercially developed.

As against the reduction in fuel expenses promised by the use of the compound locomotive fitted with superheaters and feed-water heaters, the electrical engineer has up his sleeve the great possibilities offered by regeneration of power while electrically braking on mountain-grade divisions. The amount of power saved by this means may in certain installations amount to as great a percentage of the total as is the saving effected in coal expenditure with steam locomotives by compounding and providing superheaters and feed-water heaters. Such an electrical saving is of course restricted to heavy-grade divisions, but the feasibility of electric braking by regeneration is unquestioned. Indeed with three-phase induction motors regeneration is automatic, the motors being perfectly reversible and returning energy when operating down grade with no change whatever in their connections. Other types of motors may be adapted for regeneration with slight modifications in the control system.

All of our railway managements have felt the need of establishing a so-called express freight service comprising a light train operating at much higher speed than is the case with the bulk of the freight movement. It is well known that the cost per 1000 ton-miles for moving express freight is very much higher than in the case of low-speed freight. An inspection of Fig. 3 illustrates the reason for this. The steam locomotive is essentially a slow-speed unit when delivering its full tractive effort; that is, a tractive effort equal to 22 per cent of the weight upon the drivers, and high speed is only obtained at the sacrifice of tractive effort. Hence a high-speed freight train is of necessity a lighter train than could be handled over the same profile by a given locomotive, and the crew and maintenance expense is therefore large. That such a class of service is nevertheless profitable or at least necessary is evidenced by the continuance of the practice and the proposed introduction of electric locomotives, in effect, makes all trains fast freights, gaining the benefits of such a service without incurring the penalty of increased operating expenses inherent to steam operation.

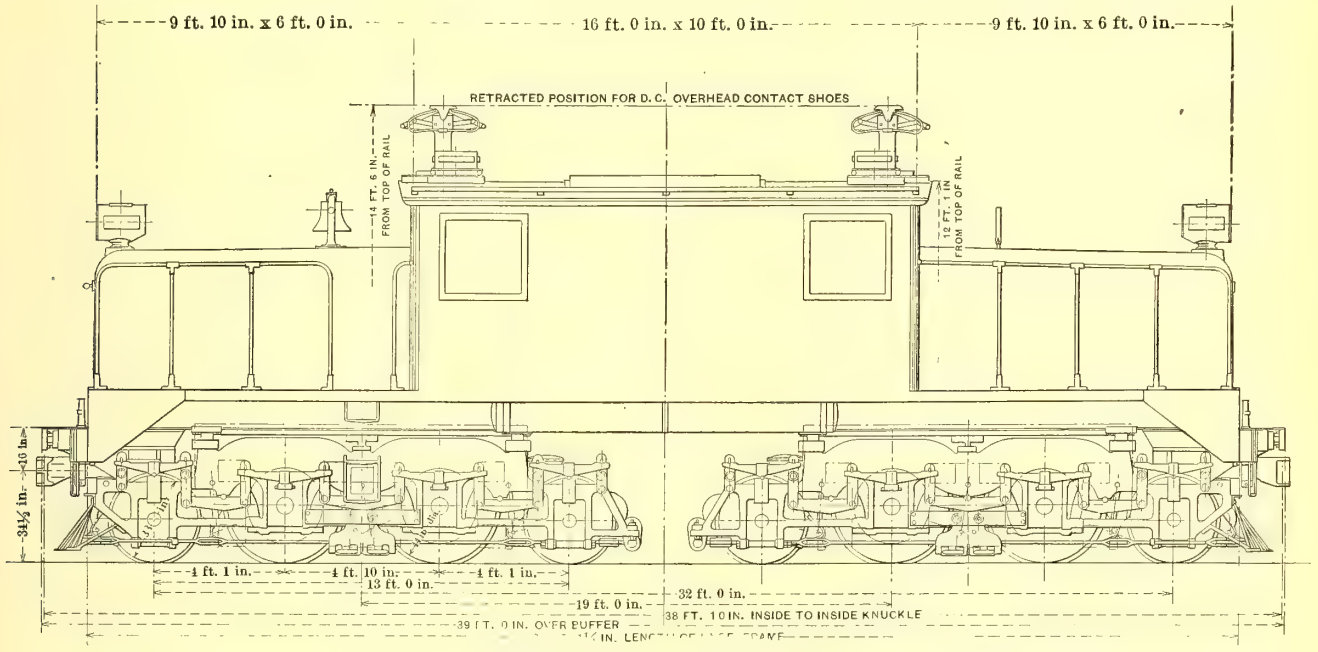


FIG. 15.—TYPICAL HIGH-SPEED PASSENGER ELECTRIC LOCOMOTIVE

In this paper the writer has attempted to outline some of the fundamental reasons for the electrification of steam roads; the figures submitted are used for illustrative purposes only and are not intended as being directly applicable to any concrete case. Many of the points touched upon, such as steam locomotive improvements, compound versus the simple, and the comparative advantages of different types of electric locomotives, etc., could all be treated in separate papers by themselves, so replete with interest are the different points raised. Rather than befog the main question at issue, which is the electrification of steam roads, detailed proof of many statements made has not been attempted. Nor does the writer believe that the time is ripe for the electrification of steam roads at large; indeed, the electrical enthusiasts would be hard put to it if called upon to show reason for the electrification of many branch steam lines carrying a small tonnage at infrequent intervals. There are, however, certain divisions of our steam railways which, either on account of their broken profile or heavy traffic, offer an opportunity to introduce a superior type of

motive power which will effect such economies in operation as to provide adequate return on the investment required for the electrification. There are still other divisions where a much desired increase in the track-tonnage capacity can only be effected by double tracking so long as the steam locomotive is adhered to as the type of motive power used. Double tracking a mountain-grade division is often a matter of enormous expense, and electrification of the single track may relieve the present traffic congestion at a moderate cost.

On mountain-grade divisions the subject of regeneration with electric locomotives should receive very careful consideration, not so much on account of the saving in power which it may effect, but rather on account of the greater safety of operation which it guarantees by eliminating the serious defects of holding trains on heavy grades by wheel and shoe friction. Finally, there are the many incidental advantages to be gained with electrification which cannot be predicted with any accuracy, as they result from changes in operating methods sure to follow the introduction of a type of motive power not subject to the service limitations of the steam locomotive. No attempt has been made even to approximate the saving effected in engine supplies, round-house expenses, elimination of water supply with its often attendant expensive purifying outfit, and the many items incident to steam locomotive operation. These items are incidental and seldom assume an importance sufficiently great to class them as fundamental, though the difficulty of procuring good water, even with purifying plants, may approach very closely to being a controlling factor in certain cases.

The freight-car shortage problem itself is a very serious one at certain times of the year on some roads, and as the total freight-car mileage can be increased with the higher speeds provided with electric locomotives, it should result in the saving of a considerable expense now incurred for rental of foreign cars, or even increase the gross receipts by the movement of tonnage which more available cars would make possible.

The subject of the electrification of steam roads is, therefore, a very broad one, and while this paper has been devoted largely to a discussion of operating expenses as affected by the different characteristics of the two types of locomotives, it has been done to illustrate the advantages resulting from increased locomotive capacity. The keynote of electrification is capacity; by approaching the problem from this standpoint only can full benefits be obtained.

DISCUSSION.

W. J. Wilgus, recently vice-president of the New York Central Railroad, believed that electricity in heavy traction work had come to stay. He said that conservative advocates of heavy electric traction, while urging its self-evident advantages in the abolition of the products of combustion in tunnels and cities, the increasing of terminal capacities and opportunities for growth of traffic, have refrained from dwelling too strongly on saving money. They have been contented with the belief that more money could be made. The burden of additional interest charges, taxes, maintenances and depreciation attendant upon the substitution of electricity for the old form of motive power, has very properly caused the careful engineer to pause in admitting, even to himself, that, in addition to increased capacity to handle traffic, there might be a net saving in cost of operation. This caution has sprung from the absence, until recently, of any actual data on the cost of heavy electric traction operation. The pioneer electrical installation in heavy trunk line service, on the New York Central & Hudson River Railroad, has now been in complete and successful operation since July 1, 1907, the gradual change from steam power having commenced in December, 1906. The working side by side of both kinds of motive power has given unsurpassed opportunities for the observation of their comparative capacity and efficiency. The results are even more gratifying than were expected, and substantiate many of the author's claims of superior capacity of electric equipment, although the conditions widely differ from those that he has assumed. After uttering a word of caution in regard to the necessity of including all factors in any statistics on cost, Mr. Wilgus gave the following concrete examples from actual practice on the New York Central:

Because of less cost of maintenance of electrical equipment, and less idle time in shops, the greater cost of interest charges and depreciation is not only neutralized, but a net saving in repairs and fixed charges over steam equipment is effected of 19 per cent.

Electric locomotive inspection and light repairs, as compared with coaling, watering, drawing fires, repairs, etc., of steam locomotives show a saving in time in favor of the former of over four hours per day, equal to 18 per cent.

The electric locomotive, while busy, is a much more nimble and efficient machine than the steam locomotive, showing an increase in daily ton mileage of 25 per cent.

While not so important in freight service, the question of locomotive weight is a large factor in a comparison of the relative economy of handling passenger traffic by steam and electricity. For instance, in switching service at the Grand Central terminal, 65 per cent of the total steam ton mileage is due to locomotive or "dead" weight, while the electric locomotive percentage is but 54 per cent, a saving for the latter of 11 per cent.

In the regular schedule service the steam locomotive shows 51 per cent dead ton mileage as against 35 per cent for the electric equipment, a saving for the latter of 16 per cent. When we realize that this saving of "dead" ton mileage has a direct proportionate effect on the cost of fuel and current, and an indirect effect on wages and fixed charges, its importance is manifest.

The speed advantage of electric over steam locomotives, to which Mr. Armstrong calls attention in mountain grade operation, is strikingly apparent in the New York Central installation, where the increase in coal consumption for car ton mileage in high speed service, as compared with slow speed service, is shown to be 165 per cent, whereas under exactly the same conditions the increased consumption of current for electrical equipment is but 18 per cent, a difference in favor of electrical operation of 147 per cent.

The net results of all of the economical advantages of electric operation over steam, for the conditions existing on the New York Central, after including all elements of cost of additional plant, show a saving in summer months of from 12 per cent to 27 per cent, depending on the character of service. A larger saving may be expected under winter conditions. In addition to this saving, the nuisance and dangers from smoke and gas in the Park Avenue tunnel have been eliminated, and the capacity of the Grand Central terminal has been increased about one-third. Later, when the New Haven Company effects its change of power, complete electrical operation in the tunnel will permit the use of shorter blocks, and correspondingly increase the capacity of the four-track main line entrance to the terminal.

Dr. Cary T. Hutchinson agreed with Mr. Armstrong that the electrical equipment of steam roads up to the present time had been undertaken on account of some special problem, either in connection with the terminals or mounting grades or the elimination of dirt or smoke. He doubted whether it was at present possible to secure data on the economy. He viewed the capacity of the locomotives from a somewhat different standpoint than Mr. Armstrong. The steam locomotive is generally limited to a weight of 50,000 lbs. on one axle. With a coefficient of traction of not over 25 per cent this will mean 9000 lbs. drawbar pull per driving axle. There is not room enough on the axle of an electric locomotive to give this amount of continuous tractive effort, but the capacity of an electric locomotive will be determined by average performance. If the grade is broken a motor can be secured which will give an average of from 5000 lbs. to 6000 lbs. per driving axle, but the same machine on ruling grades will give a tractive effect of 10,000 lbs. to 15,000 lbs. without slipping the wheels. From this point of view, the consideration of the ruling grade in determining the size of motor is eliminated; that is, the electric motor can be chosen with sufficient capacity for the average service, while the steam locomotive has to be chosen for the maximum service. The six-axle Mallet compounds which had been mentioned cannot do better in every-day service than pull 800 tons or less up a 2.2 per cent grade at a speed of 8.5 miles per hour. This is equivalent to about 1200 hp. at the driving wheel, and the locomotive with tender will weigh 250 tons. An electric locomotive weighing 100 tons will haul this same load up the same grade at a speed of 15 m. p. h. and will develop approximately 1800 to 1900 hp. It will not do so continuously, but long enough to get up a grade of fifteen or twenty miles. Another point is in connection with the saving of dead haulage owing to the less weight of the electric locomotive. There are 150 tons difference in the two machines working under the same conditions, and taking a mileage of 100 miles per day there are 15,000 ton miles per day worth $30 a day, or $10,000 a year, in the actual cost in the dead haulage of the two machines. It is sometimes thought that one of the great objections to the three-phase system is the fixed speed, but on a mountain problem on the Great Northern Railway, with which the writer has been concerned recently, it was considered by the operating officials an advantage to have a locomotive which could not run above a certain speed going down hill. This simplified the handling of freight trains, which was the principal question considered. The effect of recuperation is also important, not so much in saving energy as in diminishing the power capacity required.

N. W. Storer, chief engineer of the railway department of the Westinghouse Electric & Manufacturing Company, expressed himself as in hearty accord with the concluding remarks of Mr. Armstrong's paper, as the keynote of the whole subject lies in increase in capacity. While not a wild enthusiast on the immediate electrical equipment of all of the steam roads, he believed that it would come as fast as the manufacturing companies of the country would be able to handle it. In regard to speed on down grades, he thought it would be an advantage if the trains could be operated safely down grades at the highest speeds, as that would mean an increase in capacity. While not expecting to discuss the relative advantages of a. c. or d. c., he thought a single-phase locomotive was more desirable than either direct current or three-phase in controlling the speed on down grades, as it would restore energy to the line at all speeds. He thought that the curve in Fig. 8 must have been based on the assumption of a lower efficiency of the a. c. motor than of the d. c. motor. In that connection he showed curves of an a. c. motor of the same capacity as the d. c. motor treated in the diagram, which had an efficiency without gears of 91 per cent and with gears of 86 per cent, instead of 83 per cent as shown in Fig. 7.

W. S. Murray, electrical engineer of the New York, New Haven & Hartford, also agreed with the closing sentences of Mr. Armstrong's paper, but would have expressed the sentence by saying that the keynote of electrification is ton-miles, then capacity to handle it. The track capacity of a railroad is tremendously enhanced by electrical equipment, but ton-miles must be on hand to make necessary the increased locomotive capacity. He also believed that the saving in electrical operation from coal consumption and cost of locomotive repairs would be greater than might be considered from a perusal of the paper where they were called "petty economies." To substantiate this he presented the following table showing the saving of fuel which will be effected on the New York division of his company, when all the steam freight and passenger trains on that division are converted to electric power.

	Ton-miles per annum	Tons of coal, steam traction	Tons of coal, electric traction	Cost of coal, steam traction	Cost of coal, electric traction	Saving of electric over steam traction
Express	592,240,000	57,447	29,870	$183,830	$89,620	$94,210
Local express.	348,000,000	58,300	28,600	186,560	85,800	100,760
Freight	2,223,000,000	187,844	139,010	563,530	417,030	146,500
	3,163,240,000					$341,470

By reference to this tabulation, it is noticed that in express work 2,055 indicated hp-hours are developed in the evaporation of 57,594 lbs. of water, giving an average, therefore, of 28 lbs. of water per indicated hp-hour. On local trains this figure is slightly increased, the evaporation being 42,987 lbs. of water for 1435 hp-hours, making the rate 30 lbs. of water per indicated hp-hour. In view of the familiar turbine guarantees of 20 lbs. of water, including auxiliaries, per kw-hour at the switchboard, or 15 lbs. per hp-hour, and remembering the ratio of 7 to 10 in the evaporation of locomotive versus stationary boilers per pound of coal, it is not a stretch of conscience to concede that twice the drawbar can be developed by the electric method of traction for coal burned under the boilers of stationary plants versus coal burned in the fire boxes of locomotives. Mr. Murray also referred to some statistics which he had presented at the meeting of the Institute on Jan. 25 (see STREET RAILWAY JOURNAL for Feb. 2) bearing on the cost of repairs and maintenance of twenty steam freight and passenger locomotives; these were kept most carefully over a period of one year and showed 8.1 cents per locomotive mile for freight engines and 5.6 cents per locomotive mile for passenger engines. The engine mileage of the New York division of the New Haven road amounts to about 4,836,992 miles. This mileage is divided for passenger and freight service into 2,993,328 and 1,843,664, respectively. These figures were based on week ending Oct. 25, 1907, and it is to be noted that it will, therefore, be below the average, on account of the summer months bringing the heaviest traffic. This means an operating cost of $316,962 per annum for the maintenance and repairing of engines.

Mr. Murray continued that the average figures that he had been able to secure on electric engine repairs per locomotive mile are about 2 cents. Increasing this figure 25 per cent for safety and assuming the same number of electric engines replacing steam locomotives (as a matter of fact,

there would be less electric engines required, on account of the greater mileage per diem derived from electric locomotives), the total would be $120,924 per annum, showing a saving over steam locomotives of $196,038, Therefore, the net saving on fuel and locomotive repairs in favor of electrification gives a round sum of $562,470 per annum. This, upon a capital basis with money at 5 per cent, represents $11,249,000, an effective credit on the expense necessary to investment. These figures confirm those presented by Messrs. Stillwell and Putnam in their recent paper. In closing, Mr. Murray referred to two other details in operation which unquestionably increase the capacity of the given trackage for trains operating by electricity, viz., yard switching and turning of engines at terminals. As regards the first, he thought that double the amount could be accomplished in the same time, and as regards the second, that electric engines are ready to make their reverse train movements in 25 per cent of the time required by steam locomotives, assuming that the water tanks, ash dumps and turn tables are within the yard limits of the terminal.

William McClellan, consulting engineer, thought that the electrical engineers would have to admit that the cost of electrical equipment was large and that it was necessary to have facts to prove the economy or desirability of its adoption. For this reason the figures presented by Messrs. Wilgus and Murray were very acceptable.

Mr. Muralt, consulting engineer, referred to a problem upon which he was recently engaged, where a road with eighty miles of double track was at the end of its ability to handle traffic so long as steam locomotives were used. Two additional tracks would cost about $15,000,000. An electrical equipment for the existing tracks could be installed for $3,000,000, and there would be a saving in operating expenses of $200,000 out of $800,000, and the tonnage capacity would be increased up to 50 per cent. Mr. Armstrong's definition of capacity not as draw-bar pull, but as draw-bar pull times speed was the correct one. A steam locomotive of the New York Central Atlantic type weighs about 160 tons and develops a tractive effort at 45 m. p. h. of about 13,000 lbs. The New York Central d. c. locomotive weighs about 95 tons, and at a speed of 45 m. p. h. will develop a tractive effort of about 15,000 lbs. One European type of three-phase locomotive weighs about 70 tons and at 45 m. p. h. will develop about 23,000 lbs. tractive effort. The electric locomotives can, therefore, per unit of weight develop far greater draw-bar pull at high speeds than steam locomotives. Thus they greatly increase the possible tonnage capacity of a given road, so that the lines likely first to be electrified will be those now at the limit of traffic capacity under steam railroad conditions. That type of electric locomotive will in the end prove to be most useful, which, for a given unit weight offers the greatest amount of tractive power.

W. N. Smith, of Westinghouse, Church, Kerr & Company, agreed with Mr. Murray that the saving in cost of fuel and repairs was of considerable importance. It is very true that the whole question focuses upon capacity, and there are several different ways of looking at capacity. The possibilities of increasing the capacity of double track by electrical equipment are considerably greater than those of increasing the capacity of single track, especially if the profile is undulating and operating conditions generally are difficult. The questions of signals, turnouts, etc., are important matters to be considered. The load factor also enters into the question.

B. F. Wood, of the Pennsylvania Railroad, called attention to the fact that some of the railroads are being reconstructed to reduce the ruling grade, and enough money is being spent in this way as almost to offset the cost of electrical equipment. He doubted the necessity of electrical equipment from the standpoint of motive power until there was a density of traffic of say half-hour service, or unless there was some other important condition.

Dr. Steinmetz, of the General Electric Company, thought that the leading conclusion of Mr. Armstrong's paper was the advantage resulting in increased capacity or the ability of the road with the same trackage to handle a greater amount of traffic. This, however, means that the change from steam power to electric power is not a mere substitution of the electric locomotive for the steam locomotive, but a readjustment of the ways of operation, that is, an increase of the speed of operation of freight service by taking advantage of the feature of the electric locomotive being able to carry its drawbar pull up to a higher speed. This appears very essential, because when one motive power is substituted for another it always means not a mere substitution, but to get the greatest benefit from the new way, a rearrangement of methods is necessary. Nearly a century ago the stage coach was replaced by the steam engine. The first attempts to attach the steam engine to the stage coach and pull it over the country roads naturally came to naught, and it was successful only when they put the carriage on an iron track, and that developed the present steam locomotive traction. One characteristic of the steam locomotive is that it is essentially a constant power motor. The steam locomotive can give approximately the same power whether running at high or low speed. The drawbar pull does not tell the whole story, the limit is the steaming capacity of the boiler. If this is exceeded, the drawbar pull is reduced. With the electric motor the efficiency rapidly increases with the speed. This would mean then a readjustment of traffic methods, including that of the freight trains, to higher speed. Higher speeds necessarily mean increased capacity of the system, even without any increased drawbar pull, even with less drawbar pull, and in this feature lie the main advantages of electric traction, but it is necessary to readjust the method of operation to the changed condition of railroad motive power, to get the best results with the electric locomotive.

In summing up the remarks, Mr. Armstrong referred to the tractive effort of electric and steam locomotives mentioned by Dr. Hutchinson. The steam locomotive with 50,000 lbs. on the drivers and a tractive effort of 20 per cent might have 10,000 lbs. available, but few, if any, roads are constructed with grades to use the full tractive effort of the locomotive indefinitely. The speaker knew of no continuous grades of more than twenty-five to forty miles, except in one case on the Southern Pacific, which had a grade of 1.54 per cent for eighty-three miles. But an electric locomotive could make that run in less than four hours, so that the continuous capacity of the steam locomotive is not of paramount importance. The word "petty" economies used in his paper was perhaps an unfortunate selection, but it had been the means of drawing out some important statistics, and so had accomplished a good purpose. It would be withdrawn in a revision of the paper. He was interested to learn from Mr. Murray that a steam consumption of about 28 to 30 lbs. per i. h. p. h. was arrived at in actual test. He was interested to learn whether it was obtained by indicator or whether it was a total coal consumption for twenty-four hours. In one instance he

had found, as shown in the paper, that on a certain road 4000 lbs. of steam were used per hour, while the locomotive was idle on turnouts or coasting down grades. He had learned that the Mallet compound, which he believed was the largest locomotive yet built, requires not only 400 lbs. of coal per hour, but a greater amount, and also requires steam when going at a speed of over ten miles per hour down grade. All of these losses count up to a large total. He thought the advantages of equipping single-track roads as important, if not more so, than on double-track roads. A single-track road is limited in its tonnage capacity by trains going in both directions over the same track with frequent meeting points. Many of the forced stops of steam locomotives on account of taking on water or coal would be eliminated by the use of electric locomotives. It is entirely safe to say, then, that the total capacity of a single track, or, in other words, the advantages of electrically equipping a single track, are very great indeed, and far surpass the advantages of equipping a double track carrying the same tonnage.

HEARINGS ON ACCOUNTING BY THE NEW YORK STATE PUBLIC SERVICE COMMISSION

The subject of a uniform system of accounts for New York State has been taken up by the Public Service Commission of the Second District of that State in conjunction with a committee of the Street Railway Association of the State of New York and one from the American Street & Interurban Railway Accountants' Association. The first hearing on this subject was an informal one, at which W. J. Meyers, of the Division of Statistics and Accounting of the Public Service Commission, presided and which was held in Albany Oct. 22. The New York State Association was represented by a number of its prominent members and the Accountants' Association by Messrs. Henry, Duffy and Ham. Subsequent to this meeting a committee of the State Association was appointed to take charge of the subject. The committee consists of T. W. Wilson, C. Loomis Allen, Edgar S. Fassett, A. L. Linn, Jr., H. M. Beardsley, J. C. Collins and W. H. Williams. This committee has appointed a sub-committee consisting of A. L. Linn, Jr., chairman, H. M. Beardsley and J. C. Collins, to take up the matter more in detail. The sub-committee has held several meetings and expects to have its report ready for the main committee next week.

NO POLICY ANNOUNCED.

In spite of the fact that several statements have been published that the Commission has announced a policy as to its treatment of the subjects of depreciation, repairs and casualties in the accounts, no decision on these points has been reached. The Commission has not issued any circulars on these matters to the railroad companies of the State, and the entire subject is still under joint consideration by the accounting departments of the Commission and the railway companies. The misunderstanding undoubtedly arose from the fact that some circulars of this kind were under consideration by the Commission. It has, however, passed the following resolution:

"*Resolved,* That all railroad corporations owning, operating, managing, or controlling any railroad, or any cars, or other equipment used thereon or in connection therewith, be and hereby are directed to report to this Commission on or before Dec. 1, 1907, all important permanent improvements to their roadway, buildings, bridges and terminals, within this state, not intending hereby repairs or replacements to existing structures, which have been completed during the year ending June 30, 1907; also all such improvements now in progress but not completed, with their estimated cost and estimate of time when the same will be completed; also all new additions to their rolling stock and equipment, together with the cost of the same; also all orders now outstanding for equipment, which have not been filled. That such reports be made in concise form in a manner to be suggested in a circular to be issued. That such reports, when properly classified or tabulated, be published in the annual report of this Commission, to be submitted Jan. 13, 1908, for the purpose of advising the public of the expenditures actually being made by railroad corporations to relieve existing unfavorable conditions. That a copy of this resolution and of such circular be served at once upon each railroad corporation operating in this state."

In conformity with this resolution the following circular was issued Nov. 1, 1907:

"*To All Railroad Corporations:*

"It is the purpose of this Commission to devise and put in operation as early as practicable a system of reports which will give complete information from time to time of the permanent additions and betterments made by railroad corporations to their tracks, bridges, buildings and terminals; of the increase to their equipment and of the cost of the same. Such information is indispensable to enable the Commission and the public to know whether proper and adequate efforts are being made to increase facilities as demands for transportation increase. It has been found impracticable to require this information in the form of precise answers to definite questions in time for the report of the Commission, which must be submitted to the Legislature Jan. 13, 1908.

"It is, however, very desirable that the work of this character which the railroads have done during the past year and that which is now in progress be made known to the Legislature and the public in that report. It is confidently hoped that such information will dispel much of the impression now prevailing with many that the railroads have not been making exertions to meet the extraordinary demands made upon them by the great increase of traffic.

"To this end, the resolution herewith served upon you has been adopted. It is in large degree self-explanatory, and it is hoped that the railroad companies will give the fullest information in their power in the limited time allowed regarding the matters specified.

"The precise form in which it shall be given necessarily cannot be prescribed, and the extent of detail and fullness of description is left to a very large extent to the good judgment of the companies. Slight and unimportant matters may be omitted, but all large works should be described in an adequate manner, to the end that their full scope and purpose may be understood. To illustrate, the Gardenville yard of the N. Y. C. & H. R. R., near Buffalo, and the work of the Lehigh in and about the same city; the cut-offs of the Erie in Chautauqua, Orange and Alleghany counties, are deserving of the fullest treatment. The electric work of the Central at New York is another instance.

"It is believed that the foregoing explanation sets forth clearly the spirit and purpose of the resolution, which is really in the nature of a request for the railroads to avail themselves of an unequalled opportunity to show just what they are endeavoring to do to meet the demands upon them. Of course those companies not reporting in time will necessarily appear to have done nothing by way of enlargement and improvement. This may be unjust, but it is unavoidable."

A moving platform is contemplated for the central parts of Paris, not on the footpaths or street level, but under the causeway in the new sections of the underground railway which is being built, and which is to comprise the Central Circular Railway, along the principal boulevards, on the right bank, and the Boulevard Saint Germain, on the left bank of the Seine. Tunnelling for the greater part of this circular railway is nearly completed, and the city engineers are considering whether it is not advisable to have a movable platform installed, instead of conveying the passengers by train. One of the Municipal Councillors, M. Duval Arnold, who is a member of the committee on the Metropolitain, states that the project is being very seriously entertained. On the existing underground lines, where trains start every two minutes, the crowding at certain hours is very great. Trains cannot be put on the line with safety more frequently, and the only solution seems to be in the movable platform.

REPORT ON THE TENTATIVE CLASSIFICATION OF OPERATING EXPENSES

As stated in the report of the Atlantic City Convention of the Street Railway Accountants' Convention published in this paper Oct. 26, the report upon the tentative classification of operating accounts, submitted by the committee on standard classification of accounts and form of report, was amended in several particulars and was referred back to the committee with instructions to embody these suggestions in the report. The committee was also empowered to change or alter the classification still further if it should be considered in their opinion desirable. The members of the committee are Wm. F. Ham, chairman; H. L. Wilson, F. R. Henry, Wm. G. McDole and C. N. Duffy.

With the permission of Frank R. Henry, president of the association, and Wm. F. Ham, chairman of the committee, a copy of the tentative report, with the changes adopted at Atlantic City, is presented herewith. It must be clearly understood, however, that the committee does not recommend the adoption of the classification in its present shape as there may be some other changes.

REPORT ON TENTATIVE CLASSIFICATION OF OPERATING EXPENSE ACCOUNTS BY THE COMMITTEE ON STANDARD CLASSIFICATION OF ACCOUNTS AND FORM OF REPORT

LIST OF ACCOUNTS.

MAINTENANCE:

WAY AND STRUCTURES.

1. Roadway and Track:
   - A. Ties.
   - B. Rails.
   - C. Rail fastenings and joints.
   - D. Special work.
   - E. Ballast.
   - F. Paving.
   - G. Bridges, trestles and culverts.
   - H. Fences, road crossings, cattle guards and signs.
   - I. Signal and interlocking system.
   - J. Roadway and track labor.
   - K. Miscellaneous roadway and track expenses.
2. Electric Line:
   - A. High-tension transmission lines.
   - B. Low-tension transmission lines.
   - C. Track bonding.
   - D. Telephone and telegraph system.
   - E. Miscellaneous electric line expenses.
3. Buildings, Fixtures and Grounds:
   - A. Power plants.
   - B. Sub-stations.
   - C. Carhouses and yards.
   - D. Shops.
   - E. General offices.
   - F. Stations, waiting rooms and platforms.
   - G. Docks and wharves.
   - H. Miscellaneous buildings.

EQUIPMENT.

4. Power plant equipment.
5. Sub-station equipment.
6. Passenger, mail, baggage and combination cars.
7. Freight and express cars.
8. Electrical car equipment.
9. Miscellaneous Equipment:
   - A. Electric locomotives.
   - B. Work car equipment.
   - C. Snow equipment.
   - D. Horses, harness and vehicle equipment.
   - E. Automobiles.
   - F. Miscellaneous equipment.
10. Miscellaneous shop expenses.

TRANSPORTATION:

OPERATION OF POWER PLANTS AND SUB-STATIONS.

11. Wages of power plant employes.
12. Fuel for power.
13. Water for power.
14. Lubricants for power plant.
15. Miscellaneous supplies and expenses of power plant.
16. Operation of sub-stations.
17. Purchased power.

OPERATION OF CARS.

18. Superintendence of transportation.
19. Wages of passenger motormen.
20. Wages of passenger conductors.
21. Wages of freight and express motormen.
22. Wages of freight and express conductors and trainmen.
23. Wages of miscellaneous car service employes.
24. Wages of car house employes.
25. Car service supplies.
26. Miscellaneous car house expenses.
27. Tickets and transfers.
28. Printing and stationery—car service.
29. Miscellaneous car service expenses.
30. Wages of station employes.
31. Miscellaneous station expenses.
32. Operation of signal and interlocking system.
33. Operation of telephone and telegraph system.
34. Dining, buffet, parlor and sleeping car service.
35. Loss and damage.
36. Injuries and damages.

MISCELLANEOUS.

37. Cleaning and sanding tracks.
38. Removal of snow and ice from tracks.
39. Rent of equipment.
40. Rent of tracks and terminals.

TRAFFIC:

41. Salaries of traffic staff.
42. Miscellaneous traffic expenses.
43. Advertising and attractions.

GENERAL:

44. Salaries of general officers.
45. Salaries of general office clerks.
46. Printing and stationery—general.
47. General office expenses.
48. Miscellaneous general expenses.
49. Law expenses—general.
50. Insurance.

ACCOUNT NO. 1

MAINTENANCE ROADWAY AND TRACK.

This account is intended to embrace repairs and renewals of roadway and track; of culverts, tunnels and subways; of tracks in yards, terminals, car houses, repair shops and other buildings; on piers, wharves, track scales, bridges and trestles.

A proportionate part of Accounts Nos. 101 to 105 should be charged to this account.

The cost of repairs and renewals of work-car equipment, harness and wagons used in connection with track and roadway maintenance, should be charged to Account No. 9, Subdivision B, Work Car Equipment, or D, Horses, Harness and Vehicle Equipment. All paving is to be charged to Subdivision F.

A Ties:

Charge to Subdivision A, cost of iron or wood cross, switch and bridge ties, head blocks and cross timbers, including freight charges, if any, cost of inspection, and all expenses incurred to the point where delivered for use in track.

(*Note.*—Cost of placing ties into track should be charged to Account No. 1, Subdivision J, Roadway and Track Labor.)

B Rails:

Charge to Subdivision B, cost of straight rails and guard rails, including freight charges if any, and all expense incurred to the point where delivered for use in track. Credit to be given for value of old rail taken up.

(*Note.*—Cost of placing rails into track should be charged to Account No. 1, Subdivision J, Roadway and Track Labor.)

(*Note.*—Third-rails used for transmission of power should be charged to Account No. 2, Subdivision B.)

C Rail Fastenings and Joints:

Charge to Subdivision C, cost of fish plates, braces, tie plates, tie rods, nuts, bolts, spikes, etc., including freight

charges if any, and all expenses incurred to the point where delivered for use in track. Cost of cast on electric welded joints should be charged to this subdivision.

(*Note.*—Cost of applying rail fastenings and joints should be charged to Account No. 1, Subdivision J, Roadway and Track Labor.)

D Special Work:

Charge to Subdivision D, cost of labor and material repairing and renewing special work, including steam and street railroad crossings, cross-overs, curves, frogs, run-offs, automatic switches and appliances, switches, switch-mats, turn-outs; cost of hauling, distributing and placing same in track; all material used directly in connection with special work; also cost of removing old material.

E Ballast:

Charge to Subdivision E, cost of all material used as ballast, including freight charges if any, and all expenses incurred to the point where delivered for use in track.

F Paving:

Charge to Subdivision F, cost of labor and material repairing and renewing paving, including granite, wood, brick and asphaltum pavement, sand and concrete work made necessary by repairs and renewals of paving; hauling and distributing of material; also cost of removing old material.

Repairs and renewals of street paving in connection with roadway and track required by municipalities, should be charged to this subdivision.

G Bridges, Trestles and Culverts:

Charge to Subdivision G, cost of labor and material repairing and renewing bridges, trestles and culverts (both sub-structure and super-structure), piers, abutments, masonry and drain-pipes, subways, tunnels, viaducts, retaining walls, rip-rapping and dikes necessary to protect or strengthen bridges and culverts against ice, water or drift; also wooden guards on bridges, framing ties for bridges, bridge signs or number boards; cost of hauling and delivering material, including freight charges, if any; cost and expense of pile drivers and other equipment; cost of cleaning channels under bridges and cleaning culverts; cost of removing old bridges, etc., whether another one is built to replace it or not; cost of construction and removal of temporary or false work; expense of maintaining gravel decking for fire protection.

(*Note.*—Any structure carrying the tracks over other tracks, a stream, highway or canal, shall be considered a bridge or culvert. The cost of maintaining structures carrying other tracks, canals, highways, etc., over the company's tracks should be charged to Account No. 1, Subdivision H, Fences, Road Crossings, Cattle Guards and Signs.)

H Fences, Road Crossings, Cattle Guards and Signs:

Charge to Subdivision H, cost of labor and material used, including freight, if any, and all expenditures incident to the maintenance of the following:

Highway Grade Crossings. Including street and road crossings at grade, crossing drains, crossing gates, crossing signal bells and batteries with their connections, water pipes, etc.

Other Crossings. Including overhead bridges of all kinds, roadways erected over tracks of the company, viaducts (foot or wagon), roadways of undergrade crossings, and warning signals and their connections; drainage and excavation for undergrade crossings; the opening of public roads in order to eliminate grade crossings.

Fences and Cattle Guards. Includes right-of-way fences, cattle guards, wing fences, aprons and hedges; not including those around station and shop grounds.

Signs. Includes yard limit signs, subdivision boards, mile, section, whistle, slow and stop signs, boundary posts, overhead bridge and tunnel cautions, and all signs except station and telegraph signs.

I Signals and Interlocking System:

Charge to Subdivision I cost of labor and material, including freight, if any, and all expenses incident to the maintenance of the following:

Signals. Including block, automatic and semi-automatic signals, home and distant signals, signal posts, signal bridges, semaphore and flag station signals, gates at crossings of other railways, and all other road and track signals not otherwise provided for in the government of cars; also signal and switch lamps and their connections; pay of signal engineers, supervisors of signals, their assistants, their office and traveling expenses, pay of mechanics and laborers while engaged in repairing and renewing signals and interlocking system, with cost of special tools used for said work.

Interlocking System. Including power interlocking plant (except buildings) and all machinery such as air compressors, levers, boilers, dynamos, engines and machinery, fixtures and appliances used in connection therewith.

(*Note.*—Cost of inspection and supplies for operation are chargeable to Account No. 32.)

J Roadway and Track Labor:

Charge to Subdivision J labor *only* removing old track whether new track is laid in its place or not, grading, relaying ties and rails, applying fish plates and rail attachments of all kinds, surfacing, ballasting, cutting weeds and caring for right of way. All track labor, not otherwise provided for, should be charged to this Subdivision.

(*Note.*—The cost of punching and drilling rails for repairs and renewals of track wire, and the removing and replacing ballast for the same purpose, should be charged to Account No. 2, Subdivision C, Track Bonding.)

K Miscellaneous Roadway and Track Expenses:

Charge to Subdivision K salaries and expenses of chief engineer, assistant engineer, general roadmaster, assistant roadmaster, draftsmen and clerks in office; injuries and damages when caused directly in connection with track and roadway maintenance, including the expenses which cannot be actually allocated to any case, which expense is to be based upon the per cent. the amount paid for injuries and damages, an account of track and roadway maintenance, bears to the total amount paid for injuries and damages; also incidental expenditures that are not properly chargeable to any of the foregoing subdivisions of roadway and track, viz.: ice, lanterns and fixtures, torches, oil, incandescent lamps, tools, water, printing and stationery, etc.

ACCOUNT NO. 2

MAINTENANCE OF ELECTRIC LINE.

This account is to cover repairs and renewals of electric line of overhead, underground or third-rail systems, and to embrace electric line in yards, terminals, tunnels, subways, car houses, repair shops and other buildings.

A proportionate part of Accounts Nos. 101 to 105 should be charged into this account.

The cost of repairs and renewals of work-car equipment, and harness and wagons used in connection with electric line maintenance, should be charged to Account No. 9, Subdivision B. Work-Car Equipment, or D, Horses, Harness and Vehicle Equipment.

A High-Tension Transmission Lines:

Charge to Subdivision A, cost of labor and material, repairing and renewing high-tension transmission lines, including taking up and resetting poles; painting poles and cross-arms; altering and changing insulators; substituting new wire for old wire. Credit to be given for value of old material.

Also, cost of delivering and distributing material, including freight charges, if any; cost of changing route of line or removing line where no replacement is made.

B Low-Tension Transmission Lines:

Charge to Subdivision B, cost of labor and material repairing and renewing low-tension transmission lines, for transmitting power from power stations and substations, including poles, cross-arms, brackets, insulators and connections; span, guard, feed and overhead trolley wires; third-rail with braces, supports and devices for insulating, covering or protectors. Credit to be given for value of old material.

Also, cost of delivering and distributing material, including freight charges, if any; cost of changing route of line, or removing line where no replacement is made.

C Track Bonding:

Charge to Subdivision C, cost of labor and material repairing and renewing track bond wires, including cost of punching and drilling rails for track bond wires; testing for defective joints; removing and replacing ballast, when made necessary by repairs and renewals of track bonding; delivering and distributing material, including freight charges, if any.

D Telephone and Telegraph System:

Charge to Subdivision D, cost of labor and material repairing and renewing telephone and telegraph lines owned by the company, or for which it is responsible, including conduits, poles, cross-arms, wires, insulators, cables, cable-boxes, instruments, battery jars, switchboards and all other appurtenances forming a part of the telephone and telegraph system. Rental of telephone and telegraph system should not be charged to this account, but to Account 33, or Account 48.

E Miscellaneous Electric Line Expenses:

Charge to Subdivision E, salaries and expenses of superintendent of electric line, assistants and clerks in office; injuries and damages when caused directly in connection with electric line maintenance, including the expenses which cannot be actually allocated to any other case, which expense is to be based upon the per cent. the amount paid for injuries and damages for account of electric line maintenance, bears to the total amount paid for injuries and damages; also, incidental expenditures that are not properly chargeable to any of the foregoing subdivisions of electric line, viz.: ice, lanterns and fixtures, torches, oil, incandescent lamps, tools, water, printing and stationery, etc.

ACCOUNT NO. 3

MAINTENANCE OF BUILDINGS, FIXTURES AND GROUNDS.

This account is to cover repairs and renewals of buildings; cost of fixtures, and repairs and renewals of same; cost of maintaining walks, driveways and grounds connected with buildings; cost of delivering material, including freight charges, if any, and all incidental expenses connected with the maintenance of buildings, fixtures and grounds.

The term "Buildings, Fixtures and Grounds," in addition to embracing the buildings proper, is understood to include: fixtures when immovable and built in as a part of the structure; pipes for gas, water, sewerage and drainage; apparatus for heating, lighting and ventilating freight and passenger elevators with fixtures and appurtenances; platforms; appliances for protecting buildings against fire; fences, walls, sidewalks and pavements within the limit of grounds immediately adjacent to buildings or yards (except paving in tracks).

The cost of repairs and renewals of tracks in buildings, yards or grounds should be charged to Account No. 1.

The cost of repairs and renewals of electric line in buildings, yards or grounds should be charged to Account No. 2.

A Power Plants:

Includes generating-station building; coal-storage building; coal bins; building fixtures which are not a part of machinery equipment; fences and grounds connected therewith.

B Sub-stations.

C Car houses and yards.

D Shops.

E General offices.

F Stations, waiting rooms and platforms.

G Docks and Wharves:

Includes piers and other landings, pontoons, slips, bulkheads, jetties and inclines thereto, including cost of filling, strengthening, bracing and painting; expenses of pile-drivers, tugs, barges and floats while engaged in such work; cost of dredging about docks, piers, bulkheads and slips, or for approaches to such properties and removing material dredged out; labor and expense operating dredges, mud-scows, barges and floats while engaged in such work; cost of crib work, tracks or caissons constructed for preserving the depth of water secured by dredging; cutting ice around docks and wharves to prevent damage; guard and other piling for protection from damage by drift or ice; also,

The pay of supervisor of docks and wharves, labor and expense operating work trains, pile-drivers, dredges and tugboats while engaged in work pertaining to docks and wharves.

H Miscellaneous Buildings:

Includes repairs and renewals of buildings not included in any of the foregoing subdivisions, also incidental expenses not applicable to any of the foregoing subdivisions of Buildings, Fixtures and Grounds, viz.: Ice, lanterns and fixtures, torches, oil, incandescent lamps, tools, water, printing and stationery, etc.

EQUIPMENT.

ACCOUNT NO. 4

MAINTENANCE OF POWER-PLANT EQUIPMENT.

Charge to this account all expenditures for labor, material, tools, freight, hauling of material and all other expenses incident to repairs and renewals of steam plant, water-power plant, or electric plant, including turbines, engines and engine parts, appliances and fixtures, belts, belt tighteners and fixtures, receivers, lubricators and oiling devices, shafting, clutches, cranes, hoists and other engine-room appliances; boilers, boiler fittings and appliances; furnaces, economizers, stacks, mechanical draft machinery, pumps, feed-water heaters, purifiers, tanks, condensers, coal and ash conveying machinery, mechanical stokers and other boiler-room appliances; piping and steam fitting, including valves, separators, water and sewer connections and water meters; generators and generator parts, switchboards, cables and feeder terminals and wiring in connection with same, storage batteries, boosters, rheostats, circuit-breakers, ammeters and other electric equipment.

Commutator brushes for generators should be charged to Account No. 15.

ACCOUNT NO. 5

MAINTENANCE OF SUB-STATION EQUIPMENT.

Charge to this account all expenditures for labor, material, tools, freight, hauling of material and all other expenses incident to repairs and renewals of sub-station apparatus, including oil switches, transformers, rotary converters, switchboards and switchboard appliances, and wiring in connection with same.

ACCOUNT NO. 6

MAINTENANCE OF PASSENGER, MAIL, BAGGAGE AND COMBINATION CARS.

Charge to this account all expenditures for repairs and renewals of passenger, mail, baggage, express cars, electric locomotives used in passenger service, and other cars (exclusive of freight cars) from the operation of which revenue is derived, including labor, material, tools, freight, hauling of material, and all other expenses incident to the work.

The term "Cars" includes car bodies and trucks and all fixtures or appliances inside of or attached to the car body or truck, except the electric equipment of the car.

The cost of cars purchased to keep good the original number of cars should be charged to this account, less the amount realized from the sale or other disposition of the cars so replaced.

The cost of repairs and renewals of the electric equipment and wiring of cars should be charged to Account No. 8.

Bell and register cord, trolley rope, incandescent lamps, commutator brushes and other supplies for cars should be charged to Account No. 25.

ACCOUNT NO. 7

MAINTENANCE OF FREIGHT AND EXPRESS CARS.

Charge to this account all expenditures for repairs and renewals of freight and express cars from the operation of which revenue is derived, and electric locomotives in freight and express service, including labor, material, tools, freight, hauling of material, and all other expenses incident to the work.

ACCOUNT NO. 8

MAINTENANCE OF ELECTRICAL CAR EQUIPMENT.

Charge to this account all expenditures for repairs and renewals of the electric equipment and wiring of passenger, mail, baggage, express and freight cars, electric locomotives not used in revenue service, work-cars, and snow equipment, including labor, material, tools, freight, hauling of material and other expenses incident to the work.

The cost of shifting the electric equipment of revenue cars, electric locomotives, work cars, or snow equipment from one type of car or miscellaneous equipment to another should be charged to this account.

The cost of equipments purchased to keep good the original number of equipments should be charged to this account, less the amount realized from the sale or other disposition of the equipments so replaced.

The cost of commutator brushes, incandescent lamps, oil and other supplies for electric equipments should be charged to Account No. 25.

ACCOUNT NO. 9

MAINTENANCE OF MISCELLANEOUS EQUIPMENT.

Charge to this account all expenditures for repairs and renewals of electric locomotives, work-car equipment (water cars, sprinkling cars, sand cars, salt cars, supply cars, other work-cars), snow equipment (snow plows, sweepers, scrapers, miscellaneous snow equipment), horses, harness and vehicle equipment, automobiles and all other miscellaneous equipment not operated for the purpose of revenue (except electric locomotives which may be operated for the purpose of revenue in passenger or freight service and may also be operated in work-car service) including labor, material, tools, freight, hauling of material and all other expenses incident to the maintenance of miscellaneous equipment.

The cost of electric locomotives, work-cars, snow equipment, horses, harness, wagons and vehicles, and automobiles purchased to keep good the original number should be charged to this account, less the amount realized from the sale or other disposition of the equipment so replaced.

Horses lost by death or worn out in service should be charged to this account.

Repairs and renewals of the electric equipment and wiring of electric locomotives, work-cars and snow equipment should be charged to Account No. 8.

Bell and register cord, trolley rope, incandescent lamps, commutator brushes and other supplies should be charged to Account No. 25.

A Electric locomotives.
B Work-car equipment (water cars, sprinkling cars, sand cars, salt cars, supply cars, other work-cars).
C Snow equipment (snow plows, sweepers, scrapers, miscellaneous snow equipment).
D Horses, harness and vehicle equipment.
E Automobiles.
F Miscellaneous equipment.

ACCOUNT NO. 10

MISCELLANEOUS SHOP EXPENSES.

Charge to this account all expenditures for repairs and renewals of shop tools, machinery and appliances, such as engines, boilers, shafting, motors, etc., used in general repair work, including labor, tools, coal, coke, lubricants, waste and other material, freight, hauling of material, fuel, light, water and ice, wages of master mechanic, shop foreman, engineers, firemen and other employees engaged in operating shop engine, and all other expenses incident to the general repair shops, including amounts paid shop employees for injuries and damages when caused directly in connection with maintenance of equipment, including the expenses which cannot be actually allocated to any case, which expense is to be based upon the per cent. the amount paid for injuries and damages for account of maintenance of equipment bears to the total amount of injuries and damages.

Hand tools of mechanics or laborers used exclusively in connection with work chargeable to Accounts Nos. 1 to 9, 15, 16, 25, 26, 29, 31, 32, 33 and 34, should not be charged to this account, but to the account benefited by their use.

TRANSPORTATION.

OPERATION OF POWER PLANTS AND SUB-STATIONS.

ACCOUNT NO. 11

WAGES OF POWER PLANT EMPLOYEES.

Charge to this account all expenditures for labor in power plants, except labor employed in making repairs or renewals.

Wages of sub-station employees should be charged to Account No. 16, Operation of Sub-Stations.

ACCOUNT NO. 12

FUEL FOR POWER.

Charge to this account all expenditures for coal, oil, gas or other fuel used at power plant, including freight and hauling.

ACCOUNT NO. 13

WATER FOR POWER.

Charge to this account all expenditures for water used to produce steam or to operate a water-power plant.

ACCOUNT NO. 14

LUBRICANTS FOR POWER PLANT.

Charge to this account all expenditures for lubrication of power plant, including oil, grease, etc.

NOTE.—Waste and rags should be charged to Account No. 15, Miscellaneous Supplies and Expenses of Power Plant. Lubricants for sub-stations should be charged to Account No. 16, Operation of Sub-Stations.

ACCOUNT NO. 15

MISCELLANEOUS SUPPLIES AND EXPENSES OF POWER PLANT.

Charge to this account all expenditures for operation of power plant not otherwise provided for.

ACCOUNT NO. 16

OPERATION OF SUB-STATIONS.

Charge to this account all expenditures for labor in sub-stations, except labor employed in making repairs or renewals; cost of lubrication and all miscellaneous supplies and expenses of sub-stations.

ACCOUNT NO. 17

PURCHASED POWER.

Charge to this account all expenditures for power purchased from other companies or power plants.

OPERATION OF CARS.

ACCOUNT NO. 18

SUPERINTENDENCE OF TRANSPORTATION.

Charge to this account wages of the superintendent of transportation, division superintendents, their assistants and aids, road officers, inspectors and others employed in superintending transportation.

ACCOUNT NO. 19

WAGES OF PASSENGER MOTORMEN.

Charge to this account wages of motormen engaged in operating passenger, mail, baggage and combination cars.

ACCOUNT NO. 20

WAGES OF PASSENGER CONDUCTORS.

Charge to this account wages of conductors engaged in operating passenger, mail, baggage and combination cars.

ACCOUNT NO. 21

WAGES OF FREIGHT AND EXPRESS MOTORMEN.

Charge to this account wages of motormen engaged in operating freight and express cars.

ACCOUNT NO. 22

WAGES OF FREIGHT AND EXPRESS CONDUCTORS AND TRAINMEN.

Charge to this account wages of conductors, brakemen and other trainmen engaged in operating freight and express cars.

ACCOUNT NO. 23

WAGES OF MISCELLANEOUS CAR SERVICE EMPLOYEES.

Charge to this account wages of starters, transfer agents, switch-tenders, flagmen, trolleymen, trail-car couplers and other car service employees.

ACCOUNT NO. 24

WAGES OF CAR HOUSE EMPLOYEES.

Charge to this account wages of car house foremen, watchmen, car placers, car shifters, car and motor inspectors, car cleaners, lamp and head-light tenders, car oilers, car-stove firemen, trolley oilers, and other car house employees not engaged in making repairs and renewals.

The cost of shifting trucks and electric equipment from summer to winter cars, and vice versa, should not be charged to this account, but to Accounts Nos. 6 and 8.

ACCOUNT NO. 25

CAR SERVICE SUPPLIES.

Charge to this account all expenditures for lubricants and waste for cars and electric equipment of cars, incandescent lamps, oil and other supplies for lighting cars, water and other supplies for cleaning cars, fuel for heating cars, bell and register cord, trolley rope, commutator brushes, tools and other material and supplies, except such as are used for repairs or renewals of cars or electric equipment of cars.

ACCOUNT NO. 26

MISCELLANEOUS CAR HOUSE EXPENSES.

Charge to this account the cost of fuel, light, water (except

water used for car washing chargeable to Account No. 25), ice and all other car house expenses not otherwise provided for.

ACCOUNT NO. 27

TICKETS AND TRANSFERS.

Charge to this account the cost of tickets, transfers, baggage and parcel checks.

ACCOUNT NO. 28

PRINTING AND STATIONERY—CAR SERVICE.

Charge to this account all expenditures for printing, stationery and stationery supplies used in connection with the operation of cars.

The cost of printing folders and other printing used for advertising purposes in the interest of traffic should not be charged to this account, but to Account No. 43.

ACCOUNT NO. 29

MISCELLANEOUS CAR SERVICE EXPENSES.

Charge to this account all expenditures for secret inspection. conductors' books, punches, portable registers, tools for motormen, car service employees' badges and uniforms, cost of getting derailed cars on track and removing obstructions and wreckage, and all other car service expenses not otherwise provided for.

ACCOUNT NO. 30

WAGES OF STATION EMPLOYEES.

Charge to this account wages of agents and others employed at stations.

ACCOUNT NO. 31

MISCELLANEOUS STATION EXPENSES.

Charge to this account the cost of heating and lighting stations, furniture, tools and implements for handling freight and baggage, station employees' uniforms and badges, water, ice, and all other station expenses not otherwise provided for.

ACCOUNT NO. 32

OPERATION OF SIGNAL AND INTERLOCKING SYSTEM.

Charge to this account wages of employees engaged in inspecting and operating signal and interlocking system, fuel, water, lights, furniture, tools and all supplies used in inspecting and operating signals.

ACCOUNT NO. 33

OPERATION OF TELEPHONE AND TELEGRAPH SYSTEM.

Charge to this account wages of train dispatchers, and their assistants, telegraph and telephone operators; cost of chemicals, copper, zinc and other supplies; payments for use of telegraph and telephone lines and conduits, and all expenses incident to the operation of the telephone and telegraph system not otherwise provided for.

Repairs and renewals of telephone and telegraph system should not be charged to this account, but to Account No. 2, Subdivision D.

This account is intended to cover the expenses of operating a telephone or telegraph system used primarily for the dispatching of cars.

The cost of telephone service for general purposes should be charged to Account No. 48, Miscellaneous General Expenses.

ACCOUNT NO. 34

DINING, BUFFET, PARLOR AND SLEEPING CAR SERVICE.

Charge to this account wages of all employees in dining, buffet, parlor or sleeping car service; office and traveling expenses of those whose wages are chargeable to this account. Uniforms and badges for employees in this service, and all expenses in this service not otherwise provided for.

ACCOUNT NO. 35

LOSS AND DAMAGE.

Charge to this account all expenditures for loss or damage of freight, express matter, live stock and baggage, and all expenses incurred in connection with the settlement of such claims.

ACCOUNT NO. 36

INJURIES AND DAMAGES.

Charge to this account all expenditures on account of persons killed or injured and damage to property, salaries and expenses of claim agents, investigators, adjusters and others engaged in the investigation of accidents and adjustment of claims, salaries, fees and expenses of surgeons and doctors, nursing, hospital attendance, medical and surgical supplies, fees and expenses of coroners and undertakers, fees of witnesses and others, also all law expenses incurred in connection with the defense or settlement of damage claims, including the compensation of general solicitor or counsel, salaries, fees and expenses of attorneys, fees of court stenographers, cost of law books, printing of briefs, court record and other records, court costs, expenses connected with taking depositions and all other court expenses.

The compensation of the general solicitor or counsel and other attorneys engaged partly in the defense or settlement of damage suits and partly in other legal work should be apportioned between this account and Account No. 49.

This account is intended to cover only the expenditures on account of injuries and damages resulting from the operation of cars.

Injuries and damages when caused directly in connection with roadway and track maintenance should be charged to Account No. 1, Subdivision K, Miscellaneous Roadway and Track Expenses; when caused directly in connection with electric line maintenance, to Account No. 2, Subdivision E, Miscellaneous Electric Line Expenses; when caused directly in connection with maintenance of equipment (other than plant and substation equipment), to Account No. 10, Miscellaneous Shop Expenses. Similarly, injuries and damages might properly be charged to Account No. 3, Subdivision H; Account No. 4; Account No. 5; Account No. 15; Account No. 16, or other proper operating account, or to Construction if the damage occurred in the process of work properly chargeable to Construction.

The expenses in connection with injuries and damages which cannot be actually allocated to any cause are to be divided in the same proportion as the amounts paid for injuries and damages in specific cases are divided among the above accounts. If it is desirable that the charge to operating expenses on account of injuries and damages shall be upon some arbitrary basis, the account so charged should be credited to a reserve account and the actual disbursements above enumerated should be charged against said reserve account.

MISCELLANEOUS.

ACCOUNT NO. 37

CLEANING AND SANDING TRACKS.

Charge to this account all expenditures for cleaning, greasing, watering, sprinkling roadway and tracks; sanding tracks, including wages of men engaged in the work; cost of sand and of hauling, drying and distributing same; cost of track brooms and other tools; curve grease, water for sprinkling and watering track and all other supplies and expenses incident to the work.

Repairs and renewals of sprinkling and sand cars used in connection with this work should be charged to Account No. 9, Subdivision B, Work Car Equipment.

Repairs and renewals of harness and wagons used in connection with this work should be charged to Account No. 9, Subdivision D, Horses, Harness and Vehicle Equipment.

Cost of sprinkling rendered necessary by repairs or construction of track or paving should be charged to the proper maintenance or construction account.

ACCOUNT NO. 38

REMOVAL OF SNOW AND ICE FROM TRACKS.

Charge to this account all expenditures for removal of snow and ice from tracks, whether done by the company or otherwise, including labor, materials, tools and expenses, cost of salt and delivering same in car houses or bins, and the wages of men engaged in salting track and operating snowplows, sweepers, scrapers, etc.

Repairs and renewals of salt cars, snow plows, sweepers, scrapers and miscellaneous new equipment used in connection with this work should be charged to Account No. 9, Subdivision C, Snow Equipment.

Repairs and renewals of harness and wagons used in connection with this work should be charged to Account No. 9, Subdivision D, Horses, Harness and Vehicle Equipment.

ACCOUNT NO. 39

RENT OF EQUIPMENT.

Charge to this account rental of cars, electrical car equipment and other equipment.

ACCOUNT NO. 40

RENT OF TRACKS AND TERMINALS.

Charge to this account all rents paid for tracks and terminals, bridge rentals and tolls.

The word "terminals" is not meant to refer to depots, car houses, or other buildings at the termini of the road. Rents for these should be charged to Account No. 26, Miscellaneous Car House Expenses, or Account No. 31, Miscellaneous Station

Expenses. Rent of leased lines or terminals, the operation of which has been temporarily or permanently abandoned by the lessor, is not considered an operating expense and should, therefore, not to be charged to this account, but treated as "Deductions from Income" under "Rent of Leased Lines."

TRAFFIC.

Note.—Accounts Nos. 41, 42 and 43 cover only expenses incidental to the securing of traffic. All expenses in connection with handling traffic are included in Accounts Nos. 18 to 37, inclusive.

ACCOUNT NO. 41
SALARIES OF TRAFFIC STAFF.

Charge to this account salaries of officers directly in charge of traffic, such as traffic directors, traffic managers, general freight, passenger and ticket agents; their clerks and assistants; of commercial, city, district or excursion agents engaged in soliciting traffic, and employees of their offices; of traffic agents and solicitors when employed on or off the line of road.

ACCOUNT NO. 42
MISCELLANEOUS TRAFFIC EXPENSES.

Charge to this account all miscellaneous expenses of the traffic department, including expenses of all officers and agents whose salaries are charged to Account No. 41; printing and stationery, furniture and supplies, heat, light, ice, water and other miscellaneous expenses of the traffic department and traffic agencies.

ACCOUNT NO. 43
ADVERTISING AND ATTRACTIONS.

Charge to this account the cost of advertising of every description, including printing hand-bills, dodgers, posters, folders, etc., net expense of music, parks, park properties and resorts (after deducting all income from admittance fees, sale of privileges, etc.), and all donations made and other expenses incurred for the purpose of attracting travel.

GENERAL.

ACCOUNT NO. 44
SALARIES OF GENERAL OFFICERS.

Charge to this account salaries of president, vice-president, secretary, treasurer, auditor, general manager, assistant general manager, chief engineer, general superintendent, purchasing agent and all other officers whose jurisdiction extends over the entire system.

ACCOUNT NO. 45
SALARIES OF GENERAL OFFICE CLERKS.

Charge to this account the salaries of bookkeepers, cashiers, receivers, paymasters, stenographers, clerks employed in counting cash, tickets and transfers, and all other clerks employed in the general office.

Salaries of clerks employed elsewhere than in the general office should be charged to the proper account affected; for instance, timekeeper in the Roadway and Track department should be charged to Account No. 1, Subdivision K, Miscellaneous Roadway and Track Expenses; also salaries of clerks in the office of the master mechanic should be charged to Account No. 10, Miscellaneous Shop Expenses.

ACCOUNT NO. 46
PRINTING AND STATIONERY—GENERAL.

Charge to this account all expenditures for printing, stationery and stationery supplies for the use of the general office.

Cost of printing tickets and transfers should be charged to Account No. 27, Tickets and Transfers.

Cost of printing and stationery in connection with the operation of cars should be charged to Account No. 28, Printing and Stationery—Car Service.

The cost of printing briefs and other legal papers should be charged to Account No. 36, Injuries and Damages, or to Account No. 49, Law Expenses—General.

The cost of printing signs, posters and other advertising matter should be charged to Account No. 43, Advertising and Attractions.

The printing of stationery in connection with maintenance of roadway and track should be charged to Account No. 1, Subdivision K, Miscellaneous Roadway and Track Expenses; in connection with maintenance of electric line, to Account No. 2, Subdivision E, Miscellaneous Electric Line Expenses; in connection with maintenance of buildings, fixtures and grounds, to Account No. 3, Subdivision H, Miscellaneous Buildings; in connection with maintenance of equipment, to Account No. 10, Miscellaneous Shop Expenses; in connection with operation of power plant and sub-stations, to Account No. 15, Miscellaneous Supplies and Expenses of Power Plant, or to Account No. 16, Operation of Sub-stations; in connection with traffic, to Account No. 42, Miscellaneous Traffic Expenses.

ACCOUNT NO. 47
GENERAL OFFICE EXPENSES.

Charge to this account the cost of office supplies, repairs and renewals of office furniture, wages of janitors, porters and messengers, rental of general offices and all other miscellaneous expenses of the general offices. Office expenses of departmental offices should be charged to account affected.

ACCOUNT NO. 48
MISCELLANEOUS GENERAL EXPENSES.

Charge to this account the cost of public telephone service, telegrams, subscriptions and donations, except those provided for in Account No. 43, Advertising and Attractions, traveling expenses of general officers and others connected with general office; and contingent expenses connected with the general management not otherwise provided for.

ACCOUNT NO. 49
LAW EXPENSES—GENERAL.

Charge to this account all law expenses, except those incurred in connection with the defense or settlement of damage claims.

The compensation of the general solicitor or counsel and other attorneys engaged in the defense and settlement of damage suits and partly in other legal work should be apportioned between this account and Account No. 36, Injuries and Damages.

The term "law expenses" should be understood to include the salary of the general solicitor or counsel, salaries, fees, and expenses of attorneys, fees of court stenographers, cost of law books, printing of briefs, court records and other papers, court costs, expenses in connection with taking depositions, and all other court expenses.

ACCOUNT NO. 50
INSURANCE.

Charge to this account the cost of fire, casualty, fidelity and all other insurance, except insurance affecting loss and damage, or injuries and damages.

If it is desirable to establish an insurance fund in the case of a company carrying its own insurance, in whole or in part, charges to this account may be made upon some arbitrary basis.

APPORTIONMENT ACCOUNTS.

ACCOUNT NO. 101
STORES EXPENSES.

Charges to Stores Expenses, including all salaries and expenses in connection with storerooms, including cost of sending material and supplies from general storeroom to branch storerooms, and the collecting of scrap material, should be closed out monthly and carried to such Operating Expense Accounts, Construction and Equipment Accounts, or other accounts, as would be proper, based on the proportionate value of the material issued by the stores department.

ACCOUNT NO. 102
STABLE EXPENSES.

Charges to Stable Expenses, including the cost of feed, keep and shoeing of horses, and all other stable expenses, also wages of drivers, (horses lost by death or worn out in service, repairs and renewals of harness and vehicle equipment to be charged to Account No. 9, Subdivision D), should be closed out monthly and carried to such Operating Expense Accounts, Construction and Equipment Accounts, or other accounts, as would be proper, based on the use made of the horses.

ACCOUNT NO. 103
USE OF POWER PLANT STEAM.

(For other purposes than generation of electric current.)

Power plant steam, used for other purposes than generation of electric current, should be charged monthly to the work or accounts benefited by its use and credited to Account No. 103, Use of Power Plant Steam. (For other purposes than generation of electric current.) The credit so shown should be deducted from operation of power plants and sub-stations in order that the actual net cost of the generation of electric current for the propulsion, lighting and heating of cars operated for revenue be ascertained as shown.

If revenue is derived from the sale of steam, the credit should not be made to this account but to Miscellaneous Earnings.

ACCOUNT NO. 104

USE OF ELECTRIC CURRENT.

(For other purposes than operation of Revenue Cars.)

Electric current, used for other purposes than the propulsion, lighting or heating of cars, operated for revenue, should be charged monthly to the work or accounts benefited by its use and credited to Account No. 104, Use of Electric Current. (For other purposes than operation of Revenue Cars.) The credit so shown should be deducted from operation of power plants and sub-stations in order that the actual net cost of the generation of electric current for the propulsion, lighting or heating of cars operated for revenue be ascertained and shown.

If revenue is received from the sale of electric current, the credit should not be made to this account, but to Miscellaneous Earnings.

ACCOUNT NO. 105

OPERATION OF ELECTRIC LOCOMOTIVES, WORK-CAR EQUIPMENT AND AUTOMOBILES.

Charges to operation of Electric Locomotives, Work-Car Equipment and Automobiles, including use of electric current, wages of employes operating electric locomotives, work-cars or automobiles, proportionate cost of car service supplies (Account No. 25) and all other supplies and expenses incident to the operation of electric locomotives, work-cars or automobiles (cost of maintenance to be charged to Account No. 9, under the appropriate subdivision) should be closed out monthly and carried to such Operating Expense Accounts, Construction and Equipment Accounts, or other expense accounts, as would be proper, based on the use made of the electric locomotives, work-cars or automobiles.

THE ALBERG TUNNEL ELECTRICAL EQUIPMENT

Further particulars are available in regard to the electrical equipment of the Alberg tunnel division of the Austrian State Railways, about which a few facts were published last week. The division lies between Innsbruck and Feldkirch in the Austrian Tyrol, and forms a link in the through line from Vienna via Innsbruck and Zürich to Paris. The division upon which it is proposed to use electrical equipment is about 140 miles long and single-track, except for a double-track tunnel at the summit about 7 miles long. The maximum grade on the west side of the tunnel is 3.14 per cent and that on the west side 2.64 per cent. The curves are numerous but are of fairly large radius. At the present time there are about 40 daily trains going over the line in each direction, about one-third being passenger and the balance freight. C. L. de Muralt, of Muralt & Company, of New York, who has been appointed consulting engineer in charge of this project by the Austrian State Railways, states that three-phase alternating-current locomotives, to develop about 25 to 30 per cent higher speed than the existing steam locomotives, will be used. The drawbar pull and speed which are specified for these machines demand an output of practically 3000 hp from a locomotive weighing not more than 60 tons. It is expected that the capacity of the line will be increased about 50 per cent. In addition it is estimated that some $200,000 will be saved annually by the return of energy to the system by trains descending the grade, not to speak of the saving in maintenance of brake rigging and wheels made possible by electric braking.

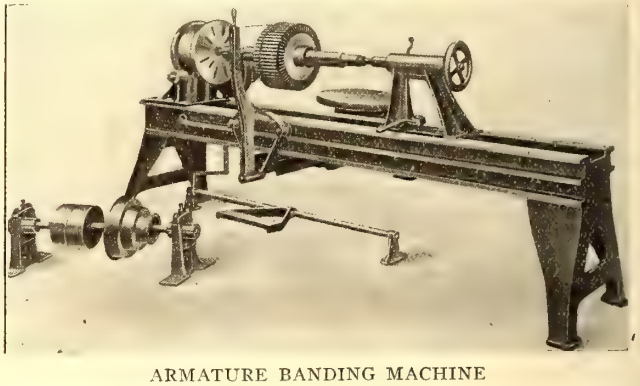
There will be about fifty locomotives, of which five or six are reserves. The hydraulic power plant will have a maximum output of 40,000 to 45,000 kw. It is probable that two separate power plants will be built, one on either side of the tunnel. Two years is the estimated time for the completion of the entire plant, and by that time the entire steam equipment of the road will be supplanted by the three-phase locomotives.

ECONOMY OF GRAPHITED WOOD GREASE IN GEAR CASES

In a recent test made by a Colorado company, with a view to determining the relative values of several different compounds used in lubricating the enclosed gears of electric cars, a remarkable record was made by graphited wood grease made by the United States Graphite Company, of Saginaw, Mich. Two gear cases were packed with from eight to ten pounds of the grease May 13, and upon being opened for inspection Oct. 15 the gears were found to be in first-class condition and well lubricated, enough grease still remaining to run the car at least thirty days longer, which would mean a six months' run on not to exceed ten pounds of grease per gear or approximately one and a half pounds per gear per month. The explanation offered of this economy is that the wood grease all did effective work in lubricating the gears instead of adhering to the interior of the case. At the same time there was opened another case filled with a compound which is softened by heating before introduction, and most of this compound was found packed to the interior of case where the gears in revolving had thrown it and where it stuck instead of dropping back on to the gears. This test was conducted during the summer, and it would seem that during the winter time a hard tar-like grease would be even more inefficient. The graphited wood grease is so compounded of wood pulp impregnated with powdered graphite as to be of practically the same consistency in any climate or season.

AN ARMATURE BANDING MACHINE

The Columbia Machine Works & Malleable Iron Company, of Brooklyn, N. Y., is now making an armature banding machine, the invention of Charles Remelius, of the Public Service Corporation of New Jersey. The device consists essentially of a suitable frame with a slideway, upon which the carriage may be anchored in any position desired, the



ARMATURE BANDING MACHINE

machine being driven by a worm and worm-wheel enclosed in air-tight dust-proof cases. All danger to the operator is eliminated, there being no necessity for straddling the wire, as the reel is hung on the carriage in the rear of the machine. By means of special tension mechanism instant adjustment may be made to any tension desired. The bearings are all of bronze. After the armature has been mounted on the machine the carriage is placed in the desired position and the wire from the reel passed around the tension rollers and around the armature. As the lathe turns, the swing guide arm is shifted sufficiently to maintain the wire in alignment. The machine is so constructed that it may be electrically driven by means of a motor.

SEMI-CONVERTIBLE CARS FOR PORTLAND, ORE., AND DISTRICT

There were recently ordered by the Willamette Valley Company from the American Car Company a number of semi-convertible cars for operation on the Eugene & Eastern line, the city lines in Portland and on the interurban line connecting Eugene with Springfield, a distance of about six miles. It is probable, however, that the line from



TYPE OF SEMI-CONVERTIBLE CAR FOR PORTLAND

Eugene north to Portland will require some of the new rolling stock. The new cars measure 25 ft. 4 ins. over the end panels and 34 ft. 9 ins. over the crown pieces. The other principal dimensions are: Width over sills including panels, 7 ft. 11½ ins.; over posts at belt, 8 ft. 2 ins.; height from floor to ceiling, 8 ft. 5½ ins.; from under side of sills over trolley board, 9 ft. 6½ ins.; size of side sills, 4½ ins. x 7¾ ins.; center sills, 3½ ins. x 4½ ins.; end sills, 5¼ ins. x 6¼ ins.; sill plates, 12 ins. x ⅜ in. The inside finish of the cars is cherry, while the ceilings are of birch. The seats and such specialties as the sand boxes, signal bells, angle iron bumpers, etc., are of Brill manufacture. The trucks are of the No. 27-G1 type with 4-ft. 6-in. wheel base. Trailers will be used in connection with the cars as is evidenced by the air-brake attachment at rear end.

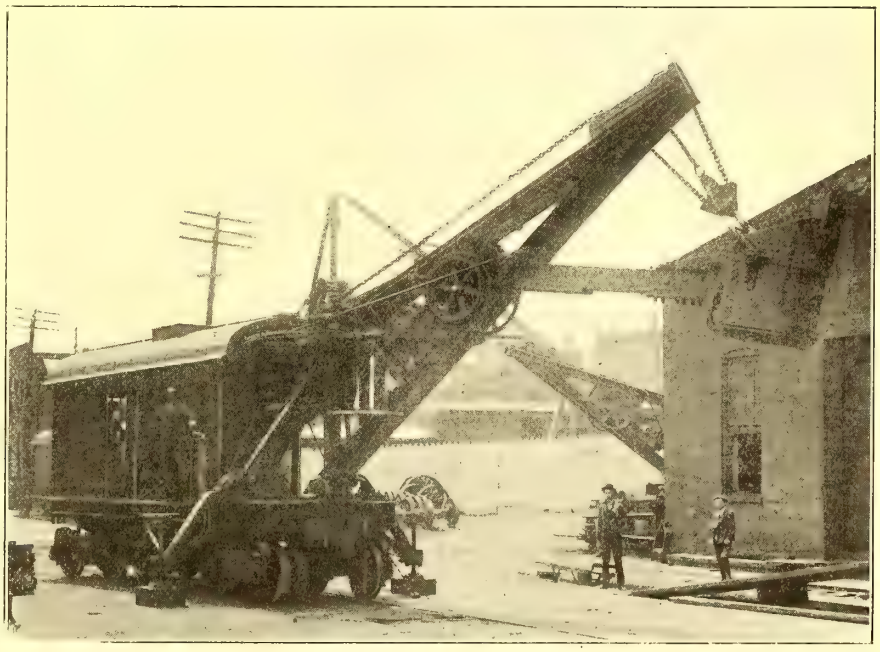
Two other roads in Portland operate with the Brill semi-convertible car, namely, the Portland Railway Company and the Oregon Water Power & Railway Company, the latter using 30-ft. 8-in. and 38-ft. 8-in. (interurban) cars. Another road in Oregon to use the type is the Astoria Electric Company.

ELECTRICALLY OPERATED BALLAST SHOVELS

The Chautauqua Traction Company, of Jamestown, N. Y., has recently installed a 45-ton shovel to dig ballast for its new lines. The shovel is the product of the Vulcan Iron Works Company, of Toledo, Ohio, and is of particular interest because it is electrically operated. The car frame for this shovel is 27 ft. long and 7 ft. 8 ins. wide, mounted on standard gage trucks. It is equipped with a dipper of 1½ cu. yds. capacity and has a clear height of 12-ft. lift above the rail with the dipper door open. It will make a 26-ft. cut at the level of the rails. Three motors are required, one for hoisting the dipper, a second for swinging the crane and a third on the crane for crowding the dipper into the bank. These motors are of standard Westinghouse railway type, built for 600 volts direct-current at 700 r. p. m. The main hoisting motor is of 75 hp, while the swing and crane motors are of 30 hp each. In working in a cut 12 ft. deep and operating at its full capacity the hoisting motors were found to take 80 amps. on an average, sometimes running up to 180 amps. momentarily when the man on the crane crowded the dipper into the bank so far that it carried a great overload, or at other times when the dipper encountered boulders. The material dug was a tough mixture of gravel, sticky clay and sand, but in no case in filling the dipper with one scoop were the motors ever overtaxed. The crowding, or crane, motor averaged about 30 amps., but sometimes ran as high as 80 amps. when crowding the dipper into the bank with its full force. The swinging motor averaged between 30 and 40 amps. The shovel used made three complete dips and swings per minute.

The power for operating the motors was tapped directly from the trolley wires. At no time during the operation of the shovel did the power-house men notice any appreciable change in the line power. Neither was the train service on the line interrupted in any way.

The general appearance of shovels of this type is shown in the accompanying illustration. This shovel is made from

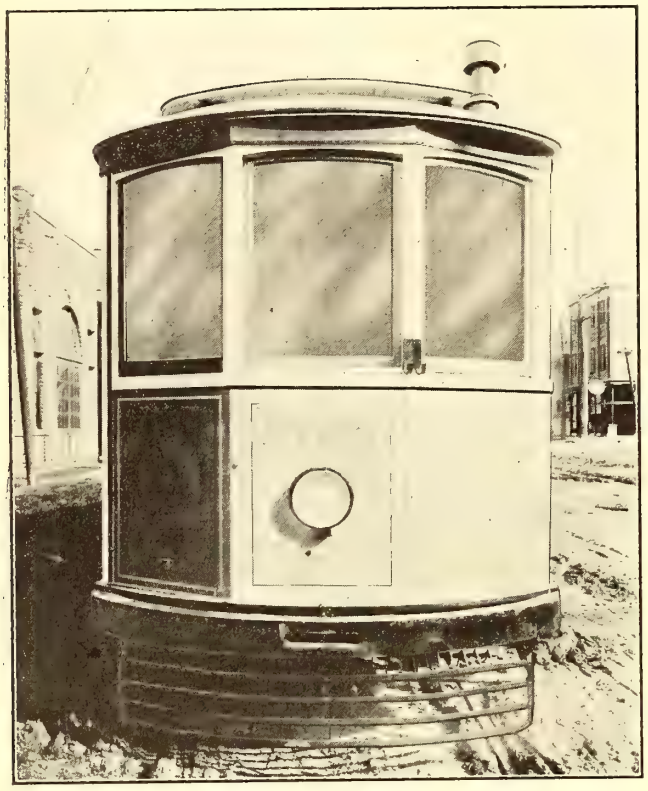


BALLAST SHOVEL OF TYPE USED BY THE CHAUTAUQUA TRACTION COMPANY

20 to 45 tons weight, but the makers are prepared to equip any other size shovel of their manufacture with electric power. The advantage of an electrically operated shovel is the elimination of the boiler, the expense of firemen and of hauling coal under unfavorable conditions. This type should appeal particularly to electric railways, especially in working on extensions to which power connections can be made as the work progresses. The Toledo & Western Railway and the Milwaukee Electric Railway & Light Company are also using machines of this character. The Milwaukee shovel was illustrated on pages 162 and 165 of the STREET RAILWAY JOURNAL for Aug. 3, 1907.

NEW CINCINNATI CARS

The Cincinnati Car Company has just delivered to the Cincinnati Traction Company fifty single and double-truck cars fully equipped, ready for operation. The accompanying ilustrations show exterior and end views. The cars are equipped with Brill No. 27-FE-1 trucks, Westinghouse



HEAD-ON VIEW OF CINCINNATI CAR

single-end quadruple equipment No. 92-A motors, K-6 controllers, National Brake & Electric Company's schedule "O", A-1 compressors with 8" brake cylinders; International double fare registers; Peacock brakes with cast-iron freight-car type hand brake wheel; Hunter fenders; perforated sheet-steel destination signs on ends and side of deck illuminated from the interior. The dashers at both ends are furnished with brackets to attach poster notices and with Dayton headlights.

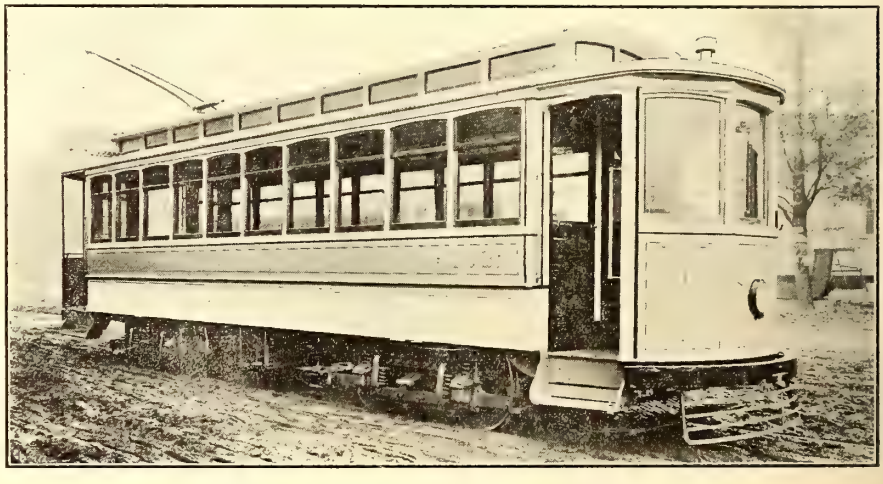
The side sills of these cars consist of heart long leaf yellow pine 3¾ ins. x 7¾ ins. finished sizes, while the end sills, cross joists and diagonal members of white oak measure 5¼ ins. x 7¾ ins., 2¾ ins. x 6 ins. and 1½ ins. x 4 ins. respectively. The cross members are reinforced with 3/16-in. steel plates, and the side sills with 20 in. x ¼ in. steel plates. The side sills are reinforced with 20 in. x ¼ in. steel plates in one piece, extending round the corner posts to the door posts. These plates are bolted to the side sills with ½-in. finished oval head bolts. The side posts are also bolted to these plates which also form the lower panel, thus making a very light, rigid construction, proof against damage by wagon tongues, hubs and wheels. The convex panels are formed of No. 16 gage steel in three sections, the center one being the longest and covering the space of four windows, while the end ones each cover the space of three windows. The roof is reinforced with nine ⅜ in. x 1½ in. steel car lines, one placed over each post. The balance of the body framing is of white ash. The interior finish including doors, sash, headlinings, etc., is of Honduras mahogany with plain molding. The seats and backs are of Heywood Bros. & Wakefield Company's longitudinal pattern, upholstered with canvas-lined hard enameled rattan.

The cars have furnace heaters placed in the front vestibule. The heat is discharged into the car through the bulkhead just below the lower deck headlining. The air is taken into the heater from the inside of the car which keeps the air in the car in circulation. The heaters were manufactured from designs by the car builder. The front and rear platforms are of the Detroit type with dividing rail. The dasher on the rear platform is placed flush with the bumper, leaving no space for passengers to stand. The window spaces have two sash; the upper one is stationary, but the lower drops into pockets with a hinged dust cap to cover the opening. The front door is placed to the right of car. The rear doors are of the mutually operated type.

The local conditions, such as narrow streets, heavy grades, heavy travel and quick transit with a minimum consumption of power, demanded a strong but light car and in designing the new type, the car builder has carefully figured each member with that end in view. The results are shown in the following tabulation of weights:

Weight of car complete, fully equipped, ready for collecting fares, 40,100 lbs.; car body fully equipped with electric controlling apparatus, air brakes, heaters, fenders, etc., except trucks and motors, 16,780 lbs.; car body as above, exclusive of heater, air brakes and electric control apparatus, 14,352 lbs.; two trucks with four motors, gears and gear covers, 23,320 lbs.; air brakes, 1225 lbs.; electrical control apparatus, 928 lbs.; hot air furnace heater, 275 lbs.

The principal dimensions of the cars are as follows: Length over bumpers, 39 ft.; from rear dasher to outside of front vestibule, 38 ft. 6 ins.; over corner posts, 28 ft.; rear platform, 6 ft.; front vestibule, 5 ft.; width over the posts, 8 ft., and over the sill plates, 7 ft. 10½ ins.; extreme width, 8 ft. 4 ins.; height from bottom of sill to top of roof, 8 ft. 11½ ins.; height from rail to top of trolley stand, 11 ft. 10¼ ins.; truck centers, 17 ft. 4 ins.; wheel base of trucks, 4 ft. 6 ins.; track gage, 5 ft. 2½ ins.; diameter of wheels, 33 ins.; width of tread, 2½ ins.; depth of flange, ¾ in., and diameter of axles, 4 ins.



GENERAL EXTERIOR VIEW OF CINCINNATI CAR

FINANCIAL INTELLIGENCE

WALL STREET, NOV. 13, 1907.

The Money Market

There has been a decided improvement in the monetary situation during the past week, and there is every indication that normal conditions will prevail in the not distant future. The improvement was due largely to the continued heavy importations of gold, which now aggregate $60,900,000, and to the return to the banks of considerable moneys that were withdrawn several weeks ago when the disturbances in the local money market first developed. These heavy additions to the supply of funds have been reflected in a pronounced relaxation in rates for call money, the range for the week being between 12 and 4 per cent, as against 50 and 10 per cent in the preceding week. In the time loan branch of the market business was practically at a standstill. The banks and trust companies are still out of the market and there is nothing in the situation at present to indicate that they re-enter the time loan market at an early date, and the supply of time money consisting of small amounts was put out by individual lenders at rates ranging from 12 to 15 per cent for over the year. One of the most important developments of the week has been the sharp fluctuations in foreign exchange, demand sterling selling as high as 4.89. Notwithstanding this high rate for exchange, and the action of the principal European banks in advancing the minimum rates of discount, local bankers have been able to draw gold from abroad, this being made possible by the high premiums paid for currency in this city, and which more than offset the advance in the rate of sterling. The advances in the European bank rates were due almost entirely to a desire on the part of those institutions to check the heavy flow of gold to New York. The Bank of England advanced its minimum rate to 7 per cent, the highest rate reached since 1873. The Imperial Bank of Germany advanced its rate to 7½ per cent, while the Bank of France and the Bank of Belgium advanced their rates to 4 and 6 per cent respectively. There was also an advance in the Bank of Bengal rate to 6 per cent and in the Bank of Bombay to 5 per cent. These advances partly checked the engagements of the metal by our bankers in Europe, but at the close of the week reports were received that the Bank of France had signified its willingness to furnish $15,000,000 gold for New York, and it is believed that further considerable amounts of the gold will be picked up in the European markets from time to time. The shipments of currency to the interior have been fairly large, the loss by the banks on Sub-Treasury operations since last Friday amounting to upwards of $3,000,000. Quite an active demand was reported for currency during the early part of the week and a premium of 3½ per cent was paid. There has, however, been a decided falling off in transactions of this kind and dealers report the supply greatly in excess of the demand.

The bank statement published on last Saturday was about as expected. Loans increased $38,863,800, and deposits increased $35,091,200. Cash decreased $4,313,000, but as the reserve required was $8,772,800 more than in the preceding week, the deficit was further increased by $13,085,800. It was generally accepted, however, that the statement did not reflect the true condition of the banks in as much as only a comparatively small part of the gold arrivals from Europe were included in the bank figures. It is expected that the forthcoming bank statement will make a more favorable exhibit. The total deficit of the banks now stands at $51,924,625 and compares with a deficit of $1,514,125 in the corresponding week of last year and a deficit of $2,428,800 in the corresponding week two years ago. The percentage of reserve held by the banks on last Saturday was 20.22, as against 20.30 in the preceding week.

The Stock Market

Slowly, but none the less surely, confidence in the financial world, which had been rudely shaken by the developments of the past few weeks in connection with the local banking, trust company and monetary situations, is being restored. This is evidenced by the complete disappearance of the panicky conditions that prevailed in the stock market and the substitution of a gradual recovery in prices, resulting largely from a continuance of the practically unprecedented demand from investors. This demand has in the main been for small lots of the dividend-paying stocks, indicating that a large percentage of the money that has been withdrawn from banks and other depositories is finding its way into the security market. In consideration of the unusually large investment yields which many of the stocks now afford, this buying is by no means surprising, and it is safe to presume that the movement will keep up until the supply of all desirable issues has been exhausted. In the mean time there has been more or less liquidation of a forced character by some of the larger holders of stocks, which has served at intervals to bring about greater or less recessions in prices. Thus a good deal of irregularity has attended the fluctuations in values, but on the whole the tendency has been unmistakably upward.

A relaxation in the money market, especially the call loan division, from the severe tension to which it has been subjected, has aided materially in restoring confidence. The decline in call money to something approaching normal rates has of course been chiefly due to the enormous importations of gold, which were assisted in no small degree by the willingness of the Bank of France to part with large amounts of the precious metal to London. It is even now asserted that in addition to the aid already given by that institution, it still stands ready to ship to this side, either direct or through London, $15,000,000 or more. The fact that the Bank of England, Bank of France, Bank of Germany and all the other leading European and Continental banks raised their minimum discount rates during the week to the highest figures in years, had no material effect on the movement of gold this way, the premium on currency prevailing here having acted as an offset to such matters.

Apart from the clearing up of the local banking and trust company situation and the easing off in money rates, there has not been much that has attracted notice, even the fact that the Clearing House banks showed in their last statement a deficit of over $51,000,000, being practically ignored, for the reason that it was known that the exhibit did not truly reflect the present condition of those institutions. An interesting development has ben the passing of control of the Tennessee Coal & Iron Company to the United States Steel Corporation, but aside from causing a sharp decline in the price of the former's stock, as well as in the latter's 5-per cent bonds given in exchange for Tennessee Coal shares, the incident was without noteworthy influence marketwise. The passing of dividends on American Cotton Oil common, North American and Parrot mining tended to unsettle the market for industrial stocks at times, but the effect was not farreaching nor of long duration, as it was appreciated that these suspensions were merely temporary and wholly the result of prevailing monetary conditions. In short, the general stock market has acted very well in consideration of the period of great despondency and depression through which it has just passed.

In so far as the stock market goes, there has ben nothing of special importance concerning the local traction situation. However, no little interest was manifested in the suit instituted in the United States Circuit Court by the Morton Trust Company, as trustee, to foreclose the mortagage executed March 21, 1902, by the Metropolitan Street Railway Company to secure an issue of $65,000,000 four per cent bonds, and of which $16,604,000 are now outstanding. This action, which was brought to protect bondholders and to prevent the separation of the system into different parts, is based upon the failure of the Metropolitan Company to pay the guaranteed rental on the Third Avenue Railroad, which, it is contended, broke the lease and constituted a default in the terms of the mortgage.

Philadelphia

The market for local traction issues during the past week was devoid of special feature. Trading was upon a much smaller scale than for some time past, and while prices moved with

more or less irregularity at times the net changes were as a rule confined to the fractions. Interest in the trading centered in Union Traction, which was the most active issue of the group. Opening at 47, the price declined a point, on rather heavy selling, and after a fractional rally it reacted and closed at the lowest. Philadelphia Rapid Transit was unusually quiet, less than 2000 shares changing hands at 16¼ @ 16. Consolidated Traction of New Jersey was comparatively active, and after a display of weakness the price rose sharply from 55 to 57. Philadelphia Traction fluctuated between 82¾ @ 83½ and closed at 83. American Railways sold at 45 and Philadelphia Company common at 35 @ 34.

Chicago

There has been no important developments in the local traction situation during the past week. Representatives of Western interests in the Chicago Union Traction Company are in New York, but it is not expected that any attempts will be made to push the reorganization of the company until the banking and monetary situation becomes clearer.

Transactions included South Side Elevated at 69; Metropolitan Elevated preferred at 49 @ 50 and Chicago & Oak Park Elevated common at 2½.

Other Traction Securities

The market for traction issues at Baltimore developed considerable activity and strength, the prominent features being the United Railway issues, all of which rose sharply on rather heavy transactions. The 4-per cent bonds which sold as low as 79¼ early in the week, advanced to 80 and closed at the highest, while the income bonds, after selling at 42, rose to 43, on transactions aggregating $125,000 by far the heaviest dealings recorded for weeks. The refunding 5-per cent bonds advanced from 67¾ to 70 and sales of the stock were made at 9. Lexington Street Railway 5's brought 96; Atlanta Steel Railway 5's, 98¾; City & Suburban 5's, 106½, and Baltimore City Passenger 5's at 99½. The Boston market was dull and irregular. Boston Elevated, after a decline of a point to 119, recovered to 120. Metropolitan Electric issues were quiet, the common selling at 10¼ @ 9¾, and the preferred from 41 to 39⅝ and back to 40. West End common sold at 79 @ 80, and the preferred stock at 95 @ 96.

Little business has been done on the Cleveland Stock Exchange the past week, the financial situation having had the effect of stopping all trading except that which is done on a cash basis. A few small lots of Cleveland Electric changed hands before the city election, but since that time the asked price has advanced and there has been little buying. Aurora, Elgin & Chicago preferred has been quoted around 65 bid and 72 asked, while Lake Shore Electric common fell off a few points and was held at 10. The bid price on Northern Ohio Traction & Light was 20¼, just about where it has stood for some time. Forest City closed at 96¼ bid and 100 asked.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Nov. 6.	Nov. 13.
American Railways	—	44½
Boston Elevated	a120	a119½
Brooklyn Rapid Transit	32½	30⅞
Chicago City	150	150
Cleveland Electric	40¼	37
Consolidated Traction of New Jersey	55½	55
Detroit United	32½	32¼
Interborough-Metropolitan	5¼	5⅝
Interborough-Metropolitan (preferred)	16½	16½
International Traction (common)	a45	40
International Traction (preferred) 4s	a59¼	a58½
Manhattan Railway	105	108
Massachusetts Elec. Cos. (common)	—	9½
Massachusetts Elec. Cos. (preferred)	39½	39
Metropolitan Elevated, Chicago (common)	21	21
Metropolitan Elevated, Chicago (preferred)	50	48
Metropolitan Street	29	—
North American	44	40¼
North Jersey Street Railway	40	40
Philadelphia Company (common)	33½	34
Philadelphia Rapid Transit	16	15⅞
Philadelphia Traction	85	84½
Public Service Corporation certificates	54	54
Public Service Corporation 5 per cent notes	90	89
South Side Elevated (Chicago)	69	69
Third Avenue	19½	15
Twin City, Minneapolis (Common)	73	74½
Union Traction (Philadelphia)	46¼	45½

a Asked.

Metals.

Special inquiries made by the "Iron Age" during the past few days show that since the first of the month blast furnaces have blown out whose weekly capacity is estimated at 28,000 tons per week. Six others with a capacity of 5500 tons per week are preparing to stop. Therefore, from Oct. 1 to the end of this week the rate of production has been cut down 53,500 tons per week or a little over 10 per cent.

In the metal trade the flurry in copper is apparently over. It has been shown that prevailing conditions do not justify any pyrotechnics and that the sounder course of allowing time to cure the severe blows under which the industry has staggered is the safest.

THE DALLAS AND SHERMAN PROJECT MEANS SIXTY-FIVE MILE LINE FOR TEXAS

The American Railway & Lighting Company, a holding and operating company, which has full ownership in and operates six electric light and gas plants within 100 miles of Dallas, has contracted to build for the Texas Traction Company an interurban line which, within a few months, will go into operation between Dallas and Sherman, a distance of some 65 miles. Theodore Stebbins, as announced in the personal column in this issue, has just been appointed general manager of the Texas Traction Company, and is in charge of the work now under way. Mr. Stebbins would like to receive a supply of catalogues from manufacturers offering goods for use on a road such as he is installing.

CHICAGO TRACTION PLAN AGREED TO—BASIS OF EXCHANGE OF SECURITIES

What is known as the "modified reorganization plan" has been agreed to by all interested parties. It was devised by Judge Peter S. Grosscup, of the United States Circuit Court, and Prof. John C. Gray, of Harvard University. Under the modified plan a new company, the Chicago Railways Company, will take up all the outstanding evidences of indebtedness of the seven constituent companies and issue in lieu thereof new bonds and stocks of its own. They will run in three series, "A" being the first lien on the property, and the other two secondary liens. The holders of the securities of the old companies will receive bonds of series "A," "B," or "C," according to the priority of their liens. The percentages on which the new securities of the Chicago Railways Company will be exchanged for the old ones of the Union Traction and its underlying companies is given in this table:

	New Sec.		
Present Securities	Series A	Series B	Series C
North Chicago City Railway Co.:			
First mortgage bonds	$1,000	.....	.....
Second mortgage bonds	1,000	.....	.....
Stock (every ten shares)	.....	$1,800	.....
Chicago West Division Railway Co.:			
First mortgage bonds	1,000	.....	.....
Stock (every ten shares)	.....	800	.....
North Chicago Street Railway Co.:			
First mortgage bonds	200	800	.....
Refunding bonds	.....	1,000	.....
West Chicago Street Railway Co.:			
First mortgage bonds	200	800	.....
Consolidated mortgage bonds	.....	1,000	.....
Certificates of indebtedness	.....	600	$400
Chicago Passenger Railway Co.:			
Consolidated mortgage bonds	.....	1,000	.....
Stock (every ten shares)	.....	250	.....
West Chicago Street Railway Tunnel Co.:			
First mortgage bonds	500	500	.....

The stock of the new Chicago Railways Company also is divided into four series. The stockholders in the old company will be allowed shares in either series A, B or C, according to their value.

Holders of the securities of the seven Chicago companies involved in the reorganization have been invited, through an advertisement which appeared in the New York papers, to deposit their securities under the modified plan of reorganization approved by Judge Grosscup and Prof. Gray.

THE WORK OF THE PUBLIC SERVICE COMMISSION OF THE FIRST DISTRICT OF NEW YORK

The Public Service Commission of the first district of New York is now engaged in the preparation of its annual report, which must be presented to the Legislature by the second Monday in January. When the report is presented it will be more complete than any summary of the commission's work up to date would be, since that body is yet only four months old. It is certain that the report to the Legislature will contain a chapter on the Interborough-Metropolitan-Brooklyn Rapid Transit investigation, which is still to be completed.

Three important orders for increases in train service have been made by the commission. All of these are being compiled with by the companies. They are:

1. Interborough Rapid Transit Company—Order requiring approximately 20 per cent increase on subway and elevated lines.

2. New York City Railway Company—Order requiring approximately 20 per cent increase on Fourth and Madison Avenue lines.

3. New York City Railway Company, Forty-Second Street, Manhattanville & St. Nicholas Avenue Railway Company—Order requiring approximately 20 per cent increase of service on Broadway line.

Besides these, an order has been issued to the Coney Island & Brooklyn Railroad Company requiring additional equipment, and an order requiring an additional stairway at the 137th Street and Broadway station on the subway.

Then also three final orders have been issued, after hearings, directing certain changes in the methods of operating which are expected to work improvements in the service. These orders were:

1. Richmond Light & Railroad Company—Order requiring safe operation of cars around Fort Wadsworth curve.

2. Union Railway Company and Westchester Electric Railroad Company—Order requiring operation of Williamsbridge cars on White Plains Road to 242d Street, instead of terminating line at 233d Street.

3. Union Railway Company and Westchester Electric Railroad Company—Order requiring transfers between cars of former company and "Bedford Park and New Rochelle express cars" of latter company.

The Interborough Rapid Transit Company order applies to all subway and elevated trains in Manhattan and the Bronx, and prescribes increases varying from about 5 per cent to about 66⅔ per cent in the service during periods extending for about an hour before and about an hour after the rush hour. The New York City Railway Company orders prescribe approximately a 20 per cent increase on the Broadway line and a similar increase on the Fourth and Madison Avenues line for the same part of the day as that covered in the Interborough Rapid Transit Company order.

The Coney Island & Brooklyn Railroad Company has announced, through its counsel, William N. Dyckman, that it will pass two dividends to provide the additional equipment required in the orders of the commission and other equipment which representatives of the company have promised. The installation of the additional equipment ordered is expected to result in a quicker movement of surface cars over the Brooklyn Bridge.

Another final order of the commission, approving the application of the Nassau Electric Railway Company for permission to extend its tracks to Livingston and other streets, settled within five days of the filing of the application a question involving material relief for the most congested point of surface transportation in Brooklyn, as treated at length in an article elsewhere in this issue. The application of the company was made in its final and proper form on Aug. 8 to the new commission. The hearing required by law was held on Aug. 12, the only delay being that required by law for advertising it lawfully, and on Aug. 13, just twenty-four hours after the hearing, Commissioner McCarroll, to whom the matter had been referred, made his report and the commission adopted a final order approving the extension.

Chairman Willcox, of the commission, says it has been a source of gratification to receive the ready compliance and, in many cases, the co-operation of public service corporations in carrying out the commission's work. Frequently the companies have joined with the commission, says Mr. Willcox, in endeavoring to improve service conditions and the officials have expressed their willingness to do all in their power because of having to look now to but a single public department, organized on a sound, sane basis.

The New York "World" on Sunday quoted Mr. Willcox in an interview as follows: "Our work in dealing with this physical condition of traffic has been divided into two endeavors, one to get the greatest amount of improvement out of existing facilities and the other looking to the construction of additional subways and extensions. It was impossible for us to proceed far in either of these directions without encountering the financial structure of public service corporations. Financiering has so direct a relation to quality of service that complete knowledge of its intricacies became a necessity to us.

"Manifestly it was the first duty of the commission to deal with the existing traffic facilities of New York, to endeavor to get out of them greater accommodations for the public. Several years would be required to construct additional lines, and meanwhile there is a constantly increasing demand for better and more extensive service. For the last few weeks the commission has been giving almost its undivided attention to this phase of the situation.

"More recently we have taken up discussion of the next step, the providing for new lines. New York is growing so rapidly that even the maximum service on existing lines cannot fully accommodate the traveling public. New subways are necessary, and we must plan them. Here, too, knowledge of actual cost is necessary and requires examination of past financing to form a basis for the future.

"The work of the Public Service Commission is constructive, not destructive. The object of our investigations is not to tear down, but to build up. It is not to retard, but to improve."

The Morton Trust Company, as trustee of the Metropolitan Street Railway 4 per cent refunding bonds, moved on Saturday to foreclose the mortgage covering these bonds in foreclosure proceedings in the United States Circuit Court, before Judge Lacombe. The Metropolitan Street Railway, as well as the receivers of the New York City Railway, Adrian H. Jolin and Douglas Robinson, are made parties defendant. This action, the Morton Trust Company states, is taken at the request of holders of the refunding bonds outstanding to a total of $16,604,000. No default has occurred on these bonds. The foreclosure petition is based on the fact that under the terms of the mortgage the Metropolitan Street Railway pledged itself to pay all amounts payable on any lease pledged under the refunding mortgage. The Third Avenue lease is so pledged, and in failing recently to meet the rental on that road the Metropolitan Street Railway, the Morton Trust Company as trustee for the bondholders alleges, was guilty of an infringement of the terms of the mortgage, which entitles the trustee for the bondholders to institute foreclosure proceedings. A majority of the refunding bonds of the Metropolitan Street Railway outstanding are in the control of a committee of which Edgar L. Marston, president of the Farmers' Loan & Trust Company, is chairman. Co-operating with the Metropolitan Street Railway bondholders' committee there is a committee of Third Avenue Railroad bondholders already organized, with Dumont Clarke, president of the American Exchange National Bank, at its head. The Third Avenue bondholders are in prospect of having the receivers default upon the interest on their bonds, throwing the Third Avenue system into their hands, just as the Metropolitan Street Railway will be thrown into the hands of the bondholders of that system in case the foreclosure goes through. This will eliminate the stockholding interest in both instances, so far as a voice in a reorganization goes, and will place the traction combination in the hands of the holders of the Interborough-Metropolitan bonds issued against the stock of the Interborough Rapid Transit Company on the one hand and the combination of bondholders' committees on the other. It is believed that in case the foreclosure is allowed, the present receivers will be named to act on behalf of the holding interest, pending the reorganization.

Four members of the Public Service Commission inspected the electrified portion of the New York Central Railroad on Saturday, traveling from the Grand Central Station to Mount Vernon, inspecting the power plant and traversing the freight route on Eleventh Avenue, the tracks of which will soon have to come up. The trip occupied the greater part of the day. The party included all the commissioners except Chairman Willcox.

The commission has issued an order to the Richmond Light & Railroad Company returnable Nov. 21 for the purpose of inquiring into the service of the company on Staten Island, where it operates.

THE CONFERENCE IN CLEVELAND

On invitation of Mayor Johnson the officers of the Cleveland Electric Railway Company held a conference with the Mayor, members of the City Council and councilmen-elect in the council chamber Saturday morning, Nov. 9, in an effort to arrive at some understanding, if possible, as to what action will be taken to accommodate the people of the West Side when the franchises expire. In his letter of invitation to the Cleveland Electric officials, the Mayor intimated that the administration might have some suggestions to make that would lead to a fair and satisfactory settlement of the entire street railway question, but it was found that he expected the company to make a proposition to that end instead. President Andrews said that he had been unable to have a full meeting of the board of directors previous to the meeting, and that he could speak only for himself. He then suggested that the fairest way to arrive at a conclusion was by arbitration, the arbitration board to consist of disinterested traction experts. This did not meet with the Mayor's views. He stated that much time would be required in a process of this kind, and that the result would be binding upon no one. It is evident that the Mayor desires a holding company to take over the property on a leasing arrangement, and it is believed that he would not favor giving the old company a franchise on any terms. It seems that he wants to adhere to the old offer made to the company of fixing leasing terms upon a certain valuation, which is far below the real worth of the property. Under the offer made last spring the basis for the lease would be a valuation some place between 42 and 46, as there was to be a drop of two points a month for the delay in accepting the offer.

As the Mayor insisted upon a proposition from the Cleveland Electric on either the holding plan or a direct franchise plan, President Andrews stated that he would call a meeting of the directors at the earliest moment to consider the matter. The Mayor then set Thursday of this week as the time for hearing the report. All through the meeting Mr. Andrews showed a disposition to treat fairly with the city and said that similar treatment is all his company asks. If the Mayor really wants to settle the question to the best interests of the people, there is a general belief that the company will meet him half way. On the other hand, if he insists that the property be turned over to an irresponsible holding company at a ridiculously low valuation, with the privilege of purchase at a figure but little higher, at any time the Mayor sees fit, it is safe to say a settlement will not be reached for some time to come.

The Cleveland Electric officials and the Mayor, in consultation a few days ago, arranged a new routing for what are known as trippers, in order to avoid congestion at the Public Square. Increasing traffic, morning and evening, with the addition of a number of cars on the low-fare lines, resulted in frequent blockades which delayed traffic quite a little at times. Under the new plan the trippers will turn before reaching the Square, and thus avoid having all the cars reach one point. Fewer East Side cars will be run to the Union Station. This is a distinct disadvantage, but under present circumstances can not well be avoided. Plans of building additional tracks about the Square have been discussed, and the Mayor has suggested that the $84,000 received by the city from the Cleveland Electric for the use of Central Avenue and Quincy Street be used for building additional tracks for this purpose, and that the property belong to the city. This matter will also be presented to the Cleveland Electric directors for consideration. In rerouting the tripper cars, the Cleveland Electric will use a short strip of track built by the low-fare companies on East Ninth Street.

The business men of Cleveland were somewhat dismayed at the result of the election in that city, as the plan suggested by Congressman Burton was considered by them to be fair and honorable in every particular. They felt that the sensible, wide-awake element of the city would support a platform of that kind, since the declaration of the Cleveland Electric that the plan would be accepted was made in the last days of the campaign, after the matter had been pointed out as uncertain by the Johnson side. It seems, however, that many voters favored the lowest fare possible, without consideration for the good of the city and the future development of its suburbs. People at large do not stop to consider what they are getting in street railway service, and the judgment as recorded at Cleveland would seem to auger anything but well for companies in other cities seeking extensions. The officers of the Cleveland Electric Railway have not given any intimation of the course they will pursue in case the administration insists upon plans that cannot be accepted, but the company is prepared to protect itself and its property in case of an attempt to confiscate. It is believed that transfers might be withdrawn between the lines that formerly composed the Cleveland City Railway Company and those of the old Cleveland Electric Railway Company, and a fare of ten cents charged to Euclid Beach, Collinwood and other points, as the company voluntarily made the reductions some years ago. While resulting in a hardship to the people, such action on the part of the company would increase its income quite materially. On the night of the election, when it became evident that Mr. Johnson was re-elected as Mayor, the company withdrew the seven for a quarter tickets and put the old rate of eleven for half a dollar in force again. Many people, anticipating what might happen, had purchased large numbers of the cheaper tickets and are taking advantage of the low fare still. These tickets might have been redeemed, but the company did not see fit to take action to that end. However, it was stated that there will be no further tests of the low fare, as a majority of the people have said they do not appreciate it.

Should the administration succeed in making an arrangement by which the Cleveland Electric will operate at a lower fare than has been offered, all hopes of rapid transit lines will be blasted, so far as it is concerned, unless a more liberal spirit should be displayed regarding this matter than has been shown in others. The city is badly in need of some form of rapid transit service in all directions and such lines would be liberally patronized by those who live in the suburbs and must now spend from forty-five minutes to an hour on the cars morning and evening.

The directors of the Cleveland Electric Railway Company held a meeting Monday to discuss the action to be taken in connection with the request of Mayor Johnson that some proposition looking toward a settlement be made. While it is not known what course the directors will favor, it is said that the holding plan on a proper valuation of the stock is looked upon as better than a franchise at a flat three-cent fare. However, it is believed that the directors will have to have some assurance that the dividends or rentals will be paid and that the holding company would have to be stronger and in better shape than the one that is now in operation here.

Rumors are to the effect that Mayor Johnson would be willing that the Cleveland Electric directors have representation in the directorate of the holding company, so that they may know at all times just what is being done. The zone question and the proposed clause allowing the holding company to change its rate of fare if found necessary, as was proposed in the original contract, will have something to do with the settlement. It will be remembered that President Andrews insisted that any holding company that proposed to take over the Cleveland Electric properties should agree to bind itself to a three-cent fare and in case it was found impossible to operate at this, the properties were to revert to the old company. Mr. Johnson objected to this, even in the zone system proposed.

On Thursday Mayor Johnson refused the proposition of the Cleveland Electric Railway to give six months' test of three-cent fares and accept 25-year franchise on any fare determined by a disinterested board of experts which would yield 6 per cent. He also refused the plan fixing the value of the stock for entering a holding company and demanded that the company state a figure at which it is willing to go on this plan.

ECHOS OF THE MATTOON CITY WRECK

Petitions, charging fraud in the management of the Mattoon City Railway, were filed in the Circuit Court at Mattoon by Attorney L. Chezem for those seeking damages for injuries received in the recent wreck on the line in which about seventeen people were killed.

Soon after the wreck the road was put into the hands of a receiver. The petitions claim the road is solvent. Damage claims amounting to $219,000 have been filed.

Regarding the petitions, Judge Grosscup, of Chicago, who is director and part owner of the road, is quoted as saying:

"The charge is either made maliciously or else by a person who does not in the least understand the situation. The receivership protects the claimants; it does not destroy their rights. It will prevent the property from being scattered and all creditors will fare alike. The reason for the receivership was to take care of the creditors, not to defraud them."

BRIDGE RELIEF IN NEW YORK

The submitting on Tuesday of this week to the Municipal Art Commission of New York of the plans for the Brooklyn Bridge station, stairway and esplanade has resulted in making public the elaborate plans that have been made for modifying this structure so as to make it of greater value in the service which it performs, and also brings forward the plans affecting the New Manhattan bridge and the Williamsburg Bridge and their relation to transit matters affecting Brooklyn.

To relieve the congestion at the Brooklyn Bridge temporarily Commissioner Stevenson originated the idea of extending the present tracks of the structure across Park Row into City Hall Park. This construction work is in progress now and will be completed shortly. The extended terminal will provide additional platform space and increase the present limited switching facilities. With its completion the cable car service during the rush hours will come permanently to an end. Through elevated trains will be operated over the structure during all hours of the day and night. Included in the plans for permanent relief one of the most important details is the distribution of the traffic which crosses the structure on the trolley lines. Under the new plan the Bridge Department proposes to raise the trolley loops from the ground surface to the mezzanine floor above. Passengers using the trolley lines will proceed through the ground floor of the bridge where the loops are located now. There will be separate stairways reaching each loop. With this arrangement the traffic will be distributed and there will be none of the confusion and congestion which now exists on the ground floor. On each of the stairways will be a sign designating the lines which may be reached on the floor above. The platforms will be large and spacious and the present system of having passengers cross four or five different tracks to reach a trolley loop will be eliminated.

The plans for the elevated service and the subway lines as soon as the subway loop is completed, are even more elaborate. The present terminal which is used for the elevated lines, will be extended out on the bridge to increase the length of the platforms and the switching facilities. As soon as this is completed the temporary extension which is being built across Park Row into City Hall Park will be taken down. The tracks will only extend to the house line on Park Row. The façade of the new terminal on Park Row will be approached by a passageway extending over Park Row into City Hall Park. On the mezzanine floor the passengers will pass along a platform which will be raised over the platforms of the trolley loops. Here another set of stairways and escalators will be found upon which the passengers will ascend to reach the platforms of the elevated lines on the floor above.

Already the work of widening the roadways of the bridge is under way. This widening is made necessary for the subway cars which will cross the bridge and descend into the tunnel which is to connect the structure with the subway terminal station and the subway loop. When the roadways are widened the trolley tracks will be moved out to permit the installation of another track on each side of the bridge to connect with the subway. While all this construction work is in progress, there will not be the slightest obstruction to the present traffic on the bridge.

Running parallel with Center Street and beginning from the site of the old "Staats Zeitung" Building, the subway terminal will cover a distance of three blocks. There will be three loading and two unloading platforms, each 450 ft. long. The trains from the bridge will cross under William Street and Park Row, where they enter the station. There will be five stairways leading to the station where Park Row and Center Street form a triangle. Three of the stairways will be for passengers, bound for the loading platforms. The other two will be exits for passengers coming from the trains. A system of railings is provided whereby these two lines of people going in opposite directions will not come in contact with each other. Half of the length of the station and directly in the center another series of entrances and exits are provided, leading from Duane, Reade and Center Streets. The people here will descend to a mezzanine floor, with stairways leading up and down from both sides to the platforms below. At the extreme northerly end of the terminal there will be another series of exits and entrances. The passengers here to reach the platforms will pass under the tracks and then up a number of stairways.

From the terminal station the subway with its four tracks will proceed through Center Street. At Leonard and Franklin Streets there is to be another commodious station; between Howard and Grand there is to be another. The subway then will turn and proceed through private property to the Delancey Street approach to the Williamsburg Bridge. At the Bowery and Delancey Street there is to be another station.

Here the trains will enter the subway station which has been constructed under Delancey Street for the entire width of the street and covering almost three city blocks. For the trains three platforms have been provided in this station. The center platform will be used by passengers leaving the trains and the two side platforms for passengers boarding trains. From the subway station the trains proceed on an incline to the elevated tracks on the Williamsburg Bridge. The Bridge Department is now at work lowering the tracks on the bridge to meet those from the subway station.

This subway station is to have a number of novel features. In addition to accommodating the elevated subway trains it will be the terminal for the trolley lines which cross the Williamsburg Bridge. Eight loops will be provided for these lines, each reached by a separate stairway.

The regulation of traffic in Manhattan, so as to allow the freest possible operation of surface cars compatible with the use of the streets for other purposes, occupied the attention of the Public Service Commission at the public hearing on Tuesday, Nov. 12. The Charter Revision Commission, the chairman of which is Williams M. Ivins, who is also special counsel for the Public Service Commission in its traction investigation, will recommend that the city's charter as amended shall centralize the power of regulating street traffic in some one city department, instead of leaving it divided up between several department heads, as at present.

Police Commissioner Bingham is in favor of a set of traffic regulations embracing practically all the features of the plan advocated by Mr. Shonts, but putting it in the hands of the police commissioner by legislative enactment to determine the conditions governing the movement of traffic. Commissioner Willcox, of the Public Service Commission, and the Deputy Commissioner agreed that further legislation was needed on this matter at least. The Deputy Commissioner suggested that it would be a wise move to take a strip of 5 ft. or 6 ft. off the sidewalk on such streets as Twenty-Third and Forty-Second, where there is approximately 40 ft. of roadway and 30 ft. of sidewalk on each side. In connection with this he favored an ordinance limiting the width of wagons to be used in the daytime to 8 ft. 6 ins.—about the present maximum for the heaviest coal wagons. The narrowing of the sidewalk and such a limitation on the width of wagons would allow two teams to pass each other on each side of the electric cars without infringing upon the car track.

INCREASING SERVICE IN SAN FRANCISCO

By Nov. 15 the United Railroads, declares General Manager Black, will have in operation a total of 450 cars, mostly of the new type, which will have an aggregate carrying capacity equivalent to 600 cars of the old cable and smaller cars used before the fire. The United Railroads has contracted with the City Electric Company for the supply of a large amount of power, and this will be available as soon as a frequency changer can be moved from the Martin station of the California Gas & Electric Company and set up in the North Beach power plant of the railway company. Within a week the lower end of Market Street, from the end of Sutter Street to the ferry loop, will have its outer set of tracks permanently set for regular service. These tracks have been raised to the new grade, ranging from 1 ft. to 3 ft. above the old grade, and the heavy rails are rapidly being imbedded in concrete, surfaced with basalt blocks as a flinty wheel guard for vehicles, while preparations are going forward for the pavement of the space between the rails with bitumen like that on Sutter Street. As soon as the outer tracks are made available for the Market and Sutter Street cars workmen will hurry the raising of the intervening grade so that the inner main tracks may be raised to the level of the outer tracks, and the whole end of lower Market Street for a distance of about three-quarters of a mile may be made like the smooth, central part of Sutter Street. Work is going ahead rapidly in the making of the new inner loop at the ferry for the passage of Clay and Sacramento Street cable cars. The old turntable and the straight tracks within the present loop are to be torn out and the loop space restored to a uniform grade.

DECORATION TO CARROLL D. WRIGHT

Hon. Carroll D. Wright, former United States Commissioner of Labor, formally received the cross of the Legion of Honor, conferred on him by the French government, for his efforts in bettering industrial conditions throughout the world, at a dinner given in his honor at the Engineers' Club, New York, Nov. 9. The host was Charles Kirchoff of the "Iron Age" and chairman of the advisory council of the American Museum of Safety Devices and Industrial Hygiene at the Thirty-Ninth Street Building, 239 West Thirty-Ninth Street. The occasion of the dinner to Mr. Wright was the recognition by his colleagues on the museum board of the distinction he had received from the French government. The letters of congratulation addressed to William H. Tolman, director of the Museum of Safety Devices and Industrial Hygiene, and read at the dinner included communications from President Roosevelt, S. N. D. North, director of the United States Census, and Andrew D. White.

The decoration was formally presented to Mr. Wright by Mr. Bonzom, acting French Consul-general.

Mr. Wright, in responding, said that the honor came as a surprise to him, and he took it as a recognition of the work which the American Museum of Safety Devices has accomplished. He said that his work in the government Labor Department was taken up by statistics, but that in all the years he was engaged in that field the need of a movement that would reduce the number of accidents appealed to him. He said that in maintaining an institution devoted to the saving of life we are following the European countries and following France. He continued: "The engineers were the first to work this new movement outside of their line of work. The movement should extend not only to adopting devices for preventing accident, but it should insist that an inspection be made by bodies of men of all parts and appliances of machinery. These are things that need action by the government as well as by society. The slaughter of life by accidents is a matter that needs thought and attention. If there is any way that the social engineers can assist the other engineers, you can count on me. I thank the French government and my colleague for the honor conferred on me."

Addresses were also made by Dr. Josiah Strong, who was the toastmaster at the dinner, and Professor F. R. Hutton, president of the American Society of Mechanical Engineers.

Mr. Wright, who is now president of Clark College, at Worcester, Mass., received a similar honor from the Italian government a year ago.

EAST CAMBRIDGE ELEVATED HEARING

A hearing was held Nov. 7 before the Massachusetts Railroad Commission in regard to the route of the East Cambridge elevated lines in the vicinity of Lochmere Square. Revised plans, avoiding the use of this square as a surface car approach to the structure, were shown by Chief Engineer Kimball. The new elevated structure, crossing the Charles River just outside the Charles River dam, will traverse the Boston & Maine Railroad yard parallel to Bridge Street until near Lochmere Square, where it will be brought down to the ground level on private land located inside the intersection of Cambridge and Bridge Streets.

From this point two sets of double tracks will connect with existing surface tracks, and the latter will, except for this new connection, remain as at present in the square. The surface lines will be necessary over the new dam into Boston to accommodate the West End and Charles Street routes, although cars for the center of the city will probably use the elevated structure. The new plan is acceptable to the city of Cambridge, the Charles River Basin Commission and the Boston & Maine Railroad, and will probably be approved.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED OCT. 29, 1907

869,275. Block Signaling System; Louis H. Thullen, Swissvale, Pa. App. filed May 15, 1907. A cab and block system wherein the current for the signal operating relay in the cab is obtained by induction from a wire or other conductor extending parallel to the track.

869,298. Split Switch; George M. Ervin, Johnstown, Pa. App. filed April 22, 1905. A tip for switch points which may be readily removed and replaced when worn.

869,364. Air Brake System; Laurence A. Hawkins, Schenectady, N. Y. App. filed Feb. 3, 1906. An electrically operated air brake system having magnet-operated valves.

869,365. Block Signal System; Laurence A. Hawkins, Schenectady, N. Y. App. filed March 28, 1906. The system employs the rail as return conductor for the power current. Parallel tracks are cross-bonded so that a circuit may still be maintained in case a rail is broken.

869,298. Automatic Device for Protecting Trains; Eduard Unverricht, Altona, Germany. App. filed Jan. 8, 1906. Automatic means for protecting railway trains and controlled by electric circuits. Designed to prevent a collision of trains running in opposite directions along the same line. Covers details of construction.

869,403. Strain Insulator; Albert Anderson, Boston, Mass. App. filed March 2, 1906. Has a metallic shell inclosing insulating material in which the terminals of the conductors are embedded.

869,404. Strain Insulator; Albert Anderson, Boston, Mass. App. filed July 5, 1906. Modifications of the above.

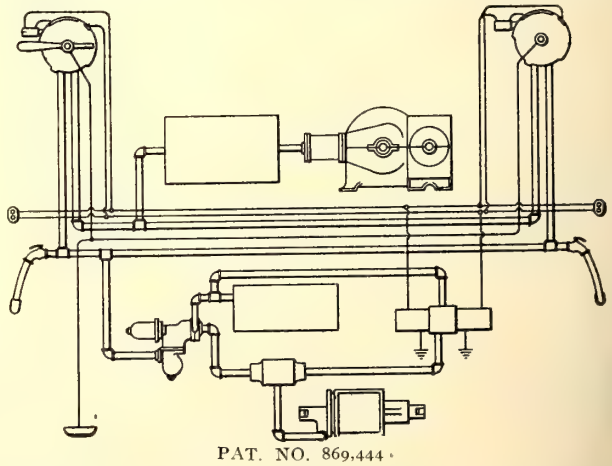
869,425. Railway Car Brake; Seth A. Crone, New York, N. Y. App. filed July 24, 1907. Has a cast metal body and plate back, the back having at its end a pair of opposite transverse inwardly inclined lips slit therefrom and embedded in the cast metal.

869,429. Folding Car Step; William G. Felkner, Sebree, Tex. App. filed Feb. 6, 1907. The car steps when not in use fold to form the lower portion of the car door, the upper part of the door being swung outwardly and upwardly simultaneously with the lowering of the steps to position.

869,444. Air Brake System; George Macloskie, Schenectady, N. Y. App. filed April 7, 1906. A combined electric and pneumatic air brake system in which the brakes are preferably controlled by electric means, but may be pneumatically controlled in case the electric means fail for any reason.

869,455. Motor Car; Spencer Otis and Harry S. Hart, Chicago, Ill. App. filed July 26, 1906. The motor mechanism is so located on the car as to take up a minimum amount of space and be readily accessible at all times to the motorman; also provides an improved motor and other details.

869,456. Motor Railway Truck; Spencer Otis, Chicago, Ill. App. filed Nov. 7, 1906. A motor truck in which the main driving motor may be operated continuously in the same direction of rotation while the drive-wheels of the truck may have their direction of rotation reversed. Has bevel gear mechanism with clutches.



PAT. NO. 869,444.

869,459. Electric Railway System; William B. Potter, Schenectady, N. Y. App. filed April 3, 1900. Relates to sectional electric railway systems provided with means for preventing trains from approaching nearer to each other than the length of the section. Has arrangements for operating the brakes and signaling devices especially adapted for the system.

869,465. Third-Rail Contact Shoe; Samuel B. Stewart, Jr., Schenectady, N. Y. App. filed July 5, 1902. A collector shoe of the underneath contact type. Relates to mechanical details of construction.

869,467. Railway Signal; Charles W. S. Turner, Mountville, Va. App. filed Feb. 1, 1907. Mechanical and electrical features of construction of a block signal system having section rails energized by a direct current and employing polarized relays.

869,506. Train Pipe Coupling; William H. Myers and William G. Stevens, Belleville, Ill. App. filed April 12, 1907. A train pipe coupling comprising a pair of fluid conducting pipes having openings in the walls thereof; valves carrying the pipes, and a pair of spring-pressed coupler heads slidably mounted upon the pipes and arranged for assemblage with each other.

869,531. Railway Signaling; Jacob B. Struble, New York, N. Y. App. filed June 27, 1906. Relates to the use of apparatus by means of which an alternating current in the railway conductors may be changed to a direct current and used in circuits for controlling the passage of the trains.

869,552. Signal Apparatus; Clarence W. Coleman, Westfield, N. J. App. filed Feb. 4, 1907. The signal has a normal bias to danger position and normally operates to go to danger position in response to said bias. Has a fluid-pressure piston motor for moving the signal to safety position.

869,555. Block Signal System; William Daves, Bloomington, Ill. App. filed April 22, 1907. Provides a signal system in which any negligent action on the part of the signalman in the manipulation of the apparatus at his station will result in the display and maintenance of a danger signal until normal conditions are resumed.

869,576. Signaling System; Edward E. Kleinschmidt, New York, N. Y. App. filed Aug. 10, 1906. A block system for single track electric roads in which the return current is carried by rails. Has means for registering the number of cars which enter a block in both directions.

869,592. Fluid Pressure Brake; Robert A. Parke, New York, N. Y. App. filed Aug. 1, 1902. An improved valve device operating in response to variations in fluid pressure and in connection with an additional or supplemental reservoir for controlling the release from the brake cylinder, and communication from the additional reservoir, or source of pressure to the auxiliary reservoir or valve device.

869,606. Fluid Pressure Brake; George Westinghouse, Pittsburg, Pa. App. filed Jan. 25, 1904. Provides an improved means for securing a local discharge from the train pipe at or near each triple valve device throughout the train in service applications of the brakes, to thereby accelerate the movement of the successive triple valves by the well-known serial action as the wave of reduction is thus carried rapidly through the full length of the train pipe.

869,645. Railway Tie; Martin J. Nolan, Philadelphia, Pa. App. filed March 5, 1907. A railway tie consisting of a solid mass of slag and having vertical openings adjacent to the rail seats for the reception of the rail fastenings.

869,711. Trolley; Samuel D. Hunt, Youngstown, Ohio. App. filed April 24, 1907. In place of a trolley wheel a pair of rounded fingers are provided with ball and socket connections to the harp and which are guided between separate trolley wires.

869,812. Controller; Emmett W. Stull, Norwood, Ohio. App. filed Aug. 17, 1904. Motor control system for a plurality of motors designed to obtain a uniform acceleration of the motors through series and parallel connections.

869,824. Control System; Louis M. Aspinwall, Wilkinsburg, Pa. App. filed Jan. 3, 1905. A control system for electrical translating devices. Provides means for preventing the formation of such circuit connections in the power motors that they may act as translators and deliver current to the controlling devices.

869,843. Trolley Head for Electric Traction; Garnet B. Holmes and Arthur D. Allen, Wellington, N. Z. App. filed Aug. 7, 1907. The axle of the trolley wheel is mounted in journal blocks which have a slidably yielding movement.

12,710. Air Pressure Brake; Erwin Kramer, Berlin, Germany. App. filed July 1, 1907. Provides a brake in which the pressure exerted by the brake-blocks above a certain speed depends on the rotative velocity of the wheels. The valve device which charges or discharges the compressed air into or out of the brake cylinder is regulated by a device which acts on the valve with a varying force, tending to displace the same in accordance with the velocity of rotation of the wheel axle.

12,712. Air Brake System; Frank H. Dukesmith, Meadville, Pa. App. filed May 10, 1907. Provides a system whereby the engineer may control the engine brakes and train brakes independently of each other or in unison.

PERSONAL MENTION

MR. ROBT. SHERMAN has resigned as superintendent of the Los Angeles-Pacific Railway.

DR. THOMAS B. SHUMWAY, president of the Plymouth & Middleboro Street Railway, of Plymouth, Mass., is dead.

MR. P. G. GOSSLER, of New York, has been elected to succeed President W. E. Harrington, of the Pottsville Union Traction Company, who resigned several weeks ago. Mr. W. L. Sheafer, of Pottsville, has been chosen vice-president of the company.

MR. C. S. MELLEN, president of the New York, New Haven & Hartford Railroad Company, has withdrawn from all official connection with the electric railway companies in Massachusetts held by the New England Investment & Securities Company, of Boston.

MR. W. F. HERRIN has been selected as the responsible head of the Pacific Electric Railway, Los Angeles Interurban Railway Company and the Los Angeles Railway Company, to act during the absence from California of Mr. H. E. Huntington, who is sick at Oneonta, N. Y., his old home.

MR. E. B. McKINNEY, superintendent of power of the New Orleans Railway & Light Company, has been appointed superintendent of equipment in connection with his office as superintendent of power, and besides the various power stations and sub-stations, will have entire control of the car barns, car shops and all rolling stock belonging to the company. Mr. McKinney is one of the best informed men in electrical matters in the South, and has been connected with the operation of power plants and equipment in New Orleans since 1889.

MR. B. E. MERWIN has resigned as general superintendent of the Interurban Railway & Terminal Company at Cincinnati to accept a similar position with the Aurora, Elgin & Chicago, with headquarters in Chicago. Mr Merwin has been with the company since its organization and when he left he was presented with a diamond stud by employes and those associated with him in the work. Mr. F. H. Talbot, who has been assistant to President Charles H. Davis for some years, has been appointed to succeed Mr. Merwin with the Interurban Company.

MR. D. L. BENSON, for a number of years on the constructon and operating staff of H. M. Byllesby & Company, of Chicago, died at the Lake Geneva Sanitarium, Lake Geneva, Wis., after a lingering illness, Monday evening, Nov. 4, at the age of 40 years. Mr. Benson was well known in the electric light, street railway and gas fields of the Middle West, having been prominently connected with the construction of utility plants at Shelby, Ohio; Muskogee, I. T.; Oklahoma City, Okla.; Ottumwa, Iowa, and other points. Mr. Benson is survived by a widow and a daughter.

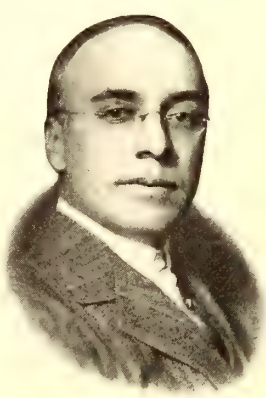
MR. ELMER M. WHITE has resigned as treasurer and auditor of the Birmingham Railway, Light & Power Company, of Birmingham, Ala., and will be succeeded by Mr. C. M. Cory, who was formerly auditor of the Birmingham system, but who has recently been auditor of Ford, Bacon & Davis. This position is now abolished, and Mr. Cory has returned to his former position. Mr. White has been secretary of the American Street and Interurban Railway Accountants' Association since January, 1904. He has been engaged in street railway work for a long time, and for 20 years was associated with the accounting department of the Hartford Street Railway Company, of Hartford, Conn. Mr. White resigned this position in 1905, after the road was acquired by the Consolidated Railway Company, of New Haven. From Hartford he went to Birmingham, first as assistant treasurer and assistant secretary, and later was appointed to the position which he has just resigned. He is now temporarily in New York at the office of the American Street and Interurban Railway Association, where he is engaged in supervising the publication of the Proceedings of the Atlantic City Convention of the Accountants' Association.

MR. H. C. PAGE, general manager of the Springfield Street Railway Company, of Springfield, Mass., has been elected vice-president and general manager of the company, while Vice-President L. S. Storrs, who is also vice-president of the New England Investment & Securities Company, has been elected

president of the company, to succeed President Charles S. Mellen, of the New York, New Haven & Hartford Railroad, who, as announced elsewhere in this issue, has decided to withdraw as an officer from the Massachusetts street railway companies controlled by the New Haven Railroad. Mr. Page has been in charge of the Springfield Street Railway for about two and one-half years, coming to Springfield from Pittsfield, where he was manager of the Berkshire Street Railway. Before that he was general superintendent of the Boston & Northern Company, which had some 450 miles of trackage. Mr. Page began his railroading experience with this latter company, and served it in various capacities for 20 years. Mr. Page is president of the New England Street Railway Company.

MR. HARRO HARRSEN, general superintendent of the Mexico Tramways Company since April and acting general manager of the company, has been appointed general manager. The new appointment does not affect the personnel of the company, as under a general order issued June 17, just previous to the departure of Mr. R. C. Brown, managing director, for the United States, heads of departments were directed to report to Mr. Harrsen as the acting general manager of the company during the absence of Mr. Brown. Mr. Harrson first came to Mexico about fourteen years ago. While acting as assistant foreman of the Emerson Electric Manufacturing Company, of St. Louis, Mr. Harrsen received the appointment as assistant superintendent of the Aguascalientes Electric Light Company, in the city of that name. After twelve or fourteen months in the employ of that company Mr. Harrsen was appointed private secretary to Mr. Thomas H. McLean, president and general manager of the old mule and steam tramways operating company of Mexico, and served in this capacity until April, 1898. He left Mexico at that time, accompanying Mr. McLean to Toledo, Ohio, where Mr. McLean had been appointed general manager and vice-president of the Toledo Railway & Light Company. After the death of Mr. McLean, Mr. Harrsen continued in the employ of the company and held successively the positions of chief dispatcher, division superintendent and superintendent. Upon severing his connection with the Toledo Company he undertook the management of the International Companies. After about a year in this capacity, Mr. Harrsen was made general superintendent of the Mexico Electric Tramways Company.

MR. THEODORE STEBBINS has accepted the position of general manager of the Texas Traction Company, which, as mentioned elsewhere in this issue, will put in operation within a few months an interurban electric railway between Dallas and Sherman, Tex. The distance between these cities is about 65 miles and the company has under contemplation important extensions southward. The line is being built by the American Railway & Lighting Company, which owns and operates six electric lighting and gas properties in the neighborhood of Dallas, with which Mr. Stebbins is also connected and for whose lighting properties he will act in an advisory capacity. Mr. Stebbins has a wide acquaintance with electric traction and lighting properties, which eminently fits him for the work which he now has on hand. Soon after his graduation from the Massachusetts Institute of Technology, in 1886, he became connected with the General Electric Company and had charge of its interests in connection with the many local electric railway and lighting companies in which it was part owner. In 1904 he resigned from the General Electric Company to accept the general managership of the important system of interurban railways centering in Columbus then owned by Mr. A. E. Appleyard. When these lines went into the hands of a receiver Mr. Stebbins was appointed manager under the receivers and conducted their operation until the early part of 1906, when their mortgages were foreclosed and they were reorganized. Just at this time the National Civic Federation commenced its investigation of the management of public utility companies and Mr. Stebbins was offered and accepted the position of expert on electric lighting properties during the investigation. He has recently returned from an extensive trip to South America and Europe, undertaken for American and London financial interests. Mr. Stebbins presented papers on economic subjects at the last two meetings of the American Street & Interurban Railway Association.



THEODORE STEBBINS.

MR. C. D. WYMAN, of Stone & Webster, Boston, died very suddenly from heart trouble, Sunday morning, Nov. 10, while en route from Boston to Seattle, where the company has important properties. Mr. Wyman was a very prominent figure in the street railway industry for the last 20 years, and held many positions of responsibility and trust. He was a native of Racine, where he was born Aug. 28, 1850. At an early age he moved with his mother to Rochester, where he lived for a number of years and where his education was for the most part gained. After spending one year at the University of Rochester he went to Chicago and completed his university course at the Chicago University, graduating therefrom with the degree of B.A. in 1872. In the fall of the same year he accepted the position of private secretary to Hon. G. Hilton Scribner, at that time secretary of the State of New York. Mr. Wyman then moved his residence to Albany, where he took up the study of law and received the degree of B.L. from Union University, at Schenectady. Mr. Wyman's street railway work began in 1874, when he was elected secretary of the Central Park, North & East River Railroad Company, of New York City, commonly known as "the belt line." He held this position until 1879, when he resigned to accept a directorship and the office of secretary and treasurer of the American District Telegraph Company. In the fall of 1880 he was elected a director and vice-president of the Belt Line Company, of which Mr. Scribner at that time was president. During his residence in New York, Mr. Wyman was active in the New York State Street Railway Association, and served as president of that organization during 1892-93. In the latter year he resigned from the Belt Line to organize and manage the electric launch service at the World's Fair grounds in Chicago at the time of the exposition. After the close of the fair Mr. Wyman accepted the position of general manager of the Milwaukee Electric Railway & Light Company, where he remained until 1896, when he accepted the position of general manager of the New Orleans Traction Company, under which title the principal railways in New Orleans had then recently been consolidated. While in New Orleans the city was visited by a yellow fever epidemic, but Mr. Wyman remained at his post throughout the entire period. In 1900 he resigned from New Orleans to accept the connection with the firm of Stone & Webster, which he held at the time of his death and where his wide experience was of the greatest value in settling the policies of management and operation of the various properties whose affairs this firm is conducting. At the time of his death he was in immediate charge of their Pacific Coast properties, serving as president of two of them, as vice-president of eight and as a director in nineteen. He was also a member of the following organizations: The Exchange Club, City Club and Twentieth Century Club, of Boston; the Transportation Club, of New York; and Lodge No. 30, B. P. O. Elks, of New Orleans. He was first vice-president of the American Street Railway Association in 1889-90 and a member of the executive committee in 1886-87 and 1897-98. He was also chairman of the committee on municipal ownership of the American Street and Interurban Railway Association for the last two years, and as such presented the reports on this subject at the last two meetings of the association which have attracted wide attention. Mr. Wyman was also a frequent contributor to the technical press, one of his most interesting articles having appeared in the Souvenir Issue of the Street Railway Journal dated Oct. 8, 1904, entitled "The Evolution of the Industry, In Horse Car Days." Mr. Wyman is survived by a widow and three daughters. The funeral services will be held Nov. 18, 1907, at 2 p. m. from his late residence in Brookline, Mass.



MR. C. D. WYMAN.

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Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1907 *to date* 386,950 *copies, an average of* 8232 *copies per week.*

Evaluating the Right of Way

A modern high-speed interurban road must be operated over a private right of way throughout a large part of its length if it is to give fast service. This is one of the truisms of progressive railroading, and yet when a new line is projected in some parts of the country it is often difficult to secure the money necessary to keep the cars off the traveled highways. In the interests of first-class service at good schedule speeds it is most important that the actual money value of the right of way be appreciated as an operating asset. Exact figures may be difficult to secure, but some sort of arithmetical estimating of the difference it will make if a right of way is not secured ought to be attempted in the great majority of cases, just as the financial cost and value of a terminal station in the heart of a great city are weighed.

In a recent case which was very carefully figured it was found that if a proposed line should be built with 25 per cent additional highway trackage, the schedule time between terminals would be increased 50 per cent. Speed-time curves were plotted for a given motor equipment and schedule, and then a new set of curves was plotted for the same equipment, changing 25 per cent of the route from the private right of way to the highway. Careful allowance was made for the grades, curves and peculiar operating conditions of both routes, and the result emphatically demonstrated the importance of figuring the influence of the right of way, while in the case in point it showed clearly that the sacrifice of time resulting from too much highway running would be prohibitive to the best modern service.

It is not the purpose of these paragraphs to urge the private right of way upon all new trolley enterprises, for in many instances it is unquestionably the better policy to build a moderate speed road on the highway. But where fast time is desired, and by this is not necessarily meant record-breaking spurts at forty to sixty miles per hour but a high average speed, including stops, the highway is no place for success. There are many aspects of the private right of way which are forgotten in some of these projects, which grow out of the old-time conditions of local step-by-step service from door to door. Thus, a reduction of the accident bills is one certain result of keeping off the highway, while another is the important point that the equipment selected for a given running time need not be as powerful for private right of way operation as it would have to be in case it was required to propel the same weight of car over the highway in the same running time between terminals. The acceleration needed will not be as stiff, and the maximum speed which the equipment and the road must be built for can be lower for the same schedule, in favor of the private right of way. Less powerful equipment on the cars means a lower power station and distribution investment for the same time-table service, and a reduced cost of roadbed, bridges and track.

There is no question that operating expenses on a private right of way are less for the same service than on a highway. It is difficult to present actual figures proving this in specific cases, for the service capacity of a road with a high percentage of private right of way is so much be-

yond that of a parallel highway line, that it almost always results in a faster and better service being given in the former case. Even comparing the cost of operation per car mile on a private right of way interurban with the cost on a highway system making slower schedule speeds, there is little to expect but a result favorable to the interurban by perhaps 20 to 30 per cent. Promoters of new lines often shy at the cost of the necessary strip of land, especially after the farmers who own the soil in the region to be traversed get wind of the prospective development, but in all cases where fast service is required it is a necessity to keep out of the speed throttling obstacles which abound even on the average country highway. In some instances a saving of 10 or 15 minutes on a run may mean all the difference between the success or failure of a competing service.

Engine Room Signals

As the capacity of power plants increases, the need of reliable signals in the engine room becomes more and more important. Hand signals between the switchboard and the generating room floor are perhaps the simplest means of communication in regular use, but in large installations it is absolutely essential to insure that there shall be no misinterpretations. Interlocks against mistakes are features of the most carefully planned switchboard practice, and the use of both visual and audible signals in the engine room are characteristic of much recent power house operation on a large scale.

Steam and air whistles, gongs, telegraphic indicators, lamps, telephones and speaking-tubes have all been pressed into this kind of service, and to a considerable extent the conditions determine the choice in a given plant. The use of long and short blasts or rings to indicate what is desired is open to the objection that counting or its equivalent is necessary in times of emergency, and perhaps the simplest and most reliable plan thus far developed is to call the attention of the men on the floor or gallery by an audible signal, leaving the subsequent indications to be given by an electrically lighted transparency. It is not a matter of serious expense to provide transparency signals at any desired point in the station, and the arrangement precludes the errors of interpretations that are so often outgrowths of complete dependence upon audible signals. The transparency and its circuits are easily maintained in good order, and are flexible in the extreme.

While unmistakable and simple signals are necessary between the floor and the switchboard gallery of a large plant, the communication essential between the engine or turbine room floor and the auxiliary or pump room below or at one side need not be of the same highly developed character to insure good results. Turbine auxiliaries are started and stopped on word from the operating engineers, but the absence of sensitive regulation and adjustment here enables the simple gong and speaking-tube to fill the need. In a recent installation the transparency is located in the middle of the switchboard gallery, indicating the machine number and all the necessary operating movements by remote control from the switchboard itself. The pump and condenser room is located beneath the turbine room floor. When an engineer wants anything done in the pump room, a mechanical gong is struck in the basement with the number of the machine affected. The pump operator at once gets in touch with the turbine room through a speaking-tube of the same number, below the corresponding generating unit, and the instructions are given and received orally. Complication is avoided, and the operation of the station becomes a simple matter on the score of internal communication. Emergency whistle or bell signals are of course desirable supplements in case of a failure of the lighting current used in the transparencies.

Making Special Apparatus in the Shop or Purchasing It

The first impulse of many enterprising master mechanics who go into a shop where there are no special appliances or facilities for performing various special operations, is to design and build such machines as will either expedite the work or cheapen it. The devices which can be gotten up are as numerous as are the operations necessary in caring for apparatus, but the frequency of their use determines, to a great extent, whether or not it will pay to spend time and money in constructing them. The small shop may not find it economical to construct many. If, for example, pinions are to be pulled only once in two or three months, there is probably no economy in going to the expense of building a device which will save a few hours during the year. On the other hand, if the work can be done better with a special piece of machinery than by hand, it may pay to build or purchase such an appliance, although the saving in time alone will not warrant the necessary expense.

Estimates of the cost of construction of such machinery, made before it is made in the shop, are usually far below the actual costs. Frequently a great deal of experimenting and many changes must be made before the device can be gotten to work successfully, and sometimes the idea is an utter failure. And in the cost estimates the time and energies of the master mechanic or superintendent are not usually considered. But the money value of the attention given by the superintendent in devising and constructing a special device is sometimes so great as to make the cost of getting it up greater than the lessened costs or benefits resulting from its use. Within the last few years several manufacturers have undertaken to supply apparatus designed for special operations in the car house. There are now to be found on the market pinion pullers, armature stands and carts, banding machines, pit hoists, babbitting machines, and a number of other repair-shop devices, which have passed the experimental stage, and which a purchaser may feel assured will do the work they were built for in a satisfactory manner. In many instances it would, no doubt, be more economical for master mechanics or car-house foremen to purchase these devices from manufacturers instead of going to the trouble to build them themselves.

The master mechanic who considers that he is a special genius in getting up homemade devices need not feel that the opportunities to work along this line will be destroyed by purchasing those devices on the market. Their number is so small, compared with that of the possible devices that can be put to good use, that there will still be demand for all the energies he cares to devote to the work.

Traffic Congestion and the Conduit System in New York

Plans for reducing street congestion in New York City have again been actively taken up, this time by the Public Service Commission of the First District, which has found time, in spite of its other multifarious duties, to hold several hearings on the subject during the past week. The problem is confessedly one difficult of solution, and the testimony shows that the blockades and delays to all surface traffic caused by the street congestion are constantly becoming more serious. Under the law the Public Service Commission has no jurisdiction over any traffic except that of the street railway companies, as power over the streets, so far as ordinary vehicles are concerned, lies with the Board of Aldermen. It is possible, however, that the hearings are being held by the Commission to determine to what extent improvement is possible and that the plan is to embody some recommendations on this subject in the forthcoming petition of the Commission to Albany for enlarged powers.

The testimony so far given has developed nothing particularly new. It is an old story that, owing to the peculiar topography of New York, including as it does many streets which were planned for the requirements of a Dutch village but not those of a modern city, the natural conditions seem to be about as bad as they could be, although the present tendency of erecting tall office buildings is constantly making them worse. As usual, certain of the witnesses consider the surface cars cause some of these delays. Perhaps they do, but there is one point in this connection which has not been clearly brought out; that is, that the companies are handicapped in giving good service by an unfortunate system of conducting current to their cars. It was not of their selection and they cannot be held responsible for its adoption. After it was forced upon them they called to their assistance the most expert knowledge in the country. Their engineers have practically made the system possible and have concentrated their attention constantly upon its improvement. The fact remains, however, that the underground conduit system is not and never can be as satisfactory or as reliable a system for street car propulsion as the overhead trolley. It has never been claimed to be so by anyone connected with the New York companies. It cannot be made as desirable because its troubles are inherent to the system.

Those residents of New York who see the cars on the streets and do not visit the repair shops, may believe that it is as simple an undertaking to collect current from conductors in a conduit as it is from a wire 18 ft. above the track, but anyone acquainted with the properties of electricity knows that the nearer the conductor is to the ground the greater are the troubles, and that when the conductors are carried in what is practically a small open drain in the middle of the street, the difficulties become enormous. Take the design of the plow itself; realize that it involves the maintenance of an efficient set of collectors in a position entirely out of sight, and the protection of comparatively high-potential leads in a shank of steel 9/16 in. wide and exposed to great side wear, and the mechanical difficulties of the problem are apparent. Its seriousness is shown by the fact that an average of one hundred electric cars per day, out of eighteen hundred or two thousand in use on Manhattan Island, are disabled from trouble with plows alone, although the plow has been greatly improved since its original design, and still is being given constant attention.

Other difficulties encountered in the system are in the maintenance of a constant width of the slot and a constant distance between the conductors. A track can be kept to gage by tie-rods, and a slight difference in width of gage can be accommodated by the treads of the wheels; in fact, in large-radius curves the gage is frequently widened a quarter of an inch. With a slot seven-eighths of an inch wide, however, the conduit engineer is working with small dimensions and has no way of tying the slot rails together, except by bracing them from below on the yoke or from the sides by rods. In summer these rods often expand sufficiently to allow the slot to get tight, while in winter the slot rails are forced toward each other by the ice which forms between the interstices of the block paving. Tight slots constitute a constant menace and are avoided only by the greatest vigilance. Even this is not always adequate, however, as is shown by the fact that one day last winter eight hundred cars out of eighteen hundred were disabled from this cause. If the trouble had been confined to the destruction of the plow alone it would not have been so disastrous, but the plow is heavy and has to be held so firmly on the truck that a tight slot usually disables the truck and other parts of the car.

Troubles connected with keeping the conductor bars in alignment are probably not so severe as those already mentioned, but the work is a great undertaking. Its extent and importance can be realized by any engineer who will consider that it corresponds to keeping in alignment, to the fraction of an inch, conductor bars equivalent in length to the distance from New York to Buffalo, located not in the open where they can be easily seen, but in a conduit too small to admit the passage of a man. Add to these conditions the occasional setback of sewage and salt water in the conduit during a high tide or after a heavy rainfall and the drifting into it of snow in winter, and the difference between overhead and underground construction can easily be appreciated. In fact, the operation of the New York City railway system at all has been due only to the exercise of constant watching and the expenditure of a large amount of money on the part of the street railway company, with the application to the problem of the best expert knowledge available.

These facts are not introduced because they are particularly new. They have been a matter of common knowledge to all who have been acquainted with the actual operating conditions in New York City, and there has been no concealment of them by either the operating managers or the engineers of the company. They have been mentioned briefly under the belief that the general public in New York is not familiar with the special difficulties which accompany conduit railway operation, and to explain some of the facts which developed at the hearing of the Public Service Commission in New York. They may also be of assistance in other cities where there is occasionally an insensate demand for the substitution of the conduit system for the trolley, on the part of those who are not acquainted with the difficulties connected with conduit operation in New York City.

POWER PLANT IMPROVEMENTS AT EL PASO

During the past two and one-half years the lighting, power and railway load of the El Paso Electric Railway Company has been increasing so rapidly that it has been necessary to add 1500 kw in turbo-alternators to the station equipment, which originally had a normal capacity of about 1000 kw. On account of the limited space available in the station for expansion and the unfavorable conditions in regard to water supply the carrying out of the changes necessary introduced several interesting problems into the work from time to time, which will be outlined in the following paragraphs. The design and construction work at El Paso was handled by the Stone & Webster Engineering Corporation, of Boston, Mass.

The arrangement of apparatus in the El Paso station at the time the first important increase in capacity was made is shown in Fig. 1. About two and one-half years ago the station contained eight boilers aggregating 1150 hp, five generating units normally good for upward of 1000 kw, a 20-in. x 30-in. x 24-in. Blake jet condenser rated at 1000

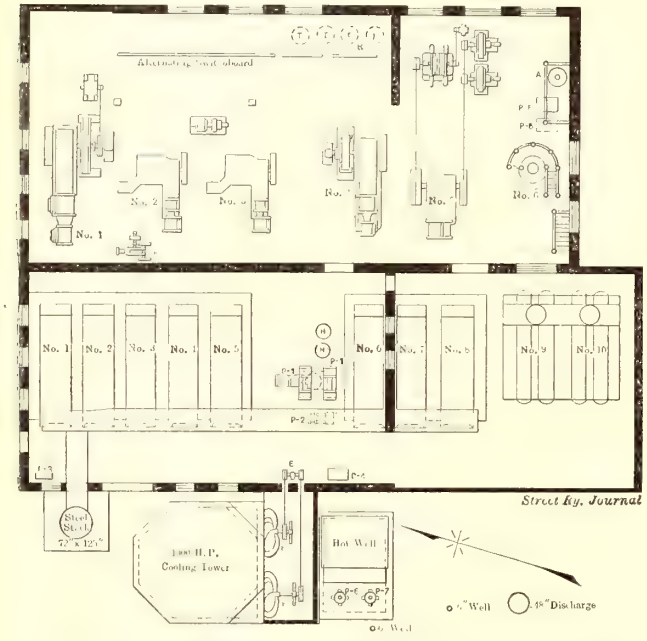


FIG. 1.—OLD GENERAL PLAN OF EL PASO STATION

LEGEND

Boilers. Nos. 1, 2, 5, 6, 7 and 8.—72" x 20", 150 hp each; steam pressure 130 lbs.
Nos. 3 and 4.—66" x 20", 125 hp each; steam pressure, 130 lbs.
Nos. 9 and 10.—Each 350 hp; steam pressure, 150 lbs.
A.—8" x 8" oil pressure accumulator.
B.—10" x 8", 150 r. p. m., 15 hp individual motor, 220 volts, 600 r. p. m.
C.—20" x 30" x 24" 1000 hp condenser.
E.—35 hp engine 9 x 6, 400 r. p. m.
F.—108" fan, 250 r. p. m., 164,000 cu. ft. per minute.
Unit. No. 1.—450 hp, 19-32 x 22, 150 r. p. m., 300 kw., altern. 2 ϕ 60 $\sim$ 2200 volts, 20-kw exciter, 125 volts.
Units Nos. 2 and 3.—150 hp, 12¾-20 x 14, 250 r. p. m.; 100 kw, alt. 2 ϕ 60 $\sim$ 2200 volts.
Unit No. 4.—300 hp, 15 x 25 x 20, 200 r. p. m., 200-kw generator, 575 volts.
Unit No. 5.—300-hp 14½ x 24 x 16,220 r. p. m.; two 100-kw generators, 550 volts, 650 r. p. m.; 200-kw No. 7 alternator, 2 ϕ 60 $\sim$ 2200 volts, 600 r. p. m.; 5-kw ex., 60 volts.
Unit No. 6.—500-kw turbo-generator, 2 ϕ 60 $\sim$ 2200 volts, 1800 r. p. m.
T.—50 light constant-current transformers.
Ex.—15 hp ind. motor, 2 ϕ 220 volts, 1200 r. p. m.; 10-kw General Electric generator, 125 volts.
P-1 6-3½ x 6 boiler-feed pump.
P-2 8-6 x 10 boiler-feed pump.
P-3 Fuel oil-feed pump.
P-4 Fuel oil-feed pump.
P-5 4½ x 4 oil pressure pumps.
P-6 6-in. volute pump, 1000 gals. per minute.
15-hp General Electric ind. motor, 220 volts, 1200 r. p. m.
P-7 8-in. volute pump, 1800 gals. per minute.
30-hp ind. motor, 220 volts, 900 r. p. m.

hp, a steel stack 125 ft. high and 72 ins. inside diameter, and a 1000-hp cooling tower outfit. Crude oil from the Texas fields was burned beneath the boilers at a cost of from 80 cents to $1 per barrel. The boiler grates originally supplied had been laid at one side and burners fitted beneath the water heating spaces, the oil being vaporized by steam pressure upon its admission to the fire boxes. The station is located about 100 yards from the banks of the Rio Grande River, but as this stream runs dry for two or three months each year, water for the boilers and condensing system is drawn from artesian wells. Some four or five years ago the engineering department of Stone & Webster designed a cooling tower to enable the water to be used over and over, taking simply enough from the ground to supply the losses in evaporation and by other causes.

At this time the station building consisted of a boiler room about 101 ft. long by 40 ft. wide, and an engine room of about the same length but 47 ft. in width. The cooling tower was located on the ground outside the boiler room, with a hot well adjoining. The following boilers were in service:

Six 72-in. x 20-ft. 150-hp longitudinal return tubulars, 130 lbs. steam.

Two 66-in. x 20-ft. 125-hp longitudinal return tubulars, 130 lbs. steam.

The generating units consisted of:

Unit No. 1, 450-hp Ridgway 19-in. x 32-in. x 22-in. engine, direct connected to a 300-kw General Electric, 2200-volt, two-phase, 60-cycle alternator, 150 r. p. m.

Units Nos. 2 and 3, 150-hp Ames 12¾-in. x 20-in. x 14-in. engine, each direct connected to a 100-kw Stanley, 2200-volt, two-phase, 60-cycle alternator, 250 r. p. m.

Unit No. 4, 300-hp Ridgway 15-in. x 25-in. x 20-in. engine, direct connected to a 200-kw Westinghouse, 575-volt, direct-current generator, 200 r. p. m.

Unit No. 5, 300-hp Ball & Wood 14½-in. x 24-in. x 16-in. engine, belted to two 100-kw General Electric, 550-volt generators, 550 r. p. m., and to one 200-kw Stanley, 2300-volt alternator, 600 r. p. m.

These machines, while for the greater part compound direct connected sets, were of too low capacity to meet the expanding loads upon the plant, and it was decided to extend the boiler room 12 ft. to the southward and to install a 500-kw Curtis turbine at the south end of the engine room. To supply steam for this unit two boilers, No. 9 and No. 10, were installed, each consisting of a 350-hp Aultman & Taylor unit built for 150 lbs. working pressure. The settings of these boilers were built without grates, to give a larger combustion chamber for the burning of fuel oil. It was found that if the grates were to be left in, the furnaces would become so contracted that the tubes would be burned out by the intense flames from the oil burners. Each of these boilers was provided with a stack 50 ft. high and 4 ft. inside diameter.

In the original installation the 1000-hp jet condenser referred to above received the exhausts of the low-capacity engines mentioned, and as a temporary expedient the new 500-kw turbine was connected to this condenser. This overloaded the condenser at times of peak load, but the operating situation was eased off by running some of the reciprocating units non-condensing when heavy outputs were required. It was felt that the turbine made better use of the condenser than the reciprocating units, so the former was given full benefit of the condensing apparatus. From the jet condenser the condensation water was carried to the cooling tower hot well and pumped to the top of the tower by two vertical shaft Worthington 6-in. and 8-in. pumps, P-6 and P-7 in Fig. 1. One pump has a capacity of 1000 gals. per minute and the other 1800 gals.,

the two being driven by a 15-hp, 220-volt General Electric induction motor making 1200 r. p. m., and a 30-hp motor of the same make and voltage, whose speed is 900 r. p. m. The original cooling tower, and this is still in service, was provided with two 108-in. Davidson fans, each driven at 250 r. p. m., with a capacity of 164,000 cu. ft. of air per minute, by a 35-hp, 9-in. x 6-in. Sturtevant engine making 400 r. p. m. The fans are belted to the engine pulleys, the latter being mounted inside the boiler room. The increase in plant capacity by the addition of the 500-kw turbine was thus effected by a very small addition to the floor area. There was very little space available for expansion on account of adjoining property.

During the past winter it was seen that further additions to the generating capacity of the station were necessary, and so fast did the load increase that 1000 kw was determined as the requisite immediate addition. It was found that two 500-kw Curtis turbo-alternators could be delivered sooner than one 1000-kw unit, and the equipment shown in Fig. 2 was therefore placed under contracts. Some of the old equipment was torn out, and the station as a whole underwent a noteworthy change in its make-up. Engine units 1, 2, 3 and 4 were retained in service. In place of the first five boilers of the old plant two new 520-hp Babcock & Wilcox units were installed and connected with the old flue by a cross breeching as shown. An addition was built on the west side of the boiler room about 45 ft. x 30 ft. in extreme dimensions, and in this area three 350-hp Stirling water tube boilers built for 150 lbs. steam pressure and 150 degs. F. superheat were installed. These were set in a full and half battery, with a 66-in. stock for each section, designed for oil burning. In connection with the new boiler installation a 2500-hp open type Cochrane feed water heater and purifier was purchased and placed in the boiler room near the original condenser pit.

The three 500-kw turbines each drive a two-phase, 2300-volt, 60-cycle General Electric generator, at 1800 r. p. m., and are all connected to a Worthington jet condenser equipped with two pumps of the crank and flywheel type. The space was too limited to permit the installation of three separate condenser outfits, so all the exhausts, which were 18 ins. each in diameter, were brought together into a 36-in. cast-iron trunk exhaust line leading into the condenser chamber. The condenser consists of two 14 in. x 26 in. x 18 in. vertical crank and flywheel pumps, each connected on the suction side to a central condensing chamber. Either pump may be out of service without interfering with the proper operation of the equipment. In the top of the condensing chambers a spray plate of rolled brass is located, and within the body of the condenser are located a combined air cone and separator of gray iron, designed to collect air and non-condensible vapors at or near the water surface in the condenser, remove all water and water vapors, and deliver them to the air cooling arrangement. The air cooling device is attached to the top of the condenser and consists of an annular chamber in which the outgoing air is brought into intimate contact with the cold entering injection water, thus reducing the volume of air to be discharged. With this installation two 8 in. x 14 in. x 12 in. rotative dry vacuum pumps were provided.

It was also necessary to install a second cooling tower and hot well, when the turbine exhaust was taken away from the old condenser and brought to the new unit. The tower and its equipment were supplied by Henry R. Worthington. The tower is of the fan type, located on the ground considerably beyond the first tower, west of the boiler room, and it is provided with interlocking pipe filling. It is a cylinderical sheet steel stock resting on a masonry foundation, and is 34 ft. high and 22 ft. in diameter. The hot delivery water is carried through a central vertical discharge pipe to a level above the filling and into a revolving distributor provided with radial arms from which the water issues through numerous brass spouts, the reaction of the jets serving to revolve the distributor. The moving portion of the distributor is provided with a babbitted bearing revolving upon a hemispherical bronze journal, and is lubricated by a hand oil pump. The lower portion of the stack is furnished with four circular steel castings riveted to the shell and provided at the outer ends with angle iron rings, to which are bolted four 108-in. circular semi-pressure

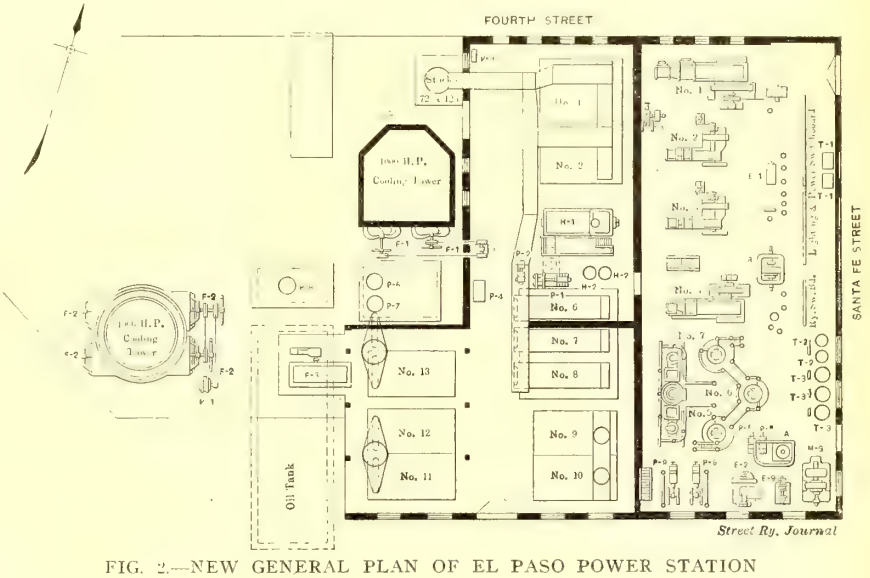


FIG. 2.—NEW GENERAL PLAN OF EL PASO POWER STATION

LEGEND

Boilers. No. 1 and No. 2.—520-hp steam pressure, 150 lbs.
Nos. 6, 7 and 8.—72 x 20″, 150 hp each, steam pressure, 130 lbs.
Nos. 9 and 10.—350 hp, steam pressure, 150 lbs., 150° superheat.
Nos. 11-12 and 13.—350-hp, 150 lbs., 150° superheat.
A.—8″ x 8″ oil pressure accumulator.
B.—10 x 8 150 r. p. m., 15 hp ind. motor, 220 volts, 600 r. p. m.
C-1.—1000-hp condenser, 20-30 x 24 single pump.
C-2.—1500-kw, 2-14-26 x 18 vert. pumps.
G.—35-hp engine, 9 x 6, 400 r. p. m.
F-1.—108″ fan, 250 r. p. m., 164,000 cu. ft. per min.
F-2.—72″ fans, 295 r. p. m.
H-1.—2500-hp open heater.
X — 102″ forced draft fan.
M-1.—75-hp 8 x 10 engine, ind. motor, 2300 volts, 690 r. p. m.
F-3.—8″-6″ forced draft fan, 8 x 10 eng., 195 r. p. m.

Pumps. P-1.—14-8 x 12 duplex feed pump.
P-2.—8-6 x 10 boiler feed pump.
P-3.—Fuel oil feed pump.
P-4.—Fuel oil feed pump.
P-5.—6-2-6 pressure pumps.
P-6.—6″ submerged pump, 1000 gals. per minute; 15-hp ind. motor, 220 volts, 1200 r. p. m.
P-7.—8″ submerged pump, 1800 gals. per minute; 30-hp G. E. ind. motor, 220 volts, 300 r. p. m.
P-8.—12″ submerged pump, 690 r. p. m.; cap. 3500 gals. per minute; 100-hp ind motor, 2300 volts.
P-9.—8″-14 x 12 dry vacuum pump.
Unit No. 1.—450-hp, 19-32 x 22, 150 r. p. m.; 300-kw altern., 2 ϕ 60 $\sim$ 2200 volts, 20-kw exciter, 125 volts.
Unit Nos. 2 and 3.—150 hp, 12¾-20 x 14, 250 r. p. m.; 100-kw, 2 ϕ 60 $\sim$ 2200 volts.
Unit No. 4.—300 hp, 15 x 25 x 20, 200 r. p. m.; 200-kw gen., 575 volts.
Units No. 5, 6, 7.—500-kw turbo-gen., 2 ϕ 60 $\sim$ 2300 volts, 1800 r. p. m
R.—300-kw rotary 2 ϕ 60 $\sim$ 550 volts, 600 r. p. m.
M-6.—300-kw motor gen., 600 volts, 720 r. p. m., 2 ϕ 60 $\sim$ 2300 volts, syn. motor.
E-1.—10-kw co. motor exciter, 125 volts, 1200 r. p. m., 2 ϕ 60 $\sim$ 220 volts, ind. motor.
E-2.—30-kw exciter, 125 volts, 350 r. p. m., 8 x 9 Batis engine.
E-3.—35-kw motor exciter, 125 volts, 850 r. p. m., 2300 volt ind. motor.
T-1.—165-kw transformers for rotary 2200/410 volts.
T-2.—100 lt. constant current transformers.
T-3.—50 lt. constant current transformers.

fans making 295 r. p. m. The fans being belt driven by a Westinghouse 75-hp 2300-volt induction motor making 690 r. p. m. There are two fan shafts, each being extended at one end and provided with pulleys to allow of cross belting.

In the center of the tower and set into the ground is a concrete suction tank or cold well. The cooling surface of the tower rests on a grating placed over I-beams, and consists of galvanized tubes arranged vertically in courses with the joints broken, so that the walls of each tube intersect the open centers of the tubes in adjoining courses, so that the water descending over each tube is distributed over the surface of several tubes in the next lower course, thus obtaining at each joint a complete redistribution of the descending water and of the ascending air, which performs the operation of cooling. The capacity of the cooling tower is 192,000 gals. of water per hour, from 110 degs. F. to 85 degs. F. at 70 degs. F. outside temperature and 70 per cent humidity.

brings the cooled water back to the condenser of the turbines from the cooling tower cold well.

Power for railway service is now available from three machines: The 200-kw engine driven generator previously mentioned; a 300-kw, 550-volt, two-phase Westinghouse rotary ammeter, and a 300-kw. motor generator set wound for 600 volts on the direct current side.

During the latter part of August and early part of September of this year it became necessary by reason of the increased price of fuel oil to make a change in the boilers to enable them to burn coal instead. The price of crude oil had advanced from about 90 cents per barrel to $1.63 f. o. b. El Paso, and it was found that coal costing about $2.50 per ton would effect a considerable saving over the expense of operating with the high priced oil. The experiment has been tried of burning pea and slack coal with forced draft, with very gratifying results. In order to make the change it was necessary to take out the oil burners and put new

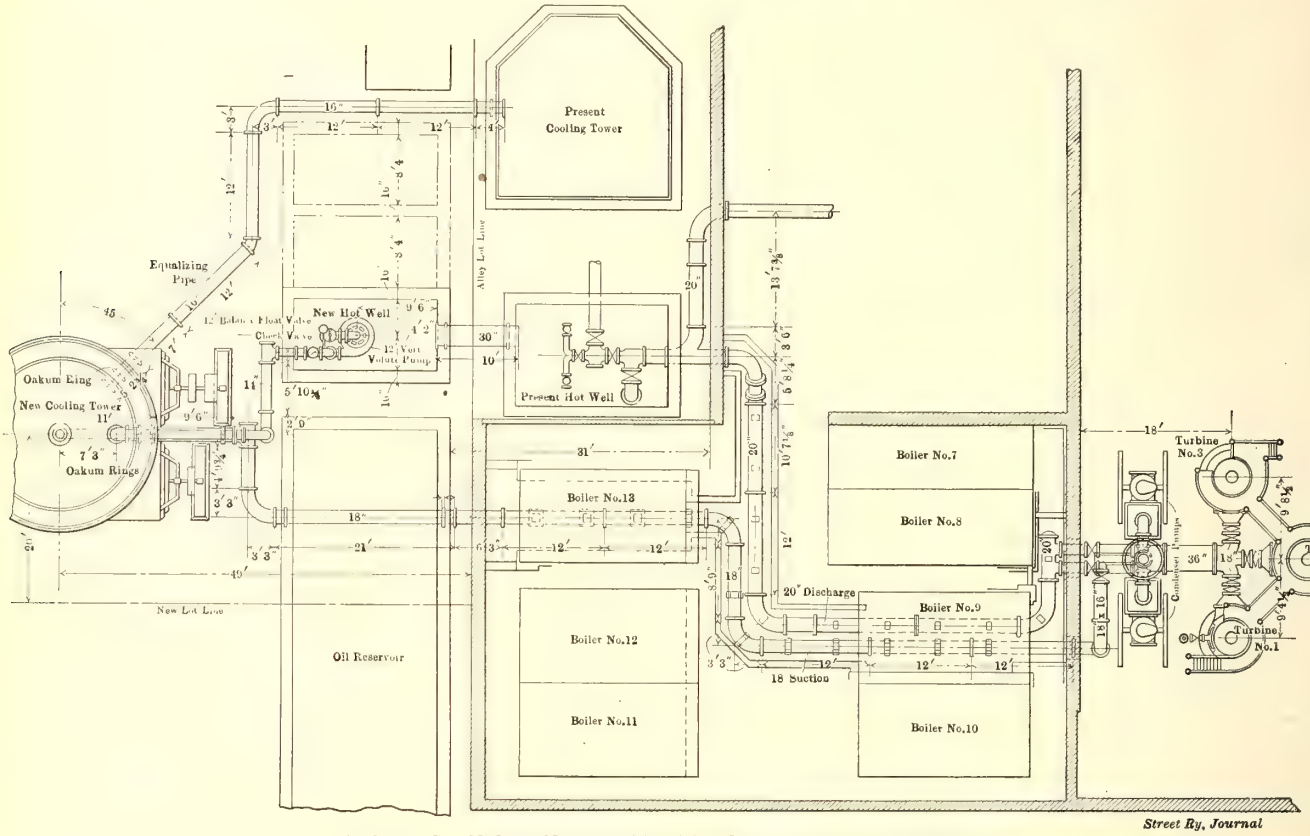


FIG. 3.—CIRCULATING PIPING PLAN OF THE EL PASO STATION

The completion of the plans for the turbine installation included the connection of the cold wells of the two cooling towers by a 16-in. cast-iron pipe serving as an equalizer between them, and various changes in the suction and discharge lines. Fig. 3 illustrates the circulating piping layout as completed. The remaining reciprocating engines exhaust into the original 1000-hp condenser hot well through a 20-in. line; and the discharge of the new condenser serving the three turbines is brought out by two 16-in. lines which join in a 20-in. main that leads to the same hot well. A new hot well was built in connection with the new cooling tower and connected with the old well by a 30-in. pipe. The whole condensing system was thus tied together. From the new hot well the water is pumped into the new cooling tower by a 12-in. Worthington submerged pump, having a capacity of 3500 gals. per minute. This pump is direct connected to a 100-hp, 2300-volt Westinghouse induction motor whose normal speed is 690 r. p. m. An 18-in. suction line

grates with ⅜-in. air space under boilers 1, 2, 9, 10, 11, 12 and 13, and also to install a fan system capable of supplying the necessary draft. It was found possible in this work to utilize as a duct the pipe conduit which connects the condensers and the hot wells, a cross section of this conduit. This conduit is built of concrete, 6 ft. wide and 6¾ ft. deep, with the pedestals and piping left in place. The general scheme of air supply to the boiler grates is shown in Fig. 4.

The under side of each boiler is supplied with air at 1 oz. pressure by a 24-in. tile duct and outlet leading from the pipe tunnel. A detail of the outlet is shown, the nozzle having been purposely turned away from the grates to allow a better distribution of the air. The discharge from the outlet is almost horizontal, and the air is deflected against the furnace walls before it reaches the grates. The fan was mounted on a reinforced concrete foundation over an underground oil reservoir formerly used in the plant, and

it is an 8-ft. 6-in. wheel driven by an 8-in. x 10-in. Sturtevant engine at 195 r. p. m. In this connection a duct was built to supply air to boilers 1 and 2.

The station as completed to the plans shown in Fig. 2 consists of a considerable variety of apparatus, including several boilers and engines of low capacity. If designed anew it is doubtless true that the arrangements would be somewhat altered, but as the recent development has been outlined in the foregoing paragraphs, it has been the intention to emphasize how a noteworthy increase in capacity has been obtained in an extremely contracted area, and with modern apparatus at the same time. The floor space economy of the turbo-alternators is significant, and by the use of the single condenser for all three units the usual space requirements of turbine auxiliaries have been greatly decreased. Efficient and reliable condenser operation should be insured by the use in this case of practically two condensers in one. If at any future time it should be decided to build a new station on some other site, much of the apparatus of large capacity in the present plant could readily be transferred.

The use of a large cooling tower system in conditions like those at El Paso is a necessity, and the present installation shows how flexible such an arrangement may be made. Either tower can be used on either engines or turbines, or both towers together. The condensing system at El Paso is guaranteed to maintain with 4 ins. of absolute vacuum when condensing steam at 35,000 lbs. per hour with air temperature at 70 degs. F., and humidity at 70 per cent. The altitude of El Paso is about 4000 ft. Under more favorable weather conditions the vacuum runs considerably higher.

The organization of the Cleveland Section of the American Institute of Electrical Engineers has been completed by the election of the following officers: Chairman, Henry B. Dates, professor of electrical engineering Case School of Applied Sciences; managers, A. C. Eastwood, C. E. F. Ahlm and C. W. Ricker; secretary and treasurer, F. M. Hibben, 807 Cuyahoga building, Cleveland. Paul Spencer, of Philadelphia, chairman of the committee on sections, was present at the organization meeting and aided in the work. Fifty-three members and associate members of the Institute registered as members of this section. A number of others in Cleveland and vicinity, who were not present at the meeting, are expected to enroll within a short time. By-laws were adopted and arrangements were made for meetings, which will be held at 8 o'clock on the third Monday evening of each month in the lecture room of Case School. Papers short and to the point will be requested from members and others and they will be followed by discussions. Standing committees will shortly be appointed, the members being under consideration at this time.

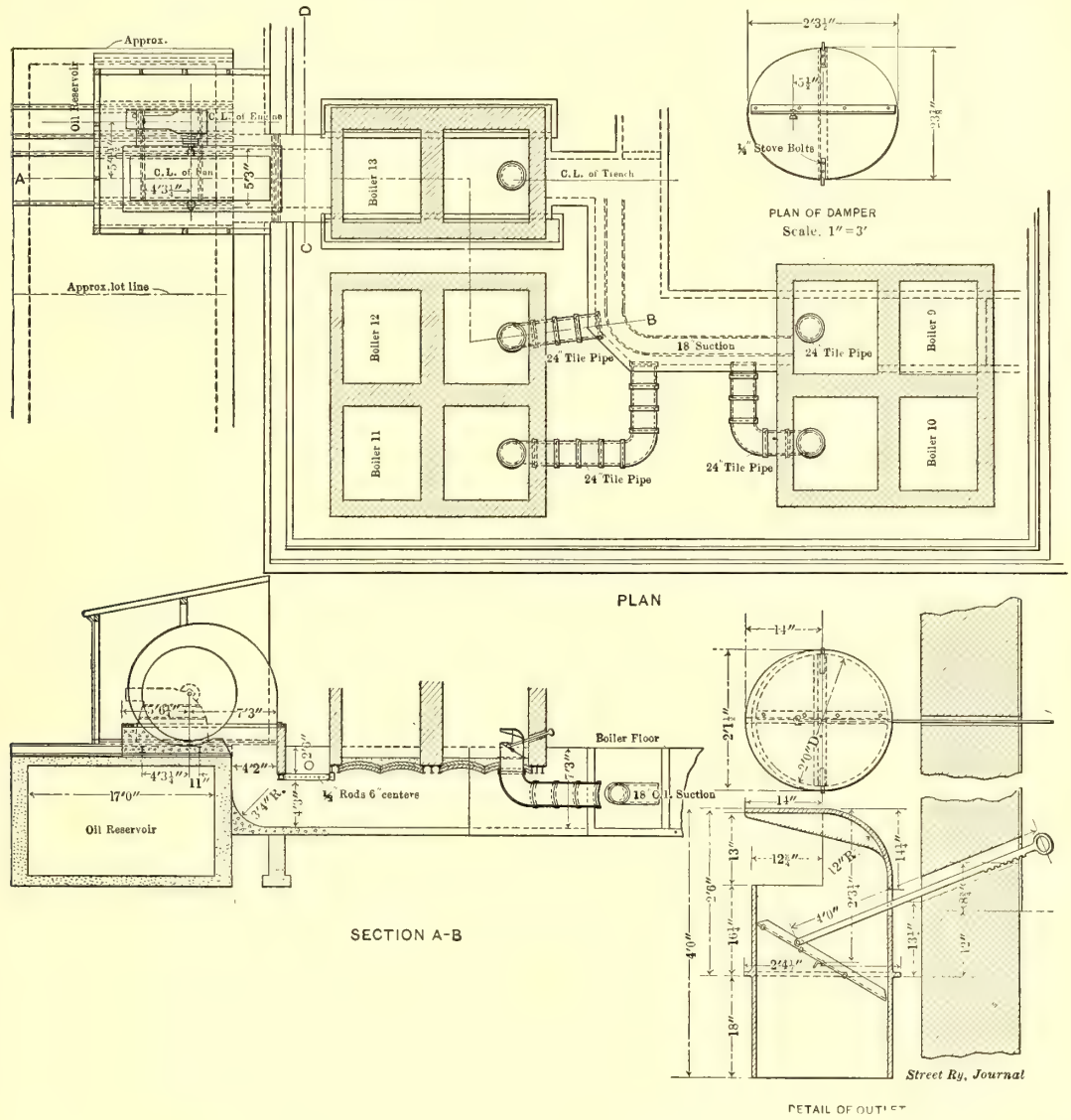
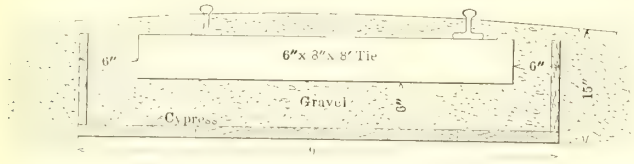


FIG. 4.—GENERAL SCHEME OF AIR SUPPLY TO THE BOILER GRATES

TRACK CONSTRUCTION IN SOME SOUTHERN CITIES

SAN ANTONIO

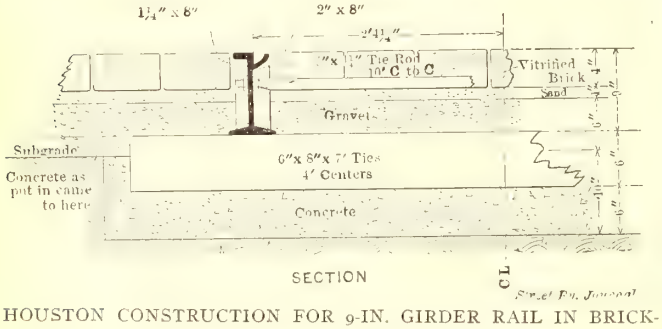
Practically all of the track in San Antonio has been rebuilt within the last three years. In paved street 6-in. grooved rails were completely immersed in a bed of concrete. This bed, which extends 4 ins. below the tie, is 14 ins. thick in asphalted and 11 ins. thick in bricked street. The track gage is only 4 ft. and a tie but 6 ft. long was used in the concrete construction. Ties used in about 12 miles of track were treated with dead oil of coal tar and zinc chloride.



TRACK CONSTRUCTION IN HOUSTON, USING A CYPRESS TROUGH TO KEEP OUT WATER

In most of the construction the ties were placed about 2 ft. center to center, but the latest practice in asphalted streets is to put them 6 ft apart. No tie-bars are used. Natural cement was used in the concrete and the mixture was in the proportions 1, 2 and 4. The concrete was allowed to set well before the track was used. In unpaved streets a 4-in. T-rail is employed. The ties, which are 7 ft, long, have 6 ins.. of gravel underneath them.

In all track A. S. C. E. angle-bar splices are used. Bonds are largely of the pin terminal type. Cross-bonds are 1000 ft. apart. Track centers of double track are 9 ft. apart or the distance between the gage line is 5 ft. Switches and curves are of standard construction with hardened centers. The method of constructing steam-road crossings in San Antonio is of special interest. Upon a 2-ft. bed of gravel 8-in. x 12-in. ties are placed crosswise of the steam-road track and as close together as they can be put. This gravel and tie foundation is used in preference to concrete because it is believed that concrete makes a too solid crossing. Instead of the usual gusset or corner plates the steam-road rails rest on a ¾-in. steel plate 10 ft. long and about 15 ins. wide. The rail spikes are driven through spike holes in the



HOUSTON CONSTRUCTION FOR 9-IN. GIRDER RAIL IN BRICK-PAVED STREETS

plate. J. J. King, general superintendent of the system, had charge of the reconstruction of the track.

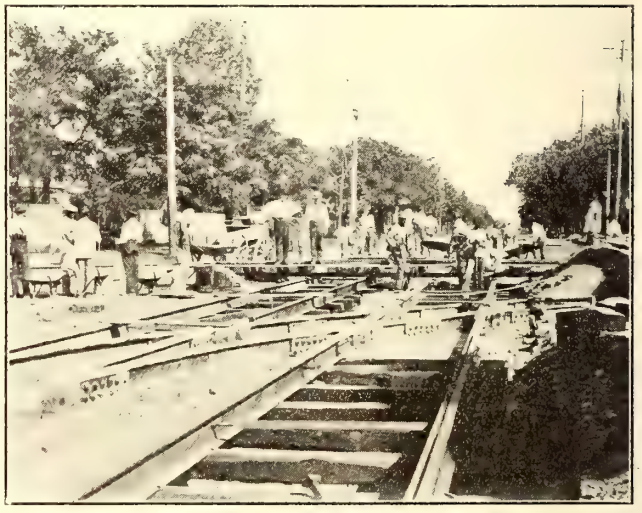
HOUSTON

The spongy nature of the soil in Houston necessitates a rather peculiar type of track construction in unpaved streets. Where the track is laid in the usual manner the spongy earth in a very short time works up through the gravel and the track gradually sinks. To prevent this the track is laid in a trough of "pecky cypress." This wood will not rot or decay so long as it is kept damp. In track construction 1-in. material in various widths and lengths is used. It costs about 13.50 per 1000 ft. at the mills, or about $700 per mile of track. In the track construction after the excavation has been made, the boards arre thrown into the bottom to make a floor about 9 ft. wide comparatively free from large openings. However, no attempt is made to make close fits, as openings an inch or two wide are not detrimental. The ties are then laid directly on this floor and the rails are spiked and bolted in position. Gravel ballast is then dumped in and the track jacked up and the ties tamped. While this is being done 12-in. side boards are placed 6 ins. beyond the ends of the ties to retain the ballast. These are held in position only by the earth on one side and the gravel ballast on the other. The top of the board comes flush with the top of the tie and this gives 6 ins. of gravel under the tie. The gravel ballast is brought within 2 ins. of the top of the rail so as to protect the tie and the top of the side board. The creosoted ties employed are placed 27 ins. center to center.

In suburban track construction small waterways are crossed by a special type of concrete culvert. The chief feature of the design is that it permits ties to be replaced without injury to the concrete. The two ties supported by the walls and to which the 4-in. floor of the culvert is nailed, are placed in a recess so that after removal of the spikes and the ballast immediately behind the top of the culvert they may be slipped back to clear the concrete and then pulled out sidewise. Other ties may then be replaced by reversing the process. The culverts are made in various sizes. The cost of one for a single track and with an opening 2 ft. wide is about $25. Of this the concrete costs about $12, the flooring $4, and the labor $9.

HOUSTON PAVED STREET CONSTRUCTION

In paved streets a concrete foundation is used. The con-



TRACK CONSTRUCTION IN HOUSTON, SHOWING ELEVATED CROSSING

crete, which is mixed in the proportion 1, 3 and 6, extends 6 ins. underneath and level with the top of the ties. The concrete was allowed to set several days. Wherever possible cars were rerouted while the street was being improved. The illustration shows a temporary cross-over used by the temporarily rerouted cars in crossing over the tracks being rebuilt. The ties are of cypress and are placed with centers 4 ft. apart. The paving is laid on a 1-in. sand cushion. A 4-in. bed of gravel intervenes between this cushion and the concrete and ties underneath.

A 9-in. grooved girder rail having a 1-in. flangeway is

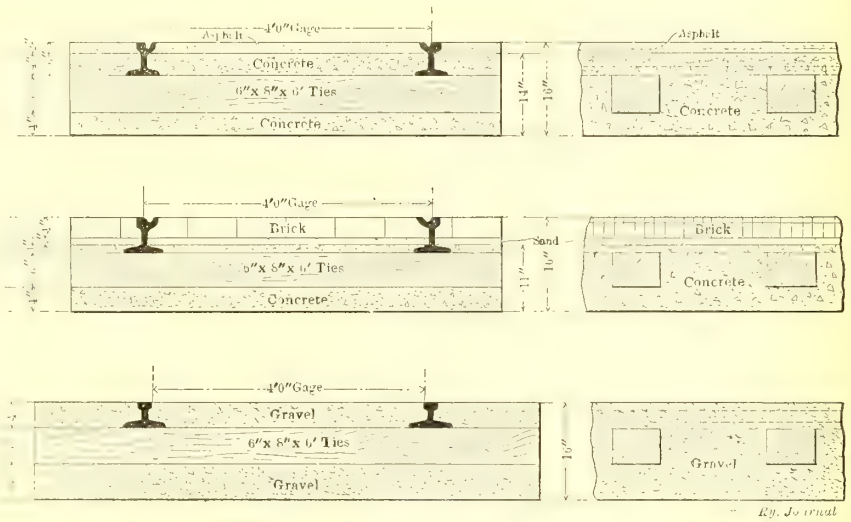
employed. The rail is filled out to the edge of the flangeway on both sides with cypress fillers. Tie-rods of ⅜-in. x 1¼-in. iron are placed 10 ft. center to center. The brick are grouted with a mixture of one part cement and two parts sand.

In asphalted streets the asphalt was formerly laid up against the rail, no intervening paving blocks being used. The asphalt went to pieces next to all rails except the Lorain Steel Company section 96-357. With this section no asphalt repairs have been made in four years except at defective joints. Rails in paved track are bonded with two No. 0000 plug bonds. Double tracks are laid with 10-ft. centers. The company pays for the paving 1 ft. outside of rails. In the 60-lb. construction the frogs are all home made. They are built up in the field by colored labor. The only materials used in addition to the rails are two bolts fastening the rails together and a ⅜-in. x 12-in. x 18-in. plate placed underneath. Some of these frogs have been in service ten years.

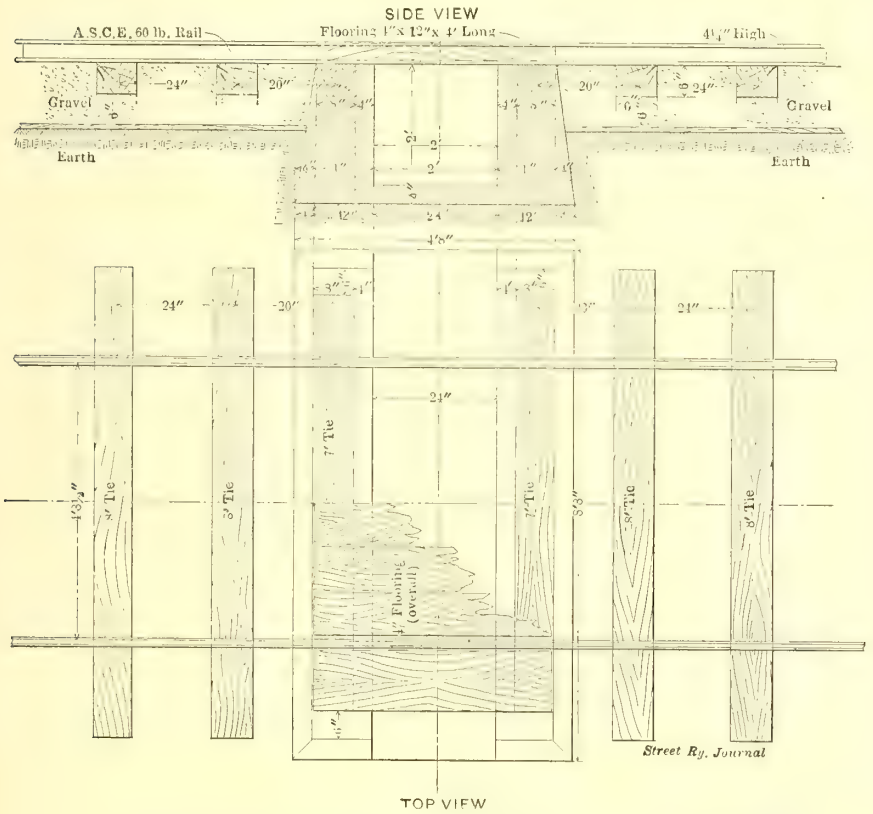
The improvements in Houston are being made by the Stone & Webster Engineering Corporation, for which Walter Goodenough is engineer in charge for all the work in the State. The work is being done under the immediate supervision of C. H. Ladd, with the aid of Flint McGregor, engineer of way.

89, No. 319 Lorain Steel Company rail in business district, and Sec. 90, No. 392 in the residence district.

In paved streets a concrete bean type of construction is being employed. In the business district the beam extends 9 ins. under the 9-in. rail and is 16 ins. wide at the bottom and 18 ins. at the bottom of the rail; in the residence district the beam extends 7 ins. under the 7-in. rail is 15 ins. wide at bottom and 16 ins. at base of rail. The two beams are connected and held rigid by the layer of concrete placed under the paving by the city. The rails are connected by ½-in. x 2½-in. tie-rod placed at the middle of the web



SAN ANTONIO TRACTION COMPANY'S STANDARDS



DETAIL SECTION AND PLAN OF CULVERT FOR HOUSTON, TEXAS

at 7-ft. intervals, and pine ties are placed 4 ft. apart.

Where creosoted blocks are not used exclusively, there are placed next to the rails creosoted pine blocks 4 ins. x 4 ins. x 8 ins. so that the sheet paving is kept 8 ins. from the rails.

Continuous rail-joints are used in paved streets. The rails of each track and double tracks are cross-bonded with No. 0000 bonds at 1000-ft. intervals. Ohio brass compressed terminal bonds are used, except at switches, where American Steel & Wire Company plug bonds are employed. The rails are laid to gage on tangents and ¼ in. wider on curves. The company pays for the paving between rails and 18 ins. outside the rails. In unpaved streets, at curves and switch points the street between rails is paved with brick to keep the sand off and avoid wear.

On unpaved streets nothing but creosoted pine ties are used in both city and interurban track construction. These are cut in the vicinity of Mobile, the company buying them direct from the cutters. They are hauled on the company's cars to a creosoting plant in Mobile, where they are treated.

E. T. Wagenhall, who has charge of the reconstruction of the tracks and overhead in Mobile, has adopted a novel plan of getting track bolts at joints tight. He has made a standing offer to the men doing the work in paved streets of 10 cents for every bolt they break. The track wrench is

MOBILE

In Mobile, approximately 40 miles of single track out of a total of 50 miles have been rebuilt within the last two years. The track replaced consisted of 35 and 40-lb. low "T" and 70-lb., 7-in. T-rails. In the new work 60 and 70-lb. A. S. C. E. rails are being used in suburban work and Sec.

fitted to a pipe 5 ft. long, one man hammers joints and one handles the wrench. No expansion is allowed in rail-joints when work is done in summer.

CHATTANOOGA

The Chattanooga Railways Company has rebuilt twenty-four steam railroad crossings within the past two years. These were constructed with a 20-in. bed of concrete underneath the ties. The bed extends over about 6 ft, underneath the wing rails. The crossings are built with 100-lb. steel. Railroad crossings are bonded both underneath and overhead. In addition to the usual rail-bonds, a bond wire is carried from the rails on one side of the crossing up a pole and overhead and down to the rails on the other side. About 4 miles of track in paved street has been built recently. In this work an 80-lb. 7-in. T-rail was used. The ties were laid with 2-ft. centers on an 8-in. bed of concrete, which extends 6 ins. beyond the ends of the ties. Concrete was tamped in between the ties, and in brick paving they were immersed 2 ins. in concrete. A special nose brick was used next to the rail and continuous rail-joints were employed. Pennsylvania Steel Company 80-lb. special work with hardened centers was employed. The standard construction in suburbs is with a 60-lb. rail with 10 ins. of ballast underneath the ties.

The company makes its own bonds by soldering No. 8 wires or other sizes into compressed terminals purchased from supply houses. Old fields and other wire which would otherwise be sold as scrap is utilized in making these bonds. The terminals are driven tightly into the drilled hole and then compressed.

STEEL RAILS

A paper on this subject was presented at a meeting of the Central Railway Club in Buffalo, Nov. 8, by Franklin E. Abbott, of the Lackawanna Steel Company. The speaker described in detail the present methods of making rails by the Bessemer process, and commented on some of the clauses used in different specifications for rails. The clause that "no bled ingots shall be used" is not necessary at the present time. In the early days it was the practice to throw ingots on their sides as soon as they were taken from the molds, and if the surface crust at the ends should break open the fluid metal at the center of the mass would bleed out, leaving a hole which would almost certainly result in piped rails. The present practice is to allow the metal to solidify in the molds and also to keep the ingots in a vertical position in the reheating furnaces. Mr. Abbott continued that if open hearth steel is to succeed Bessemer, it will take a term of years and the expenditure of an enormous sum of money to build furnaces enough to provide the steel needed for rails alone. Before this could be accomplished it is more than probable that the .085 phosphorus Bessemer ores would run out, and with an inadequate production of open hearth steel, the railroads would have to either get along with a short supply, or import the tonnage lacking. In the event of such sources not being able to keep pace with the demands, their only alternative would be to take a grade of Bessemer steel far inferior in wearing qualities to what they are now getting. To avoid this apparent short cut to the end of good quality Bessemer rail steel, the makers insist that the phosphorus limit shall be left as it has been for a number of years past, at .10 per cent, and a somewhat modified carbon content be used. It is entirely practicable to use enough carbon with .10 per cent phosphorus to make perfectly sound, safe and serviceable Bessemer steel, and with that limit accepted, the manufacturers will be able to produce good quality Bessemer steel rails for many years to come. The speaker also discussed the proposal to discard 25 per cent from the top of the ingot, an amount which he considered excessive, as perfectly sound rails of standard composition can be secured if the clause reads that sufficient material shall be discarded from the top of the ingot to insure sound rails.

In referring to the history of the T section, he stated that Robert L. Stevens, president and chief engineer of the Camden & Amboy Railroad, in 1830 invented the first rail ever rolled with a base. The shape was similar in outline to the present rail, with a head 2 ins. wide, a base 3 ins. wide and a height of 3½ ins. Following the Civil War so many various sections were brought out that a committee was appointed in 1889 by the American Society of Civil Engineers to consider a standard section. The result of this study was what is now known as the A. S. C. E. sections. The distribution of metal in these sections is: In the head, 42 per cent; in the web, 21 per cent; in the base, 37 per cent. This distribution of metal is very satisfactory to the manufacturers, as there is but five points difference between the bead and the base. Any revised rail section should be obtained through the co-operation of both manufacturers and users. The speaker suggested that in comparison with the A. S. C. E. sections, both head and base shall be reinforced, and that the distribution of metal be nearly balanced, making that in the base equal or slightly greater than in the head. It is also proposed that width of base shall be less than height of rail, which will admit of forming thicker flanges. The advantages of a balanced section, with comparatively thick base, are:

First. Lower temperature of the whole section at the final pass—hence a colder finish of the rail head, giving denser and better wearing material.

Second. Less cambering and better hot straightening, reducing, as much as possible, the objectionable cold straightening work.

Third. A reinforced head to provide against splits and other head failures.

Fourth. A reinforced hase to overcome the weakness that seems so prominent in present pattern rails.

It is expected, also, that with this pattern of rail the higher carbon steel from grades of ores now available may be made with safety, and by longer service prove a benefit to the railroads. The balanced sections can be made easily and economically, and will thereby contribute to the interest of the manufacturer.

MANHATTAN RAILWAY EARNINGS

The Manhattan Elevated Railway Company, of New York, reports for the year ended Sept. 30, gross income of $8,816,101, against $8,061,554 for the year ended Sept. 30, 1906, an increase of $754,547. Its net income for the same period was $5,592,595, against $4,859,972, an increase of $732,623. The surplus after the annual dividend amounted to $1,392,595, or 9.32 per cent upon its entire capital stock. The net income of the Interborough Rapid Transit Company for the same period, which income is primarily applicable to the dividends on Manhattan stock, amounted to over 13 per cent on the entire Manhattan Railway Company's capitalization. The Manhattan Railway Company's balance sheet shows that this company has on hand in cash $1,530,943, and its only current liabilities amounted to $10,586, showing a profit and loss surplus of $8,278,406. The only taxes it has in litigation amount to $19,866.

CORRESPONDENCE

HIGH SPEED OF ELECTRIC LOCOMOTIVES ON GRADES

SCHENECTADY, N. Y., Nov. 18, 1907.

EDITORS STREET RAILWAY JOURNAL:

I notice that in your editorial on "The Twentieth Century Locomotive," commenting on my Institute paper, you state that "we are not inclined to lay very much stress on the mere increase in speeds up grade" and doubt "whether high speed up grades is worth the while in case of freight haulage." You give as a reason the desirability of uniformity in station load. You must realize that the generating station of electrically operated railroads occupies the position of an auxiliary and must conform in its practice and economy to the demands of the operating department, which latter are paramount. Electric power is manufactured and distributed not as an economic industry in itself, but solely to promote the general movement of trains, and the operating department cannot be put to any inconvenience or have its facilities for moving freight in any way abridged by an inadequate supply of power, or by any consideration of extreme demands upon the generating and distribution system. The expense to shipper and railroad incurred through delays occasioned by insufficient or restricted use of power may easily exceed the interest on the difference in first cost between a power supply capable of taking care of all exigencies of service operation and a smaller supply proportioned for average demands only.

Returning to the question of speed on mountain grade divisions, while the sight of two or more steam locomotives laboring heavily up a grade is only a pathetic incident to the casual onlooker, it is a most serious matter of expense to the management, and furthermore, it is inseparable from steam locomotive operation. My Institute paper, therefore, points out the lesson of increased speed, its benefit to the road, the shipper and the traveling public. Furthermore, the conclusions reached indicate that electrification of steam roads is not attractive either financially or otherwise if the electric locomotive is called upon simply to duplicate the present performance of the steam locomotives. It is largely in connection with increased speed that the supporters of electrification hope to make a showing sufficient to warrant the expense of electrification.

Considered in its broadest application, the introduction of the electric locomotive not only gives the operating department a means of quickening the passage of freight and passenger trains over heavy grade divisions with resulting reduction in operating expenses, but it also permits an increase in the tonnage capacity of congested track sections by reason of this increased speed. Take away from the electric locomotive this asset of increased speed, and one must fall back on such reasons for electrification as control such cases as the New York Central Terminal, New Haven, Baltimore & Ohio, and other tunnel installations, that is, reasons other than economy, but commanding a full knowledge of the full capabilities of the electric locomotive, we are unable to justify the electrification of many main line divisions, both on grade and even on level sections where such local conditions as heavy traffic, poor water, etc., may obtain. Furthermore, reasons for electrification can be demonstrated in dollars and cents, and that, too, with such conservatism based upon actual operating expenses as to be all-convincing to those giving the subject careful attention.

A. H. ARMSTRONG.

TESTING RAILS, NOT LOCOMOTIVES

Articles which have appeared during the past week in the daily papers, concerning certain tests which the Pennsylvania Railroad has been making on the West Jersey & Sea Shore Railroad, near Clayton, N. J., have created an entirely erroneous impression. It has been stated that the company was racing steam and electric locomotives, with a view to determining the speed capacity of each type. The Pennsylvania Railroad has other, more accurate and much less dangerous methods of testing the speed of locomotives than trying them out in such a manner as this. Furthermore, the types of electric and steam locomotives which have been used in these experiments were not designed primarily for speed, and any inference based on their performance in this regard would be incorrect. What the company is doing is this: Experience indicates that the operation of electric locomotives, owing to their lower center of gravity, has an effect upon the track entirely different from that due to the action of steam engines. It is to ascertain the exact nature and extent of this pressure upon the rails that the Departments of Electric Traction and of Motive Power have devised the apparatus which is being utilized at Clayton.

A stretch of track about 166 ft. in length has been equipped with rails and cast steel ties, designed and made especially for this purpose. Instead of attaching the rail to the ties by spikes, a special form of block has been substituted, which allows a slight movement of the rail as the engine goes over it; this movement registers the force with which the flanges of the wheels strike or press against the rails. It is expected that a large number of experiments with this apparatus will show the company quite accurately what the effect is of both steam and electric locomotives moving at different speeds over both straight and curved track. Necessarily to make these tests, the engines must move at different speeds, and at times each attains its maximum speed. An electric apparatus has been devised to measure the precise amount of time elapsing while the different locomotives pass over this 166 ft. of track, in order that in computing the effect upon the track the exact speed attained may be known.

The electric locomotives used are Nos. 10,001, 10,002 and 10,003, which have been described in these columns. As No. 10,003 is designed for single-phase traction, special connections were required to permit it to operate on the direct current system of the West Jersey & Sea Shore Railroad. These are provided in a baggage car which is attached to the locomotive, and which contains the direct current control apparatus. The tests are being conducted under the general management of George Gibbs, chief engineer of electric traction, and Hugh Pattison is in direct charge. Philip Mohun is assisting Mr. Pattison. Various types of steam locomotives are also being tested, and the trials will continue for some time.

The Columbus, Delaware & Marion Railway Company is considering novel plans for converting one of its cars into a funeral car. The plan is to have a black leather covering, to be buttoned onto the side, including the panels between the windows, by means of carriage buttons, making an entirely black car. This can be removed and the car used in the regular service at other times. It is expected that removable black drapery for the inside of the car will also be designed. The plan was devised by L. W. Harrington, passenger and freight agent of the company in Columbus.

THE NEW SULLIVAN SQUARE ELEVATED STORAGE YARD OF THE BOSTON ELEVATED RAILWAY

The Boston Elevated Railway Company has lately completed a new storage yard for elevated cars at its Sullivan Square terminal, which is of special interest on account of the use of reinforced concrete in the design of the deck or yard floor. Additional car storage facilities have been necessitated by the growth of traffic, and as it was deemed desirable to extend the existing yard at Sullivan Square rather than to build storage tracks at a point more remote from the company's main elevated repair shops, plans were worked out for the installation of 8 new parallel tracks immediately north of the existing car house and repair shop built in connection with the original elevated lines which began operation in 1901. The work was in general charge of George A. Kimball, chief engineer of elevated and subway construction. The designing engineer was Robert B. Davis, the construction being handled by the Hugh Nawn Contracting Company, of Boston.

Fig. 1 is a general plan of the Sullivan Square terminal and yard, showing the route of the main line track through the station between Main and West Streets, Charlestown, the loop transversed by inward-bound trains after leaving the terminal, the sidings, cross-overs and yard tracks leading into the shop and car house mentioned above. Eleven tracks enter the car house, the total capacity of the tracks beneath the car house roof being about sixty-seven 47-ft. cars. The new yard lies at the north of the car house, as before noted, and it was built upon the site of an old surface car house and miscellaneous other buildings which had occupied the property for many years. The surface car house was torn down, with the other buildings, and the ground floor utilized as a new storage space for surface cars, the floor of the elevated yard being designed to serve as a water-tight roof for the surface car storage beneath. The capacity of the new elevated yard is about 70 cars, exclusive of a little additional space near the ladder track and beyond Bent 32 in the direction of Main Street. The new yard connects directly with the westerly side track on Main Street, and with the westerly loop track in the original yard, over which movements between the shops and the terminal take place. Heavy repair work takes place on the ground floor of the original shop and car house, an elevator being provided for the handling of trucks and motors.

The new yard is entirely in the open air, and the floor is level, the base of rail being at a grade 23 ft. 11 ins. above the surface car-house floor. The parallel tracks in the yard are spaced 12 ft. apart on centers, and have a car capacity varying from twelve to seven cars each, according to length. The total area of the reinforced concrete section of the yard is 47,000 sq. ft., and about 1,380,000 lbs. of steel were used in the construction. Typical details of the floor construction and a general layout of the floor are illustrated herewith.

The floor construction in general consists of a supporting slab of rock concrete 4 ins. thick, reinforced with steel, on which is laid a four-ply waterproof seal over the entire area, and flashed up all around the floor drains, making the work perfectly water tight. On top of the waterproof seal is laid cinder concrete having a minimum thickness of 2 ins. at the low point at drains, and a thickness of 3½ ins. at the summit. On top of the cinder concrete is a granolithic finish not less than 1 in. thick at any point, and varying in thickness under track stringers from 1 in. at the summit to 2½ ins. at the low point. The granolithic surface is jointed to form panels. The under surface of the floor is level, the finished top of the floor being laid to successive grades, to shed water from the summit to the low point, or line of floor drains.

All steel members forming the floor system, with the exception of plate girders, are protected with cinder concrete extending to the line of floor slabs. The soffits of beams are wrapped with metal fabric and plastered 1½ ins. thick.

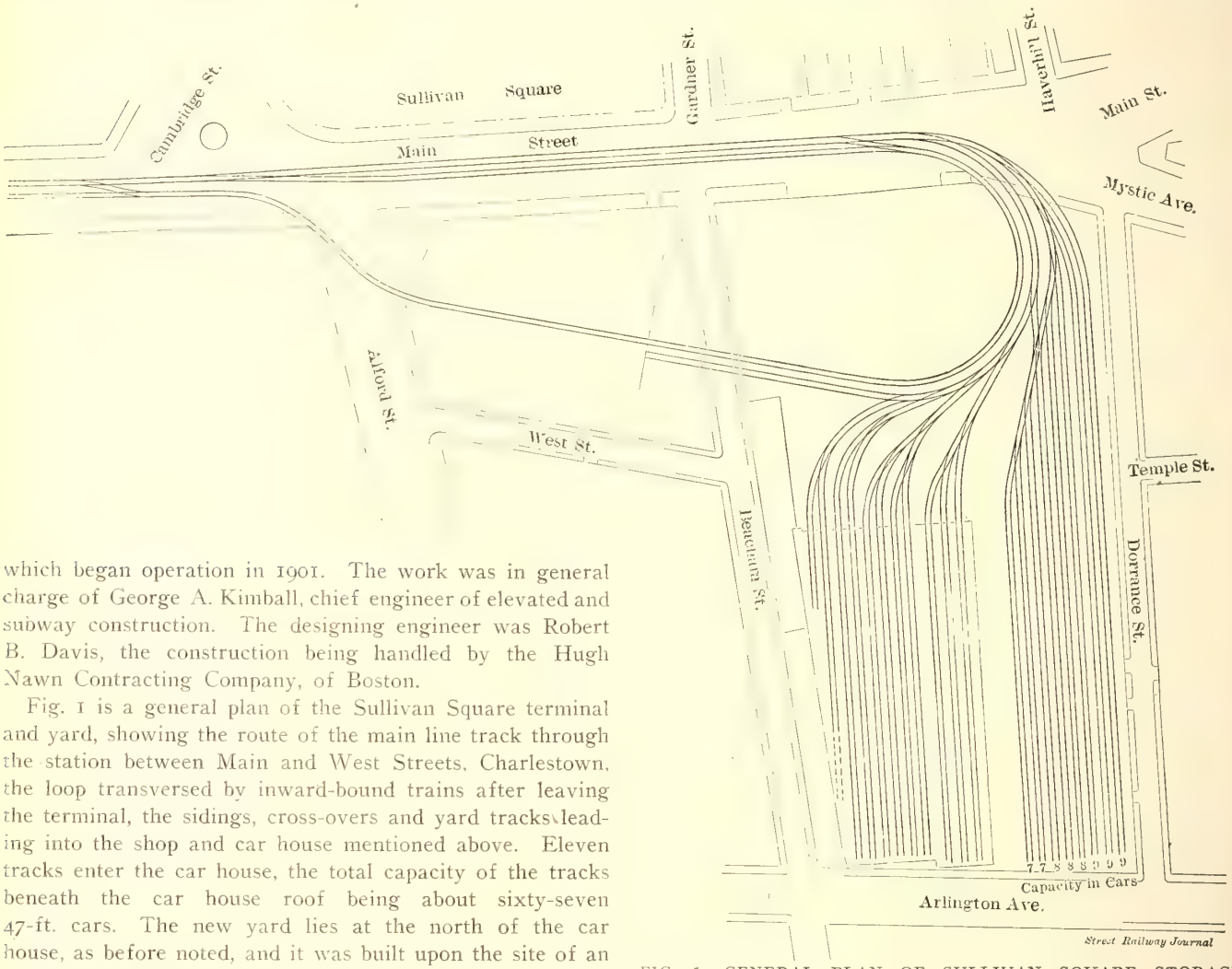
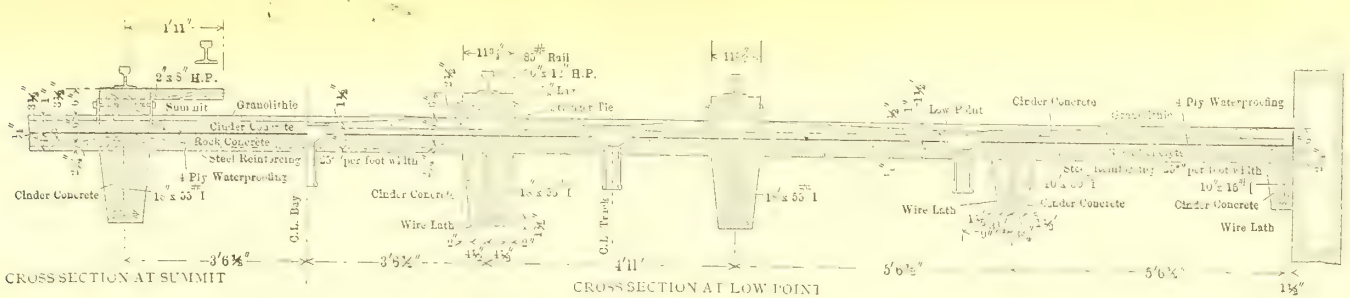
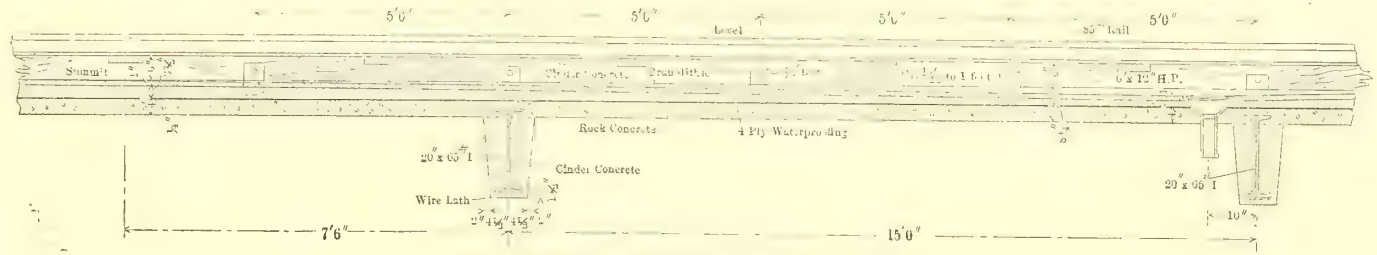


FIG. 1.—GENERAL PLAN OF SULLIVAN SQUARE STORAGE YARD, BOSTON

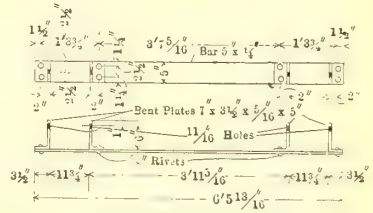


CROSS SECTION AT SUMMIT

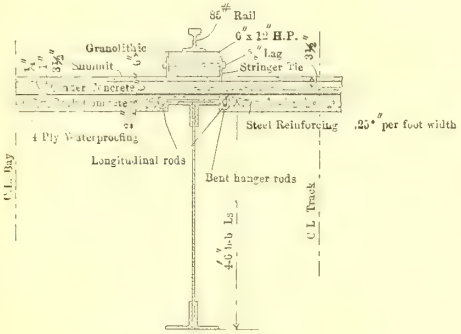
CROSS SECTION AT LOW POINT



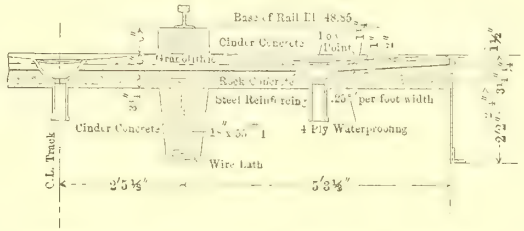
LONGITUDINAL SECTION AT CENTER LINE OF BAY



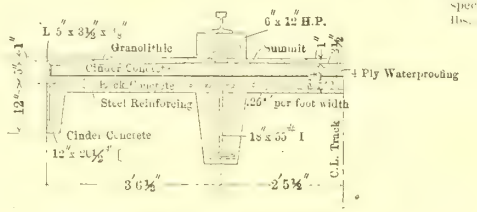
700 Stringer Ties Req'd as shown
Lugs on stringer ties must be spaced exact as shown and placed absolutely square with the bar
Material structural steel, manufacturer's standard specification, ultimate strength 55,000 to 65,000 lbs. per sq. in.



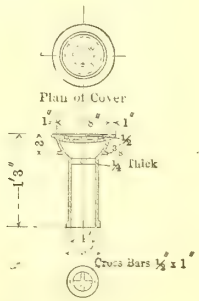
CROSS SECTION AT SUMMIT
GIRDER OVER TRANSFER SPAN



CROSS SECTION THRO' FASCIA GIRDER AT LOW POINT

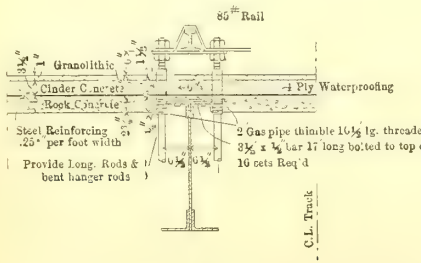


CROSS SECTION ON LINE A-B (Sheet# 27082

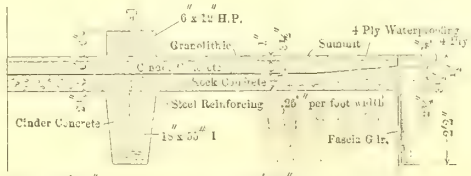


Cast Iron Floor Drain

100 Cast Iron Floor Drains Req'd as shown
Cast iron floor drains to be of tough gray iron, free from injurious cold shuts, blowholes or cinder, true to pattern and of workmanlike finish

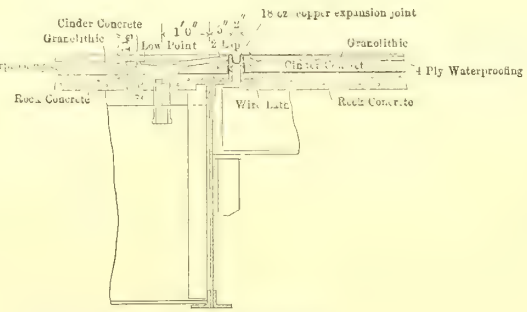


CROSS SECTION AT SPAN 0-1



CROSS SECTION THRO' FASCIA GIRDER AT SUMMIT

2 Gas pipe thimble 10½ lg. threaded & screwed into 8½" x ⅛" bar 17" long bolted to top chord of Gdrs. Span 0-1 with ⅜ bolts
16 sets Req'd



CROSS SECTION AT EXPANSION JOINT

Street Railway Journal

FIG. 2.—DETAIL SECTIONS OF REINFORCED CONCRETE FLOOR (See plan on page 1030)

The slab construction over plate girders is shown in the accompanying typical sections. As there are no haunches on the plate girders, bent hanger rods are provided over the top flanges of the girders to support longitudinal rods on each side of the girder flange, this reinforcement taking care of the total shear in the slab at this section.

The reinforcement for 4-in. concrete slabs consists of 0.25 sq. in. of steel per foot of slab width. The minimum thickness of concrete below the steel reinforcement is ¾ in. In general, longitudinal beams beneath track rails consist of 18-in. 55-lb. I-beams enclosed in cinder concrete. The rails are laid on 6 in. x 12 in. hard pine stringers. The latter are held in position by metal stringer ties of the construction illustrated, 6 ft. 5 13/16 ins. long and 5 ins. wide each. Seven hundred of these were required, made of structural steel having an ultimate tensile strength of 55,000 to 65,000 lbs. per sq. in. The tie bar is ¼ in. thick, and at each end are riveted a pair of bent plates 7 ins. high and 11¾ ins. apart on the inside, placed exactly square with the tie-bar. These metal ties were placed in position by the company's engineers, the tie-bars and about 2½ ins. of the angles being surrounded by granolithic concrete. The granolithic finish under track stringers was made absolutely true and level to the grade given by the engineers, with a clean finish around the projecting angles of the metal ties, so that the track stringers could be placed in position without the necessity of cutting away any of the granolithic. The metal ties are placed 5 ft. apart on centers and the track stringers are secured to them by two ⅝-in. lag screws at each tie. The entire yard is provided with 85-lb. third-rails.

In general, cross beams are spaced 15 ft. apart on centers and consist of 20-in. 65-lb. I-beams surrounded by cinder concrete. About 300 ft. west of the end of the storage yard a 50-ft. span is provided on account of a transfer table which is in service in the surface car storage quarters below the elevated tracks. The girders over the transfer span are 4 ft. 6 ins. deep and are not surrounded by concrete. All columns are encased in concrete.

At the easterly bent of the transfer span a copper expansion joint is installed the full width of the floor. A cross section of this joint is shown. The copper is 18 oz. cold rolled, bent to form a gutter 2 ins. wide and 3 ins. deep between stop angles. On the outside of these angles the copper was turned down and flashed for 2 ins. on the waterproof seal by mopping it with coal-tar pitch.

In order to drain the floor, grades of about 1/16 in. per foot were provided, leading to 190 cast-iron floor drains with perforated covers 8 ins. inside diameter, the outlet pipes being 4 ins. in diameter. The lower flanges of the drains were placed at the grade of the waterproofing and mopped with hot coal-tar pitch to make a tight joint, the upper flange being set at the grade of the granolithic finish.

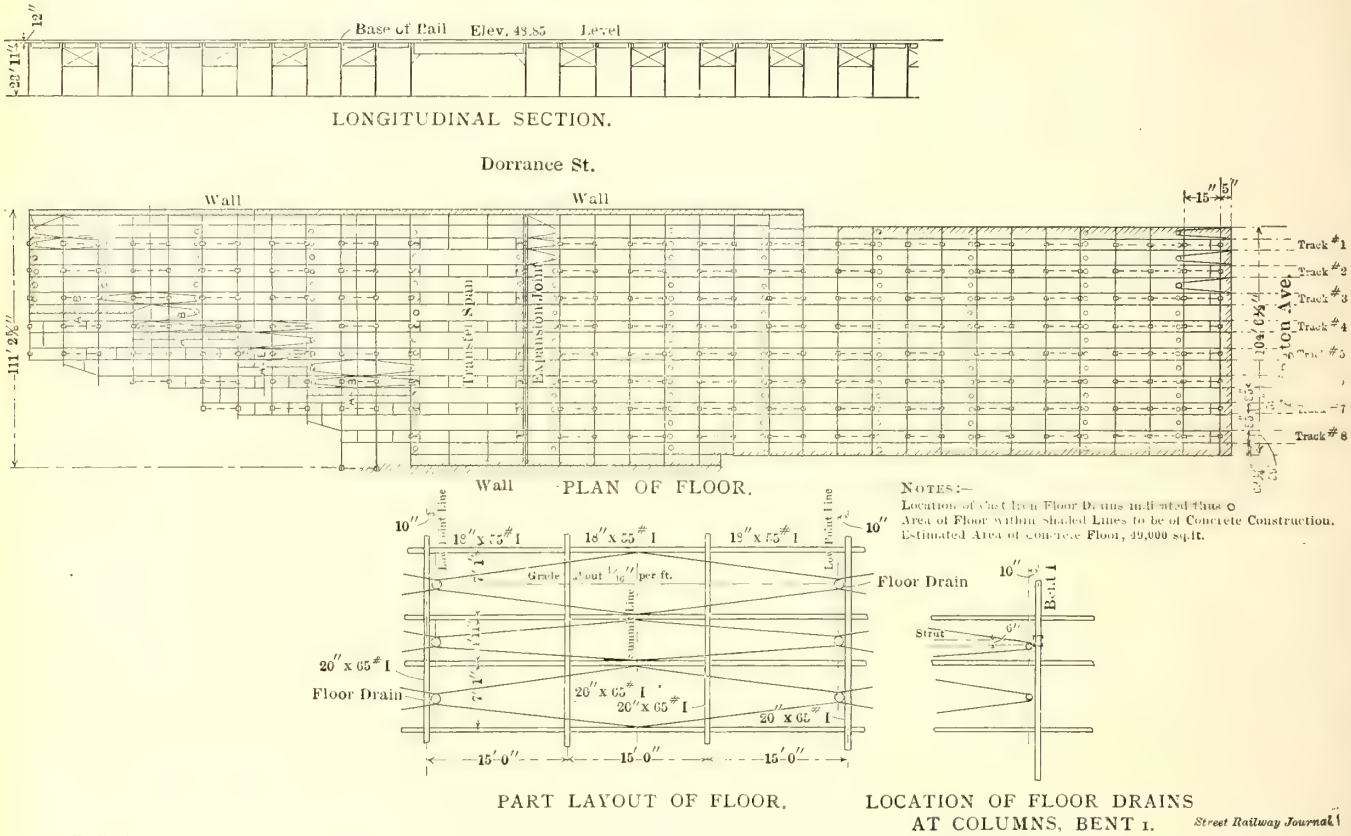


FIG. 3.—PLAN AND SECTIONS OF REINFORCED CONCRETE FLOOR, SULLIVAN SQUARE STORAGE YARD, BOSTON

Waterproofing was laid over the entire floor area on top of the rock concrete slab after the latter was dry. The waterproofing consists of four-ply Beehive roofing felt laid in straight run coal-tar pitch. The top of the rock concrete slab was thoroughly mopped with hot coal-tar pitch, and the roofing felt applied while the latter was hot, the felt being pressed down and mopped before the next layer was put down. The top layer was also mopped over, and special care taken to flash with the waterproofing all around openings for floor drains and against all steel work or brick walls forming outer sides of the floor.

Portland cement was used, and the broken stone was crushed to a maximum size of 1 in. The floor was built to withstand a load of 150 lbs. per sq. ft. in addition to its own weight. The proportions of the concrete used were:

Rock concrete: Portland cement, 1; sand, 2½; broken stone, 5.

Cinder concrete: Portland cement, 1; sand, 2; cinders 4.

Granolithic finish: Portland cement, 1; fine crushed stone, 1½.

The granolithic finish of the floor was kept moist with wet sand or sawdust for several days after completion to prevent its drying too rapidly.

TWO THOUSAND VOLT D. C. RAILWAY IN GERMANY

Further particulars are available of the German 2000-volt direct-current railway, the locomotive for which was illustrated in the STREET RAILWAY JOURNAL for May 4, 1907. This line has been recently installed by the Siemens Schuckert Werke, in Lorainne, to connect the Moselhütte iron mines and some blast furnaces owned by the same company at Ste. Marie. The line is 8.7 miles in length and one-meter gage, and with steam locomotives about 2600 tons of ore have been hauled per day. Both empty and loaded trains have to be taken over grades ranging up to 3 per cent. Two locomotives are used and the round trip takes about two hours. The weight of the train is from 200 to 300 tons. Owing to the severe loads and the desire to increase the capacity to 4000 tons per day, it was decided to install electric locomotives in place of steam locomotives.

Three-phase current at 5700 volts was available at either end of the line, but three-phase traction was considered unsuitable on account of the number of trolley wires required and 800-volt d. c. owing to the length of transmission. Estimates were consequently prepared on 2000-volt d. c. and 6000-volt single-phase. Owing to the narrow gage, 60 hp was the maximum output for the largest single-phase motor which could be used, but it was found that a d. c. motor of 160 hp could be built within the space allowed between the wheels of the locomotive.

Current is supplied by two sub-stations, one at each end of the line. Each contains a motor-generator made up of a synchronous three-phase motor giving 880 hp at 375 r. p. m., its starting motor, a 2000-volt d. c. generator and a 65-volt exciter for both generator and motor. The armatures of these four machines are mounted on one shaft. Especial care is devoted to the insulation of the commutator of the high-tension generator which is of the interpole type, and brushes of opposite polarity are separated by insulating barriers.

Two overhead trolley wires are used. They are carried 5 in. apart and are supported from a single catenary. A bow collector is employed on the locomotive.

Each of the locomotives, of which three have been delivered, weighs 55 tons and is equipped with four 160-hp interpole geared motors. The motors are permanently collected in two groups of two in series. The motor armatures have 61 slots, each of which has twelve coils of flat copper. The commutator is built with 83 segments. The controller is of the ordinary cylinder type, although larger than employed for tramway service, so as to give the necessary space for the insulation required for 2000 volts. The main circuit breaker is of the horn type, as it was found that this gave less surging in the circuit than either a magnetic blow-out or oil switch. The information given above is taken from a recent issue of London *Electrical Engineering.*

A "newspaper special" was run by the Indianapolis & Louisville Traction Company Nov. 13, starting from Louisville, coming as far north as Seymour and returning to Louisville. The car was in charge of General Manager A. A. Anderson, and his guests included representatives of the newspapers in towns and cities along the line.

A CRANE FOR HANDLING MOTORS IN CARS

Motors installed in snow plows are frequently removed from them and used under the passenger equipment during the summer season. To those master mechanics on whose systems this practice is followed and who have experienced difficulties in getting the motors in and out of the sweepers, a "C" crane in use in the shops of the Washington Railway & Electric Company will probably be of interest. The crane, which is shown in the accompanying reproduction, was designed by Gordon Campbell, purchasing agent and master mechanic of the Washington Railway & Electric Company, especially for use in removing motors from and installing them in the bodies of snow plows and sweepers. It is suspended from an overhead traveler running on a transverse I-beam. The weight shown on the inner end is required to balance it properly. The suggestion presents itself that a similarly designed crane could be used in storerooms or about freight houses or other places where heavy materials are loaded into box cars.



"C" TYPE CRANE IN WASHINGTON

SUBWAY IN BUENOS AYRES

The Argentine legation has requested American railway contractors to submit bids for the construction in the city of Buenos Ayres of two of the principal lines constituting the proposed system of Metropolitan subway electric railways. It also requests bids for the purpose of lease of the exploitation of the two lines as soon as the construction work is completed. Bases for the bids and some of the plans containing data regarding the proposed railways, it is explained, may be seen by interested parties at the Argentine legation and the consulate at Washington. They are in Spanish, which is the official text, and French and English translations. All bids for the construction and exploitation of the railways are to be sent to the municipal intendente of Buenos Ayres, so that he shall receive them before May 1, 1908, on which day the bids will be opened.

CLASSIFICATION OF ACCOUNTS PROPOSED BY INTERSTATE COMMERCE COMMISSION

Owing to the recently enlarged powers of the Interstate Commerce Commission and the appointment of various public service and railroad commissions in States which hitherto have not possessed bodies of this character, the question of classification of accounts of steam railroad and street railway companies has suddenly been brought to the front. As has been stated in these columns, the New York Public Service Commission have been actively debating the subject with committees of the American Street and Interurban Railway Accountants' Association and the Street Railway Association of the State of New York, and a number of joint meetings have been held. As the readers of this paper know, the subject also occupied a considerable portion of the time of the Atlantic City convention of the Accountants' Association, at which a tentative classificaion of operating accounts was presented differing in a number of respects from that which has hitherto been standard. This classification, with the changes adopted at Atlantic City, was published in this paper last week, although it has not yet been formally adopted by the association or recommended by it. The Interstate Commerce Commission has also been engaged upon the work and has under consideration a classification of accounts which differs quite radically from that of either the old or the new standard of the Accountants' Association, as the operating accounts number 103, while there are forty-four construction accounts. The decision of the Interstate Commerce Commission on the subject is considered of great importance owing to its possible effect on the boards of railroad commissions of the different States.

A meeting of state and interstate railroad commissioners for considering this subject has been called by the commission, to be held at the rooms of the Interstate Commerce Commission, at Washington, on Friday, Nov. 22. It is expected that the Street Railway Accountants' Association will be represented by its committee on standard classification of accounts, Messrs. Ham, Henry and Duffy, and that the American Street and Interurban Railway Association and the New York State body will also be represented at the hearing by a number of its prominent members.

One of the features of the tentative classification of operating accounts drawn up by Henry C. Adams, the statistician of the commission, for consideration is the method of making provision for depreciation. Upon this point the report says:

CONSIDERATION OF DEPRECIATION.

A number of points have been raised by correspondents relative to depreciation that call for the following general statements, all of which bear upon the manner in which depreciation accounts should be treated:

1. The question of depreciation is fundamentally a question of values, and not a question of maintaining the original capacity, or a standard of operating efficiency, or of keeping full the numbers in equipment series.

2. The depreciation rules may be worked either on the basis of the value of individual cars and locomotives or on the basis of the value of series of cars and locomotives. On this point accounting officers are at liberty, until advised to the contrary, to follow whichever method seems to them the more appropriate.

3. The basis of accumulation—that is to say, the amount to which the percentage rate is applied—ought, in strict theory, to be the original cost. For the current year, however, accounting officers are at liberty to accept original cost (estimated, if not known), record value, or purchase price. The term "record value" should not be interpreted to mean the value of the equipment as it stands in the capital account (unless that account represents the original value of the equipment on hand), but the actual cost of value of all equipment, regardless of where charged when purchased; and in case purchase price be accepted as the basis of the percentage charge to depreciate, the percentage rate should be limited to the rate required to replace the price paid. A second-hand car, for example, is not called upon to provide for its replacement, when abandoned, by a new car. As stated above, it is values and not cars with which depreciation charges deal.

4. The application of depreciation charges for the current year and subsequent years must not be influenced by the practice of years past. In case property has been appreciated by excessive charges to operating expenses in years past, the value thus placed in the property must be regarded as a permanent undivided asset to the stockholders. On the other hand, in case property has depreciated on account of insufficient charges to operating expenses in years past, this fact must not be permitted to influence the determination of the depreciation rate for the current year.

5. The monthly charges to operating expenses for "depreciation" on the several classes of equipment will, of necessity, create or require corresponding liability accounts to which such depreciation may be credited. To that end carriers will be required, beginning ————, ———, to set up an appropriate liability depreciation account for each of the several classes of equipment upon which depreciation is charged. These accounts should be designated as follows:

(a) Electric Locomotives—Replacement.
(b) Passenger-Train Cars—Replacement.
(c) Freight-Train Cars—Replacement.
(d) Electric Equipment of Cars—Replacement.
(e) Work Equipment—Replacement.

To these replacement accounts should be credited monthly the amount of accrued depreciation on each class of equipment, respectively. Such credits should invariably equal the gross charges to maintenance for depreciation.

To these several replacement accounts under their appropriate heads should be charged, at cost, all equipment purchased, built or otherwise acquired for the purpose of maintaining the value of a carrier's equipment.

The monthly charges to operating expenses for "renewals" of the several classes of equipment will be similarly treated.

It is not intended that these accounts should be restricted to individual cars or locomotives, or that carriers are not at liberty to renew or replace equipment upon which depreciation has accrued prior to the retirement of such equipment. On the other hand, the several amounts standing to the credit of those replacement accounts should be available to carriers for the purpose of replacement of equipment to the extent of such credits; however, all replacements in excess of such credits must be considered as Betterments or Additions, and charged either to income or to capital.

After referring to the questions of per diem and rental payments, the report defines the operating accounts, of which there are 103, as follows:

TENTATIVE CLASSIFICATION OF OPERATING EXPENSES OF ELECTRIC RAILWAYS.

GENERAL ACCOUNTS.

I. Maintenance of Way and Structures.
II. Maintenance of Equipment.
III. Traffic Expenses.
IV. Transportation Expenses.
V. General Expenses.

PRIMARY ACCOUNTS.

I. Maintenance of Way and Structures.
1. Superintendence.
2. Ballast.
3. Paving.
4. Ties.
5. Rails.
6. Other Track Material.
7. Roadway and Track.
8. Removal of Snow, Sand, and Ice.
9. Tunnels.
10. Bridges, Trestles and Culverts.
11. Over and Under-Grade Crossings.

12. Grade Crossings, Fences, Cattle Guards and Signs.
13. Snow and Sand Fences and Snowsheds.
14. Signals and Interlock Plants.
15. Telegraph and Telephone Lines.
16. Electric Power Transmission.
17. Buildings, Fixtures and Grounds.
18. Docks and Wharves.
19. Roadway Tools and Supplies.
20. Work Equipment—Repairs.
21. Work Equipment—Renewals.
22. Work Equipment—Depreciation.
23. Injuries to Persons.
24. Stationery and Printing.
25. Insurance.
26. Other Expenses.
27. Other than Railway Operations—Cr.
28. Maintaining Joint Tracks, Yards and Other Facilities—Dr.
29. Maintaining Joint Tracks, Yards and Other Facilities—Cr.

II. Maintenance of Equipment.

30. Superintendence.
31. Electric Locomotives—Repairs.
32. Electric Locomotives—Renewals.
33. Electric Locomotives—Depreciation.
34. Passenger-Train Cars—Repairs.
35. Passenger-Train Cars—Renewals.
36. Passenger-Train Cars—Depreciation.
37. Freight-Train Cars—Repairs.
38. Freight-Train Cars—Renewals.
39. Freight-Train Cars—Depreciation.
40. Electric Equipment of Cars—Repairs.
41. Electric Equipment of Cars—Renewals.
42. Electric Equipment of Cars—Depreciation.
43. Shop Machinery and Tools.
44. Power Plant Equipment.
45. Injuries to Persons.
46. Stationery and Printing.
47. Insurance.
48. Other than Railway Operations—Cr.
49. Other Expenses.
50. Maintaining Joint Equipment at Terminals—Dr.
51. Maintaining Joint Equipment at Terminals—Cr.
52. Equipment Borrowed—Dr.
53. Equipment Loaned—Cr.

III. Traffic Expenses.

54. Superintendence.
55. Outside Agencies.
56. Advertising.
57. Traffic Associations, Fast Freight and Traffic Bureaus.
58. Stationery and Printing.
59. Insurance.
60. Other Expenses.

IV. Transportation Expenses.

61. Superintendence.
62. Operating Power Plants.
63. Power Transferred—Cr.
64. Other than Railway Operations—Cr.
65. Purchased Power.
66. Dispatching Trains.
67. Motormen.
68. Road Trainmen.
69. Train Supplies and Expenses.
70. Lubricants for Electric Locomotives.
71. Other Supplies for Electric Locomotives.
72. Carhouse Expenses.
73. Station Employes.
74. Weighing and Car-Service Associations.
75. Station Supplies and Expenses.
76. Yardmen.
77. Yard Supplies and Expenses.
78. Interlockers, Block and Other Signals—Operation.
79. Crossing Flagmen and Gatemen.
80. Drawbridge Operation.
81. Clearing Wrecks.
82. Telegraph and Telephone—Operation.
83. Stationery and Printing.
84. Insurance.
85. Other Expenses.
86. Loss and Damage—Freight.
87. Loss and Damage—Baggage.
88. Damage to Property.
89. Damage to Stock on Right of Way.
90. Injuries to Persons.
91. Operating Joint Tracks, Yards and Other Facilities—Dr.
92. Operating Joint Tracks, Yards and Other Facilities—Cr.
93. Salaries and Expenses of General Officers.
94. Salaries and Expenses of Clerks and Attendants.
95. General Office Supplies and Expenses.
96. Law Expenses.
97. Insurance.
98. Relief Department Expenses.
99. Pensions.
100. Stationery and Printing.
101. Other Expenses.
102. General Administration Joint Tracks, Yards and Other Facilities—Dr.
103. General Administration Joint Tracks, Yards and Other Facilities—Cr.

CONSTRUCTION ACCOUNTS.

The tentative classification of expenditures for road and equipment for electric railways provides the following accounts:

GENERAL ACCOUNTS.

I. Road.
II. Equipment.
III. General Expenditures.

PRIMARY ACCOUNTS.

I. Road.

1. Engineering.
2. Right of Way and Station Grounds.
3. Real Estate.
4. Grading.
5. Tunnels.
6. Bridges, Trestles and Culverts.
7. Ties.
8. Rails.
9. Frogs and Switches.
10. Ballast.
12. Paving.
13. Track Laying and Surfacing.
14. Roadway Tools.
15. Fencing Right of Way.
16. Crossings and Signs.
17. Interlocking and Other Signal Apparatus.
18. Telegraph and Telephone Lines.
19. Station Buildings and Fixtures.
20. General Office Buildings and Fixtures.
21. Shops, Carhouses and Turntables.
22. Shop Machinery and Tools.
23. Dock and Wharf Property.
24. Electric Light Plants.
25. Electric Power Plants.
26. Electric Power Transmission.
27. Gas-Producing Plants.
28. Miscellaneous Structures.
29. Transportation of Men and Material.
30. Rent of Equipment.
31. Repairs of Equipment.
32. Earnings and Operating Expenses During Construction.
33. Cost of Road Purchased.

II. Equipment.

34. Electric Locomotives.
35. Passenger-Train Cars.
36. Freight-Train Cars.
37. Electric Equipment of Cars.
38. Work Equipment.

III. General Expenditures.

39. Law Expenses.
40. Stationery and Printing.
41. Insurance.
42. Taxes.
43. Interest and Commissions.
44. Other Expenditures.

CHICAGO CITY RAILWAY COMPANY'S INSTRUCTIONS FOR HANDLING PAY-AS-YOU-ENTER CARS

The Chicago City Railway Company has just issued a neat 3½-in. x 6-in. 26-page pamphlet covering the rules made for the use of motormen and conductors operating the pay-as-you-enter cars. The booklet includes illustrations showing the correct position of the conductor on the divided platform and when requesting passengers to take the next car; also the proper method of collecting fares on the rear platform when the passengers are entering, and a seating and platform plan of the car with arrows to designate the passengers' movements. The instructions point out to the conductor the advantage the new car possesses in eliminating platform accidents, and impresses upon him the importance of recommending the passengers not to board a car already carrying more than the eighty passengers considered as the desirable maximum. The conductor must also see that the exit portion of the rear platform is kept clear at all times and the entrance portion occupied only by passengers while paying fares. Only the last few passengers taken on before the car becomes fully loaded are allowed to remain on the rear platform.

CHICAGO CITY RAILWAY COMPANY

Traffic Slip

LINE *Indiana Ave.* **CAR No.** 5226

DATE 10—17 07 **TIME LEAVING TERMINAL** 7.30 **A. M.** **P. M.**

GREATEST NUMBER PASSENGERS ON CAR AT ONE TIME

NORTH 44 **SOUTH** 56

CONDUCTOR BADGE No. 1478

CONDUCTOR'S TRAFFIC SLIP

As the method of collecting fares on the rear platform before the passengers enter the car is a novel one in Chicago, there will be at the outset a certain amount of leeway allowed by the conductors to guard against delays to traffic for disturbances caused by misunderstandings with the passengers. The conductor, however, is expected to minimize such troubles by courteously requesting passengers to "Have your fares ready, please." In general, the conductor will not enter the car to collect fares except where, on account of some accident, he has been obliged to leave the platform while passengers were boarding the car and going inside. To assist in the rapid collection of fares, all conductors will be supplied daily with a change carrier containing $15.

The guard rail on the front platform protects the motorman from the crowding of passengers, relieves him from much annoyance and insures quicker action on his part in case of accident. The front platform is the only place where smoking is permitted.

The company has adopted a dispatching system which by the use of telephones and starters places the movement of the cars upon all parts of a line directly under the control of the dispatcher at all times, thus insuring greater flexibility in case of delays and closer regulation to traffic requirements. The office of the dispatcher will adjoin that of the division superintendent and will be connected with signal boxes located on the streets. These boxes, to which each conductor and motorman will be given a key, will contain a telephone for direct communication with the dispatcher. Trainmen will use these telephones in calling for the repair wagon or on other emergency occasions. In the loop district the signal boxes are supplied also with a signal whereby the wagon located in that section may be called by the simple turning of a lever. At the outer end of each line the company will maintain depots with telephones and starters who will act as assistants to the dispatcher in controlling the starting of cars by signal bells. Runs will be assigned as heretofore, except that cars will leave the outer ends of lines only as directed by the starters, and will be operated upon such running time as he may designate by the display of a number in plain view. Printed running time-cards in accordance with these numbers displayed will be supplied to each crew. Traffic slips of the type shown in the accompanying cut will be filled out by the conductor on each half trip. The slips will be turned in at the starter's terminal depot each round trip. The relieving conductor will take up and use the slip of the conductor relieved.

President T. E. Mitten, under whose direction the foregoing procedure has been devised, announces that in a few days information cards will be distributed to passengers before the pay-as-you-enter cars are placed in service.

MEETING OF THE MASSACHUSETTS STREET RAILWAY ASSOCIATION

At a meeting of the Massachusetts Street Railway Association, at Young's Hotel, Boston, held Nov. 13, Lee H. Parker, of the Stone & Webster Engineering Corporation, presented a paper suggesting certain economies in railway operation. One point mentioned was the importance of providing as closely as possible for future requirements of the road. A fairly close estimate can be made of future business by a study of statistics. The speaker recommended the plotting of curves showing (1) population, (2) passengers per capita, (3) car-miles per passenger carried, (4) average weight of cars, (5) watt-hours per ton-mile. The product of the last two gives the energy per passenger, and the product of all five the kw-hour output. By a study of these curves the manager should be able to determine fairly closely the probable maximum kilowatt capacity required for a given period in the immediate future. This having been determined, a study of saving by redistribution of feeder copper can be taken up. The writer referred to the facilities for investigations of this kind possessed by large engineering firms. He also referred to some recent electric railway projects in Texas, notably one between Dallas and Sherman, a distance of 63 miles, and one between Galveston and Houston, 45 miles. The former will use 80-lb. rail, creosoted pine ties, gravel ballast, No. 00 overhead wire, and single cars with four 75-hp motors. These cars will also be fitted with multiple-unit control, and will have a schedule speed of 24 m. p. h. and a maximum speed of 45 m. p. h. The total cost of this road, including engineering contingencies and interest during construction, will be about $36,000 per mile. On the road between Galveston and Houston trains of two cars will be run, operating d. c. when on the lines of the existing city systems and single-phase between the city limits. The schedule speed will be 45 m. p. h. with seven or eight stops, and the maximum speed 65 to 70 m. p. h. The motor cars will weigh 50 tons and will be equipped with four 125-hp motors and will haul 25-ton trailers. The cost of the single-phase section only of this line will be $40,000 per mile.

TELEPHONE BLOCK SIGNAL SYSTEM

The Rochester, Charlotte & Manitou Beach Railway Company has been using during the past summer a block signal system with semaphore control, manufactured by the Telegraph Signal Company, of Rochester. The line is about eight miles in length, and reaches Manitou Beach and Manitou Beach Park, attractive pleasure resorts near Rochester, and operates only during the summer. The signal system is controlled by the dispatcher's office.

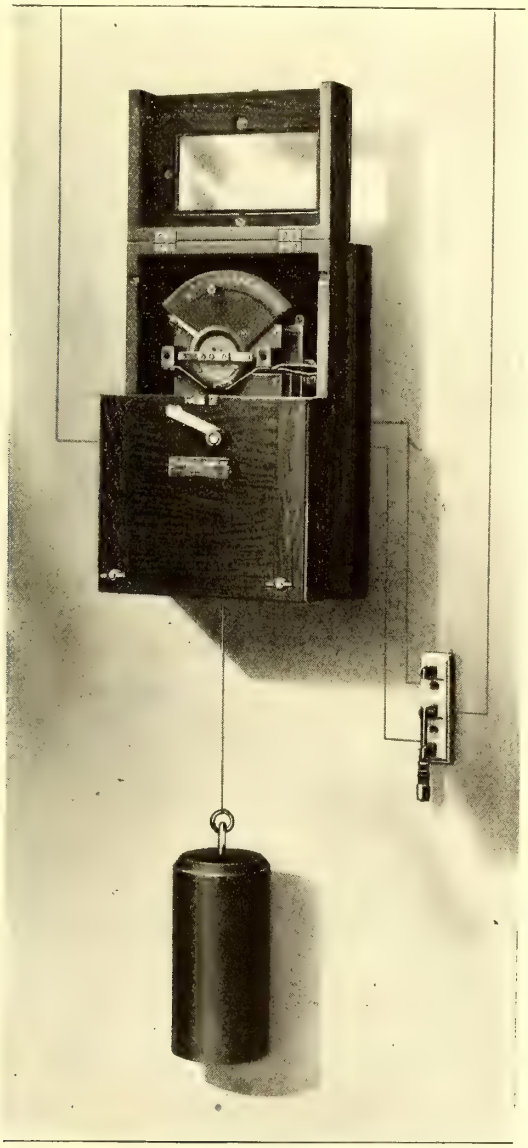


FIG. 1.—MASTER SWITCH IN DISPATCHER'S OFFICE

The semaphore stations, which are erected at every siding, consist of a small booth about 4 ft. x 4 ft., and 8 ft. high, and contain the station signal appliance and a telephone. Adjoining the station is a single blade semaphore governing both directions. The mechanism for operating the semaphore is arranged to be operated by the trolley circuit if desired, and all of the semaphores are controlled from the dispatcher's office by a master machine. The train crews, as usual, operate under train orders, which specify the stations at which they are to stop or sidings at which they are to pass, and the signal system is used to notify them to communicate with the dispatcher. If the latter wishes to halt a train at any of the stations on the line and give the crew new or changed orders, it is within his power to do so in a very few seconds.

To illustrate; let it be supposed that the dispatcher has given orders in the regular course of business for train No. 3 going west and train No. 4 going east to meet at station No. 6. Before giving these orders he, desiring to utilize the system, as a reminder of orders, places the plug in No. 6 on the dial shown in Fig. 1. In ten seconds or less the semaphore at station No. 6 has been thrown to danger, and that fact certified upon the dispatcher's tape register After communicating with the dispatcher, the conductor places the signal at clear and both trains proceed normally.

Again, let it be supposed that a change of orders is desirable, and that it is the purpose to cause two trains to meet at other than the regular meeting point; for instance, station No. 4. First the dispatcher places his master machine plug in No: 4 on the dial. The semaphore blade at No. 4 will go to danger and record that face on the dispatcher's tape register. To facilitate traffic, save time and render the meeting point absolutely certain, the dispatcher, in rapid succession, occupying but a few seconds' time, throws signals at stations No. 3 and No. 5, getting his

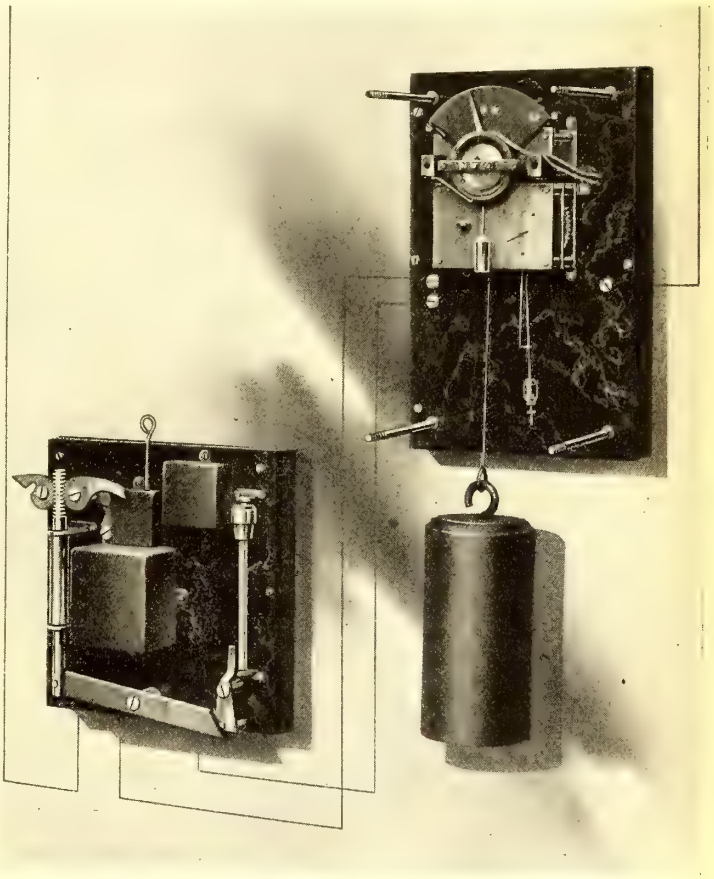


FIG. 2.—SIGNAL DEVICE AT BLOCK STATION, COVER REMOVED

record on his tape register, the three throws occupying less than 20 seconds time. The crew of the westbound train, therefore, finds the signal set against them at station No. 3, and, opening the booth, they get orders to run to switch No. 4, and there meet the eastbound train. Likewise the crew on the eastbound train finds the signal at station or switch No. 5 against them, and opening the booth receives orders to meet the westbound train at station No. 4. If for any reason there was a misunderstanding or orders by either crew, both crews would find semaphore signals set against them at station No. 4, the prescribed meeting place. After reporting to the dispatcher the semaphore signal is drawn to clear and the trains proceed. Fig. 2 represents the station appliance and trip with the case removed.

On interurban lines the appliance is worked on open cir-

cuits. On the Rochester, Charlotte & Manitou Beach line kerosene oil lamps are used in the signal, burning day and night. These lamps are trimmed every four days and are filled every six days.

In steam railroad single-track service the signal system is varied somewhat from that described. The master-machine and various appliances at each station are cut in, if desirable, on the dispatcher's train order wire, operating, of course, with closed circuit. By means of a simple device for short-circuiting the operator's key, the dispatcher at his office is enabled exactly, as in the case of the interurban trolley line, to throw the regular semaphore against a train going in either direction regardless of the operator. Thus, in a case of emergency, where a mistake or a misunderstanding of orders has been discovered, the dispatcher can set the target at a selected station at danger where the operator is absent, disabled, or even dead.

If the operator's key at the station is open a prescribed number of seconds that key is automatically cut out of circuit, and to be effective on the line must be restored. Thus, if the operator has closed his office and left his key open, the key is automatically cut out of circuit. Thus the semaphore at that station and those at all stations are placed at the disposition of the dispatcher. The telegraph signal appliance is connected with the regular semaphore in the usual manner.

Installation of this system has just been completed on the line of the Indiana Union Traction Company, between Wabash and Anderson, and installation is under way on the International Railway, Buffalo to Olcott Beach.

It should be understood that the telegraph signal system, both on trolley and trunk railways, is independent of any existing signal system, and properly supplements such system for emergency semaphore control.

NEW VOLUME OF RAILWAY LAW IN MASSACHUSETTS

What is regarded in railway and railroad circles as an important publication is now about to issue from the offices of the Massachusetts Railroad Commission. It is the new compilation of railway, railroad and interurban laws, as at present standing on the books, with an elaborate and minute index and marginal references and citations. The book, now coming off the press, is to be bound in boards, and will comprise about 200 pages.

This is the third compilation of these laws issued by the commission since Charles E. Mann became clerk of the board in 1903. Each volume, under Mr. Mann's painstaking editing, has shown improvements in arrangement and annotation over those preceding, and the volume now about to issue will include such markings as will enable a lawyer to find at once not only the particular section he is after, but also to tell at a glance what chapter it came from and what decisions in the courts have acted to modify or to define it. More than this, the index has been so extended and amplified that under some headings the list of titles is increased in twofold or threefold ratio.

The annual report of the board, which has been making its appearance earlier and earlier each year since Clerk Mann entered upon his duties, is expected to be ready practically as soon as the Legislature comes in in January. An effort will be made to have it complete at that time, without the need of supplementary report, and if this is successfully achieved the report will provide the special reports required by the last Legislature with reference to fares in the Boston suburban district, and the condition of the Boston & Albany Railroad with reference to whether the State should or should not terminate the lease to the New York Central & Hudson River Company. The report on suburban fares, intended to determine whether some general readjustment is necessary to the public interest, will be of interest to street railway men, inasmuch as the increase of street railway lines has an important bearing on fares for suburban travel on the steam roads.

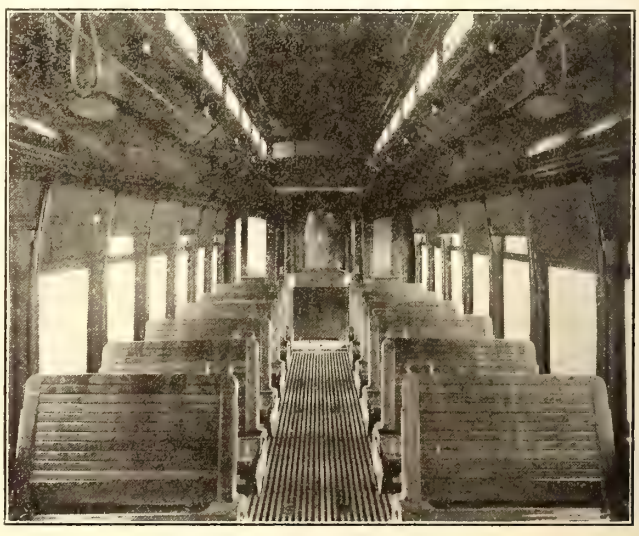
NEW ROLLING STOCK FOR COLUMBIA, S. C.

The Columbia Electric Street Railway, Light & Power Company, of Columbia, S. C., has just received from the G. C. Kuhlman Car Company three semi-convertible cars



EXTERIOR OF COLUMBIA CAR

mounted on No. 21-E trucks. The company operates 22 miles of track and forty-one cars, and its service increased from 1,827,770 passengers in 1904 to 2,446,274 in 1905, and 2,975,472 in 1906. In eight months during the present year 2,166,344 passengers were hauled, and new rolling stock became imperative, and it is expected that still more cars will be ordered in the near future. The principal dimensions of the new cars for Columbia are as follows: Length over end panels, 20 ft. 8 ins.; over crown pieces, 30 ft. 1 in.; width over sills, including panels, 7 ft. 8½ ins.; over posts at belt, 8 ft.; size of side sills, 3⅝ ins. x 5 ins.; end sills, 3½ ins. x 8⅜ ins.; sill plates, 12 ins. x ⅜ in. The trucks have a wheel base of 7 ft. 6 ins. The inside finish is of cherry. The slat seats are of Brill make, as are numerous



INTERIOR OF COLUMBIA CAR

specialties used throughout the cars, such as angle-iron bumpers, radial drawbars, etc.

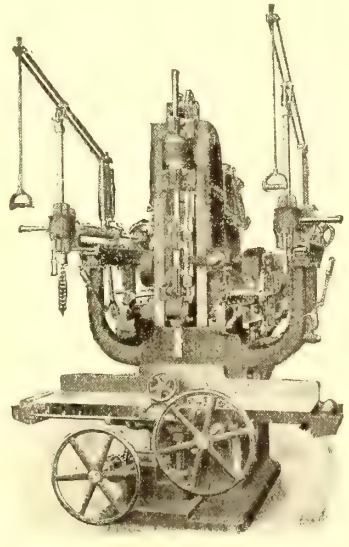
All the principal street railway systems in South Carolina—Anderson, Charleston, Columbia and Greenville—operate with semi-convertible cars, and in the last city the convertible is operated as well.

HANDLING PRESS COMMENTS ON THE NEW HAVEN

It is the practice of the New York, New Haven & Hartford Railroad Company, through its press bureau, to bring to the attention of all the officials of the company news items appearing in the daily papers throughout the territory which both the steam and the electric properties cover. In this work is used a four-page folder of heavy cardboard, which is dated at New Haven. Each page is divided into three columns, leaving considerable margin, and at the top of the first page, as a cross heading, is the caption, "Comments of the Press." Each morning the Press Bureau pastes up the clippings, cutting the date and the name of the paper from the paper itself and pasting them at the beginning of the clipping. On the last page of the folder a space is set apart for the signatures of the president, assistant to the president, the two vice-presidents, the attorney, the general manager, the passenger traffic manager and the freight traffic manager. The folder, when it has been prepared for the day, is first sent to the president's office, after which it is passed on to the other officers.

A CAR MORTISER DESIGNED FOR HEAVY WORK

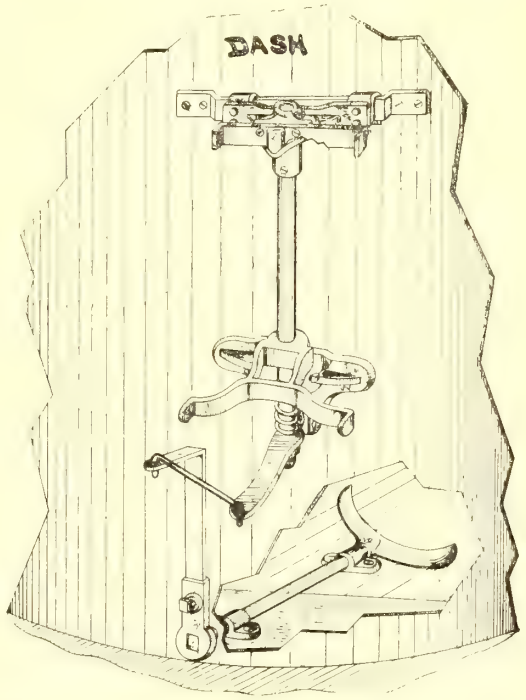
The latest car mortiser built by the J. A. Fay & Egan Company, of Cincinnati, is designed for heavy work in both car and bridge construction, and is made with one, two or no auxiliary boring attachments. It has a capacity for mortises from ½ in. to 3 ins. square, and up to 6 ins. deep; or, by reversing timbers, 12 ins. deep. The frame is a single-cord casting with wide base of immense weight. The housing is securely gibbed to the frame with provision for taking up wear and moves transversely on frictionless rollers by hand wheel and can be securely locked in any position desired. The chisel ram is gibbed to the housing, and has a vertical travel of 18 ins. The auger spindle is driven at the proper speed by a belt with take-up so that the strain is constant regardless of the position of the housing. The reciprocating motion of the chisel ram is produced by a pinion in a rack operated by friction pulleys, giving a constant and positive drive. The table is made either stationary or traveling. The stationary table is 6 ft. 6 ins. long and is provided with stops to regulate the length of mortise. It is operated by hand wheel, rack and pinion and can be raised and lowered by hand. The traveling table can be furnished any length desired. It is made of steel I-beams, has automatic feed under instant control of the operator and is provided with adjustable stops for regulating the distance between mortises. The countershaft is self-contained in the base of the machine, convenient for direct connection of motor drive. It has tight and loose pulleys 18-in. x 8½-in. face, and should make 840 r. p. m. The auxiliary boring attachments angle 30 degs. in either direction. The two spindles have a vertical stroke of 18 ins. and a laternal adjustment of 18 ins., and are driven by independent counter hafts, having tight and loose pulleys 10-in. x 4½-in. face, and should make 750 r. p. m.



CAR MORTISER FOR HEAVY WORK

AN ADJUSTABLE ARC HEADLIGHT HOLDER

An adjustable arc headlight holder, designed along new lines with the object of having the light illuminate the track in rounding curves and not spend its rays on the adjacent roadway and leave the car unprotected, has recently been perfected and placed on the market by the Adams & Westlake Company of Chicago. It is known as the Gardner-Furber Headlight Adjustable Holder, and is a simple shiftable support, requiring no change in the headlight or in the dash-bracket in which it is hung, the device itself being hung in the bracket and the headlight on the device in the same manner that it is ordinarily hung on the dash-board. A T-shaped treadle is secured to the floor of the platform, and from it a rod extends through the dash-board carrying an upright rod connecting with the lower part of the support, as shown in the accompanying illustration. The treadle is in front of the motorman's right foot, three-quarters of an inch above the floor, and a downward pressure on either side of the treadle shifts the position of the headlight and throws the light rays to the right or left to take in any curve of track. This swing of the holder may also be taken advantage of to throw the glare of the light out of, or away from, a frightened horse's eyes, and still have part of the rays on the track. The device centers itself and stays on the center when the motorman's foot is not on the treadle, and can of course be moved from one end of the car to the other. It has no bolts to be screwed in the front of the car, can be applied in a very few minutes by any ordinary mechanic and can be used on open or vestibuled cars. It has been thoroughly tested in practical service and is adapted for use in connection with Mosher, Wagenhals, Wellman, Eureka, Venus, Monitor, and other types of outside dash electric arc headlights.



DETAILS OF ADJUSTABLE HEADLIGHT HOLDER EXPOSED

FINANCIAL INTELLIGENCE

Wall Street, Nov. 20, 1907.

The Money Market

Further improvement was reported in the local money market during the past week, due in part to the continued heavy importations of gold from Europe and to the heavy liquidation in gilt-edged bonds on the part of individuals and also by some financial institutions, the latter representing the closing out of loans. Money on call ranged between 15 per cent and 5 per cent, the average rate for the week being about 9 per cent. The time-loan department was again at a standstill, the banks and trust companies being entirely out of the market, so that only small amounts were available. Sixty-day money was quoted at 14 per cent and ninety-day funds at 12 per cent. The inquiry for time money was not large, borrowers generally realizing the impossibility of obtaining any considerable amount, but at the same time round amounts could be placed at the above rates if money was available. A feature of the week has been the continued heavy transfers of currency to the interior points, the local institutions showing a loss since last Friday of $5,000,000 on their operations with the Sub-Treasury. Foreign exchange has ruled firm, but nevertheless a considerable amount of gold continues to be engaged by our bankers in Europe. During the week the engagements of the yellow metal aggregated about $15,000,000, bringing the total engagements to date up to about $75,000,000. Of this amount $40,000,000 has been received. Quite an active business has been transacted in currency at premiums ranging from 2 to 4 per cent. The demand for small bills and for gold came from practically all parts of the country and especially from the West and South, where money is needed for crop-moving purposes. At the close of the week, however, there was a material falling off in transactions of this character, and the premiums ran off to below 2 per cent. By far the most important development in the monetary situation during the week was the decision of the Secretary of the Treasury to afford immediate and effective relief to the money market. According to the plans of the Treasury Department it is proposed to issue $50,000,000 bonds of the Panama Canal loan to bear interest at the rate of 2 per cent. Bids for these bonds will be received up to Nov. 30. The Department will also offer at par and accrued interest $100,000,000 certificates of indebtedness. These certificates will be in denominations of $50. As both the Panama Canal bonds and the certificates of indebtedness will be accepted by the Treasury Department as the basis for new circulation, it is expected that these issues will do much to bring about normal conditions in the money market inasmuch as it will put into circulation about $200,000,000, providing the Secretary of the Treasury deems it necessary to issue the full amount of certificates of indebtedness. It is stated by the Secretary of the Treasury that in order that the certificates may be properly distributed throughout the country, $50,000,000 will be allotted by the Secretary in his discretion, and the remaining $50.000,000 will be allotted through the Assistant Treasurers at San Francisco, New Orleans, St. Louis, Chicago, Cincinnati, Boston, Baltimore, Philadelphia and New York, and through the Treasurer of the United States at Washington. It is expected that the issue of the Panama Canal bonds and the certificates of indebtedness will be successful, and that as a result of the effective measures adopted by the Treasury Department, the premiums on currency will entirely disappear and that money which has been withdrawn from the banks and hoarded, will again be returned to the usual business channels. The object in issuing the certificates of indebtedness above referred to is not only to release moneys hoarded by individuals, but also to bring out the bills of small denominations now held by many financial institutions. As a matter of fact the latest relief plans have already been reflected in a decidedly better feeling in financial circles, and it is expected by dealers who have made a specialty of the currency business for the past fortnight that the market for currency will gradually disappear, and that by the end of a week the premium will have entirely disappeared.

The bank statement, published on last Saturday was about as expected. Loans increased $4,694,000 and deposits increased $425,700. Cash decreased $1,135,900, but as the reserve required was $506,425 larger than in the preceding week, the deficit was increased by $1,742,325. The total deficit now stands at $53,666,950, as against a deficit of $51,924,625 in the preceding week, a surplus of $2,371,675 in the corresponding week of last year and surplus of $2,915,150 in 1905.

The Stock Market

By far the most important development in the financial world during the week, and for that matter, for months past, was the action of the Secretary of the Treasury, with the approval of President Roosevelt in deciding to issue $100,000,000 certificates of indebtedness, if such an amount should be found necessary to relieve the situation, and in offering for public subscription $50,000,000 Panama Canal bonds, all of which may be made the immediate basis for taking out circulation by the banks. This announcement was hailed with delight by the entire business community because it will afford a great measure of help to the strained monetary position of the country. With the National Government now pledged to give such substantial relief as that above indicated, however, and with a return to practically normal conditions in banking circles, at least in so far as New York is concerned, a much more cheerful sentiment is gradually being developed and prices for securities generally are recovering, though this movement must necessarily be rather slow. The immediate effect of the Government's intention is apparent in the decided decline in the premium on currency and in a somewhat easier tone to the local call money market. Disappointment is felt over the failure of the enormous gold imports from Europe—now amounting to more than $70,000,000—to exert a better influence here, especially as concerns the statement of the Associated Banks, as well as because of the refusal of the Bank of France to send any gold to this country unless under some sort of an arrangement with the United States Government. However, the proposed issue of certificates of indebtedness by our Treasury will overcome the latter obstacle should it be found necessary to bring further amounts of the precious metal from abroad, while it is thoroughly understood that the reason the heavy gold imports have not figured in the reserves of the local banks has been the disposition on the part of out-of-town banks to hoard money, frequently building up by them of unusually big reserves.

The stock market has at times suffered some from liquidation, notably on the part of Pittsburg and some of the Western cities, as also from heavy selling of United States Steel bonds for the account of members of the defunct Tennessee Coal & Iron pool. In a general way, however, the trend of values has been upward, although the industrials have not advanced with as much freedom as the railroads on account of the fact that because of lack of capital at a time when unusually large orders are on hand, many of the manufacturing concerns are being forced to suspend operations in whole or in part, and at the same time either cut or discontinue dividends. The Government's action is expected to do much to alleviate this condition, and it is the consensus of opinion in banking circles that by Jan. 1, if not before, there will be more money in circulation than for years past. Sentiment in Europe is distinctly better, and these facts, together with the practically unprecedented investment yields which many securities now afford, are counted upon still further to improve the general situation.

The local traction shares as a group have been quiet and without noteworthy feature, though participating in the general improvement that followed the action of the Treasury in coming to the relief of the money market. The extremely low prices at which many of these stocks are now selling, and the fact that the properties which they represent are not near so apt to feel the influence of any protracted business depression as are the great railroad systems and industrial enterprises, are

attracting buyers and the result may be seen in a substantial enhancement in value when least expected.

Philadelphia

Trading in the local traction group continued on a comparatively small scale during the past week and prices generally sustained further substantial losses. Philadelphia Rapid Transit was the leader of the group in point of activity, and after an early advance to 16¼, the price yielded to 12, a net loss for the week of nearly four points and the lowest price on record. Union traction was fairly active at prices ranging from 46¾ to 43¼. Philadelphia Traction was somewhat firmer, with sales at 82¾ @ 83. Consolidated Traction lost 2 to 55 and United Companies of New Jersey sold at 226. American Railways sold at 45, and Philadelphia Company common at 34.

Baltimore

Interest in the traction issues at Baltimore during the week centered largely in the United Railway issues, and especially the 4-per cent bonds, which scored a sharp advance on investment buying. Opening at 82, the price ran off to 80½, but subsequently there was a recovery to within ½ point of the highest. The income bonds, however, were under pressure practically throughout the week, about $75,000 selling from 43½ to 42½. The refunding 5-per cent bonds sold at 69½ and 69, and the stock at 8⅞ @ 9. Other transactions included Baltimore City Passenger 5s at 99½ @ 99 and Knoxville Traction 5s at 104½.

Other Traction Securities

Trading in the Boston market was comparatively quiet, but prices moved with considerable irregularity. Boston Elevated declined from 119½ to 118½. Massachusetts Electric common from 9⅞ to 9½, while the preferred declined from 40 to 38, on light transactions. On the other hand West End common advanced to 80½, while the preferred moved up from 94 to 95. Boston & Worcester common sold at 16, and the prferred at 57. The Chicago market was practically at a standstill, transactions being confined entirely to odd lots. Chicago & Oak Park sold at 2⅛ @ 2, South Side Elevated at 68 and Metropolitan Elevated preferred at 48.

Tractions have been very weak on the Cleveland Stock Exchange the past week, and little trading has been done. Cleveland Electric sold in small lots as low as 33, while a number of other issues have been equally as low. Cincinnati, Dayton & Toledo was quoted at 26 and Northern Ohio Traction & Light at 16½. Forest City was up a few points, the closing figures being 99½ bid and 101¼ asked. Washington, Baltimore & Annapolis certificates remain between 10 and 11.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Nov. 13.	Nov. 20.
American Railways	44½	44½
Boston Elevated	a119½	117½
Brooklyn Rapid Transit	30⅞	30½
Chicago City	150	a150
Cleveland Electric	37	30
Consolidated Traction of New Jersey	55	56
Detroit United	32¼	31
Interborough-Metropolitan	5⅝	5
Interborough-Metropolitan (preferred)	16½	15
International Traction (common)	40	40
International Traction (preferred) 4s	a58½	57¼
Manhattan Railway	108	110
Massachusetts Elec. Cos. (common)	9½	9¼
Massachusetts Elec. Cos. (preferred)	39	38
Metropolitan Elevated, Chicago (common)	21	a19
Metropolitan Elevated, Chicago (preferred)	48	45
Metropolitan Street	—	23
North American	40¼	39½
North Jersey Street Railway	40	40
Philadelphia Company (common)	34	33
Philadelphia Rapid Transit	15⅞	12½
Philadelphia Traction	84½	83
Public Service Corporation certificates	54	54
Public Service Corporation 5 per cent notes	89	89
South Side Elevated (Chicago)	69	67
Third Avenue	15	18
Twin City, Minneapolis (common)	74½	74¼
Union Traction (Philadelphia)	45½	44½

a Asked.

Metals.

According to the "Iron Age" there is a slightly better feeling in the iron trade, which has settled down to a practical solution of the problem facing it. One fact is being reflected in the order books of the producers, and that is that both consumption and buying are continuing at a rate which appears to be somewhat between 60 per cent and 65 per cent of full capacity. The pig iron markets have been quiet, and while prices have been irregular and generally lower, the situation has not been clearly defined.

Copper metal displays an easier tendency, and prices are slightly below those heretofore prevailing. Lake 12⅞ @ 13⅛, electrolytic 12⅝ @ 12⅞, and castings 12⅜ @ 12⅝.

NEW ORDINANCES PRESENTED IN CLEVELAND

Seven new street railway ordinances were presented for consideration at the regular meeting of the Cleveland City Council Monday evening. Five of these provide for fixing compensation for the use of certain tracks of the Cleveland Electric on the West Side by the Forest City Railway Company. The others relate to the routing of cars in the down-town district. One provides that the tracks on Superior Avenue, between East Ninth Street and the Public Square, shall be relocated. A pair of tracks are to be located on each side of the street, with a devil strip five feet wide between each pair. The members of Council seem to think that this will be better than having the tracks together in the middle of the street. The other provides that the city shall spend $40,000 in building temporary tracks for the use of the Cleveland Electric in re-routing its cars so as to avoid congestion in the down-town district. This money is to be taken from the $84,000 which the company paid the city for the use of Central Avenue and Quincy Street after the franchises had expired. The board may put in as many tracks as it sees fit, providing that the cost is kept within the limits of the sum set aside by the ordinance.

RECEIVER FOR INDIANAPOLIS, NEW CASTLE & TOLEDO ELECTRIC RAILWAY

The Indianapolis, Newcastle & Toledo Electric Railway Company and the Newcastle-Indianapolis Construction Company were placed in the hands of the Union Trust Company, of Indianapolis, as receiver, on Nov. 8. The proceedings on which the action was taken in the Superior Court of Indiana were instituted by the Electrical Installation Company, of Chicago, which alleged that the defendant owed it about $650,000. Attorneys for the defendant admitted their client's indebtedness and joined in the petition for receiver. There has been invested up to this time about $1,100,000 in rights-of-way, franchises, material and labor, and only for the existing financial condition the road would have been in operation by Jan. 1, 1908. Plans for completion under the receivership are maturing, and it is expected the road will be finished in the spring.

EARNINGS IN ST. LOUIS FOR OCTOBER AND FOR TEN MONTHS

The gross earnings of the United Railways Company of St. Louis for October, 1906, show an increase, while the net earnings show a small decrease. The increase in the net earnings indicates heavier traffic. The decrease in the net earnings and the net income is due to larger expenses, taxes and depreciation charges. The company has invested considerable money in reconstructing its own lines and also in improving what was formerly the Suburban property. The following is the comparative statement for the month and year to date:

MONTH OF OCTOBER

	1907	1906
Gross earnings and other income	$971,322	$933,613
Expenses, taxes and depreciation	607,450	558,915
Net earnings	$363,872	$374,698
Charges	231,483	231,984
Net income	$132,389	$142,714

JAN. 1 TO OCT. 31

Gross earnings and other income	$9,087,659	$8,566,571
Expenses, taxes and depreciation	5,906,466	5,344,588
Net earnings	$3,181,193	$3,221,983
Charges	2,315,214	2,318,131
Net income	$865,979	$903,852

THE CLEVELAND SITUATION

People of Cleveland were disappointed last Thursday when it was found that the Cleveland Electric and Mayor Johnson were about as far apart as ever on a settlement of the troublesome question of fare and franchises. The fact that both plans proposed by the Cleveland Electric Railway contained an agreement to arbitrate made them distasteful to the Mayor, who had insisted upon a proposition to turn the properties over to a holding company. In other words, the Mayor wanted the company to name a stock value at which the directors would be willing to transfer the properties to a holding company on a leasing plan. The proposition of the Cleveland Electric was contained in the following communication to the Council committee of the whole, including the Councilmen-elect and the Mayor:

November 14, 1907.

Hon. Tom L. Johnson, Chairman,
Council Committee of the Whole,
Cleveland, Ohio.

Dear Sir:—

In response to your suggestion that this company advise the public as to its present position with reference to a renewal of its street railway franchises, we avail ourselves of this opportunity again to assure you and the public that this company is now, as it has at all times been, ready to contract with the city for the maintenance and operation of its system of street railway, and to build all needed extensions, under a grant which shall provide such a rate of fare as will pay the cost of operation, taxes, maintenance and depreciation, furnish a service satisfactory to the public, and return to the company 6 per cent per annum upon the fair valuation of its present property, to be determined by any competent, disinterested parties, and that will be sufficient to justify, in ordinary times, the investment of sufficient money in new stock of the company to provide for such extensions of the property and betterment of the service as the steady growth of the city will undoubtedly require from time to time.

As a business proposition, we have not believed, and do not now believe, that the property could be so maintained and operated at the rate of fare of three cents within and five cents without the city limits. We are, however, willing to make the city the following proposition in order positively to prove or disprove its possibility:

1. In consideration of a new grant to be made, we will surrender all of our Cleveland grants under which we are permitted to charge a cash fare of five cents, with tickets at the rate of 11 for 50 cents.

2. In consideration of such surrender, the city to make to the company a 25-year grant covering its entire city system, including the Central and Quincy Avenue route.

3. The rate of fare under the new grant to be finally determined after a test of six months.

During this period the rate of fare shall be three cents within the city limits and our present authorized fare outside the city limits. During the test period the city to have access to the accounts of the company, and, at the end of the period, the results of the test to be placed in the hands of a board of arbitration made up of impartial, competent experts, they to determine whether the rate of fare collected has earned such 6 per cent on the cost of reproduction of the property, including pavements, foundations and special street improvements, and also upon the value of its unexpired grants as of December 1, 1907.

If it is found that the rate of fare produces the said 6 per cent, then that rate of fare is to continue during the remainder of the term of the grant. If, however, it is found that such six per cent has not been earned, after making due allowance for operating expenses, taxes, maintenance and depreciation, then a rate of fare shall be fixed for the remainder of the term of the grant that will return such rate of interest. During the test period the city is to approve all operating schedules and to have control of the routing of the cars.

4. The result of this arrangement would be to put into effect at once over the entire system of this company the rate of fare now provided by the ordinances of the Forest City & Low Fare Railway Companies, and to continue that rate of fare for 25 years, if it is found that a return of such six per cent is obtained.

While we are ready to make this test, we can but still feel that the low rate of fare advocated by you will not return the 6 per cent interest referred to; and, although we favor a plan like the foregoing, yet we are willing to consider the "holding company" plan originally proposed by you; but we would have certain suggestions to make—among others, that the value of the property and franchises of this company should not be arbitrarily fixed by either party, but should be referred to a competent board of arbitration made up of disinterested experts, and that upon the award so made the rental should be at the same rate as is fixed in the agreement of lease between the Forest City Railway Company and the Municipal Traction Company. This arbitration, in our judgment, need not consume more than thirty days, as a complete inventory of the physical property of the company was made less than a year ago, and can be used, with modifications, as a basis for new estimates, saving a great deal of time. In the grants which have been made by the city to the Forest City Railway Company, the value of the property at the expiration of the grants is to be determined by arbitration. We would also suggest that inasmuch as the holding company proposed has no financial responsibility, some provision should be made out of the earnings of the holding company, for a fund which will adequately take care of depreciation, claims for damages on account of accidents, etc. There are other details which we would suggest if the holding company plan is to be further discussed, among which, of course, would be a method of providing funds for the future growth of the system.

This letter was unanimously approved at a meeting of the board of directors held this morning, and is submitted by order of the board.

Horace E. Andrews,
President.

The discussion which followed the reading of this communication was confined mainly to the Mayor, although President Andrews at times took occasion to reply to some of the statements made. Mayor Johnson strenuously objected to any plan that smacked of arbitration. He said that in the first plan suggested the company wanted to arbitrate fares, and in the second it wanted to arbitrate the value of the stock if it accepts the holding plan. Regarding the proposition to provide for a fund for taking care of depreciation, accidents and other things of the kind, he said the old company would receive a franchise that would protect it in all these matters. He thought this the best security a company could have.

As to the valuation of the stock, the Mayor said that an agreement can be reached in a very short time, if the company will name a figure instead of proposing arbitration. He stated several times that the people had made him and the City Council the arbitrators and that they had rejected the proposition of the Cleveland Electric and refused it a franchise. In answer to his demand for the price at which the company holds its stock so far as the holding plan is concerned, President Andrews stated that the directors have not considered the question of price and that he was not authorized to make other propositions than those contained in the communication. He said his company wants no advantage over the city and he believed that the city desires to take no undue advantage of the company.

President Andrews said that his offer respecting the holding plan contemplated the same arrangement that the Forest City Railway Company has. The mayor denied this because, he said, the value of the franchises was not taken into consideration in fixing the price of the stock of that company. He says that value was the actual cost of the property.

The mayor contended that the value of the properties in the suburbs should not be taken into consideration in fixing a leasing price, but President Andrews combatted that assertion vigorously. He said that the suburban lines and franchises are valuable and should be taken into consideration in anything that may be done.

Pinned down to the basis price he is willing to consider, the Mayor said he would stand by the offer made in April of this year, which was 60 with a drop of two points for each month of delay in accepting the offer. That would make his offer 46 at the present time, but he also suggested that some of the track had been torn up since then and that the figure should be still lower than that to be in accord with the spirit of the offer. He objected to a suggestion from a councilman that a board of experts fix a price for the guidance of both sides and said no good could come of any arbitration unless both sides are bound by it. The city, he said, could legally enter into no arbitration agreement, although President Andrews cited the Chicago case and said he believed that the plan in that city could be followed with propriety.

When the second meeting convened Saturday morning, it was found that the Cleveland Electric was not officially represented, but instead a short communication was received, in which it was stated that the board of directors could see but one fair and honorable manner of arriving at a valuation of the properties for holding company purposes and that is by arbitration and arbitration only. The directors refused to say what will be done with the tracks on the West Side streets, where it is claimed the franchises expire in February next. The Mayor suggested to the Councilmen that the directors be asked to name representatives to meet with the council committee of the whole and negotiate on values and that if they can not agree upon certain points, experts be called in to give an opinion. However, the Mayor still insisted that no arbitration could be binding upon the Council, which he says has been named by the people as their arbitrators. He forgets that almost one-half of the voters did not agree to these men and himself as arbitrators and in his consideration of the matter has not included them at all.

In a supplemental petition in the circuit court in the two cases appealed from the common pleas court a few weeks ago, the Cleveland Electric asserts that the curative franchise passed on Aug. 3 is illegal, because Mayor Johnson, in procuring the new ordinance, acted as agent for men who were persuaded to invest their money upon the assurance of the Mayor of the safety of the investment. The petition further states that the curative act is illegal because it attempts to release the Forest City Railway Company from obligations imposed by the original Denison Avenue franchise. The statement in the new ordinance, that the company cannot be compelled to issue transfers unless 6 per cent is earned on the cost of construction, constitutes an increase in the rate of fare, the petition states.

MEETING OF THE NEW ENGLAND STREET RAILWAY CLUB

Thanksgiving coming on the fourth Thursday in the month, the New England Street Railway Club has decided to hold its meeting and smoke talk in the auditorium of the Edison Electric Illuminating Company, Boston, on Thursday, Nov. 21. Lunch will be served at 6:45, and the regular business meeting will begin at 7:45. Following the business meeting, Hon. George W. Bishop, member of the Massachusetts Board of Railroad Commissioners, will address the club, his subject being "Experience and Observation in Transportation Matters."

TO ELIMINATE GRADE CROSSINGS IN INDIANA

The Indiana Railroad Commission, in a recent circular to the railroads in Indiana, sounds a warning for failure upon the part of engineers and motormen to signal at grade crossings and failure on the part of the roads to keep grade crossings in proper care, two things which the commission says, if properly attended to, will lessen the fatalities at grade crossings. Twenty-eight people were killed on grade crossings in Indiana in July, August and September. The commission recommends to the companies to issue special instructions to the roadmasters and supervisors to put these crossings in first-class shape, and requests managers and superintendents to issue special instruction as to the manner of giving signals. In order that motormen and engineers may be fully informed, and, therefore, not subject themselves to the severe penalties of the law, the commission further requests that the attention of operators be called to the following statute bearing on this subject: "Burns statutes, section 2299. Whoever having charge of a locomotive engine or motor car upon any railroad, fails or neglects when such engine is approaching any road crossing to sound the engine whistle at a distance of not more than one hundred nor less than eighty rods from such crossing, shall be fined not more than $50 nor less than $10; and if any person be injured or killed by reason of such failure or neglect, he shall be imprisoned in the state prison not more than fourteen years nor less than two years. But nothing herein contained shall be so construed as to interfere with any ordinance or by-law that has been or may be passed by any city or town regulating the management or running of engines or trains within such city or town."

INTERURBANS NOT COMMON CARRIERS IN MINNESOTA

Attorney-General Young's ruling that the Twin City Rapid Transit Company's suburban lines are under the jurisdiction of the State Railroad and Warehouse Commission does not affect the company's lines operating within the city limits of St. Paul and Minneapolis. The ruling was based on a decision of the Supreme Court last May, in which it held that the suburban lines were common carriers and railroads, and hence had the right of eminent domain.

In that case the Supreme Court held that the company had a right to condemn certain property in towns along its projected extension of the Lake Minnetonka line. Attorney-General Young's ruling has raised the question whether the fact that the company, so far as these lines are concerned, is a railroad company does not put it in the position of paying the 4 per cent gross earnings tax exacted from the railroads.

While the attorney-general has not examined the question thoroughly, he is of the opinion that this would be the result. However, the taxation of the company for this year already has been provided for by the local assessment officials and the state board of equalization, and it is probable that the matter will be submitted to the next Legislature for such action as may be deemed proper.

The statute provides that railroad companies shall pay a percentage of their gross earnings in lieu of other taxes, but the statute defining common carriers expressly excepts streets railways so far as relates to the carriage of persons or property wholly within the limits of any municipality or municipalities. This would exempt the St. Paul-Minneapolis lines from the operation of the gross earnings law at any rate, as well as the other lines running wholly within the limits of either city or both cities.

MEETING OF NEW PARK ASSOCIATION IN NEW YORK

An important meeting of the National Amusement Park Association was held at the Hotel Knickerbocker on Thursday, Nov. 14. There were in attendance a distinctly representative number of amusement men from both amusement parks and street railway interests. Among those in attendance were representatives from Boston, New York City, New Jersey, Pennsylvania, Virginia, Kentucky, the trans-Mississippi country and the Southwest. The meeting was called to order by the president of the association, Jas. B. Pratt, of the United Railways & Electric Company, of Baltimore. The committee on by-laws reported a form of administrative government for the organization, which was unanimously adopted, and it was decided, in order to attract and stimulate membership in the association, to have Secretary-Treasurer Oberheide visit different parts of the country in an effort to interest amusement park people in the new organization. Two important committees were appointed, one on reciprocity and the other on statistics. The members of the committee on reciprocity are Fred C. Schanberger, Baltimore, chairman; J. J. Weaver, Cincinnati; C. H. Oberheide, Trenton. The members of the committee on statistics are L. B. Sloss, Scranton, chairman; A. S. McSwigen, Pittsburg; C. H. Oberheide, Trenton. After the appointment of these committees the meeting was adjourned subject to call by the president.

An address of welcome was extended to those present by Secretary-Treasurer Oberheide, of the association, in which some very pertinent remarks were made on the conduct of parks in general and on the relation of park managers to the public. Mr. Oberheide said that the first consideration in planning a park was that of scenery. He said that recreation was what was desired by the masses, and that in providing it for them the park managers should see to it that the landscape scene was attractive and that suitable provision was made for women and children. As regards attractions, Mr. Oberheide expressed the opinion that music was both cheap and effective. He said that the three R's of park management were rest, recreation and revenue, and that to secure revenue the public must be given an attractive park, properly policed and kept in good sanitary condition, and that suitable rest features and recreation should be provided. He said, however, that no property could be a success if there were inadequate transit facilities, and proposed a more harmonious relation between the street railway manager and the park manager where the two properties are not controlled by the same interests. Mr. Oberheide expressed the opinion that if parks were not successful the reason could be traced either to inadequate transportation or faulty management on the part of the park managers themselves in not supplying what the public wanted. He said that no general specific could be offered for the selection of park attractions, but that each manager should make a careful study of the people upon whom he would have to depend for patronage, and select his attractions carefully to meet the requirements. He said that the matter of advertising was very important, but heretofore it had been carried on in a makeshift way, if at all. An association such as the National Amusement Park Association, Mr. Oberheide said, was just what was needed to make a success of the amusement park business, as it would provide an exchange where men having common interests could meet and discusss the problems of how to please the public, how to run the park, how to co-operate with the street railways, how to advertise, how to provide for the safety and comfort of patrons, and consider other questions that confront the capitalist, and the manager and his assistants.

The object of the association, as stated in the by-laws, is "to secure unity of action, to promote a more friendly intercourse among its members, to adjust differences between them, to foster business and protect it against unjust or unlawful exactions, to reform abuses, collect statistics and generally to advance the interests of the owners and managers of places of amusement on the North American Continent."

Any owner or lessee of a park is eligible to membership in the association. The initiation fee is $50 and the annual dues $25. The regular annual meeting of the association will be held on the third Tuesday of November of each year at a place to be selected by the president and the board of trustees of the association. Special meetings will be held from time to time by order of the president or vice-president at the request in writing of five members of the association.

CONSOLIDATION OF YORK COMPANIES

The electric railway properties in York County have been merged into one consolidation, under the title of The York Railways Company. Letters patent for the new company have been issued and it will become operative in a short time. The following companies are in the merger: The York Street Railway Company, Wrightsville & York Street Railway Company, the York & Dover Electric Railway Company, the York & Dallastown Railway Company, York Haven Street Railway Company, Red Lion & Windsor Street Railway Company, Hanover & York Street Railway Company. The capital of the consolidation will consist of $19,000,000 in bonds and $450,000 stock. The officers of the new company are: Hon. W. F. Bay Stewart, of York, president; A. H. Haywood, of York, vice-president; David Young, Jr., manager; George S. Schmidt, treasurer and secretary.

WILL TEST SAFETY APPLIANCE LAW

The inspectors employed by the Indiana Railroad Commission have been investigating the causes of several accidents that have occurred recently upon the interurban railroads, and as a result the commission has ordered the attorney general to file suit against one company for the alleged violation of the new safety appliance law. This is the first suit filed by the commission to collect the statutory penalty from an interurban railway for the violation of the safety appliance law. The prosecution grows out of a collision between an interurban car of the road in question and a city car, during a heavy fog, while entering the city of Indianapolis. It is the purpose of the commission, if possible, to discover whether this accident and the several others that have recently occurred in the state, resulting in loss of life and injury to passengers, were due to lack of appliances required by law. A penalty of $100 is provided for each violation of the safety appliance law, and it is made the duty of the commission to collect the penalty by bringing suit, if necessary. It is also the purpose of the commission to find out if the testimony will fix the responsibility of the accidents in question.

ANOTHER MANUFACTURER OF BIG GAS ENGINES

As an indication of the rapid development in the manufacture of big gas engines and the importance of the field occupied by this type of prime mover, it is of interest to note that another manufacturer of large Corliss steam engines has actively taken up the manufacture of gas engines, and is bidding strongly for engines in medium and large sizes.

The Wisconsin Engine Company, with works at Corliss, Wis., which has built some very large and successful Corliss steam engines, is constructing gas engines in sizes from 400 hp to 5000 hp. The engines utilize natural gas, producer gas, coke-oven gas or blast-furnace gas in the Otto cycle (4-cycle), and are of the horizontal tandem and twin-tandem double-acting type. This company controls the Sargent patents on internal combustion engines and has employed Charles E. Sargent as the engineer of its gas engine department. Mr. Sargent has a wide reputation as an engineer, and in 1898 designed a horizontal tandem double-acting gas engine claimed to be the first of that type. It is a notable fact that the largest and most successful gas engines of the present day are of this form.

The gas engines built by the Wisconsin Engine Company bear some of the distinctive features of their big Corliss engines, and utilize in design most of the Sargent patents. The design is remarkably simple, and embodies features which are of considerable interest to the engineer and power user; e. g., there is but one poppet valve for each explosion chamber, and as this is located on the bottom of the cylinder the cumbersome and unsightly air and gas pipes, as well as the stairs, galleries, and railings found on most horizontal tandem engines, are entirely eliminated; provision is made for preventing the dangerous pressures caused by possible preignitions; and the engines are started automatically. Tests of even small Sargent engines show a heat consumption of less than 9000 B. t. u. per brake hp-hour.

This company has recently shipped some large steam engines to such concerns as the Illinois Steel Company, Jones & Laughlin Steel Company, Packard Motor Car Company, American Sheet & Tin Plate Co., Amoskeag Mfg. Co., New Hampshire Spinning Mills, National Tube Company, City of Milwaukee, Carnegie Steel Company, American Woolen Company, United States Envelope Company, and the Carnegie Natural Gas Company, and has built up an unusual reputation for shipping "on time." It promises to do as well on gas engine orders.

SEVENTH ANNUAL REPORT OF THE INTERNATIONAL RAILWAY EMPLOYES' ASSOCIATION

The trustees of the International Railway Employes' Association have presented the seventh annual statement of the association. The membership is 1527, which is an increase of sixty-eight over the previous year, and comprises 58 per cent of all employes of the International Railway system, trackmen excepted. The increase in receipts for the year was $1,404,89, and increase in death benefits paid was $550. The increase in sick benefits and medical attendance paid during the year was $889 over the previous year. Notwithstanding these increased expenditures, the surplus has increased during the year $3,048.85, reaching a total of $14,269.18. During the year the association invested $3,930 in International Traction Company 4 per cent gold bonds; the total amount invested in securities of all kinds being $12,367.50. The International Railway Company contributed $3,082.56 toward the expenses of the association in addition to the free use of the club rooms at Virginia Street. Since the organization of the association seven years ago, the members have paid for dues and initiation fees $56,989.32, and with payments to the beneficiaries of thirty-seven members who have died since its organization and also payments to members for sick benefits and medical attendance, the members have paid into the association but $724.81 more than has been returned to them and their beneficiaries. There is at present a surplus of $14,269.18, resulting almost entirely from donations from the International Railway Company and others, interest on securities and profits from the annual ball. Following is a comparative statement of membership:

	1906	1907
Total for year	994	1158
Dropped from roll	949	1090
Increase for year	45	68
Previous membership	1414	1459
Membership at end of year	1459	1527

The treasurer's comparative report for year ending Oct. 31, 1906, and year ending Oct. 31, 1907, shows as follows:

INCOME ACCOUNT—CLASS "R"

	Year Ending Oct. 31, 1906		Year Ending Oct. 31, 1907	
RECEIPTS				
Initiations, Class "R"	$865.00		$967.00	
Dues, Class "R"	8,249.50		8,730.00	
Toilet supply	97.20		117.25	
Interest receivable	296.20		608.16	
Sale of lost articles	106.50		85.06	
Net proceeds of ball	1,679.40		2,191.22	
		$11,293.80		$12,698.69
DISBURSEMENTS				
Sick benefit, Class "R"	$4,541.00		$6,430.00	
Death benefit, Class "R"	650.00		1,200.00	
Medical attendance, East Side	849.96		849.96	
" " West Side	849.96		849.96	
" " South Side	99.96		99.96	
Medical attendance, Niagara Falls, N. Y.	120.00		120.00	
Medical attendance, Lockport	99.96	7,210.84	99.96	
Net surplus for 1906		$4,082.96		
Net surplus for 1907				$3,048.85

PROFIT AND LOSS ACCOUNT

CREDIT	1906		1907	
Net surplus, Oct. 31, 1905	$7,137.37			
Net surplus, Oct. 31, 1906			$11,220.33	
Surplus in income account for the year	4,082.96		3,048.85	
Profit and loss surplus, Oct. 31, 1906		$11,220.33		
Profit and loss surplus, Oct. 31, 1907				$14,269.18

GENERAL BALANCE SHEET

	1907 Assets	1907 Liabilities
International Traction Co. 4 per cent bonds (par value for 1906, $10,000, and for 1907, $15,000)	$11,867.50	
Reserve fund (Buffalo Railway Co. 6 per cent debenture bond)	500.00	
Cash on deposit	1,988.18	
Deposit for locker keys		$41.00
Honorary members' fund		45.50
Surplus		14,269.18
	$14,355.68	$14,355.68

BOSTON & PROVIDENCE COMPANY GETS CERTIFICATE

The Massachusetts Railroad Commissioners have granted the certificate of public exigency for the Boston & Providence Interurban Electric Railroad, as promised by their so-called interurban decision made public about six weeks ago. The actual issue of the certificate has been delayed pending the settlement of a difference between the company and local authorities in Hyde Park as to the route through that town, but this matter has been settled by the acceptance of the route first proposed. The company's next step is to go ahead with the securing of locations from local authorities all along the line, these to be subsequently approved by the Railroad Commission. It is understood to have these locations already pretty well secured by options on private property.

THE CHICAGO REORGANIZATION

An advertisement signed by the reorganization committee of the Chicago Union Traction Company and addressed to the holders of the securities of the underlying companies, which has been appearing in Chicago papers during the week, urges holders of securities to deposit them in acceptance of the modified plan and agreement recently approved by Prof. John C. Gray and Judge Grosscup. Those who have already made deposits under the former plan, dated Aug. 9, are urged to transfer the securities to a deposit under the modified plan. The Harris Trust & Savings Bank, Chicago, and the Farmers' Loan & Trust Company, New York, are named as depositaries. Deposits may be made on or before Monday, Nov. 25.

Regarding the success of the new reorganization plan, W. W. Gurley, general counsel for the Union Traction Company, on his return from New York recently is quoted as saying that prospects are brighter than ever before for the success of the new plan. The trustees, with the exception of the Guaranty Trust Company, are a unit for it and the opposition of this company is not active. Representatives of the creditors and the stockholders also endorse it.

THE B. R. T. HEARING—UTILITIES BILL UPHELD BY COURT

The Public Service Commission of the first district of New York resumed its consideration of affairs of the Brooklyn Rapid Transit Company, on Wednesday, and inquired into an alleged agreement said to have been entered into some time ago between the Brooklyn Rapid Transit Company and the Long Island Railroad regarding the division of territory on Long Island. Neither President Winter nor Vice-President Williams seemed to know about the alleged compact, and it was shown that its very purpose was being defeated to-day, as both companies were doing and had done things said to have been prohibited.

By a divided court, the Appellate Division, Third Department, upholds the right of the Legislature to delegate its powers to fix a tariff of rates for a public service corporation to a commission. The constitutionality of the new Public Service Commission act was also involved in this case. The prevailing opinion is by Presiding Justice Smith. Justices Chester and Cochrane concur. Justice Kellogg in an opinion dissents, and is concurred with by Justice Sewell. The appeal was from an order of the State Commission of Gas and Electricity, recently succeeded by the Public Service Commission in the Second District, fixing a maximum charge for gas and electricity within the village of Saratoga Springs.

STREET RAILWAY PATENTS

UNITED STATES PATENTS ISSUED NOV. 5, 1907.

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

869,955. Switch for Trolley Wires; Frank M. Zimmerman, Aurora, Ill. App. filed Oct. 23, 1905. Provides at a turn-out a movable double conductor element which swings into alignment either for the direct track or the turn-out.

869,970. Railway Signal and Safety Appliance; Charles J. Kintner, New York, N. Y. App. filed Jan. 18, 1907. Includes mechanical features and electrical circuits, having among other features a train stop lever on the roof of the car which is engaged by an arm from the semaphore signal.

869,987. Means for Keeping Switch and Signal Apparatus Free From Snow and Ice; Francis G. Shaw, Boston, Mass. App. filed April 29, 1907. A casing constituting a heating chamber extending beneath the rails between the ties and supported independently of the ties, and heat generating means therein.

870,029. System of Motor Control; Jay H. Hall, Cleveland, Ohio. App. filed March 19, 1906. A system of controlling one or more electric motors from a distant point. The motor has a magnetically operated switch and an auxiliary switch magnetically opened by the closure of the main switch.

870,051. Car Door and Step Operating Mechanism; Harold Rowntree, Chicago, Ill. App. filed May 13, 1907. The step is lowered to usable position coincident with the opening of the door and raised when the door is closed.

870,080. Trolley Wheel; Charles P. Bostian and Homer C. Bostian, Milton, Pa. App. filed July 15, 1907. Among other features provides V-shaped spurs in the peripheral groove of the trolley wheel for breaking up ice on the conductor.

870,089. Railway; Mark St. Clair Ellis, of the U. S. Navy. App. filed Aug. 23, 1907. A monorail pleasure railway operated by gravity.

870,101. Sand Box; Charles G. Hensley, New York, N. Y. App. filed March 2, 1907. A sand box of that type in which the valve is a swing gate valve, adapted to swing on an axle and to control the flow of sand. The swing valve in this instance has a curved bottom made on a large arc, so that there will be no leak of the sand when the valve is closed.

870,111. Sand Box; Joseph L. Levy, New York, N. Y. App. filed March 2, 1907. See preceding patent.

870,139. Track Relay; John D. Taylor, Swissvale, Pa. App. filed April 18, 1907. An alternating current relay in the form of a wattmeter which operated with only one current frequency. The rotation makes contact through a centrifugal device.

870,145. Electric Signaling System for Railways; Harry J. Warthen, Washington, D. C. App. filed Jan. 13, 1907. A system of that type in which audible and visible signals are displayed in the cab and has automatic means for recording the exact time at which the signal was received and the length of time the train is running after the receipt of such signal.

870,147. Multiple-Unit-Controlling System for Electric Locomotives or Motor Cars; Ragnar Wikander, Westeras, Sweden. App. filed Jan. 5, 1907. Provides means whereby the respective voltages supplied to the motors of each unit may be independently regulated.

870,181. Railway Track Construction; Henry B. A. Keiser, Akron, Ohio. App. filed June 11, 1902. A continuous track support consisting of transversely stiffened metallic plates secured directly to each other at their ends, means for securing the rail-bases directly to the plates, which plates form the sole support for the rails.

870,188. Brake for Vehicles; Joseph N. Mahoney, Brooklyn, N. Y. App. filed June 2, 1905. Relates to brakes of that class which are actuated by springs placed under tension by electric motors.

870,189. Brake for Power Driven Vehicles; Joseph N. Mahoney, Brooklyn, N. Y. App. filed Oct. 30, 1905. See above patent.

870,232. Signaling Device for Railways; George S. Getchell, Los Angeles, Cal. App. filed Jan. 24, 1907. Has a plurality of features, including depressible tappets adjacent the track rail, which are impelled to close the signal circuits by the wheels of a passing train.

870,255. Composite Railway Tie; John Smith, El Paso, Tex. App. filed April 3, 1907. A reinforced concrete tie having recesses in which wooden blocks are inserted for the reception of the rail engaging spikes.

870,284. Safety Device for Air-Brakes; John W. Guffey, Arkansas City, Ark. App. filed Aug. 28, 1907. A pipe section rigidly secured to the platform of the car and communicating with the train pipe, and frangible portions carried by the opposite ends of the pipe section and adapted to be broken by contact with the adjacent car wheels upon the derailment of the car.

870,328. Electric Signaling Mechanism; Jean F. Webb, Jr., Chicago, Ill. App. filed May 31, 1907. Embodies a step-by-step uni-directionally rotatable shaft upon which is an escapement wheel and a ratchet disc which co-operate with the escapement

verge and pawl respectively, carried by the armature of the operating magnets, and a contact carrying wheel also mounted on the uni-directionally rotatable shaft to which one terminal of an electric circuit is connected, the contact wheel carrying a contact plate which is adapted to be engaged by a dog, which is electrically connected to the other terminal of an electric circuit.

870,385. Reversible Car Seat; Eugene P. Rideout, East Oakland, Cal. App. filed Feb. 20, 1907. The seat and back portions of the seat are interchangeable. Means for reversing all the seats on one side of the car simultaneously.

870,427. Train Controlling Apparatus; William Germiner, Pueblo, Colo. App. filed April 2, 1907. Includes a series of independent track circuits, normally open circuits carried by the locomotives and adapted to be closed in conjunction with each other and with any one of the track circuits, an electromagnet in each of the locomotive circuits, and a bleed valve for the train pipe operated on the movement of the armature.

870,440. Horizontal Roller Coaster: Burton A. Karr, Omaha, Neb. App. filed Aug. 12, 1907. Details of construction.

870,489. Amusement Device; John W. Bourke, New York, N. Y. App. filed Dec. 8, 1906. An "autowhirl" in which the car has a depending member on which is a roller which engages the under side of a rail hung from a bracket to thereby keep the car on its track at all times.

PERSONAL MENTION

MR. WILLIAM LOEB, secretary of the President, has declined the presidency of the Washington Railway & Electric Company.

MR. THOMAS McCAFFERTY has been appointed master of transportation of the Pacific Electric and Los Angeles Interurban railways of the Huntington lines.

MR. R. E. BURRISS has resigned as superintendent of the Anderson Traction Company, of Anderson, S. C. Mr. L. R. Nelson, late with the General Electric Company, succeeds Mr. Burriss.

CAPT. J. V. MEIGS, of Lowell, Mass., who, about twenty years ago, attracted considerable attention by proposing a peculiar form of elevated railroad construction for Boston, is dead. It is said that part of the Boston Elevated Railway Company's system is built over a route originally granted to Mr. Meigs.

MR. C. C. REYNOLDS, formerly general manager of the Indianapolis & Northwestern Traction Company, but now general superintendent of the merger system known as the Terre Haute, Indianapolis & Eastern Railway, was painfully injured in an automobile accident at Lebanon, Nov. 12, when the car in which he was riding collided with a wagon.

MR. S. MITSUI, an engineer of Osaka, Japan, is making a visit of a few weeks in this country. Mr. Mitsui's purpose is to inspect electric railway and lighting plants and electrical apparatus ordered in this country by electric lighting and railway companies in Japan. He was in New York last week, and from this country will go to Switzerland, where he will spend several months studying hydraulic installations.

MR. C. S. YOUNG, formerly in charge of the engineering work of the New Orleans & Baton Rouge Railroad, and recently in charge of the Fort Worth-Dallas Electric Railway, operated by Stone & Webster, has been appointed chief engineer of the Fort Worth & Mineral Wells Interurban Electric Railroad, with headquarters in Fort Worth. The new electric line is being built by the Gid. Turner Construction Company.

MR. FLETCHER N. DURBIN, recently appointed general manager of the Evansville & Southern Indiana Traction Company, of Indianapolis, Ind., was graduated from Williams College in 1903, and from that time until he was appointed to the Evansville & Southern Indiana Company, was connected with the Indianapolis Traction & Terminal Company, working through the operating department and serving as assistant superintendent during the last three years of his connection with that company.

MR. S. MATSUMO, mechanical engineer of the Imperial Government Railway of Japan, has arrived in Pittsburg to pay a visit to the Westinghouse Works at East Pittsburg, with a special view to inspecting the Westinghouse single-phase alternating-current railway system. He will also be taken on a trip over the Pittsburg & Butler Electric Railway to show him this system in practical operation, and will inspect some of the other large local industrial plants. Mr. Matsumo expects to depart for England at the end of this week.

MR. JOHN F. REARDON, of Everett, Wash., who, as announced in the Street Railway Journal for Nov. 9, has been appointed superintendent of the Lehigh Valley Transit Company of Allentown, Pa., was born in Northern Michigan, 35 years ago, and first entered the street railway business eighteen years ago in Minneapolis, Minn., where he was employed by the Twin City Rapid Transit Company for ten years. After leaving Minneapolis, he went to Everett, Wash., where he became master mechanic of the Everett Railway, Light & Water Company. Later he was made superintendent of the company, which position he resigned to come to Allentown.

MR. JOHN F. McCABE is purchasing agent for all lines in Massachusetts controlled by the New England Investment & Security Company and is office assistant to the vice-president, with headquarters in Boston. In 1891 Mr. McCabe was appointed clerk in the store-keeper's department of the West End Street Railway Company, of Boston, where he remained for a few months and was then transferred to the auditor's office in the passenger revenue department as clerk. After a year's service here he was temporarily appointed as assistant clerk in the office of the president, and in May, 1902, he was transferred to division 6 of the same company, as assistant clerk, having in charge track department accounts and division correspondence. Here he remained until March, 1901. Subsequently he was appointed chief clerk to Mr. R. T. Laffin, general superintendent of the Worcester Consolidated Street Railway Company, at Worcester, Mass., in charge of all purchases, inspection and office work. In 1903, he was given the title of purchasing agent, with no change of duties.

MR. JAMES F. JACKSON, chairman of the Massachusetts Railroad Commission, has resigned his position to take up the private practice of law. Mr. Jackson will form a business relationship with former Attorney-General Herbert Parker, of Massachusetts, and Brigadier-General Hugh Bancroft, son of Major-General William A. Bancroft, president of the Boston Elevated Railway Company, and will open offices in Barristers' Hall, opposite the Court House in Pemberton Square, Boston. Mr. Parker is already engaged in private practice here, and Brigadier-General Bancroft is filling out the unexpired term of Mr. George A. Sanderson as district attorney of Middlesex, which expires with the incoming of the new year. Mr. Jackson for some time has made no secret of the fact that he intended to retire from the service of the Commonwealth, and the principal reason, without much doubt, is that the salary paid the chairman of the Railroad Commission in Massachusetts, $6,000 per annum, is considerably less than a lawyer of Mr. Jackson's ability and experience may reasonably expect to make in private practice. Mr. Jackson requested that his resignation take effect Nov. 30, and Gov. Guild has written him a letter commending his service and accepting his resignation.

MR. A. L. WHIPPLE, Eastern manager of the Curtain Supply Company, of Chicago, has resigned that position to become second vice-president of the Telharmonic Securities Company, of New York. This company is the financial agent of the Cahill Telharmonic Company, of New York, whose system for the distribution of music by electricity from its central station at Thirty-Ninth Street and Broadway constitutes a center of great interest from both an electrical and musical standpoint to all visitors to the metropolis. Mr. Whipple is very well known in railway circles in this country, through the active part taken by him in organizing the entertainments at the last street railway convention and at previous conventions of the Master Car Builders and Master Mechanics. He has been connected with the Curtain Supply Company for the last nine years, and has been engaged in the railway supply field for fourteen years. During the last convention of the Master car Builders' and Master Mechanics' Associations, at Atlantic City, Mr. Whipple made an effort to have telharmonic music transmitted by wire from New York to Atlantic City. It was largely through the negotiations carried on in connection with this proposal that Mr. Whipple became intimately acquainted with the system of the Telharmonic Company, and this led up to the present engagement.

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DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1907 *to date* 394,950 *copies, an average of* 8228 *copies per week.*

Temperature and Station Loads

The study made by Mr. Corning of the relations between temperature changes and power station outputs, and of which a résumé is printed in another column, throws light upon a phase of operation which has hitherto received comparatively little attention, and indicates with unmistakable emphasis how closely related are the component physical parts of every large electric railway system. It is not a little surprising that the output of such a system should follow such a close relation to the temperature throughout the entire year, in spite of the change from closed to open cars in the spring and back again to boxed-in bodies and heaters in the fall. Even during the same season a large number of observations show that a drop in temperature is accompanied by a substantial increase in load.

The explanation of these relations by the increase in friction due to greater viscosity in the car lubricants as the atmosphere grows colder appears reasonable, though it is an interesting problem just how far the behavior of oil or grease can be charged with the variations outlined in the data printed. The riding habits of the population, the number of cars in service, the general weather conditions, the status of the line and return circuits, the motor efficiency at different seasons of the year, and the condition of the track, all bear upon the load curves at the generating plants. To a considerable extent in a large city these latter factors may offset one another, and certainly the increased friction of cold bearings can be allowed to account for an important share of the day-to-day temperature load variations in the light of the supplementary coasting tests made by Mr. Corning.

The striking lesson of the investigation is undoubtedly the importance of studying the car lubrication problem as a whole in a thoroughly scientific way. It is customary now to use different lubricants for summer and winter service, but it may be desirable to vary the number or composition or both of the lubricants used much more than is done at present. Much emphasis has been laid of late on the possibility of saving oil by working from the car house end, by keeping careful records of the consumption of different cars in terms of gallons per thousand miles or per month, and by watching out for waste in handling the oil. All this is desirable, but it is equally important to select the proper oil for the most reliable service and for the best long-run economy. We are gradually getting away from the point of view which regards low oil consumption as the index of mechanical operative efficiency. To save a few cents in the oil bill of the car and lose dollars in excess from power generated is a policy of doubtful economy. It is very probable that the effect of temperature variations upon bearing friction may be responsible in part for the discrepancies in train resistance measurements often noted in comparing different authorities. Mr. Corning's study shows that whoever sets down any scientific investigation of technical relations in electric railway service as of purely academic interest is taking dangerous ground, and it is to be hoped that further study will be made by operating companies and oil experts of this important subject of lubrication.

Concerning Concrete

The extent to which concrete is now being used as a building material for car houses, sub-stations and even

power houses warrants a further consideration of the topic than has been given in these pages. For the past two or three years the country seems to have been entering upon an age of concrete building to an extent that could scarcely have been imagined a decade since, and it is now high time to look about and take account of stock. A first-class article of cement concrete properly proportioned and honestly mixed is a wonderfully strong and reliable material. It gets harder and harder as time goes on until the structure is almost as solid as a monolith. Yet concrete is now customarily employed in cases where it requires and receives steel reinforcement to adapt it for purposes for which it is by itself mechanically unsuitable. What is going to be the fate of the steel thus embedded after the lapse of twenty-five or fifty years? This question has been asked often enough, but as yet the data are lacking for an answer. A little fairly old reinforced concrete has been examined, and the results have been generally rather encouraging. The uncertainty resides mainly in the fact that the earlier examples of concrete show that the material was used in a rather conservative manner and was itself of a richer and more carefully blended mixture than is now common. In plain English, jerry building in reinforced concrete is of rather recent origin and it is still too early to tell how bad it really may be. With concrete good enough to form almost an hermetical seal about the reinforcement, steel would probably acquire merely a superficial protective coating of oxide and would then last almost indefinitely.

If, however, the concrete mixture is lean and slapped together haphazard the chances are that in some situations at least the steel will be accessible enough to moisture to degenerate into something hardly more tenacious than a streak of rust. The danger lies in hasty and careless work and to judge from some of that we have personally observed, as well as from some of that from which failure has been already recorded, such work is not, to put it mildly, exceedingly rare. There has not been sufficient lapse of time to bring the deterioration of the reinforcement prominently to view, but for every instance of absolute failure of the concrete there are probably several, possibly many, which are saved from immediate failure only by the initial excellence of the reinforcement. What will be the fate of these when the reinforcement is impaired? Some experiments have already been made showing the possible dangers from electrolytic action in concrete and steel beams. Such action is probably not very common, although cumulative in its effect and ultimately, perhaps, destructive.

The fact is that concrete construction gives almost unique opportunities for scamping, and it cannot be watched too closely. There are plenty of reputable firms who can be trusted to do good work and plenty of the other kind who cannot. When contracts for such work are being drawn, they should be most carefully safeguarded, and during execution should be superintended with the utmost vigilance. Granting that the contractor is scrupulously honest it is still possible for very serious mischief to be done in a few hours by a negligent or unskilled foreman, and mischief, too, that is at once covered up and undetectable until the day of reckoning. Concrete has certainly come to stay and a most excellent material it is—at its best. It is likely, however, that there is much still to be learned regarding the safe limits of its employment, and it is well to be cautious lest one furnish a sorry lesson.

Giving the Workmen a Definite Aim

When there is something definite to work for, or when two or more persons are competing, an individual is more inclined to put his best efforts into his work. The operation of many electric railway systems could no doubt be carried on more cheaply and the men doing the work would be brought to enjoy it in a greater degree if the aim at reduction in costs were kept before the men and a rivalry were developed between the department foremen to see which could conduct his department at the least expense.

This would involve the introduction, into a large portion of the work, of some kind of a competitive plan. Where there are several line crews under separate foremen and each has charge of separate sections of the line, expenses of maintaining the line could be reduced to cost per mile per month, or probably a more accurate basis would be cost per car-mile per month with allowances for curves, etc., if this would not involve too much work. Again where there are several sub-shops doing inspection and light repairs on cars or at least the same class of work the costs in each shop could be gotten out in cents per car-mile at the end of each month. Further comparisons could be made between labor and material costs. The plan would include a comparison of the records of the different shops or of the different line crews each month, so that each foreman could find out just where he stood in comparison with his fellow foremen. The workmen themselves might be acquainted with the costs in order to imbue them with a spirit of rivalry.

Power-house foremen usually work against the cost per kilowatt-hour, but it is not customary to acquaint the foremen and engineers with the results. If these men are of the proper stamp and have the company's interests at heart no harm could result and possibly much good would be accomplished if they were kept informed of the records each month. The firemen would, of course, be more interested in the pounds of water evaporated per pound of coal, and if they were kept constantly informed of the figures obtained from month to month the pleasure of trying to accomplish something would often result in them firing more carefully and more economically.

The engineers should be directly interested in the pounds of water per kilowatt-hour and in order to reduce the quantity from month to month they would probably be more thoughtful about running units at their most economical loading. The desire to reduce costs in general would probably result in a hundred little economies in the power-station operation, which in the aggregate would amount to a substantial saving.

Some earnest thought along this line might result in the development of plans peculiarly suited to the local conditions of every system, whereby men could be brought to feel that they were working with a definite aim in view with resulting economies.

Protecting Trees from Wire Injuries

The question of protecting trees from the effects of high voltage currents and from improper guying and attachment of wires, has received considerable attention from electric light and power companies, and to a less degree perhaps,

electric railways have been interested in the subject. There is no doubt that the attitude which an operating company takes in regard to tree protection exerts a wider influence on public sentiment than is generally realized. It is advisable that all suggestions from responsible authorities on the growth of trees and their protection against improper wiring should be given a careful consideration by street railways, though in some cases, of course, the treatment recommended may not be feasible from the company's standpoint.

A paper by Prof. Geo. E. Stone, of Amherst, in a recent number of "Woodland and Roadside," treats the protection of trees in a broad way which seems fair both to the electric companies and the public, and it includes a number of practical suggestions worth mentioning in these columns. It appears that some methods of attaching wires to trees are extremely injurious, while others are not so harmful, and if properly employed will seldom or never cause the tree to be damaged. For example, Professor Stone states that the usual method of guying a pole to a tree by means of a log bolt driven into the back side of the tree, the wire being kept away from the tree by rough bits of wood, is to be condemned, since in a few years the wire is certain to become imbedded in the bark and cause partial girdling, and the log bolt will also become imbedded as the tree grows. Placing a wire around a tree directly is sure to cause strangulation and kill the trunk or limb to which it is attached. According to Professor Stone, the best method of guying to trees consists in having a large loop of wire passed around the tree, the tree being protected from the wire by oak or hard pine blocks grooved in the middle. The loop should be made large enough to allow for the future growth of the tree and should be clamped in place.

Such injury to trees has been prevented by the use of wooden sleeves which surround limbs where wires would come in contact with them. In some cases, notably in Boston, good results have been secured by sleeving the feed wire as it passes the trunk or limb. Professor Stone points out that many cases have been known in which trolley feed wires have been in direct contact with sleeve-protected trees without producing the slightest burning. Attaching wires to trees by means of a porcelain insulator does not prevent leakage in wet weather, and many deaths of trees are attributed to this cause by Professor Stone, who states that trees often get severe shocks by this method of connecting. He states that lightning discharges sometimes pass to trees in this way via trolley guy wires. From the standpoint of the operating company, however, it is hard to see how protection against lightning can be expected of it in its attachments of this kind.

Professor Stone concludes with a plea that trolley poles be braced in Portland cement instead of by wooden guys where they are in close association with trees, urging that the life of the pole in the ground will be increased in addition to the protection given the tree. He concludes that guying to a tree is preferable to unsightly makeshifts of any character. The cost of imbedding poles is something of an item, but it is certain that if more thought is given to specific pole line installations in relation to their surroundings, many operating companies will not regret the consideration paid to the subject, from the standpoint of policy alone, leaving aside the actual physical results. In fact, there is more than one electric railway in the United States attractive to the trolley tourist because of giant elms, oaks and other trees along the wayside. The protection of such trees is surely a matter of self-interest to the local railway as well as to the community.

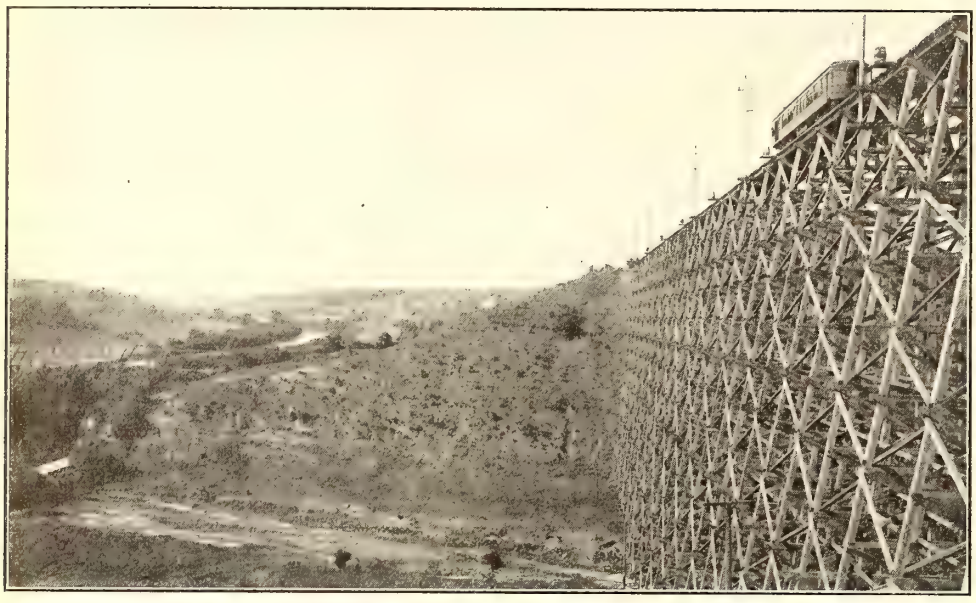
The Action of Steam in Cylinders

Though Hirn by his careful experiments and scientific investigation may be admitted to have laid pretty firmly the foundation of the theory of steam action in a cylinder and to have thoroughly established the theory of cylinder condensation, certain experimenters in Great Britain have for some time been seeking doubtful laurels in overturning Hirn's conclusions, or rather should we say in endeavoring to overturn them, for it cannot be said that any convincing figures have been advanced by the new school. Indeed, from figures which have appeared from time to time it may be said that the conclusions drawn by Hirn are strengthened rather than that the contentions of the new school are in the least borne out. Hirn, it is well known, argued that since the steam in a cylinder is constantly varying in pressure and therefore in temperature, the cylinder metal must be continually striving to attain the same temperature as the steam. The steam and the cylinder metal are but a very brief time in contact, and it is argued by the new school that this time is too short to produce the effects noticed, so the theory of leakage is advanced to explain the facts. A study of the indicator diagrams certainly gives no support to this hypothesis. The *Engineer* (of London) now comes forward and endeavors to show that even if the time of exposure of the steam to the cylinder surfaces is not sufficient to allow of the interchange of heat sufficient to produce the results so well known, it is possible that a film of water globules on the surface would do so. We admit that this is so and we see no objection whatever to this rendering of Hirn's theory. Indeed, we never knew an upholder of Hirn to omit the consideration of water action. Is not the cry for superheat simply an endeavor to abolish the film of water? Has it not always been held that if there be no water to re-evaporate there can be little cylinder cooling and so again still less water?

But granting that the metal surface reactions are intensified by water globules, we would have no one forget in this contention that when the gases from a boiler furnace pass over the heating surfaces of a boiler they do so at a high velocity, yet they lose their heat in an incredibly short space of time. Thus in the case of water tube boilers half the heat of the gases is abstracted in the course of a passage of two or three rows of tubes. Why should the wet gas in a steam cylinder be less active in the interchange of heat than the dry, non-conducting gases of a furnace? We think that a little attention to this curious phase of the steam raising problem may do much to clear up this interesting problem. We see nothing yet to push Hirn's theory off its pedestal, and we might add as another example of rapid interchange of heat the rapid dearth of steam in the surface condenser. The instant formation of a good vacuum seems to us to prove that so far as regards moist steam the transfer of heat to or from metal of a different temperature hardly calls for much time.

THE FORT DODGE, DES MOINES & SOUTHERN RAILWAY OF IOWA

The cities of Fort Dodge, Boone and Des Moines, Iowa, separated by a total distance of only about 90 miles, were for the first time on Nov. 4 placed in direct railway communication by the opening for traffic of the Fort Dodge, Des Moines & Southern Railway. This system combines the electrification of a steam road with new interurban construction. Fort Dodge, like Des Moines, is a very active business town and is also a railroad center of importance. The town of Boone, located midway between, is also an active center. Each of these three cities is situated on one or more important trunk line railways, which in no case connect directly with the other cities. The railroads in question are the Illinois Central and Chicago Great Western at Fort Dodge, the Rock Island and Chicago, Milwaukee & St. Paul at Des Moines, and the Chicago & Northwestern at Boone, all of which with one exception lie practically parallel. The new system links the towns, and therefore connects the railroads at these points, and it will readily be seen that its operation bears vitally on the local traffic problems of the trunk lines concerned, although it is essentially an independent interurban property. The operation of this railway will undoubtedly afford data useful to steam roads in the general problem of the electrification of branch lines.



HIGH TRESTLE WEST OF BOONE, LOOKING UP THE VALLEY OF THE DES MOINES RIVER

When the project was undertaken there was a small steam railroad property, the Newton & Northwestern Railroad, running about northwest from Newton through Boone to Rockwell City, or almost in the direct line between Fort Dodge and Des Moines, though without reaching either city. Briefly then the present project has consisted in the electrification of 42 miles of this steam road and the construction of 25 miles of new line from each end of the electrified section to Fort Dodge and to Des Moines, respectively. A branch line 5 miles long has also been built from Kelley on the main line to Ames, where the Iowa State College is located.

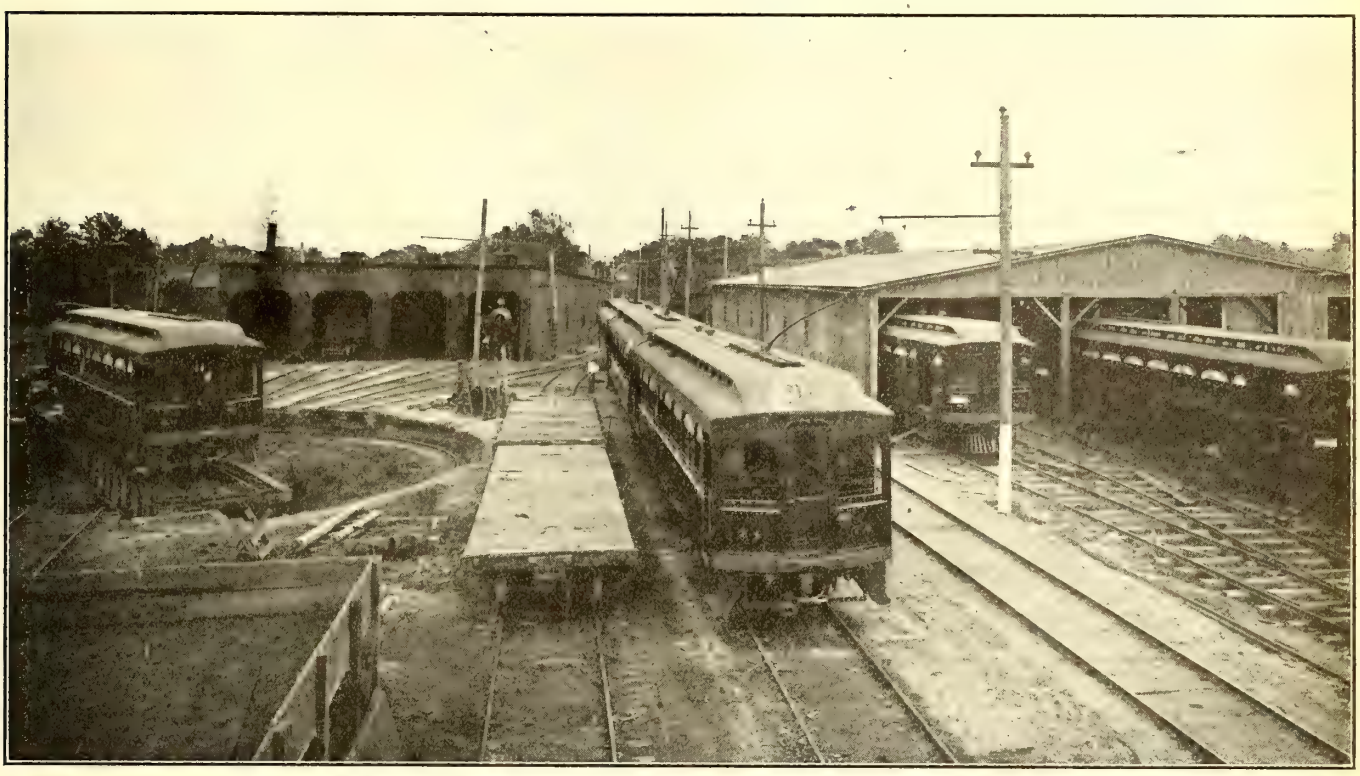
The extension and electrification of the Newton & Northwestern Railroad were carried out on the basis of an estimate of the earnings of the altered property, and the results attained in the brief period of electric operation are better than estimated. No comparison can be made of electric operation with steam operation, as the conditions are materially changed by the extensions. The plans originally contemplated and now in force involve the operation of through electric cars between Des Moines and Fort Dodge, but certain portions of the original Newton & Northwestern, which now become spurs to the through route, are still operated by steam.



THROUGH CAR LEAVING BOONE

In the details of passenger, express and freight tariff collection and in other operating features the Fort Dodge,

Des Moines & Southern Railway is administered according to steam railroad practice. Passenger ticket offices and express and freight offices are established at all regular stations and the aim is to eliminate cash fares. Mileage books for 500 miles are sold for $7.50. A rate of 1¾ cents per mile is established for round-trip tickets, while one-way fares are sold at the rate of 2 cents per mile. Through passenger traffic arrangements have already been made with the Illinois Central and the Chicago Great Western railroads to connect them with Des Moines and Boone from Fort Dodge and the through express business promises equally well.



CAR HOUSES OF THE FORT DODGE, DES MOINES & SOUTHERN RAILWAY AT BOONE



BRIDGE ACROSS THE DES MOINES RIVER

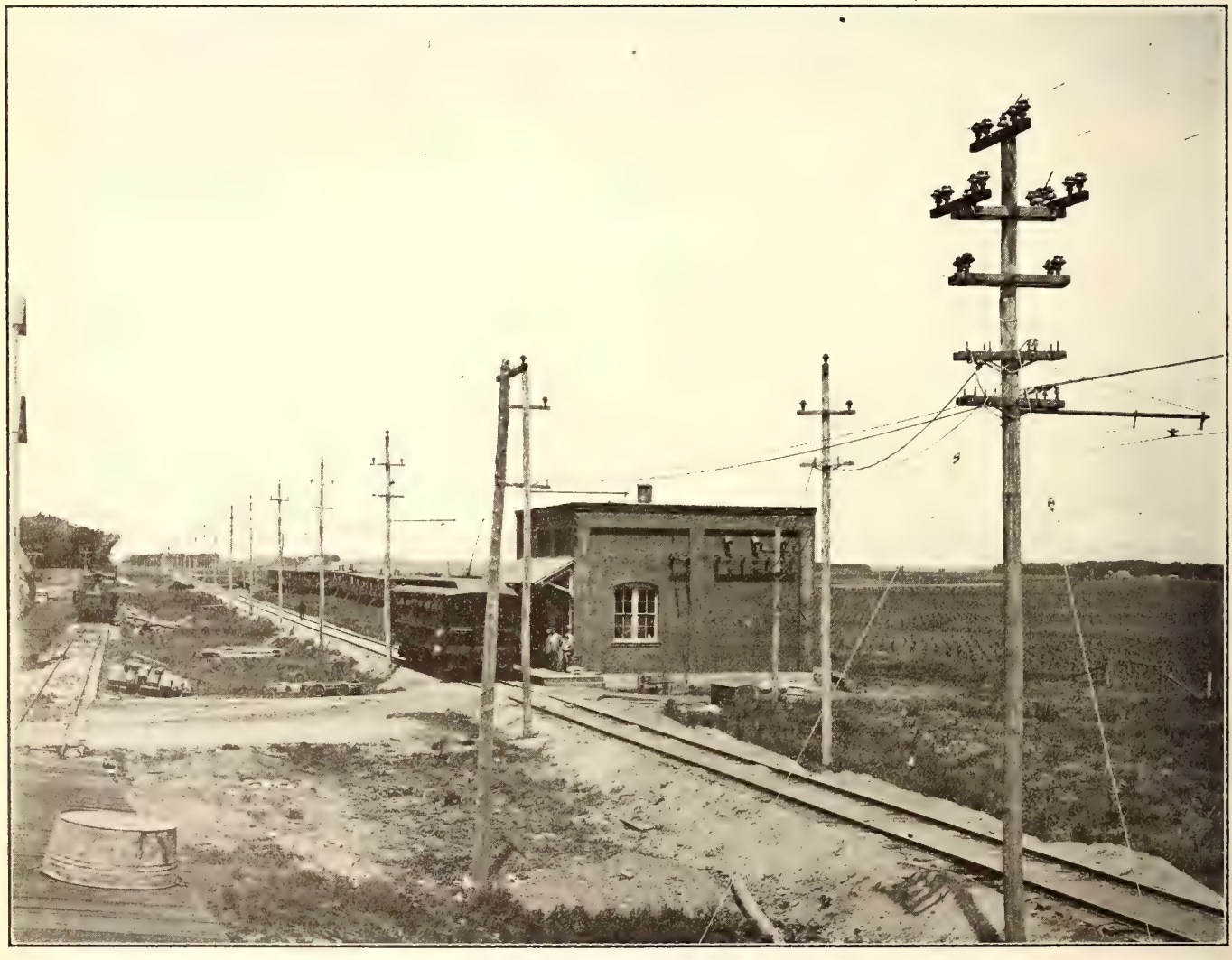
The electric passenger train service, first established between Fort Dodge and Des Moines on Nov. 4, is based on an average speed of 27½ miles per hour, including fifteen regular stops, which means that a maximum speed of nearly 60 miles per hour is frequently attained between stations by the heavy electric express and passenger cars. The total running time from terminal to terminal is three hours fifty minutes, but forty-three minutes are consumed in covering 4 miles within city limits at Des Moines and 2½ miles in Fort Dodge.



MOTOR CAR TAKING UP FREIGHT

Comparison between speed of the electric and steam passenger trains on the above systems is possible only on the stretch between Buxley and Lanyon, which is used in common by Newton & Northwestern and Fort Dodge, Des Moines & Southern trains. The distance here of 42 miles is covered by the average steam trains en route between Newton and Rockwell City in about two hours and by all the electric trains in one hour thirty-six minutes, including the same regular stops.

To provide for the high maximum speed on the system it was necessary to rebuild the permanent way of the electrified section of the Newton & Northwestern Railroad. The road was reballasted with gravel and equipped with heavy rails throughout, and the extensions were constructed to the same standard. Fairly level country is

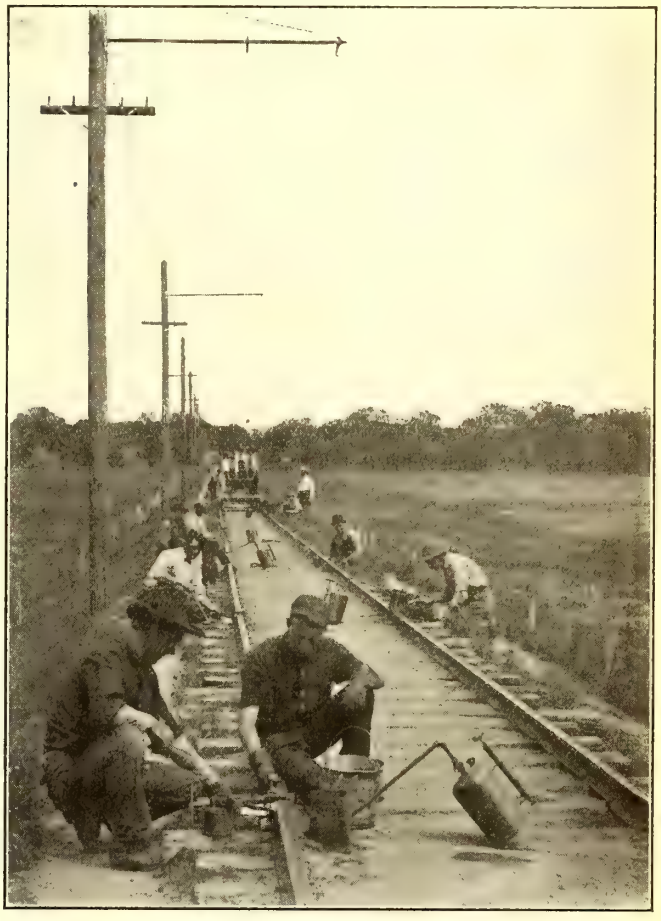


SUB-STATION ON MAIN LINE AT KELLEY

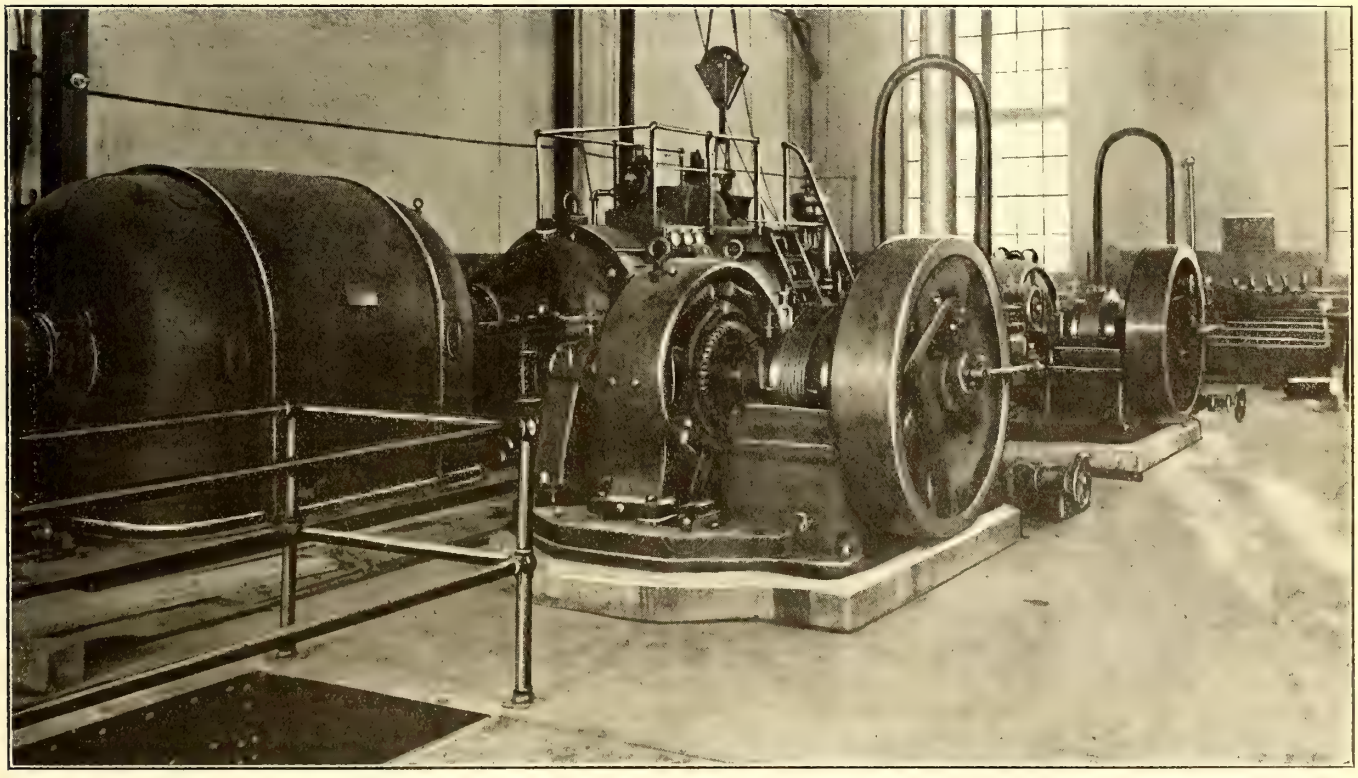
traversed permitting small gradients except near Boone, where the line crosses the Des Moines River, and the country is rugged and cleft by deep ravines. On this section a 2½ per cent grade is encountered, while still heavier grades were obviated on the original line in the Des Moines River Valley only by a series of trestles, bridging the ravines before mentioned, where they emerge into the river flats. One of these trestles just west of Boone is among the highest and longest in the country. The rugged and picturesque character of the country, which gives the Fort Dodge, Des Moines & Southern Rail-



POWER HOUSE AT FRAZER, IOWA



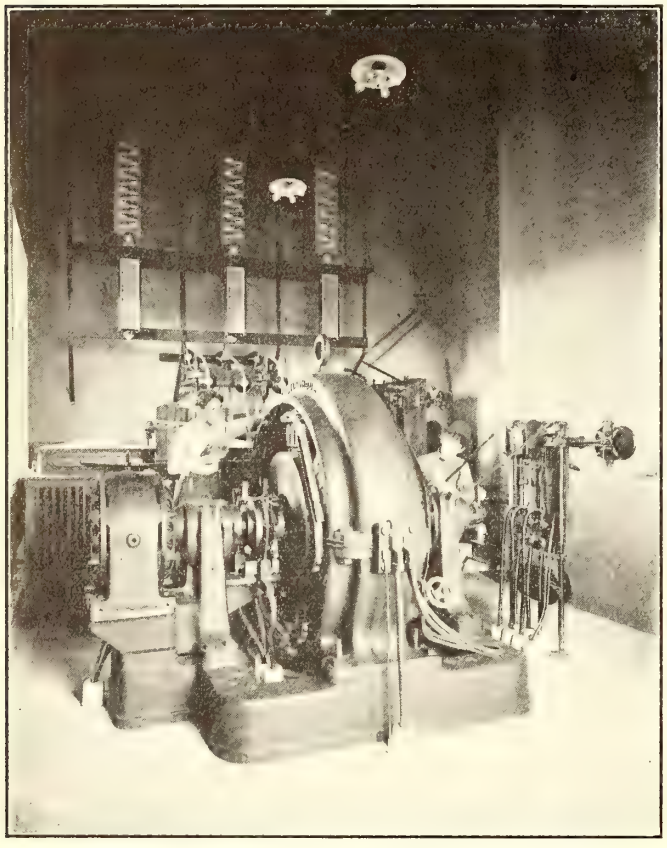
RAIL BONDING GANG AT WORK



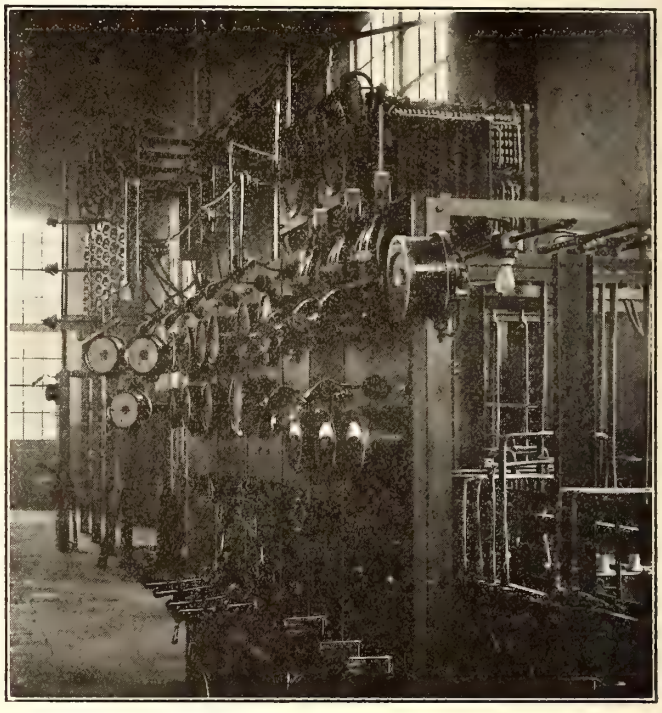
ENGINE ROOM OF THE FRAZER POWER HOUSE

way decided scenic advantages is shown by the illustrations.

The electric rolling stock is of especial interest. It consists of exceptionally commodious interurban passenger and express cars, built on liberal lines to meet the conditions of combined interurban railway and electrified steam railroad practice. In electrical, and generally in mechanical equipment, as well as in principal dimensions, the passenger and express cars are similar. They are 53 ft. long over the buffers and have a width of 9 ft. 6 ins. over the sills. The power equipment consists of four 75-hp direct-current motors. which give a maximum speed on the level of nearly 60 miles an hour. All cars are single ended and have locomotive pilots. They are equipped with standard radial draw bars and M. C. B. railway couplers to permit coupling to the steam railroad cars. Multiple unit control apparatus is installed on all electric cars for operating in trains.



ROTARY CONVERTER IN ANKENY SUB-STATION



MAIN SWITCHBOARD IN FRAZER POWER HOUSE



INTERIOR OF PASSENGER CAR

The passenger car bodies are 43 ft. long over corner posts and are very handsome, with mahogany interior finish, semi-empire ceilings, leather upholstery and plate glass windows. At the front end there is a baggage compartment 10 ft. long containing movable seats, and back of that a smoking compartment 12 ft. 6 ins. long containing seats. The heating is by hot-water apparatus. With the seats filled these cars weigh about 38 tons.

The power for electric operation is derived from a turbine-driven plant of 3000 hp capacity, located at Frazer on the Des Moines River, about equidistant from the terminals. Coal mines nearby supply cheap fuel in the form of Iowa bituminous slack coal, while the feed water comes from the river, passing through purifiers to reduce the scale-forming salts. The main power equipment consists of two 1250-kw Parsons type turbo-generators supplied with steam at 175 lbs. pressure from two batteries of water-tube boilers, the flues of which connect with a 180-ft. chimney.

The electric current is generated, alternating, three-phase, twenty-five cycles at 2300 volts and, excepting a part supplied to a sub-station within the power house, is stepped up to 20,000 volts for transmission to five sub-stations located at Ankeny, Kelley, Boone, Fort Dodge

Junction and Otho at an average distance apart of about 15 miles. The sub-station in the power house consists of three 145-kw water-cooled, oil-insulated, 2300/370-volt, single-phase, step-down transformers and one 400-kw, 600-volt rotary converter. The other sub-stations are uniform, containing each three 145-kw, single-phase, 20,000/370-volt, oil-cooled, step-down transformers and one 400-kw, 600-volt rotary converter with room for the installation of a second duplicate converter if desired. The converters are of standard Westinghouse design.

The transmission line is designed for a maximum pressure of 33,000 volts, the wires being No. 4 B. & S., spaced 48 ins., and carried on porcelain insulators 7½ ins. high and 8½ ins. in diameter. The insulators are tested to 75,000 volts. Poles of not less than 8 ins. top diameter are used and are spaced 100 ft. apart on tangents, being set in concrete were advisable.

The overhead work is the standard bracket construction except at turnouts, where span construction is used. Frogs are not used on the trolley wires at turnouts, the wire for the siding being run parallel to the main wire with a space of 18 ins. for a distance of 100 ft. beyond the end of turnout in either direction. The track is bonded with 300,000 circ. mil soldered bonds and cross bonded at intervals of 500 ft. with No. 4/0 B. & S. copper wire.

The engineering, construction and equipment of the system, including power house, transmission lines, sub-stations, overhead work and bonding, telephone dispatching facilities, rolling stock and car barns have been in charge of J. G. White & Company. The Northwestern Construction Company carried out the construction and reconstruction of permanent way. The entire work was carried out under the supervision of J. L. Blake, general manager of the Fort Dodge, Des Moines & Southern Railway, representing the owners. The main turbo-generators with the other principal electrical apparatus, including the car equipment, are of Westinghouse manufacture. The cars were made by the Niles Car & Manufacturing Company and the trucks by the Baldwin Electric Works. They are heated by the Peter Smith hot-water apparatus. In the power house the boilers are from the Babcock & Wilcox Company, Aultman-Taylor type. Wheeler Condenser & Engineering Company's surface condensers and Cochrane feed water heaters are used. The chimney was built of concrete and steel by the American Chimney Company under the specifications of J. G. White & Company.

STEAM LOCOMOTIVES AND BRIDGE CORROSION

The corrosive effect of steam locomotive gases has long been realized in a general way, but in the case of the Boylston Street Bridge, in Boston, over the four main tracks of the Boston & Albany lines, concrete evidence have just been uncovered which furnish in themselves a strong argument for the electrical equipment of all urban tracks carrying dense traffic.

The bridge was built in 1888. A plank floor has covered the floor beams and the bottom part of the trusses. Above this floor the members are still of the full original section; below the floor the metal has disappeared on the average for a depth of about an eighth of an inch on each exposed surface. Several of the steel eye-bar diagonals have lost 60 per cent. of their original section, and some iron floor beam angles have lost the entire outstanding leg. The mechanical effects of the blast are much less marked than the chemical effects of the gases.

RELATION BETWEEN TEMPERATURE AND POWER STATION LOADS

At a meeting of the Boston branch of the American Institute of Electrical Engineers, held in the auditorium of the new Edison Building, on Nov. 20, John W. Corning, electrical engineer of the Boston Elevated Railway Company, presented some data of unique character on the relation between atmospheric temperature and power station loads. A study of the operating conditions on the Boston Elevated System during the past few years has shown the existence of a marked parallelism between the total station output per diem, the average load between 5 and 6 p. m. and the external temperature. Curves plotted between these quantities show that the load and temperature variations follow one another closely both during the warm and cold seasons, when heaters are in use, and when only open cars are in service. The following approximate tables transcribed from the data presented by Mr. Corning at the meeting illustrate these relations.

Table I shows the variation in the total daily kilowatt-hour output of the Boston Elevated generating stations from Oct. 1, 1906, to Oct. 1, 1907, in relation to the average temperatures at which these outputs occurred:

TABLE I

DAILY KW-H.	DEGREES F.	DAILY KW-H.	DEGREES F.
340,000	84	500,000	40
360,000	76	520,000	35
380,000	69	540,000	30
400,000	62.5	560,000	27
420,000	58	580,000	21
440,000	53	600,000	18.5
460,000	49	620,000	16
480,000	44		

These values were obtained from a large number of readings and an average curve was drawn which shows a progressive relation of the inverse order between the output and temperature. The company's heaviest load occurs in the winter season, but regardless of the time of year increase of temperature lowers the station output, and decrease of temperature is associated with larger outputs. The average daily output to be expected at a temperature of about 84 deg. is 340,000 kw-hours, while at the other end of the scale a temperature of 16 deg. is associated with 82.5 per cent increase of output to 620,000 kw-hours.

Table II shows the load temperature relation for the hour of maximum traffic, 5 to 6 p. m., derived from readings taken in the year from Oct. 1, 1905, to Oct. 1, 1906:

TABLE II

AVERAGE KW.	DEGREES F.	AVERAGE KW.	DEGREES F.
26,000	93	36,000	45
28,000	80	38,000	36.5
30,000	70	40,000	29
32,000	60	42,000	20
34,000	52	44,000	14

Here the change in load is at the rate of approximately 0.6 to 0.8 per cent per degree. The peak load varies from 26,000 kw in summer to 46,000 kw in winter, but aside from traffic variations there is a definite increase of load with temperature decrease, independent of the season of the year. From the winter conditions Mr. Corning found that the following equation expresses the relation between the maximum rush-hour load and the temperature, N being the number of cars in service and t the temperature in degrees Fahrenheit:

$$\text{kw} = 2660 + N\ (24.3 - 0.134\,t)$$

In this equation 2660 represents the stationary load upon the generating plants, consisting of motors in shops and car houses, heaters in stations and other buildings, and lights in fixed structures. The number of equivalent 25-ft.

cars in service during the rush hour in the winter was about 2350 on the average, and the figure 24.3 represents the average kilowatt consumption per car at the generating plants, taken at about 30 deg. F. Knowing the number of cars and the temperature it was found that the load could be predicted within about 2.5 per cent.

At the meeting a large chart was shown giving the plots of maximum hour loads and temperature variations through the different months from October, 1905, to October, 1906. In general the outputs varied from a minimum of 30,000 kw in October through a maximum of 44,000 kw in March, to a minimum of 22,000 kw in August. The temperature average followed the load as plotted throughout practically the whole year, the corresponding temperature to the figures above quoted being 75, 80 and 85 deg. The general shape of each curve was a species of sine wave with, a period of one year per cycle.

Mr. Corning stated that bearing friction appeared to be the principal cause of the phenomena discussed, eliminating as far as possible other variable factors. Table III shows values of drifting times derived from three car coasting test curves. In this test a car was allowed to coast from standstill down a grade and then up a rise to a tangent track, the time required to negotiate given distances being measured. Three runs were made with the same car, the first being made with bearings relatively stiff and cold. As the bearings warmed up during the runs, the friction decreased, and the time required to coast a given distance grew less, gradually approaching a fixed time for each distance.

TABLE III

SECONDS.

DISTANCE FEET	RUN NO. 1	RUN NO. 2	RUN NO. 3	DISTANCE FEET	RUN NO. 1	RUN NO. 2	RUN NO. 3
100	36	30	27	600	104	89	78
200	63	52	45	700	109	95	83
300	78	65	56	800	115	100	88
400	87	75	65	900	120	105	93
500	96	82	72	1000	125	109	97

Table IV shows the results of a test made to determine the relative heating of grease and oil when used in motor bearings. The motor was tested on a stand in the shop and the temperature rise in degrees Centigrade taken above the surrounding air. Each set of figures represents an average of tests on four bearings, grease and oil being tried separately in each journal.

TABLE IV

TEMP. RISE DEGREES C

MINUTES	GREASE	OIL	MINUTES	GREASE	OIL
0	3	3	90	26.5	15
10	6	5	100	28	15.8
20	12	7.6	110	29	16.3
30	18	9	120	29.6	17
40	20	10	130	30	17.3
50	21	11	140	31	19
60	22	12	150	32	19
70	23	13	160	33	19
80	25	14			

The superiority of oil compared with grease as regards heating is clearly apparent from these tests. Mr. Corning emphasized in conclusion the importance of a closer study of the lubrication problem in relation to the best service at different seasons of the year, including the effect on the generated output as well as the cost of lubrication on the car itself.

W. K. Vanderbilt, Jr., V. W. Rossiter, Albert H. Harris and John Carstensen, of the New York Central, inspected the electrified division of the West Shore Railroad one day last week as the guests of C. Loomis Allen.

INDIANAPOLIS MEETING OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

The November meeting of the Central Electric Railway Association was held at the Claypool Hotel, Indianapolis, Thursday, Nov. 21. Two very interesting papers were presented and discussed, and there was also a general discussion on the subject, "Does It Pay Interurban Electrics to Cater to Long Distance Travel?" The papers presented were, one by Albert B. Herrick, "Analysis of the Cost and Methods of Electric Railway Maintenance," and one by Fred Heckler, master mechanic of the Lake Shore Electric Company, "Foundation Brake Arrangement for Electric Railway Cars."

MORNING SESSION

President H. A. Nicholl opened the morning session at 10:30 a. m. He said the committee appointed by the association to meet the standardization committte of the American Association had, through the press of business, not been able to attend the Atlantic City convention. However, the chairmen of the two committees had conferred. It was probable that a meeting would be held early in 1908 between the representatives of the Central, the New York State and the New England associations to see if the three associations could not get together on standard rules. The standardization committee of the Central Association felt gratified that the report of the American Association committee had been adopted, particularly because this report was practically the same as the Central Association's recommendations.

MAINTENANCE OF ELECTRIC RAILWAYS

Under this title Albert B. Herrick presented an interesting paper on methods of making tests on feeder and return systems and the car equipment of electric railway companies. He gave particulars of his system of testing, which is described in detail in his handbook, and also in his book, "American Electric Railway Practice." He also discussed the general subject of expenditures for maintenance. To illustrate the marked difference betwen various companies in this respect he presented a diagram, Fig. 1, in which these expenditures have been reduced to a percentage basis. The roads selected for this comparison are those in which the character of the service and the conditions of transportation are fairly close. The number of cars on each system is given at the top of each vertical column and none of the expenditures was abnormal or could have been charged to capital account. A study of diagrams of this kind in individual cases, Mr. Herrick said, will indicate directions in which economy can be secured. The aggregate of the cost of maintenance above the average cost, conservatively estimated, amounts to $19,700,000 per annum in the territory enclosed by the Mississippi River on the west, a line drawn through Covington, Ky., and Washington on the south and including Canada on the north.

An abnormal loss in one department in an electric railway transportation system is not necessarily confined to the portion of the system in which it occurs, but the different parts of the system are so correlated that the secondary effects of the loss are reflected in increased cost in other parts of the system. For instance, an abnormal drop of potential in the distribution system increases the current required per car mile, raises the output of the station, decreases the percentage of useful energy to the total energy developed, increases the heating and depreciation of equipment and decreases the schedule speed that can be obtained.

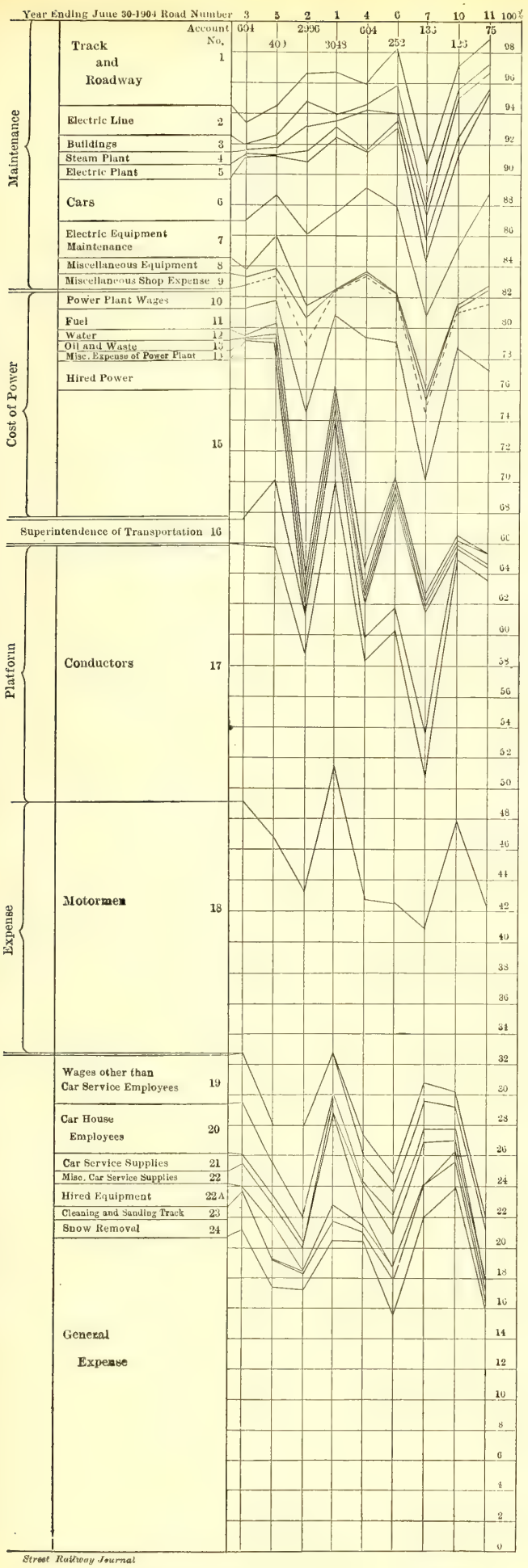


FIG. 1.—COMPARISON OF OPERATING EXPENSES.

Fig. 2 illustrates the cost of electrical and car maintenance on twenty-five roads. The upper line includes maintenance of trucks, brakes and car body. The figures show the number of equipments operated by each of the different properties analyzed. The letter "I" means that the service on these roads is interurban. At the top of Fig. 2 there are two lines. The heavy black line is the average car miles per equipment per annum. The dotted line is the average number of stops per mile per equipment per annum. It will be seen that there is no connection in cost of maintenance between the number of car miles the equipment makes per annum and the number of stops per mile. In other words, these elements which are supposed to militate against economical car operation have been neutralized by careful and intelligent maintenance of the equipment.

In referring to the test car, "Florence," operated by the speaker, Mr. Herrick said that it had made records of more than 11,000 miles of track and had tested over 3,800,000 bonds; more than a ton of paper had passed through its apparatus in making these records. During the past year this car has made records on most of the electric railways in Pennsylvania and has just completed 400 miles in Baltimore and 200 miles in Rochester.

While presenting the paper, Mr. Herrick remarked that his car for testing bonds had a weight of 30 tons on each truck. The weight moved the joint and broke any temporary connection at the joint. He also stated that tests showed that it cost twice as much to start a two-motor as a four-motor car.

DISCUSSION

F. D. Carpenter, general manager of the Western Ohio Railway, asked Mr. Herrick if he could determine the source from which current was attacking water pipes. Some of the towns along his line claimed that return current was straying from the tracks and attacking the water pipes. He considered the road well bonded and thought it might be some other electric property that was causing the trouble. Mr. Herrick replied that where there is an interconnected system not only the source of the current but the amount from each source could be determined. In getting at results a certain test point would be taken and the flow of current under normal conditions obtained. He would then ask the railway company to shut down its plant for, say, a period of five minutes for one or two times. The difference in the reading would enable him to decide definitely.

G. H. Kelsey, superintendent of power of the Indiana Union Traction Company, said about a year ago he made some measurements and computations on a feeder system which traffic had outgrown to determine whether or not it would pay the company to install additional feeders. His point was to find whether or not the total power lost in the feeder for the year would pay interest on an investment in copper which would eliminate the loss of power. He found that the loss in current would only pay an interest of 2 or 3 per cent on the copper. Mr. Kelsey asked also how the copper should be installed. On modern installations it was customary on interurban lines to install a uniform cross section of copper feeders the entire distance between sub-stations. It was sometimes a question whether or not wedge shaped feeders should not be installed, or feeders with a greater cross section near the sub-station. Mr. Herrick replied that with one equipment between sub-stations, or when cars met at a point one-half way between sub-stations, the tapered or wedge-shape

feeder would be of no advantage, but conditions were changed when there was more than one equipment between sub-stations, or when the cars did not meet at a central point. The presence of grades in between sub-stations would make the wedge-shape feeders of more advantage.

Mr. Herrick added that he had noticed in the Middle West a tendency for cars to drop their speed between feeder taps. He thought that with taps 1,200 ft. apart there was enough drop in the line to warrant two more taps. Mr. Herrick wanted to get the idea of load factor of a feeder clear in the minds of those present. The load factor did not take into consideration the ammeter readings, but the square of the readings, so that the area of the plotted curve was proportional to the loss. Mr. Kelsey thought if the saving of power alone were considered that there were many roads with more copper in their feeder systems than was warranted. He believed that the saving in power would often warrant only 2 or 3 per cent interest on the investment represented by copper installed, and to prove the necessity for the copper it would be necessary to bring in the question of external economy. To bring out the idea of external economy, Mr. Herrick said that on a 20-mile road which operated three cars, he had been able, by an investment of $7,000 in additional copper and in straightening a curve, to make it possible to operate the road with two cars to produce a saving of $1,200 a year.

F. J. J. Sloat, general manager of the Concinnati Northern Traction Company, wanted to know why, when the current density in the feeders had gotten too high, the operation of the road on higher voltage should not be considered. Mr. Herrick replied that Mr. Sloat's suggestion had been made by Mr. Sprague, and that he thought raising the potential was the only salvation for future electric railway work. Mr. Sloat added that if steam roads were going to electrify under present conditions they would have to own a copper mine.

Mr. Sloat called attention to the statement of Mr. Herrick that after the armature cores of motors had rubbed against the pole pieces the lamintions were pressed together in such a manner that currents were generated in the cores. He thought this might have something to do with the fact, as noted in his experience, that during the first year of operation new motors were subject to very few breakdowns, but after the first year of operation the motors were subject to frequent breakdowns from various causes. He asked Mr. Herrick whether ribbon-wound fields or fields wound with round wire were subject to more frequent defects. Mr. Herrick replied that a great deal of trouble occurred with rewound fields and was due to the stretching of the wire and the lessening of its cross section in rewinding. The ribbon type gave better results than the round wire type except that there was greater probability of the coils of the ribbon type fields coming loose and chafing. He believed that we were coming to the point of immersing the coils and impregnating them so they would be held absolutely rigid.

Mr. Kelsey brought up the question of the efficiency of the motormen. He made a test of two motormen on a limited run of 340 miles per day. The motormen were shifted every other day and the car ran within two or three hundred feet of the same distance daily. Wattmeters placed on the car showed that the power consumed by one man had a value of 35 cents more than that of the other. Mr. Herrick stated his method of testing the motormen by putting ammeters on insulated sections of the trolley wire would discover the characteristics of the individual motorman as to nervousness, carelessness, etc. The difference in the motormen was not only made evident by the current consumed, but also by the frequency with which the cars were sent to the repair shop. Mr. Sloat remarked that on one road there was a hilly section 18 miles long and a level section of 37 miles. On the hilly section tests showed almost identical current consumption by two or three different motormen; while on the level portion, one motorman would use considerable more power than the other. Mr. Herrick's observations were identical with those of Mr. Sloat, for he had found that on a hilly road all the motormen seemed to catch the car and turn on the power or cut it off at the same time.

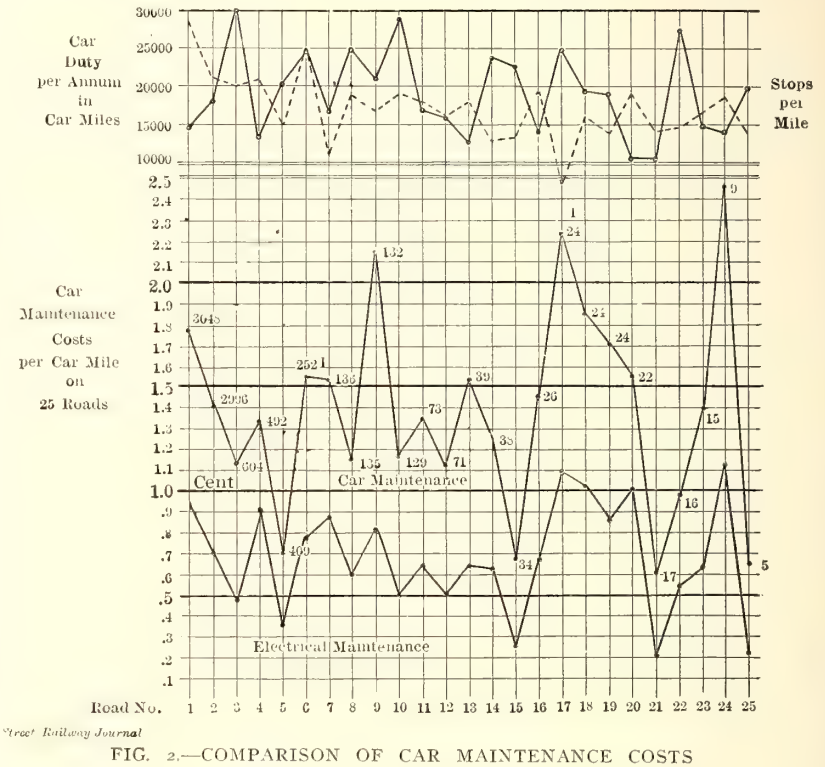


FIG. 2.—COMPARISON OF CAR MAINTENANCE COSTS

Mr. Sloat cited a very interesting case relative to operating cars in series or in parallel on grades. Coming out of Cincinnati there was a 4½ per cent grade two miles long. Motors operated in parallel up the grade consumed 404 amperes and when running in series 202 amperes. The gain in time of multiple running over series operation was only about 3 minutes in 15 minutes. Under the circumstances, he considered it best and had issued orders to the trainmen to run in series.

Mr. Sloat wanted to know Mr. Herrick's opinion concerning the capacity of bonds. He thought the present methods might be inadequate for heavy electric service. The carrying capacity of the contact surfaces was not utilized to the full extent because of the limited carrying capacity of the central portion of the bond. He suggested a slab type of bond holding the rails rigid and expansion joints at proper intervals. Mr. Herrick stated the type of bond suggested had been tried without much success.

In connection with the subject of increased weights of cars, Mr. Herrick brought out a very interesting point regarding the distance between truck centers of heavy and high-speed interurban cars. With the present method of

putting the trucks several feet under the end, in taking a curve the car body is off the tangent some time before the truck strikes the curve. This results in an excessive stress on the trucks and rails, and increases the hazard of turning the rail. With truck centers placed farther apart, the car would be turned slower, and the stresses on the rails and flanges would be reduced.

At the close of the discussion and before adjournment for lunch, on a motion by Mr. Carpenter, a vote of thanks was tendered to Mr. Herrick for the paper presented.

AFTERNOON SESSION

At the afternoon session, in the absence of the author, Fred Heckler's paper on "Foundation Brake Arrangements for Electric Cars" was read by S. D. Hutchins, special representative for the Westinghouse Air Brake and Westinghouse Traction Brake Companies.

Mr. Hutchins said it required a long period of missionary work to bring about the present conditions regarding braking on steam roads. He thought the air brakes on these roads operated with the highest efficiency. A six-car passenger train, traveling 60 miles per hour, could be stopped in 1,000 ft. Improvements in brakes had kept pace with the increased weights of trains. Interurban traffic had increased to proportions where the same conditions regarding braking obtained as on steam roads, but he found a different condition existing on the two kinds of roads. The company supplying the brakes found different types of trucks to contend with, and it seemed that the trucks were designed almost completely without thought of applying the brake apparatus and then the levers were placed in any position possible. The leverage of the truck brake rigging seemed to depend on how it was possible to locate the levers on the already designed truck and varied from 2½ to 1 to 6 to 1.

His company's endeavor was to brake the car at 100 per cent of its light weight. With a car weighing 50,000 lbs. a brake cylinder would be furnished to provide a leverage of not over 10 to 1. A 10-in. cylinder would be required. The endeavor was to get the lowest ratio on the truck levers and carry this ratio to the body levers where there was plenty of room to get whatever total leverage was desired. Instead of low truck leverage it was frequently the case that this leverage was so high that before the shoe was one-third worn out the angle of the brake levers was so great that the shoe could be worn no further without putting the car in the barns for adjustment of the turnbuckle.

Mr. Hutchins urged the railroad companies to supply the weight of the cars in specifications for brakes. This was of great importance, yet in very few instances were the brake manufacturing companies able to obtain it. The result of installing cylinders too small in diameter on cars was that the total leverage was made too high in order to get the requisite braking power. An 8-in. cylinder on a 50,000-lb. car would require a total leverage of about 18 to 1. This meant that for every one inch wear of the shoe the piston would move 18 ins. The result of such leverage was that the car had to make very frequent trips to the shop for adjustment of the brakes. With a 12-in. cylinder on such a car the leverage could be brought down to 10 to 1. In concluding he urged the railroad companies to furnish the brake companies with a proper truck leverage. The brake company could be held responsible for the brakes as installed.

Mr. Sloat inferred from Mr. Hutchins' remarks that the proper course would be to have representatives of the brake companies meet with a committee and decide on the leverage of trucks for certain weight of cars. Mr. Hutchins, however, explained that the total light weight of the car did not enter into the question of truck leverage. All that was required was as low a truck leverage as it was possible to obtain. If a standardization committee would decide on a leverage of 3 to 1 the brake companies would take care of the total ratio.

Mr. Hutchins brought up the question of the suspension of the shoe head. He recommended that it be suspended from a point not affected by the light or loaded condition of the car. The lower the shoe was forced by the load on the car the farther it was thrown from the wheel and the greater the piston travel necessary to set the brakes. With increased load, therefore, the braking power was reduced when in fact it should be increased. He thought it was always possible to hang the shoe from some point not affected by the load on the car, although it was nearly always suspended so as to be affected.

Mr. Sloat wanted to know if putting a piston on each truck would not get away from some of the present difficulties. Mr. Hutchins replied that this scheme had been tried out a few years ago when it was desired to avoid a brake cylinder larger than 14 ins. in diameter on some heavy cars. The results, however, were unsatisfactory, as distortion of the truck resulted due to the fact that the stress could not be taken care of. On a locomotive the boiler has sufficient strength to resist the stress. An additional drawback to the installation of the cylinders on the trucks would be that they would necessarily be connected to the piping on the body through hose connections which might rupture at a critical moment.

At the conclusion of the discussion, President Nicholl read a communication from the St. Clair Air Brake Company to the effect that the company has its brake on exhibition in the basement of the Newton-Claypool Building, and extended an invitation to all interested to inspect the apparatus. President Nicholl also announced that it had been decided to hold the next meeting of the association at Dayton, Ohio, Thursday, Jan. 4, 1908. This would be the annual meeting and the customary annual banquet would be held.

The remainder of the afternoon was devoted to the discussion of the subject, "Does it Pay Interurban Electrics to Cater to Long Distance Travel." S. R. Dunbar, purchasing agent of the Indiana Union Traction Company, suggested that it might be well at the outset to agree on what mileage constituted long distance travel—whether 60 miles or 160 miles. F. D. Norveil said that a few years ago a trip of 50 miles by interurban lines was considered a long distance. Now runs of 150 miles were very frequent. He thought interurban lines should be out for all the business they could get legitimately, and as the public appreciated the interurban for long as well as short distances the companies should go after the long distance haul business from a standpoint of earnings. It was better for the long distance car to make its entire trip only half or one-third filled with passengers than for a car to start out of a terminal with all standing room taken and to discharge its pasengers two or three miles out, continuing the remainder of the trip almost empty.

Mr. Carpenter said he had been working up long distance travel on his road for some time. About 25 per cent. of the business on limited cars was made up of long hauls. For some unknown reason, people liked to ride on interurban cars both in summer and winter. The people were pushing the interurban to give better facilities for long distance travel. A few days ago a passenger who bought a ticket to Kansas City was routed over the interurban

line a portion of the distance. He mentioned this to show the increasing field of the interurban, and as evidence that the steam roads were going to help get business for the electrics.

Mr. Starkey said that while it paid to haul passengers distances such as those between Indianapolis, Fort Wayne and Dayton, the time was not ripe to attempt to get through business between Indianapolis and New York. Mr. Norveil said that with present facilities the interurban should not attempt to get business over distances of 400 or 500 miles, but with people pushing the interurban as they were now doing, the long distance travel would increase to the extent that the interurban showed its ability to take care of it.

Mr. Carpenter urged the interurbans to remove present difficulties of long distance travel. Changes of cars should be eliminated, and he suggested the use of through cars which could be coupled on to the regular cars of the different lines. It would not be advisable under present conditions to get motor cars too far from home as it might be difficult to make proper repairs.

E. C. Van Valkenburg, in calling attention to the extent that a change of cars cut down through traffic, said that in one instance when change of cars was eliminated at the point where two roads connected and through cars were put into operation, the through traffic increased about 30 per cent.

John H. Crall, district passenger and freight agent of the Terre Haute & Eastern Traction Company, and the Indiana Union Traction Company, gave an instance of what the interurbans could do in the matter of long distance travel. He had contracted to haul a party through to Zanesville, Ohio, a distance of 250 miles. The car left Indianapolis at 8 a. m., made one hour stop at Dayton, and a stop of one and one-quarter hours at Columbus, arriving at Zanesville at 7 p. m. The passengers were delighted with the trip and came back the same way.

Mr. Sloat said that before interurbans could make a regular business of long distance travel they would have to operate their trains entirely different from the manner they had been operating them in the past. He considered three-car trains necessary. These trains should be made up of a baggage, smoker and day coaches. This was the universal practice of steam roads, and people had become so accustomed to the facilities of these roads that they would demand the same from the interurbans. Such heavy trains would require a different method of current distribution, and double the present voltage would be required. Terminal and switch facilities radically different from the present ones also would be necessary.

Mr. Dunbar suggested that a good deal of energy spent in catering to long distance travel and getting the "velvet" might better be spent in taking care of local travel. J. B. Crawford, superintendent of transportation on the Fort Wayne & Wabash Valley Traction Company, thought his road, at least, took good care of local passengers. A recent report of the board of directors of the paralleling steam road stated that all of the local travel had been lost to the interurban.

Mr. Herrick, upon being called on by President Nicholl, related an incident where removing the difficulties of long distance travel had increased the traffic wonderfully. At South Norwalk, between New York and Boston, passengers were formerly compelled to change cars and walk over a bridge about 100 ft. long in doing so. Putting a track across the bridge and running through cars resulted in an increase in traffic of about 180 per cent.

President Nicholl closed the discussion by saying that its trend was to the effect that the interurban people should go after long distance travel and that they made a mistake if they did not do so.

FOUNDATION BRAKE-GEAR DESIGN FOR ELECTRIC RAILWAY CARS*

BY FRED HECKLER,
Master Mechanic, Lake Shore Electric Railway Company.

Before dealing with the mechanical consideration of a proper foundation brake gear for electric cars, it is deemed advisable to call attention to the importance of the brake as a whole. Unfortunately, the brake is usually looked upon as a safety device only, and we believe it is because of the prevalence of this idea that the installation and maintenance does not receive the consideration it merits. Considering the investment, there is no part of the railway equipment that will give greater material returns than the brake when properly installed, operated and maintained. Its importance would be more fully appreciated if we could separate to some extent the brake from the idea or impression that it is a safety device only, and show that it makes possible the hauling of heavier cars, and faster and more frequent service as much or more than the high-power motor, the signals and the good roadbed. If given the consideration it should have, it would increase the possibilities of all these things. Therefore, at least the same consideration should be given to its design and installation that is accorded to other parts of railway equipment. As a safety device, the brake is excellent, but it has other reasons for existence.

The brake is often looked upon as a mere piece of mechanical apparatus which can be designed by "rule of thumb," applied in any haphazard fashion to the vehicle it is intended to control, then operated by "go as you please" methods, whereas all these things call for the exercise of the highest intelligence if even approximate perfection is to be obtained. The magnitude of the problem can be seen when the thought is kept in mind that the brake has often to do in seconds what it has taken the motive power minutes to accomplish, and that it is far more important to be able to stop a car than to start it. From a speed of 60 miles per hour, on a level track, it is possible to stop a car in about 1000 ft.; whereas, under the same conditions, the car would run 28,000 ft. if no brakes were used. Any difference between these extremes may result according to the condition of the brake; and no matter how perfect and well maintained the apparatus may be, a great part of the brake efficiency may be lost by improper design of foundation brake gear, which condition will undoubtedly continue to exist until the brake ceases to be looked upon as a necessary evil. When it is realized that the brake equipment is not merely an auxiliary apparatus but a controlling element—not merely a necessary expenditure, but a dividend-earning asset—then sufficient pressure will be brought to bear on the car and truck designers and builders to induce them to consider the brake installation before it becomes impossible to put on one that will even merit the name of a brake in the true sense of the word.

Perhaps the reason for so many monstrosities is lack of information on the part of the designer, and to this end it might be well to give a few reasons why the brake should be so designed that there is a proper proportion between air pressure, cylinder piston area and leverage.

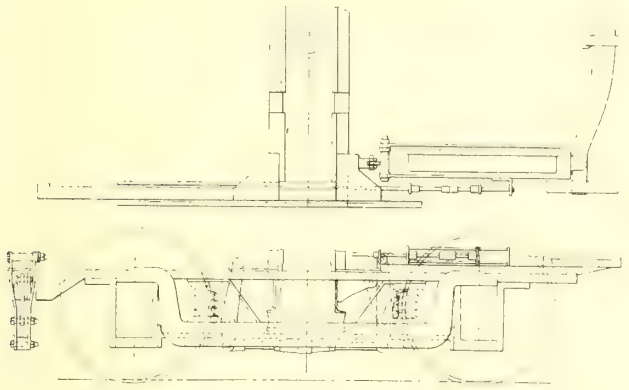
First, as to pressure: If more than 2 per cent. braking power per lb. of cylinder pressure is attempted, a very

*Paper presented at meeting of Central Electric Railway Association, Nov. 21, 1907.

high braking power power for light cylinder pressures is obtained and, therefore, the cars cannot be handled without shocks at low speeds, and either the range between maximum and minimum braking power obtainable must be very narrow or else wheel sliding will result when the maximum power is used.

Second, as to area of brake piston: If the ratio of cylinder piston area to cylinder pressure is excessive, it means either a low leverage, which means great shoe movement; or higher leverage with low pressure, which means very narrow range between maximum and minimum braking power.

Third, as to leverage: If the leverage is too low, it means excessive air consumption and too much shoe movement; if too high (that is, brake cylinder too small for weight of car, and it is here that the principles governing brake design are violated most frequently), smooth and accurate handling of the car or train becomes impossible and the shoes are constantly grinding on the wheels, consuming the current, wearing out the shoe and causing loss of time; or else piston travel must be lengthened out, thus greatly increasing the air consumption, lengthening the time of application and release, and reducing both service and emergency braking power. Besides, the high leverage makes necessary a frequent adjustment of piston travel or a constant and very rapid decrease of braking power will result. Furthermore, high leverage, if made at truck levers, necessitates low hung brake shoes, which, when suspended from a spring supported part of the truck, results in great increase of piston travel and resultant decrease of braking power with the loading of the car; this always occurs at a time when readjustment of piston travel is impracticable and when instead of a decrease of braking power an increase is greatly to be desired. In addition, the danger of the levers fouling is greatly increased, particularly where the truck leverage ratio is high, and very frequent and careful inspection is required or the total loss of the brake may result.



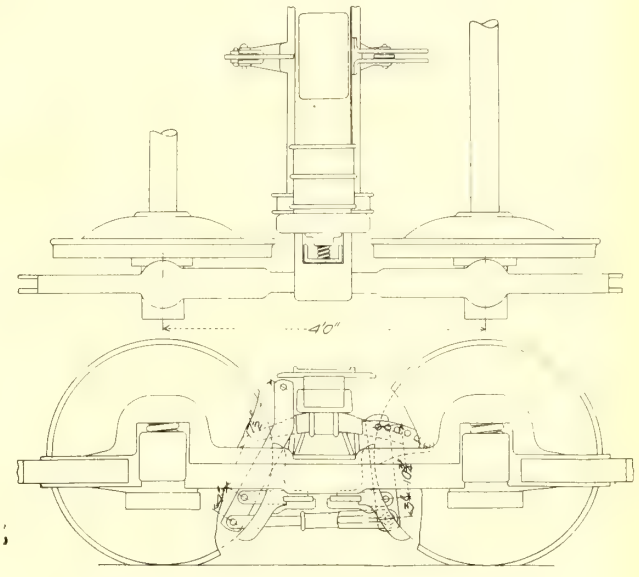
Merits of This Truck from a Brake Design Standpoint

1. Inside hung brake shoes.
2. Equalized brake leverage system.—That is to say, it is arranged so that unequal shoe clearance will not throw all the pressure on one pair of wheels.
3. Radius bar connection to live truck levers.—In addition to its use when on a curve, the radius bar construction also eliminates the great deflection of weak brake beams, due to the truck levers acting at their center.

Demerits from a Brake Design Standpoint

1. High truck leverage ratio.—This total ratio is 7.22 to 1 (i. e.), one pound applied at the middle of radius bar gives a total of 7.22 pounds distributed at the four-wheel shoes, and therefore necessitates a large movement of the live truck levers in setting the brake shoes, with consequent bad angles and danger of striking an obstruction, since the room for movement is generally limited on an electric railway truck. A high leverage ratio is altogether unnecessary on the truck, since the multiplication can readily be made in the car-body levers where there is greater clearance room. The total truck lever ratio should not exceed 6 to 1.
2. Angle of live truck levers bad, since they are almost vertical in release position.—If lever is too near vertical in release position, it assumes a bad angle when brake shoes are set up against wheels.
3. Available movement of radius bar too limited.
4. Brake shoes hung slightly too far below the center of wheels.—This will increase after the car body placed on truck, and also in proportion to the load.
5. Dead lever dimensions not of the same proportion as those of the live truck levers.—For one pound applied at the middle of radius bar, the leverage, as now proportioned, results in 3.53 pounds pressure, distributed at the live lever brake shoes, and 3.69 pounds at the dead lever shoes. This results in unequal shoe wear, and also makes it impossible to use the best percentage of braking power, since the correct percentage on one pair of wheels, makes the percentage incorrect for the other pair, due to this discrepancy in proportion of truck levers.

NOTE.—Absence of the thickness and width of truck levers, rods, etc., makes it impossible to figure the strength of the brake rigging, but on electric railway trucks, generally, it is almost invariably too weak, with consequent deflection, and often failure of the brake rigging.



Merits of This Truck from a Brake Design Standpoint

1. Inside hung brake shoes.
2. Equalized brake leverage system; that is to say, it is arranged so that unequal shoe clearance will not throw all the pressure on one pair of wheels.

Demerits from a Brake Design Standpoint

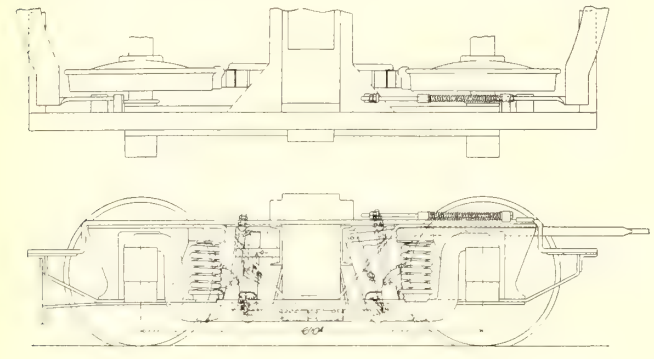
1. Very high leverage ratio.—This total ratio is 10.96 to 1 (i. e.), one pound applied at the top end of live lever gives a total of 10.96 pounds distributed at the four-wheel shoes, and therefore necessitates a large movement of the live truck lever in setting the brake shoes, with consequent bad angles and danger of striking an obstruction, since the room for movement is generally limited on an electric railway truck. A high leverage ratio is altogether unnecessary on this truck, since the multiplication can be readily made in the car body levers, where there is greater clearance room. The total truck lever ratio should not exceed 6 to 1.
2. Brake shoes hung somewhat too far below center of wheels.—This will increase after the car body is placed on truck and also in proportion to the load.
3. Dead lever dimensions not of the same proportion as those of the live truck lever.—One pound applied at the top of the live lever, as now proportioned, results in 5.37 pounds pressure distributed at the live lever brake shoes and 5.59 pounds at the dead lever shoes. This results in unequal shoe wear and also makes it impossible to use the best percentage of braking power, since the correct percentage for one pair of wheels makes the percentage incorrect for the other pair, due to this discrepancy in proportion of truck levers.
4. Dead lever fulcrum should be horizontal instead of curved.
5. Dead lever is too short, thereby assuming a bad angle with the brakes set, especially with worn shoes.
6. Angle of main truck lever, as shown, too near the vertical in release position.

NOTE.—Absence of the thickness and width of truck levers, rods, etc., makes it impossible to figure the strength of the brake rigging, but on electric railway trucks, generally, it is almost invariably too weak, with consequent deflection, and often failure of the brake rigging.

All of the preceding could be very much elaborated upon, but it is thought that enough has been said to show that the braking problem has much reason from a profit standpoint to warrant careful consideration being given both to the kind of brake and its proper installation. When to these reasons is added the one of safety, this part of the car equipment and its installation and care become paramount. The methods so long pursued of building the cars and trucks with little or no thought for the brakes, and then "sticking on" just what will happen to go and where it will happen to go, should be abandoned. The brakes should be given equal consideration with the other necessary points of design, for at all times much money will be made thereby, and there are times when not money, but life and limb become the measure of this value.

Coming to the mechanical requirements of the foundation

brake gear, the most desirable features in connection with this matter are a motor truck that will permit a brake design providing a lower truck leverage ratio and a clear movement of the same for the entire wearing out of the brake shoes of, say, 1½ ins. thick; also provision in motor truck construction for the best location of the brake shoes on the wheel and the suspension of the brake head or beam hangers at a proper angle and at such a point on the truck as will maintain a standard location of the shoes on the wheel regardless of whether the car is light or loaded. These recommendations should also apply to the car builders who in many cases design the car body portion of the foundation brake in which very often the harmonious working of the hand and air brakes is not taken into account. In fact, it is seldom that a car and truck design can be found upon which even a passable brake installation can be made.



Merits of This Truck from a Brake Design Standpoint

1. Inside hung brake shoes.
2. Equalized brake leverage system.—That is to say, it is arranged so that unequal shoe clearance will not throw all the pressure on one pair of wheels.
3. Good angle of live lever in release position.
4. Radius bar connection to live truck levers. In addition to its use when on a curve, the radius bar construction also eliminates the great deflection of weak brake beams, due to the truck levers acting at their center.

Demerits from a Brake Design Standpoint

1. Very high truck lever ratio.—This total ratio is 9.85 to 1 (i. e.), one pound applied at the middle of radius bar gives a total of 9.85 pounds distributed at the four-wheel shoes, and therefore necessitates a large movement of the live truck levers in setting the brake shoes, with consequent bad angles and danger of striking an obstruction, since the room for movement is generally limited on an electric railway truck. A high leverage ratio is altogether unnecessary on this truck, since the multiplication can readily be made in the car body levers, where there is greater clearance room. The total truck lever ratio should not exceed 6 to 1.
2. Dead lever dimensions not of the same proportion as those of the live truck lever.—For one pound applied at the middle of radius bar the leverage, as now proportioned, results in 5 pounds pressure distributed at the live lever brake shoes and 4.8 pounds at the dead lever shoes. This results in unequal shoe wear and also makes it impossible to use the best percentage of braking power, since the correct percentage for one pair of wheels makes the percentage incorrect for the other pair, due to this discrepancy in proportion of truck levers.
3. Brake shoes hung somewhat too far below center of wheels.—This will increase after the car body is placed on truck and also in proportion to the load.
4. Hanging of shoes not good.—The suspension, as shown, made at upper end of shoe instead of at center of same.

Note.—Absence of the thickness and width of truck levers, rods, etc., makes it impossible to figure the strength of the brake rigging, but on electric railway trucks, generally, it is almost invariably too weak, with consequent deflection, and often failure of the brake rigging.

To the end that improvement be made in this direction, the following is suggested for your consideration.

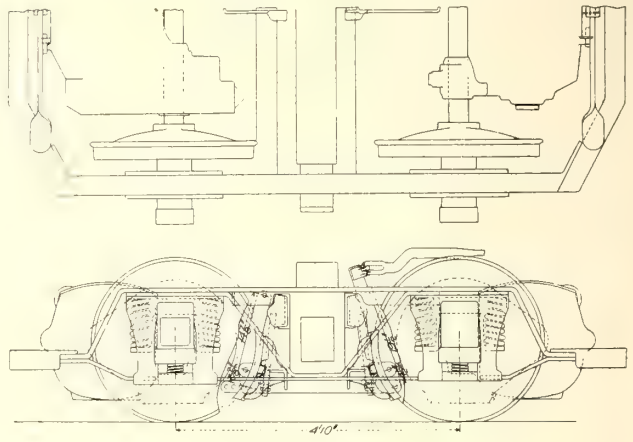
First, that the brake be considered as much an asset as are the motors, etc., and as a part of the profit-making equipment instead of an expenditure and nonproducer, classed, for instance, with the color of the paint on the car.

Second, that as safety is a prime requirement in railway operation, the brake being the most vital factor in this connection, should have consideration commensurate with its importance.

Third, that in the design of the car and truck ample space be allowed for the application of the proper brake equipment and a suitable foundation brake gear right down to the brake shoes.

Fourth, that sufficient clearance should be allowed to permit of the wearing out of the shoe and that in the event of piston travel adjustment being neglected, the piston should strike the head before the radius bar or levers foul.

Fifth, that while a total leverage of from 9 to 1 to 12 to 1 is proper, yet the total truck leverage ratio should not exceed 6 to 1, i. e., one lb. exertion on truck pull rod should not give more than 6 lbs. of force distributed at the four wheel shoes. This, of course, would mean a ratio of 3 to 1 for each truck lever but 2½ to 1 would be even more preferable; this latter would mean a total truck leverage ratio of 5 to 1. This because when it is exceeded, the travel of the top end of the lever becomes great as compared



Merits of This Truck from a Brake Design Standpoint

1. Inside hung brake shoes.
2. Equalized brake leverage system.—That is to say, it is arranged so that unequal shoe clearance will not throw all the pressure on one pair of wheels.
3. Good angle of live leverage in release position.

Demerits from a Brake Design Standpoint

1. Very high leverage ratio.—This total ratio is 10.8 to 1 (i. e.), one pound applied at the top end of live lever gives a total of 10.8 pounds distributed at the four-wheel shoes, and therefore necessitates a large movement of the live truck lever in setting the brake shoes, with consequent bad angles and danger of striking an obstruction, since the room for movement is generally limited on an electric railway truck. A high leverage ratio is altogether unnecessary on this truck, since the multiplication can be readily made in the car body levers where there is greater clearance room. The total truck lever ratio should not exceed 6 to 1.
2. Brake shoes hung somewhat too far below center of wheels. This will increase after the car body is placed on truck and also in proportion to the load.
3. Dead lever dimensions not of the same proportion as those of the live truck lever. One pound applied at the top of the live lever, as now proportioned, results in 5.33 pounds pressure distributed at the live lever brake shoes and 5.46 pounds at the dead lever shoes. This results in unequal shoe wear and also makes it impossible to use the best percentage of braking power, since the correct percentage for one pair of wheels makes the percentage incorrect for the other pair, due to this discrepancy in proportion of truck levers.
4. Shoe hangers so straight as to preclude proper release by gravity action when pressure is removed.

Note.—Absence of the thickness and width of truck levers, rods, etc., makes it impossible to figure the strength of the brake rigging, but on electric railway trucks, generally, it is almost invariably too weak, with consequent deflection, and often failure of the brake rigging.

with shoe wear; also, the shoe has to be placed very low on the wheel, besides the danger of the lever fouling on the shoe; also the lower the ratio the less change of angle for a given shoe wear.

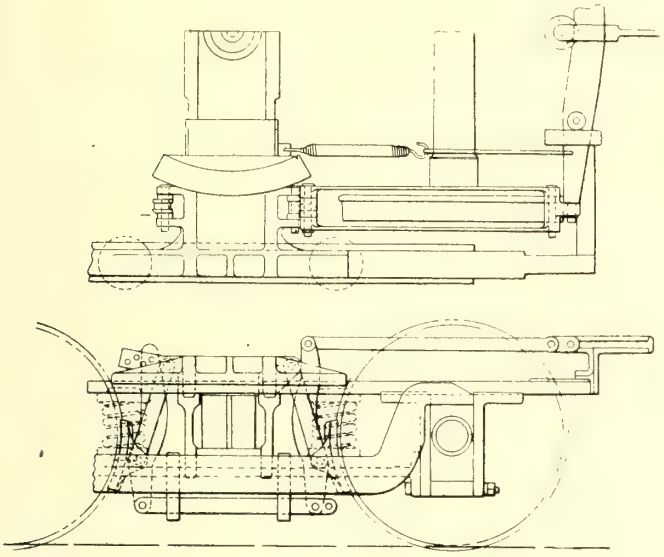
Sixth, that proper provision be made for maintaining as near a uniform piston travel as practicable, that (1) the air consumption may be kept low; (2) that uniform braking power may always be had and (3) a brake of full power assured at all times.

Seventh, that all truck levers, brake beams, clevises, pins and rods for truck should be made strong enough to withstand safely the stresses produced with a total braking power on the shoes equal in lbs. to the maximum weight of car for which the truck is suitable. This also applies to car body pins, rods and levers.

Eighth, the following points should also be considered: Release springs of proper strength; brake shoes as to thickness, area and friction; live and dead truck levers be of the same proportion when motor is used on each truck axle,

otherwise proportion to allow for motor and idle axles, ample provision for take up of shoe wear, slack, etc.; elimination as far as possible of lost motion in journal boxes, pin holes, center plates, etc.; that car should have reasonably large truck centers to admit of proper connection of body levers to truck levers by means of pull rods, and that the hand brake be equalized and that the multiplication made mostly in the cab by gears, i. e., so that a large force can be applied to the hand brake chain with consequent small amount of chain to be wrapped up.

Attached are drawings showing designs for truck with brake rigging. These are intended to give some idea of



Merits of This Truck from a Brake Design Standpoint

1. Inside hung brake shoes.
2. Equalized brake leverage system.—That is to say, it is arranged so that unequal shoe clearance will not throw all the pressure on one pair of wheels.
3. Radius bar connection to live truck levers.—In addition to its use when on a curve, the radius bar construction also eliminates the great deflection of weak brake beams, due to the truck levers acting at their center.

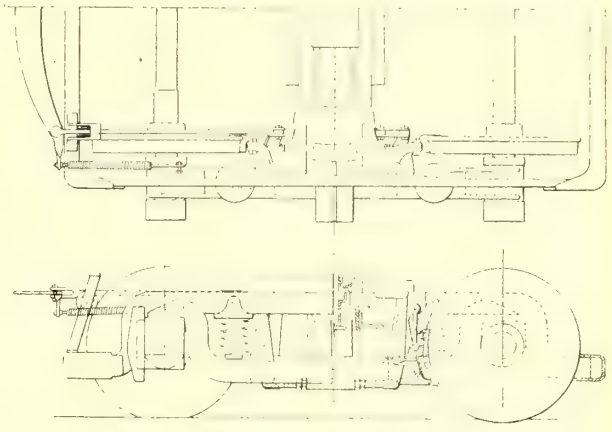
Demerits from a Brake Design Standpoint

1. High truck leverage ratio.—This total ratio is 7.5 to 1 (i. e.), one pound applied at the middle of radius bar gives a total of 7.5 pounds distributed at the four-wheel shoes, and therefore necessitates a large movement of the live truck levers in setting the brake shoes, with consequent bad angles and danger of striking an obstruction, since the room for movement is generally limited on an electric railway truck. A high leverage ratio is altogether unnecessary on the truck, since the multiplication can readily be made in the car body levers, where there is greater clearance room. The total truck lever ratio should not exceed 6 to 1.
2. Angle of live truck levers too near the vertical in release position.—If lever is too near vertical in release position, it assumes a bad angle when brake shoes are set up to wheels.
3. Available movement of radius bar in guide too limited.
4. Brake shoes hung slightly too far below the center of wheels. This will increase after the car body is placed on truck, and also in proportion to the load.
5. Dead lever dimensions not of the same proportion as those of the live truck levers. For one pound applied at the middle of radius bar, the leverage as now proportioned, results in 3.7 pounds pressure, distributed at the live lever brake shoes, and 3.8 pounds at the dead lever shoes. This results in unequal shoe wear and also makes it impossible to use the best percentage of braking power, since the correct percentage on one pair of wheels makes the percentage incorrect for the other pair, due to this discrepancy in proportion of truck levers.

NOTE.—Absence of the thickness and width of truck levers, rods, etc., makes it impossible to figure the strength of the brake rigging, but on electric railway trucks, generally, it is almost invariably too weak, with consequent deflection, and often failure of the brake rigging.

what should be considered in the design as well as to show that many things have not been considered, and for easy references the defects and merits have been printed thereon, Some of them show that the efficiency of even a good brake may be reduced to a minimum and in many cases become a source of trouble, and, as far as ordinary service operations are concerned, of loss. Others show that what the brake is expected to do is more nearly approximated, care and maintenance reduced to a minimum, and troubles eliminated.

It is to be regretted that we do not have for your consideration more designs showing both desired and undesirable truck designs, but the former are so scarce as to be practically unobtainable, while the latter can be seen under any car you may care to examine. As these problems are physical, mathematical and mechanical, it is certainly not beyond the range of possibility that they may be solved in a way that will be satisfactory to the car and truck builders, profitable to the railway companies and certainly more conductive to the comfort and safety of the public. It is hoped that these recommendations may meet with your approval and receive favorable action.



Merits of This Truck from a Brake Design Standpoint

1. Brake shoes hung the proper amount below center of wheels.
2. Brake shoe hanger bracket supported by the equalizer bars.—With this construction the distance of brake shoes below center of wheel remains constant, whether the truck is supporting the car body and its varying load, or not.
3. Inside hung brake shoes.
4. Equalized brake leverage system.—That is to say, it is arranged so that unequal shoe clearance will not throw all the pressure on one pair of wheels.
5. Live and dead levers of same proportion, thus giving same shoe pressure on each pair of wheels.
6. Radius bar connection to live truck levers.—In addition to its use when on a curve, the radius bar construction also eliminates the great deflection of weak brake beams, due to the truck levers acting at their center.

Demerits from a Brake Design Standpoint

1. High truck leverage ratio.—This total ratio is 7.48 to 1 (i. e.), one pound applied at the middle of radius bar gives a total of 7.48 pounds distributed at the four-wheel shoes, and therefore necessitates a large movement of the live truck levers in setting the brake shoes, with consequent bad angles and danger of striking an obstruction, since the room for movement is generally limited on an electric railway truck. A high leverage ratio is altogether unnecessary on the truck, since the multiplication can readily be made in the car body levers where there is greater clearance room. The total truck lever ratio should not exceed 6 to 1.
2. Angles of live truck levers too near the vertical in release position.—If the lever is too near vertical in release position it assumes a bad angle when brake shoes are set up to wheels.
3. Shoe hanger connected above instead of at center of shoe.

NOTE.—Absence of the thickness and width of truck levers, rods, etc., makes it impossible to figure the strength of the brake rigging, but on electric railway trucks, generally, it is almost invariably too weak, with consequent deflection, and often failure of the brake rigging.

One of the latest petitions for approval of electric railway freight rights to reach the Massachusetts Railroad Commission is from the Springfield & Eastern Street Railway Company, covering its line through the town of Brimfield. This marks the intention of the New Haven interests to put through the project of freight service on the electric railways between Springfield and Worcester. The New England Investment & Securities Company controls the street railway systems of both cities and, while it has barely secured local rights in Worcester, it has begun the operation of two lines of cars in Springfield. The Brimfield petition would pave the way for an extension of the service now in operation out of Springfield as far as Palmer.

The strike of the employes of the Louisville Railway Company, referred to elsewhere in this issue as having been broken, was formally declared off Wednesday, Nov. 27.

HEARING ON CLASSIFICATION OF ACCOUNTS BY THE INTERSTATE COMMERCE COMMISSION

The hearing on the proposed classification of accounts of electric railway companies by the Interstate Commerce Commission, as announced last week, was held at the rooms of the Commission in Washington, D. C., on Friday, Nov. 22, at 11 a. m. The meeting was called by Prof. Henry C. Adams, statistician of the Commission, who called attention to the tentative classification of electric railway accounts, suggested by the Commission, and printed in this paper last week.

The following, among others, were present at the hearing:

Milo R. Maltbie, member of the Public Service Commission of the First District of New York.

Martin S. Decker, member of the Public Service Commission of the Second District of New York.

Wm. J. Meyers, statistician of the Public Service Commission of the Second District of New York.

T. W. Wilson, president of the Street Railway Association of the State of New York and general manager of the International Traction Company of Buffalo.

A. L. Linn, Jr., chairman of the committee on a standard classification of accounts of the Street Railway Association of the State of New York and auditor of the Mohawk Valley Company.

E. S. Fassett, general manager of the United Traction Company, of Buffalo.

H. M. Beardsley, secretary and treasurer of the Elmira Water, Light & Railway Company, Elmira, N. Y.

J. C. Collins, secretary and auditor of the Rochester Railway Company, Rochester, N. Y.

B. V. Swenson, secretary of the American Street and Interurban Railway Association.

Mr. Swenson stated that the American Street & Interurban Railway Association and the American Street & Interurban Railway Accountants' Association were very much interested in the subject of the proposed classification of operating expenses, and that the officers of the association were anxious to co-operate with the Interstate Commerce Commission in the preparation of any classification which should be adopted. He said, however, that the notification of the meeting and copies of the suggested classification of accounts had been received by the associations so short a time prior to the meeting—only two days—that it had been impossible for the officers to examine carefully the proposed classification or to be in attendance at the meeting. He therefore suggested that the actual decision on the classification should be postponed until there was time to make a study of the matter when the association would be pleased to send representatives to take up the subject with the Commission. Messrs. Wilson and Linn also referred to the shortness of the time with which the Street Railway Association of the State of New York had been informed of the meeting, but presented a comparison of the different accounts which had been prepared in the interim, and which is reproduced herewith. This comparison shows the tentative classification of the American Street & Interurban Railway Association as adopted at Atlantic City, and as somewhat modified by the New York State Association, the tentative classification of the Interstate Commerce Commission, as published last week, and the steam railroad classification. Messrs. Wilson and Linn argued that the tentative classification of the Commission was not adapted to electric railway work, as many of the subjects were insufficiently covered, as for instance, "operating power plants," which had only one account, whereas many others were almost superfluous.

After an extended discussion it was decided to hold another conference on Dec. 10 at the rooms of the Interstate Commerce Commission, at Washington. As a preliminary to this hearing, it was decided to appoint a committee to make a report on the subject, this committee to consist of six members. Three of these members are to be appointed by the Interstate Commerce Commission, one by the American Street and Interurban Railway Association, one by the American Street and Interurban Railway Accountants' Association, and one by the Street Railway Association of the State of New York.

TENTATIVE ELECTRIC RAILWAY.	TENTATIVE I. C. C. ELECTRIC.	STANDARD I. C. C. STEAM.
I. Way and Structures.	I. Way and Structures.	I. Way and Structures.
II. Equipment.	II. Equipment.	II. Equipment.
III. Transportation (Power Plants).	IV. Transportation.	IV. Transportation.
IV. " (Operation Cars).		
V. " (Misc.).		
VI. Traffic.	III. Traffic.	III. Traffic.
VII. General.	V. General.	V. General.
	PRIMARY ACCOUNTS.	
I. Maint. Way and Structures.		
A. Engineers' Sal. and Exp.	1 Superintendence.	1 Superintendence.
B. Roadway & Track Labor.	7 Roadway and Track.	6 Roadway and Track.
C. Ties (Material).	4 Ties.	3 Ties.
D. Rails (Material).	5 Rails.	4 Rails.
E. Rail Fastenings & Joints (Mat.).	6 Other Track Material.	5 Other Track Material.
F. Special Work (Material).	6 Other Track Material.	5 Other Track Material.
G. Ballast (Material).	2 Ballast.	2 Ballast.
H. Paving (Material).	3 Paving.	(None.)
I. Bridges, Trestles and Culverts (Material).	10 Bridges, Trestles and Culverts.	9 Bridges, Trestles and Culverts.
J. Fences, Road Crossings, Cattle Guards and Signs (Material).	12 Grade Crossings, Fences, Cattle Guards and Signs.	11 Grade Crossings, Fences, Cattle Guards and Signs.
K. Signals and Interlocking Systems (Material).	14 Signals and Interlocking Plants.	13 Signals and Interlocking Plants.
L. Miscellaneous Roadway and Track Expenses.	23 Injuries to Persons.	22 Injuries to Persons.
(Acct. 34) Removal of Snow and Ice. (None.)	24 Stationery and Printing.	23 Stationery and Printing.
	26 Other Expenses.	25 Other Expenses.
	8 Removal of Snow, Sand and Ice.	7 Removal of Snow, Sand and Ice.
	9 Tunnels.	8 Tunnels.
J. Fences, Road Crossings, Cattle Guards and Signs (Material).	11 Over and Under Grade Crossings.	10 Over and Under Grade Crossings.
(Acct. 34) Removal of Snow and Ice.	13 Snow and Sand Fences and Snow Sheds.	12 Snow and Sand Fences and Snow Sheds.

TENTATIVE ELECTRIC RAILWAY.	TENTATIVE I. C. C. ELECTRIC.	STANDARD I. C. C. STEAM.
II. Maint. Electric Line.		
A. Engineers' Sal. and Exp.	15 Telegraph and Telephone Lines. 16 Electric Power Transmission.	14 Telegraph and Telephone Lines. 15 Electric Power Transmission.
B. Electric Line Labor.	15 Telegraph and Telephone Lines. 16 Electric Power Transmission.	14 Telegraph and Telephone Lines. 15 Electric Power Transmission.
C. High-Tension Transmission Lines (Material).	16A Low-Tension Transmission Lines.	15 Elec. Power Transmission.
D. Low-Tension Transmission Lines (Material).	16A Low-Tension Transmission Lines.	15 Elec. Power Transmission.
E. Track Bonding (Material).	15 Telegraph and Telephone Lines.	14 Telegraph and Telephone Lines. 15 Elec. Power Transmission.
F. Telephone and Telegraph System (Material).	15 Telegraph and Telephone Lines.	14 Telegraph and Telephone Lines.
G. Miscellaneous Electric Line Expenses.	15 Telegraph and Telephone Lines. 16 Elec. Power Transmission. 23 Injuries to Persons. 24 Stationery and Printing. 26 Other Expenses.	14 Telegraph and Telephone Lines. 15 Elec. Power Transmission. 22 Injuries to Persons. 23 Stationery and Printing. 25 Other Expenses.
III. Buildings, Fixtures and Grounds.		
A. Eng. Salaries and Exp.	17 Buildings, Fixtures and Grounds.	16 Buildings, Fixtures and Grounds.
B. Bldgs., Fixtures & Grounds Labor.	17 Bldgs., Fixtures and Grounds.	16 Bldgs., Fixtures and Grounds.
C. Power Plants (Mat.).	17 do	16 do
D. Sub-stations (Material).	17 do	16 do
E. Car Houses and Yards (Mat.).	17 do	16 do
F. Shops and Yards (Mat.).	17 do	16 do
G. General Offices (Mat.).	17 do	16 do
H. Stations, Waiting Rooms and Platforms (Mat.).	17 do	16 do
I. Docks and Wharves (Mat.).	18 Docks and Wharves.	17 Docks and Wharves. 71 Coal and Ore Docks.
J. Miscellaneous Bldgs. (Material).	17 Buildings, Fixtures and Grounds.	16 Buildings, Fixtures and Grounds.
K. Miscellaneous Supplies and Expenses.	19 Roadway Tools and Supplies. 23 Injuries to Persons. 24 Stationery and Printing. 26 Other Expenses.	18 Roadway Tools and Supplies. 22 Injuries to Persons. 23 Stationery and Printing. 25 Other Expenses.
IV. Maint. Power Plant Equipment.		
A. Engineers' Salaries and Expenses.	30 Superintendence.	28 Superintendence.
B. Power Plant Labor.	44 Power Plant Equipment. A Steam and Water Plant. B Electric Plant. C Sub-station Equipment.	48 Power Plant Equipment. A Steam and Water Plant. B Electric Plant.
C. Boiler Plant (Mat.).	44 A Steam and Water Plant.	48 A Steam and Water Plant.
D. Steam Engine Plant (Mat.).	44 A Steam and Water Plant.	48 A Steam and Water Plant.
E. Hydraulic Plant (Mat.).	44 A Steam and Water Plant.	48 A Steam and Water Plant.
F. Gas Engine Plant (Mat.).	44 A Steam and Water Plant.	48 A Steam and Water Plant.
G. Electric Plant (Mat.).	44 B Electric Plant.	48 B Electric Plant.
H. Miscellaneous Equip.	49 Other Expenses.	52 Other Expenses.
I. Misc. Power Plant Exp.	23 Injuries to Persons. 24 Stationery and Printing. 26 Other Expenses. 45 Injuries to Persons. 46 Stationery and Printing.	22 Injuries to Persons. 23 Stationery and Printing. 25 Other Expenses. 49 Injuries to Persons. 50 Stationery and Printing.
V. Maint. Sub-station Equipment.		
A. Engineering Salaries and Expenses.	30 Superintendence.	28 Superintendence.
B. Sub-station Labor.	44 C Sub-station Equipment.	48 B Electric Plant.
C. Sub-station Material.	44 C do	48 B do
	44 C do	48 B do
VI. Maint. of Revenue Cars.		
A Passenger Cars (Mat.).	34 Passenger Train Cars Repairs.	35 Passenger Train Cars Repairs.
A1 do (Labor).	34 do	35 do
B Combination Cars (Mat.).	34 do	35 do
B1 do (Labor).	34 do	35 do
C Express Cars (Mat.).	(None.)	35 do
C1 do (Labor).	(None.)	35 do
D Freight Cars (Mat.).	37 Freight Train Cars Repairs.	38 Freight Train Cars Repairs.
D1 do (Labor).	37 do	38 do
E Mail Cars (Mat.).	34 Passenger Train Cars Repairs.	35 Passenger Train Cars Repairs.
E1 do (Labor).	34 do	35 do
F Locomotives (Mat.).	31 Electric Locomotives Repairs.	32 Electric Locomotives Repairs.
F1 do (Labor).	31 do	32 do
G Foreign Equipment (Mat.).	31 do	32 do
	34 Passenger Train Cars Repairs.	35 Passenger Train Cars Repairs.
	37 Freight Train Cars Repairs.	38 Freight Train Cars Repairs.
G1 Foreign Equipment (Labor).	31 Electric Locomotives Repairs.	32 Electric Locomotives Repairs.
	34 Passenger Train Cars Repairs.	35 Passenger Train Cars Repairs.
	37 Freight Train Car Repairs.	38 Freight Train Cars Repairs.

TENTATIVE ELECTRIC RAILWAY.	TENTATIVE I. C. C. ELECTRIC.	STANDARD I. C. C. STEAM.
VII. Maint. of Electrical Car Equipment of Revenue Cars.		
A Passenger Cars (Mat.).	40 Electric Equipment of Cars Repairs.	41 Electric Equipment of Cars Repairs.
A1 do (Labor).	40 do	41 do
B Combination Cars (Mat.).	40 do	41 do
B1 do (Labor).	40 do	41 do
C Express Cars (Mat.).	40 do	41 do
C1 do (Labor).	40 do	41 do
D Freight Cars (Mat.).	40 do	41 do
D1 do (Labor).	40 do	41 do
E Mail Cars (Mat.).	40 do	41 do
E1 do (Labor).	40 do	41 do
F Locomotives (Mat.).	31 Electric Locomotives Repairs.	32 Electric Locomotives Repairs.
F1 do (Labor).	31 do	32 do
G Foreign Equipment (Mat.).	31 do	32 do
	40 Electric Equipment of Cars Repairs.	41 Electric Equipment of Cars Repairs.
G1 do (Labor).	31 Electric Locomotives Repairs.	32 Electric Locomotives Repairs.
	40 Electric Equipment of Cars Repairs.	40 Electric Equipment of Cars Repairs.
VIII. Maint. of Miscellaneous Equipment.		
A. Work Car Equip. (Mat.).	20 Work Equipment Repairs.	19 Work Equipment Repairs.
A.1 do (Labor).	20 do	19 do
B. Snow Equip. (Mat.).	20 do	19 do
B.1 do (Labor).	20 do	19 do
C. Elec. Locomotives (Mat.).	31 Elec. Locomotives Repairs.	32 Elec. Locomotives Repairs.
C.1 do (Labor).	31 do	32 do
D. Horses, Harness and Vehicle Equip. (Mat.).	49 Other Expenses.	52 Other Expenses.
D1. do (Labor).	49 do	52 do
E. Automobiles (Mat.).	49 do	52 do
E.1 do (Labor).	49 do	52 do
F. Miscel. Equip. (Mat.).	49 do	52 do
F.1 do (Labor).	49 do	52 do
G. Foreign Misc. Equip. (Mat.).	49 do	52 do
G.1 do (Labor).	49 do	52 do
IX. Misc. Shop Expenses.	30 Superintendence.	28 Superintendence.
	43 Shop Machinery & Tools.	47 Shop Machinery and Tools.
X. Wages Power Plant Employees.		
A. Boiler Plant.	62 Operating Power Plants.	92 Operating Power Plants.
B. Steam Engine Plant.	62 do	92 do
C. Hydraulic Plant.	62 do	92 do
D. Gas Engine Plant.	62 do	92 do
E. Electric Plant.	62 do	92 do
XI. Fuel for Power.	62 B Fuel.	92 Operating Power Plants.
XII. Water for Power.	62 C Water.	92 Operating Power Plants.
XIII. Lubricants for Power Plant.	62 D Lubricants.	92 Operating Power Plants.
XIV. Misc. Sup. and Expenses of Power Plant.	62 E Operation of Sub-stations.	92 Operating Power Plants.
XV. Operation of Sub-stations.		
A. Labor.	62 F Operation of Sub-stations.	92 Operating Power Plants.
B. Misc. Sup. and Expenses.	62 F do	92 do
XVI. Purchased Power.	65 Purchased Power.	93 Purchased Power.
XVII. Supt. of Transportation.		
A. Wages of Supts.	61 Superintendence.	66 Superintendence.
B. Train Dispatchers, Telegraph and Telep. Operators.	61 Superintendence.	66 Superintendence.
	66 Dispatching Trains.	67 Dispatching Trains.
	82 Teleg. & Telep. Operation.	100 Teleg. & Telep. Operation.
C. Road Officers.	61 Superintendence.	66 Superintendence.
	66 Dispatching Trains.	67 Dispatching Trains.
XVIII. Wages Passenger Motormen.	67 A Passenger Motormen.	85 Motormen.
XIX. Wages of Passenger Conductors and Trainmen.	68 A Passenger Conductors.	94 Road Trainmen.
	68 B Other Passenger Trainmen.	
XX. Wages of Express and Freight Motormen.	67 B Freight Motormen.	85 Motormen.
	67 C Other Motormen.	

TENTATIVE ELECTRIC RAILWAY.	TENTATIVE I. C. C. ELECTRIC.	STANDARD I. C. C. STEAM.
XXI. Wages of Express and Freight Conductors and Trainmen.	68 C Expressmen. 68 D Freight Conductors. 68 E Other Freight Trainmen. 68 F Other Trainmen.	94 Road Trainmen. 102 Express Service.
XXII. Wages of Miscellaneous Car Service Employees.	79 Crossing Flagmen and Gatemen. 80 Drawbridge Operation.	97 Crossing Flagmen and Gatemen. 98 Drawbridge Operation.
XXIII. Wages of Car House Employees.	72 Car House Expenses. 76 Yardmen.	77 Yard Enginemen. 73 Yardmasters and Clerks. 74 Yard Conductors and Brakemen. 75 Yard Switch and Signal Tenders.
XXIV. Car Service Supplies.		
A. Lubricants and Waste.	69 Train Supplies and Expenses. 70 Lubricants for Eelectric Loco. 71 Other Supplies for Electric Loco. 72 Car House Expenses.	95 Train Supplies and Expenses.
B. Incandescent Lamps.	69 Train Supplies and Exepnses. 71 Other Supplies for Electric Loco. 72 Car House Expenses.	95 Train Supplies and Expenses.
C. Fuel for Heating Cars.	69 Train Supplies and Expenses. 71 Other Supplies for Electric Loco. 72 Car House Expenses. 77 Yard Supplies and Expenses.	95 Train Supplies and Expenses. 76 Yard Supplies and Expenses.
D. Miscellaneous Supplies.	69 Train Supplies and Expenses. 71 Other Supplies for Electric Loco. 72 Car House Expenses. 77 Yard Supplies and Expenses.	95 Train Supplies and Expenses. 76 Yard Supplies and Expenses.
E. Miscellaneous Expenses.	69 Train Supplies and Expenses. 71 Other Supplies for Electric Loco. 72 Car House Expenses. 77 Yard Supplies and Expenses.	95 Train Supplies and Expenses. 76 Yard Supplies and Expenses. 78 Enginehouse Expenses—Yard. 87 Enginehouse Expenses—Road.
XXV. Printing and Stationery (Car Service).		
A. Tickets.	83 Stationery and Printing.	103 Stationery and Printing.
B. Transfers.	83 do	103 do
C. Baggage and Parcel Checks.	83 do	103 do
D. Exp. and Freight Printing.	83 do	103 do
E. Miscellaneous Printing.	83 do 58 Stationery and Printing.	103 do 63 Stationery and Printing.
XXVI. Misc. Car Service Expenses.		
A. Secret Inspection.		
B. Derailed Cars and Wreckage.	69 Train Sup. and Expenses. 79 Crossing Flagmen & Gatemen. 80 Drawbridge Operation. 81 Clearing Wrecks.	95 Train Sup. & Expenses. 97 Fuel for Yard Loco. 98 Drawbridge Operation. 99 Clearing Wrecks.
C. Miscellaneous.	69 Train Sup. & Expenses. 79 Crossing Flagmen & Gatemen. 80 Drawbridge Operation. 85 Other Expenses.	95 Train Sup. & Expenses. 97 Fuel for Yard Loco. 98 Drawbridge Operation. 105 Other Expenses.
XXVII. Station Wages & Expenses.		
A. Passenger Dept. Wages.	73 Station Employees.	68 Station Employees.
B. Exp. & Frt. Dept. Wages.	73 Station Employees.	68 Station Employees. 102 Express Service
C. Passenger Dept. Sup. & Exp.	75 Station Sup. & Expenses.	72 Station Sup. & Exp.
D. Exp. & Frt. Dept. Sup. & Exp.	75 Station Sup. & Exp.	72 Station Sup. & Exp. 102 Exp. Service.
XXVIII. Operation of Signal and Interlocking System.		
A. Wages.	78 Interlockers, Block and Other Signals—Operation.	96 Interlockers, Block and Other Signals—Operation.
B. Supplies & Expenses.	78 do	96 do
XXIX. Operation of Telephone and Telegraph System.	82 Telegraph & Telep.—Opera.	100 Telegraph & Telep.—Opera.
XXX. Dining, Buffet, Parlor and Sleeping Car Service.		
A. Wages.		
B. Misc. Sup. & Expenses.		

TENTATIVE ELECTRIC RAILWAY.	TENTATIVE I. C. C. ELECTRIC.	STANDARD I. C. C. STEAM.
XXXI. Loss and Damage Traffic.	86 Loss & Damage—Freight. 87 Loss & Damage—Baggage.	106 Loss & Damage—Freight. 107—Loss & Damage—Baggage.
XXXII. Injuries and Damage.	88 Damage to Property. 89 Damage to Stk. on R-of-W. 90 Injuries to Persons.	108 Damage to Property. 109 Damage to Stk. on R-of-W. 110 Injuries to Persons.
XXXIII. Cleaning & Sanding Track.		
A. Labor.		
B. Material and Supplies.		
XXXIV. Removal of Snow and Ice.		
A. Labor.		
B. Materials and Supplies.		
XXXV. Rent of Equipment.		
A. Passenger Cars.		
B. Combination Cars.		
C. Express Cars.		
D. Freight Cars.		
E. Mail Cars.		
F. Electric Locomotives.		
XXXVI. Rent of Tracks and Terminals.		
TRAFFIC.		
XXXVII. Salaries and Expenses.		
A. Passenger Dept. Salaries.	54 Superintendence. 55 Outside Agencies.	57 Superintendence. 58 Outside Agencies.
B. Exp. and Frt. Dept. Salaries.	54 Superintendence. 55 Outside Agencies.	57 Superintendence. 58 Outside Agencies.
C. Passenger Dept. Sup. and Exp.	54 Superintendence. 55 Outside Agencies. 60 Other Expenses.	57 Superintendence. 58 Outside Agencies. 65 Other Expenses.
D. Exp. and Frt. Dept. Sup. & Exp.	54 Superintendence. 55 Other Agencies. 60 Other Expenses.	57 Superintendence. 55 Outside Agencies. 65 Other Expenses.
XXXVIII. Advertising & Attractions.	56 Advertising.	59 Advertising.
GENERAL.		
XXXIX. Salaries of General Officers.	93 Sal. and Exp. of General Officers.	113 Sal. and Exp. of General Officers.
XL. Salaries of Clerks.		
A. Executive Officers' Clerks.	94 Sal. & Exp. of Clerks & Attendants.	114 Sal. & Exp. of Clerks & Attendants.
B. Accounting Department.	94 do	114 do
C. Treasurer's Department.	94 do	114 do
XLI. Printing and Stationery (General).	100 Stationery and Printing.	120 Stationery and Printing.
XLII. General Office Expenses.	95 General Office Sup. and Exp.	115 General Office Sup. and Exp.
XLIII. Misc. General Expenses.		
	93 Sal. & Exp. of Gen'l Offrs.	113 Sal. & Exp. of Gen'l Offrs.
	94 Sal. & Exp. of Clks. & Attendants.	114 Sal. & Exp. of Clks. & Attendants.
	98 Relief Department Exps.	118 Relief Dept. Exps.
	99 Pensions.	119 Pensions.
	101 Other Expenses.	121 Other Expenses.
XLIV. Law Expenses—General.	96 Law Expenses.	116 Law Expenses.
XLV. Insurance.	25 Insurance.	24 Insurance.
	47 Insurance.	51 Insurance.
	59 Insurance.	64 Insurance.
	84 Insurance.	104 Insurance.
	97 Insurance.	117 Insurance.
XLVI. Taxes.		
A. Real Property.		
B. Personal Property.		
C. Earnings.		
D. Special Franchises.		
E. Miscellaneous.		

HINTS FROM A CONDUCTOR

CONTROL OF THE BELL STRAP

A thing simple in itself yet of utmost importance to a street car company is for a conductor to keep his car bell strap under control until the car gets under headway. A company should positively insist upon this being done. Thus a conductor may be inside the car, collecting fares, and cannot get a good view of the rear platforms, when three women are about to board the car. After two of them mount the platform the conductor gives the motorman two bells, leaving one woman on the car step. The passengers on the rear platform call out and the conductor gropes for the strap, but probably by the time he has found it the woman has been dragged some distance, necessitating a suit against the company. If the conductor had retained control of his bell he could at once have given the motorman the third bell, and the car would have stopped. Retaining control of the bell gives a conductor more confidence and enables him to get his car over the line more quickly.

MEALS AT TIMES OF EXTRA RUNS

When a crew of a car is unexpectedly ordered out they should be allowed money for meals. Thus, if a special car is ordered out and a crew just finishing a run is ordered to take command, it is no more than right that they should be allowed meal money, if they have not time to reach their homes. This practice prevails among trucking companies and should be followed among street railway companies.

DISTRIBUTION OF LAMPS

We frequently hear discussions regarding the distribution of lights in street cars, yet the two most important requirements of a proper distribution of illumination seem to be entirely overlooked, namely, that that the register can be read from any part of the car, and that a passenger can see the locality at night. Regarding the first, if a register has a glazed surface, it cannot be read unless the observer is within 5 or 6 feet, yet it is the exception rather than the rule, to place a lamp near the register. As to the ability of a passenger to see the particular point at which he wants to get off, in some elaborately furnished box cars in which the writer has ridden lately, the lights are placed in the roof of the cars in such a manner that they throw a reflection on the windows, so that it is impossible at night time to see out of them. This should not be, for on the old-time cars anyone could always see the street and landmarks and did not have to bother the conductor by asking him questions.

EXTRA CHANGE

An excellent way for a conductor to prevent himself from running short of change is to keep $2 in change on reserve in an unused pocket, and only open this pocket pocketbook when he runs out of change. This gives him more confidence in running his car.

COPYING REPORTS OF ACCIDENTS

A good idea, not original with the writer, is to keep in every depot a copy book for accidents. At one street railway depot with which the writer is acquainted a copy book is kept, and when a conductor writes out an accident report it is at once copied. This is a much better practice than that which prevails in other places of copying the main features of the report in a book. Naturally, division superintendents like to see accident reports, and as the original report goes as soon as possible to the claim department, other means should be taken by superintendents to have a copy for their own use. Some use a letter press and have the reports copied by this means, others require a clerk to copy the reports in a book. As good a way as either of the above, and one which is just as desirable for the claim department, would be to have all accident reports written with an indelible pencil, and a carbon copy taken of them. Many large concerns, such as shipping departments of stores, express companies and docks use indelible pencils, and find them very satisfactory.

AN EFFECTIVE REMEDY

On nearly all street car systems there are along the route "safety stops," such as firehouses, schools, etc., where the electric cars are required to come to a full stop. At times some motormen will get lax about stopping at these points and have to be disciplined by being laid off for a day or in some other way. A division superintendent of a certain electric railway has adopted an effectual device for making the men remember this rule. In the depot there is a large blackboard to mark up the runs of extra men. One day a motorman was reported for running by a "safety stop," and he was ordered to write the word "stop" 100 times on this blackboard. The lesson was effectual. It is noticed that all motormen now observe this stop.

A SMALL TALK ON TRANSFERS

The best method of preventing a. m. and p. m. transfers from getting mixed by conductors is a problem that has given many street railway companies an endless amount of study. The writer suggests a simple remedy to overcome the difficulty cheaply and effectively and one that will kill two birds with one stone as it helps in another direction. Make it a rule that when a conductor starts out on his run he carry two sets of transfers, a. m. and p. m. Have in the car, in an out-of-the-way place, a little box, 8 ins. by 3 ins., and require the conductor to place in this box the transfers of the kind that he is not going to distribute. Have a small alarm clock in the front part of the car near the motorman and set this clock 11 p. m. or 11 a. m. At 11 p. m. or a. m. this alarm will ring, and the motorman can at once notify the conductor to change his transfers, avoiding all confusion, and possible lawsuits, which have frequently taken place from conductors getting their transfers mixed in the crowded cars.

CLOCKS

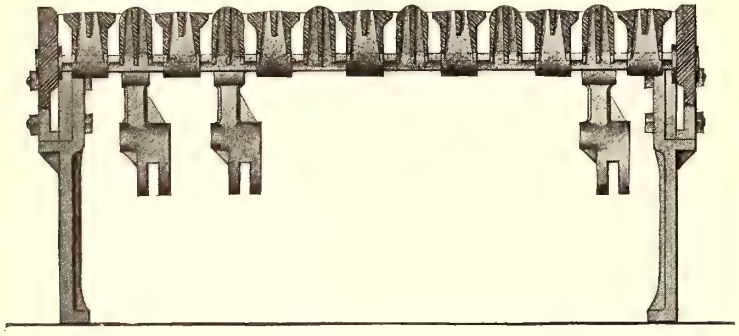
In connection with the previous suggestion I consider that every motor car should have at the front end a clock for the use of the motorman. Time is an important matter in the operation of an electric railway. All companies require their motormen and conductors to carry watches, but it frequently happens that these watches are not good time pieces. A clock will stand the racking incidental to electric railway service better than a watch, and, if hung on the dash in front of the motorman, offers a distinct advantage, especially in cold weather when the motorman is bundled up. It would also be a good idea to put a clock in the front part of the car, as it would be an accommodation to the public and would also induce passengers to move forward in the car.

A LARGE ORDER FOR THERMIT JOINTS IN AUSTRALIA

The Goldschmidt Thermit Company announces the closing through its Australian office of an order for welding portions for 10,000 joints on the new tramway system being constructed at Adelaide. Thermit joints have been used to a considerable extent already in Sydney and other systems in Australia, and this order comes as the result of the satisfaction given at those places.

NOTES ON GRATE PRACTICE

The Boston Elevated Railway Company and the Boston & Northern and Old Colony Street Railway companies are giving especial attention to the problem of securing efficient combustion. In this connection each road has installed a number of Reagan grates in its various power stations, and the performance is being quite closely watched. This grate is familiar to steam users in general as a chopping grate, built of special quality iron of unusual weight; it can be operated whether hot or cold, and obviates



END VIEW OF GRATE

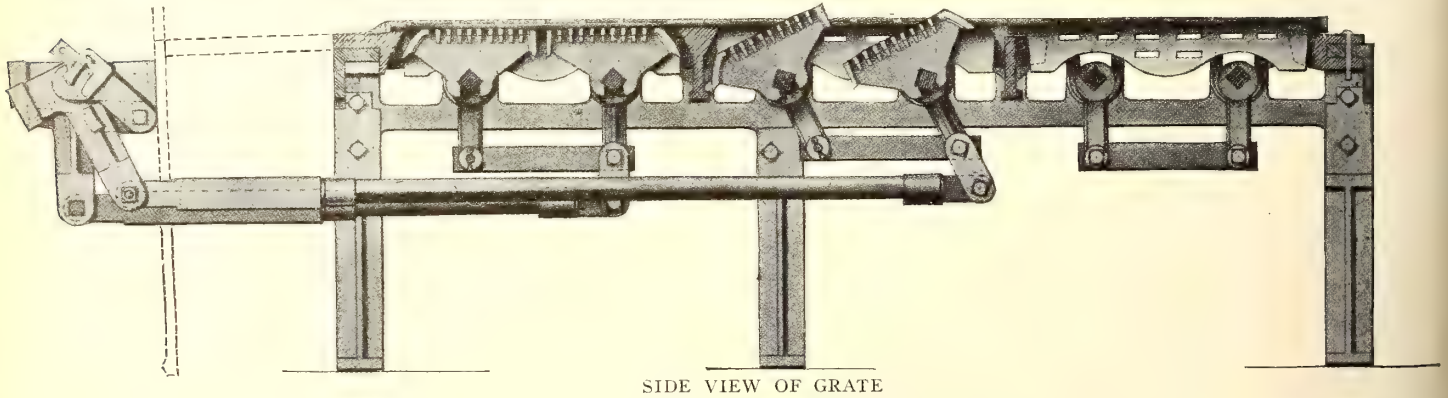
any necessity of running with the fire doors open unless handling a badly clinking coal.

About seventy-five or eighty of these grates have been in use for from two to four years on the Boston & Northern and Old Colony systems. They are installed in thirteen power stations under boilers ranging in capacity from 100 to 575 hp. Very few repairs have thus far been necessary and no trouble has been experienced from burning out. The draft over the fire ranges from 0.24 in. to 0.94 in. in these plants, with an average of about 0.75 in., the chimney heights varying from 75 ft. to 200 ft. The thickness of the fires is ordinarily from 12 to 14 ins. Standard New River or George's Creek coal of 14,000 to 14,500 B. T. U. per pound, particularly the latter fuel, is burned in these grates. Some of the plants contain economizers, and for this and other reasons flue gas temperatures and CO_2 analyses are not included in these notes. A marked increase in boiler capacity has resulted from the introduction of these grates. The grates are shaken hourly or more frequently, according to the character of the coal used.

The Boston Elevated Railway Company has been using the Reagan grate to some extent for about two years. Thirty boilers are now equipped, and fifteen more are being fitted up with these grates. When this installation is completed, about 47 per cent of the boilers in the company's steam power plants will be so equipped. The sizes range from an 8½ ft. x 7 ft. grate under a 350-hp boiler to a 12 ft. x 7 ft. grate in a 500-hp furnace. Repairs have been very slight, and during one year's service it was necessary to replace but four pieces in eight grates. The draft over the fire in the Boston Elevated plants ranges from 0.1 to 0.5 in. The company endeavors to run with a fire thickness of about 7 ins., but the average is probably nearer 12 ins.

The rate of combustion averages from 22 to 25 lbs. of coal per sq. ft. of grate surface per hour at times of peak-load. The Reagan Grate Company claims that this rate of combustion can be increased to 40 or 45 lbs. if necessary, according to draft, even with the damper practically closed. During the lighter hours the rate falls to an average of about 16 lbs. In the Boston Elevated plants the flue temperatures average about 600 degs. F., and the percentage of CO_2 is about 9, without figuring the hours from 1 to 5 a. m., when the system is very lightly loaded. Many grades of bituminous coal are burned, and the analyses vary from 13,300 B. T. U. or lower to 14,000, with the per cent of ash varying from 5 to 12.6. A fair average for the per cent of ash is 8. The company has found that the number of heat units per pound is not an accurate index of the combustion adaptability of the coal, and neither is the ash percentage.

In firing at the Boston Elevated plants the effort is made to have the men cover the fire lightly and frequently. The grates are shaken hourly, and during the rush hours probably three times an hour. One man at Central power station during peak-loads devotes his entire time to shaking the grates. These grates have been found to extend the time through which the maximum boiler capacity can be carried without cleaning; in fact, the fires have been satisfactorily maintained for days at a time without any cleaning being necessary further than the shaking above referred to, with the boilers actually doing work beyond the rated capacity. The rugged design of the grate parts undoubtedly is a contributory cause of the excellent maintenance records thus far obtained. One of the chief claims made for this grate is that boilers can be held in suspense while the load is light and can be thrown into service again almost instantly by simply shaking the grate and opening the damper, thus doing away with delay in getting into condition to take care of the increased load.



SIDE VIEW OF GRATE

The Louisville Railway Company has refused to consider the proposal of its former employes to submit the alleged differences to arbitration. President Minary says he will receive the applications of the old employes as individuals.

A MODIFIED TROLLEY WHEEL.

The Recording Fare Register Company, of New Haven, Conn., announces a new type of trolley wheel, provided with an oil chamber and with bushings made in two sections, between which is placed a felt washer of the proper thickness. The felt presenting a wiping surface to the spindle, oil is drawn from the chamber by capillary attraction, thus insuring perfect lubrication without excessive oiling. The graphite, which is a non-conductor, offers great resistance to the current, and the necessary grooves required to hold the graphite leave just so much less metal for bearing surface. At the same time, the bushings being perfectly smooth, without grooves or channels, give double the bearing surface. Containing no graphite they offer no resistance to the current. As a result longer life is claimed for the wheel, with no expense for extra bushings and no labor of rebushing, as the original bushing will outwear the wheel. Further, the oil bill is said to be entirely eliminated, as the wheels are shipped from the factory filled with oil which it is said will last until the wheel is worn out. The self-lubricating wheels are made in three sizes: No. 400, standard 4-in. wheel; No. 430, standard wheel, 4⅜ ins. in diameter, and the No. 530 wheel, which is 5¾ ins. in diameter. They are composed entirely of new metal, 88 per cent copper and are guaranteed to contain no lead. The company also furnishes, when desired, the standard sizes of trolley wheels with regular graphite bushings.



NEW WHEEL WITH OIL CHAMBER

NEW YORK ASSOCIATION ISSUES PROCEEDINGS.

The Street Railway Association of the State of New York has just published its printed proceedings of the Lake Champlain meeting. The pamphlet is uniform in size with the reports of other meetings of the association, and on account of the importance of the papers presented at that meeting constitutes a valuable volume for reference. The association, in connection with the Empire State Gas & Electric Association, has also reprinted in pamphlet form the addresses at the joint meeting of the associations at Madison Square Garden, Oct. 1. The addresses were by Hon. Frank W. Stevens, chairman of the Public Service Commission for the Second District, New York; Henry J. Pierce, president of the International Railway Company, Buffalo, N. Y.; Alexander C. Humphreys, president of Stevens Institute of Technology, Hoboken, N. J., and Everett W. Burdett, of Boston, Mass. An abstract of these addresses appeared in the STREET RAILWAY JOURNAL for Oct. 5, but as they all relate to the present-day problem of the relations between State authorities and public utility corporations, they will well bear rereading.

A TRANSFER WHICH DESIGNATES THE STARTING POINT

A year or more ago H. M. Sloan, general manager of the Calumet Electric Street Railway, of Chicago, adopted a double stub transfer to prevent a continuous circuit with one fare. Mr. Sloan has recently had added to this transfer a feature which designates by means of one extra punch approximately where the passenger boards the car, so that if the direction of the car he transfers to is incorrect, or if he changes his mind, the conductor on the car receiving the transfer will know from its origin whether or not the pasenger is entitled to ride. The heavy or light lines through the body of the transfer are punched for a. m. or p. m.. The arrow marks indicate the direction the car is traveling, and the streets designated across the arrow lines are the transfer points on this particular line.

NEW CARS FOR GALESBURG, ILL.

The accompanying illustration shows one of several semi-steel semi-convertible cars built by the Danville Car Company, of Danville, Ill., for the Galesburg Railway Company. The outside panels of the cars are composed of a series of steel plates with metal moulding covering the joints. The inside finish is with mahogany. There are polished bronze trimmings throughout. The seats are of the walkover type, upholstered in rattan, manufactured by the Hale & Kilburn Manufacturing Company, of Philadelphia. Electric heaters of the Consolidated type are distributed under each seat, and electric lamps, liberally distributed, give illumination.

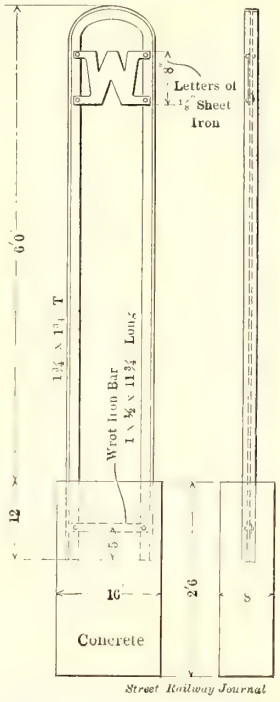
Bodies are mounted on trucks manufactured by the J. G. Brill Company. Four G. E. motors are used per car. Westinghouse air brakes and hand brakes are used.



NEW CAR FOR SERVICE IN GALESBURG

A STEEL WHISTLING POST

It is now possible to replace the familiar white stones and wooden posts with their black "W" that appear along steam and electric railways at crossings, bridges and elsewhere, by a durable, cheap and attractive steel whistling post. The Continental post has been designed especially to reduce the high cost of maintenance, to give longer life to the post and to keep the first cost as near that of the wooden post as possible. A light "T" iron is bent in an arch shape, the long ends of the "T" forming the legs of the post. The letters are stamped from sheet iron and riveted or bolted to the stems of the "T" near the top of the post. A bar riveted between the legs at the bottom of the post acts as an anchor when the post is set in concrete or in the ground.



PLAN OF STEEL WHISTLING POST

The claims for this post are that being made of structural steel, it will outlive the wooden post by many years; it will reduce the amount of paint used to maintain the posts by at least 75 per cent; it will reduce the amount of time necessary properly to maintain the posts by at least 75 per cent; the letters will be silhouetted against any background in winter or summer; snow cannot drift against it; the letters can be held in stock and new ones attached to a post at any time. The device is the invention of E. D. Hillman, mechanical engineer of the U. S. Metal & Manufacturing Company, New York, which company will shortly place the post on the market.

FUNERAL OVER THE BOSTON & WORCESTER.

On Wednesday, Nov. 20, the Boston & Worcester Street Railway Company ran a funeral car from Brookline to Worcester, a distance of 40 miles. The company used one of its regular closed cars, taking out one of the side seats on the end and one of the large windows on the side to allow the casket to be placed in the car. The funeral party used the balance of the seats in the car which were not removed. The running time from Brookline to Worcester between the points which the funeral party was carried was about 2 hours 20 minutes, the party being given the right of way. This is a new departure for New England, but probably will not be a novelty as the party was extremely well satisfied with the service on this trip. The expense was not so great as it would have been by the steam railroad, and the trip was not subjected to delays as would have been the case by steam. General satisfaction was expressed by relatives and friends of the deceased at the conduct of the funeral.

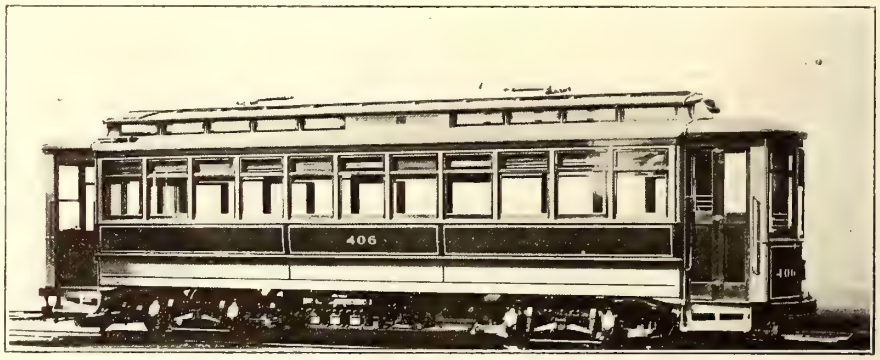
STATISTICS ON PRUSSIAN EMPLOYES

A recent inquiry by the Prussian Ministry of Public Works brought to light some interesting data on the number of men employed in street railway service in Prussia, the percentage for each class of work, hours of labor, etc. In May, 1906, 135 street railways in Prussia had 33,869 employes divided as follows: Executive and managerial departments, 3.6 per cent; operating department, 29 per cent, of whom 61.2 per cent were in actual car service; shops, 14 per cent; track and overhead maintenance, 9.5 per cent; power plant and sub-stations, 1.7 per cent; mixed service, 2.2 per cent. The shop apprentices numbered only 1 per cent of the shop employes.

The great difference in the operation of small and large systems is shown by the fact that while the town of Aurich requires only fifteen men in all for its line of 3.74 km., or four men per km. (.62 mile), Berlin averages 29.4 employes per km., or 11,098 men for 377.2 km.; Stettin averages 16.2 employes per km.; Posen, 20.8; Wiesbaden and Cologne, 19.1 per km. each. Of the 20,725 employed in the transportation department, 19,048 were employed under written agreements, and 18,876 were subject to discharge upon notice. Of the car men, 81.1 per cent worked less than eleven hours daily on the schedule, and, in fact, 59.6 per cent less than ten hours. Regular working time exceeding thirteen hours constituted 3.9 per cent of the total, while only 7 per cent ever had to work more than fourteen hours a day, including overtime. During May, over 82 per cent of the men were allowed three or more days' absence from duty, a day being understood as twenty-four consecutive hours' absence.

FIFTEEN CLOSED CARS FOR WORCESTER CONSOLIDATED

Fifteen cars like the one illustrated were delivered last month to the Worcester Consolidated Street Railway Company, by the John Stephenson Company, and follow closely on the ten Brill "Narragansetes" described recently in the Street Railway Journal and furnished by the same builder. The chief dimensions of the closed cars are as follows: Length over the end panels, 30 ft.; over the crown pieces, 39 ft. 5 ins.; over the sills, including the sheathing, 7 ft. 3 ins.; height from the floor to the ceiling, 8 ft. ¾ in.; from the underside of the sills over the trolley board, 9 ft. ½ in.; size of the side sills, 4¾ ins. x 7¾ ins.; end sills, 5 ins. x 8⅞ ins.; sill plates (outside), 6 ins. x ½ in. Like the "Narragansett" cars mentioned, these were mounted on the Brill No. 27-G1 truck with 4 ft. 6 ins. wheel base. The seats are of the longitudinal variety, upholstered in plush. The lower sashes of the windows raise in the ordinary manner, the top sashes remaining stationary. The weight of the car completely equipped is 43,000 lbs.



TYPE OF CLOSED CAR FOR SERVICE IN WORCESTER

FINANCIAL INTELLIGENCE

WALL STREET, NOV. 27, 1907.

The Money Market

Monetary conditions have improved materially during the past week, and the situation at the close may be said to be clearer than at any previous time for a month or more. The demand from all of the leading interior points has been almost as heavy as in the two preceding weeks, but the loss from those sources has been largely offset by the arrivals of gold from Europe. Since the beginning of the gold import movement upward of $95,000,000 gold has been contracted for abroad, of which considerably more than half has been received, and despite the action of the foreign bankers in advancing the official discount rates, and the employment of other methods to keep their gold supplies intact, our bankers continue to report new engagements of the yellow metal, and indications now are that much more than $100,000,000 will be brought here on the present movement. A feature has been the decision of the Bank of France to send gold to the United States against commercial bills. Several million dollars of gold were secured in Paris near the close of the week, the first since the beginning of the movement, for shipment to this side. One of the most encouraging features of the week was the falling off in the demand for currency which was attended with a sharp decline in premiums. Quite an active business has been done in this branch of the market during the past fortnight and premiums at times have reached 3½ and 3¾ per cent; but at the close of the present week, the premium declined to below 1¼ per cent, and dealers generally were of the opinion that the money market would soon become normal. Much relief will result from the carrying out of the plans of the Secretary of the Treasury by issuing $50,000,000 2 per cent Panama Canal bonds and the $100,000,000 one-year 3 per cent certificates of indebtedness. These issues will be the basis for new circulation by the banks throughout the country. The foreign exchange market has ruled firm, owing to the light supply of commercial bills, shipments of cotton and grain being somewhat retarded by the existing money stringency.

Money on call on the Stock Exchange has been in freer supply at rates ranging from 15 per cent to 3 per cent, the average rate for the week being about 10 per cent. Business in the time loan branch has been practically at a standstill, the banks and trust companies showing no disposition to re-enter the market at this time. Some transactions, however, were reported at 14@15 per cent for 60 days, but such transactions were subject to special agreements. Mercantile paper was extremely quiet and rates were quoted nominal at 7@7½ per cent for the best double names.

The bank statement published last Saturday was somewhat better than expected. There were substantial decreases in both loans and deposits, the decline in the former item amounting to $4,012,000, while the decrease in the latter was $9,485,000. The reserve required, however, was $2,371,250 larger than in the preceding weeks, and the loss in cash amounted to $2,807,900. Deducting the reserve required from the loss in cash shows an increase in the deficit in the clearing house banks of only $436,650. The total deficit now stands at $54,103,600, as compared with a deficit of $53,666,950 last week and a surplus of $2,371,675 in the corresponding week of last year. A feature of the bank statement was the large increase in circulation, amounting to $3,423,000.

The Stock Market

Dealings on the Stock Exchange were upon an extremely small scale, and were accompanied by a decidedly irregular price movement. The sharp advance in prices which resulted from the decision of the Government to relieve the money stringency by the issuance of $50,000,000 Panama Canal bonds and of $100,000,000 certificates of indebtedness was followed by a sharp reaction in prices, which carried values for many issues to the lowest of the year. The uncertainty regarding the success of the issue of the certificates of indebtedness was in a measure responsible for the downward trend in prices, but perhaps the greatest influence in bringing about the lower levels was the forced liquidation which was in evidence in many of the standard stocks and bond issues. Sentiment was also chilled by reports of further contraction of business throughout the country, and by the persistent demand for and the high premium paid for currency. It was generally expected that the heroic efforts making by the Government and leading bankers in this city to restore confidence would result in an absolute disappearance of the premiums on currency. Contrary to general expectations, however, quite an active business was transacted in that branch of the money market, and at times the rate paid for bills of small denominations and gold reached 3½ per cent. The liquidation in stocks was confined to certain quarters of the market. The weakness in United States Steel stocks was due almost entirely to the continued heavy selling of the U. S. Steel 5 per cent bonds by parties who took the bonds in payment when the transfer of the Tennessee Coal & Iron stocks was made several weeks ago. Chicago, Rock Island & Pacific 4 per cent bonds also exhibited pronounced weakness, the price for that issue falling sharply. Atchison issues were also under pressure and declined sharply, and weakness was also displayed by many of the Southern railway issues. At the close of the week, however, the market recovered sharply and in many issues the earlier declines were partly or wholly regained. The chief influences in bringing about the recovery at the end of the week included the sharp break in the rates for currency, and in some quarters it was believed that the premiums would soon disappear entirely. The conference between President Roosevelt and members of his cabinet and several leading financiers had a very beneficial effect upon sentiment, although the matters discussed were not made public. Considerable amounts of gold continue to be secured in the European markets by our bankers, perhaps the most important development in this connection being the engagement of several million dollars at the Bank of France and the reported willingness on the part of that institution to furnish further considerable amounts if necessary. The bank statement was also a helpful influence, inasmuch as it showed only a nominal increase in the deficit of the clearing house banks, and also an increase in note circulation of nearly $3,500,000, showing that the banks are taking advantage of the relief measures put into effect by the Secretary of the Treasury.

Philadelphia

Dealings in the Philadelphia traction stocks were considerably larger than in the preceding week, and while prices moved with more or less irregularity the general trend of values was toward a higher level. During the first part of the week practically all of the active issues were under pressure, and in some instances new low records for the movement were established. Philadelphia Rapid Transit was forced down to 12, but at the low level very heavy buying developed which carried the price up to 13½, a gain of 1½ points. About 15,000 shares were dealt in. Union Traction was also under pressure, the price receding to 42½, a loss of 2¾ from the previous week's close, but later on there was an advance to 44. Philadelphia Traction sold at 82½. Consolidated Traction of New Jersey held steady at 55, but United Companies of New Jersey lost a point to 215. American Railways was firm at 45.

Baltimore

Trading in the local traction issues was comparatively quiet during the week, but nevertheless prices held decidedly firm. United Railway issues were especially firm upon a reduced volume of business, the 4 per cent bonds selling at 80¼@80, while the income bonds brought 42¼@42. The refunding 5s sold at 69¼@69. Baltimore City Passenger 5s sold at 99, and transactions in Washington City & Suburban were recorded at 97½.

Other Traction Securities

The Boston traction shares were extremely quiet and without especial feature. Boston Elevated after an early decline to 117¾ recovered to 118. Massachusetts Electric common sold at 9½, and Boston & Worcester preferred sold at 55. West End common advanced to 81 and the preferred at 95.

A few sales of Cleveland Electric were made on the Cleveland Stock Exchange the past week at 33. Since the election this security has gained little strength and perhaps not much change will be shown until some definite action is taken toward a settlement of the franchise question. Northern Ohio Traction & Light showed a little strength because of the declaration of a dividend, but the sales were small at that. Fifty shares of Western Ohio preferred changed hands Thursday at 51½. Little trading was done in any of the other traction stocks, and in fact business on the exchange in all securities was very quiet.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Nov. 20.	Nov. 27.
American Railways	44½	44
Boston Elevated	117½	117½
Brooklyn Rapid Transit	30½	31½
Chicago City	a150	a150
Cleveland Electric	30	32
Consolidated Traction of New Jersey	56	54½
Detroit United	31	30
Interborough-Metropolitan	5	5⅝
Interborough-Metropolitan (preferred)	15	15¾
International Traction (common)	40	a40
International Traction (preferred) 4s	57¼	57¼
Manhattan Railway	110	110
Massachusetts Elec. Cos. (common)	9¼	9¼
Massachusetts Elec. Cos. (preferred)	38	—
Metropolitan Elevated, Chicago (common)	a19	a19
Metropolitan Elevated, Chicago (preferred)	45	45
Metropolitan Street	23	21
North American	39½	40
North Jersey Street Railway	40	40
Philadelphia Company (common)	33	32½
Philadelphia Rapid Transit	12½	13
Philadelphia Traction	83	79½
Public Service Corporation certificates	54	54
Public Service Corporation 5 per cent notes	89	89
South Side Elevated (Chicago)	67	60
Third Avenue	18	16
Twin City, Minneapolis (common)	74¼	73
Union Traction (Philadelphia)	44½	42

a Asked.

Metals.

The copper market was somewhat firmer, prices for the leading grades advancing ¼ @ ⅝ cents. Domestic consumers are buying moderately, while foreign consumers have bought freely. Indications are that the exports for the month of November will be the largest on record. Lake is quoted at 15¼ @ 13¾c.; Electrolytic at 15 @ 15½, and Castings at 12¾ @ 13¼.

OPENING OF THE TUNNEL TO BROOKLYN

On Nov. 27 the Interborough Rapid Transit Company ran a trial train from Wall Street Station through to Borough Hall Station, Brooklyn, via its East River Tunnel. The train was sent through the north tube and carried a special party of officials, engineers and others. Among those present were Messrs. Bassett and Maltbie, of the Public Service Commission; Belmont and Shonts, of the Interborough-Metropolitan Company; Bryan, Hedley, Stott, Doyle, of the Interborough Rapid Transit Company; Vreeland, Quackenbush and Robinson, of the New York City Railway Company, L. B. Stillwell, John Van Vleck, J. B. McDonald, F. R. Fuller, Alfred Skitt, Wm. G. McAdoo and W. B. Parsons. The train consisted of two motor cars and one trail car and about 15 minutes was taken for the trip from Bowling Green to Borough Hall, but much quicker time was made on the return trip. A luncheon was served the guests at the Borough Hall station.

The distance between this station and Bowling Green is 1.6 miles and the length of each of the two tubes is 1.2 miles. The inside diameter is 15 ft. 6 ins. The lowest part of the tubes is 95 ft. below mean high water and 40 ft. below the bottom of the river. The grade on each side is 3.1 per cent. Ventilating shafts are provided at each terminal. There are three sumps, one at the middle of each grade and one at the foot of the grades, equipped with pumps sufficient to handle a very large volume of water. The tunnel is equipped with a separate lighting system, independent of the main source of supply, and a separate telephone system.

THE PAY-AS-YOU-ENTER CARS IN SERVICE IN CHICAGO

The new pay-as-you-enter cars were put in service in Chicago for the first time Sunday, Nov. 22. On the Cottage Grove Avenue line of the Chicago City Railway all of the old cars were replaced by 131 of the new type. The results were very gratifying to the company. Passengers had been prepared for the new cars by frequent press notices and instructions sent out by the company, and there was less misunderstanding regarding the operation than had been expected. The most severe test of the new method of loading was made at Congress Street on the dismissal of church at the Auditorium Theater. The crowd was handled in a very satisfactory manner. President T. E. Mitten, of the railway company, who is responsible for the introduction of the cars, spent most of the day observing their operation. His observations resulted in the following statements:

"In my judgment the 'pay-as-you-enter' system of fare collection will prove a signal success in Chicago. I was much pleased with results as they came under my personal observation and as reported to me by representatives of the transportation department.

"I am pleased to note that crowds were handled easily and quickly, and we have every reason to believe the system will produce even more than was expected of it. Some of the counts made showed that 75 persons per minute were loaded under the 'pay-as-you-enter' rule.

"The main purpose of the 'pay-as-you-enter' plan, which is in force in Montreal, and which is introduced for the first time in Chicago and for the first time in any American city, are to reduce the number of accidents, prevent overcrowding, regulate ventilation, and to increase the comforts of patrons and trainmen. The responsive attitude of the public and of employees of the company is especially encouraging."

On Monday the newspapers all contained spread stories about the success of the cars, congratulating both the company and the riding public. In fact, the story of the working of the cars telegraphed East resulted in details being published in a number of cities. In New York, the *Evening World,* in anticipation, as it were, of the introduction of the cars for service in that city, went so far as to publish pictures of the Chicago cars, duplicates of the ones shown recently in the Street Railway Journal.

ORDINANCE PASSED TO PERMIT INTERURBANS TO ENTER MILWAUKEE OVER CITY LINES

The committee on railroads of the Common Council of Milwaukee considered the proposed franchise ordinances for a number of connecting lines on the south side last week, but finally postponed further consideration of the measure to give the committee opportunity to view the premises. An amendment was proposed to provide that any interurban line which shall apply for admission to the city in the future shall have the use of the tracks of the Milwaukee Electric Railway & Light Company. President Beggs, of the Milwaukee Company, stated that more concessions had been secured for the city by the railroad commission and by City Attorney Kelly from the street railway company in the past year than had been secured by the Aldermen in ten years. He praised the fairness of the commission and the city attorney. City Attorney Kelly tried to explain to the Aldermen the theory upon which he had been acting and urged them to get into their minds the idea that if they are to insist upon a low rate of fare, they ought to regard the company as agents for the city and allow it to conduct its business as economically as possible in order that the company may give as low rates of fare as possible. He said that he differed with Mr. Beggs in the prospects of winning for the city a 3-cent fare, but that it could not be won if the city continued to harass and annoy the company by placing additional burdens upon it which would increase its operating expenses. Mr. Beggs stated positively that he would not accept an ordinance which contained burdens not contained in the franchise of 1900 as he did not care to establish a precedent. The amendment to compel the company to pay for the pavement inside its tracks was killed by a vote of six to three. The amendment to compel the company to strengthen Clinton Street bridge was adopted. The amendment to limit the franchise to the time the new Kinnickinnic Bridge is being built was killed. The amendment to allow future interurban lines to use the tracks was adopted unanimously.

CONTINUING THE B. R. T. INQUIRY—TRACTION MATTERS IN GENERAL IN NEW YORK

The inquiry by the Public Service Commission of the First District of New York into the affairs of the Brooklyn Rapid Transit Company, which was continued last Thursday, had to do with the company's finances, more especially the capitalization of the constituent companies. It was continued on Friday along the same lines, and an adjournment was then had until Tuesday. As a result of what transpired at the hearing, the commission's special counsel and one of the commissioners took occasion publicly to commend the Brooklyn Rapid Transit management for expending large amounts for maintenance and charging such expenditures to operating expenses, thereby keeping down the cost of road and equipment. The commission has also let it be known in other ways that its examination of the books of the company under the present management as so far made reveals nothing to cause any apprehension. The commission does not regard so favorably, however, the methods followed by the company in the first few years of its history, and furthermore takes exceptions to the way in which some of the subsidiaries of the Brooklyn Rapid Transit were reorganized. Before the hearing ends an investigation of the Transit Development Company and the American Railway Traffic Company no doubt will be made. The Brooklyn Rapid Transit owns practically all of the stock of both companies. The Transit Development Company operates all of the system's power houses, buys all equipment and keeps all of the rolling stock, equipment and tracks and elevated structures in repair. The American Railway Traffic Company has the ash removal contract in Brooklyn. With the ashes and garbage it has removed it has filled up lowlands along the seashore. The attempt probably will be made to find out who has profited from the filling up of this land.

The hand that Mayor Tom L. Johnson of Cleveland played in the affairs of the Nassau Electric Railroad, now one of the constituents of the Brooklyn Rapid Transit Company, was brought out at the hearing on Tuesday, Nov. 26. It seems that the Brooklyn Rapid Transit Company, in taking over the Nassau, assumed a charge of $167,500, which Mr. Ivins, as counsel for the commission, desired to know more about than was contained in the mere entrance of the sum under construction account. Col. Williams, for the Brooklyn Rapid Transit Company, said that it was a charge assumed by his company and as such had to be paid. The money, Col. Williams said, was largely used for legal expenses in connection with the securing of certain franchises by the Nassau Company, but he did not know its division. Mr. Williams is quoted as saying: "It was a case of politicians on the one hand and reformers, headed by Tom L. Johnson, on the other, and they made an alliance for accomplishing certain results. The motives which animated them and the methods they followed I have no way of knowing about."

The Appellate Division of the Supreme Court handed down a decision Nov. 22 upholding the injunction issued by Judge Giegerich in the Supreme Court more than a year ago which forbade John H. O'Brien, then fire commissioner, and other city officials from interfering with the construction of the Steinway or Belmont tunnel under the East River. The decision is unanimous. The opinion of the court was written by Justice John Proctor Clarke. The opinion, which is a long one, recites the legal history of the Steinway enterprise and of the legislation under which it has been carried out. The judge holds that the old tunnel act of 1880, under which the Steinway tube was projected, was constitutional, and that within the provisions of this act underground tubes might be built in the City of New York as well as elsewhere in the state. The opinion declares that the various proceedings by which the company changed its route are valid and that the Cantor act, requiring the sale of franchises at public auction, was not applicable to the franchises granted by the city to the tunnel company. The court also holds that the company has the right to construct its tunnel under land immediaely adjacent to the shore. This refers to the fact that the company did not obtain the consent of the Dock Department to its tunneling under submerged land lying technically within Dock Department jurisdiction.

On behalf of Solomon H. Kohn the law firm of Wollman & Wollman filed a bill in the United States Circuit Court Monday, Nov. 25, asking to have receivers appointed for the Metropolitan Street Railway other than Douglas Robinson and Adrian H. Joline, who were first appointed receivers for the New York City Railway by Judge Lacombe. Papers were formally served from the United States Supreme Court on Judge Lacombe of the United States Circuit Court Nov. 22, directing him to show cause why the receivership of the New York City Railway Company and the Metropolitan Street Railway Company should not be vacated. The service is the result of an appeal to the Supreme Court by Lawyer Roger Foster, who on behalf of several judgment creditors sought at first to have the receivership vacated and then for intervention by his clients in the suit brought by the Pennsylvania Steel Company and the Degnon Contracting Company, against the street railway company. Both motions were denied by Judge Lacombe and Mr. Foster carried the matter to Washington. The papers are returnable on Dec. 2. They require no other action on the part of Judge Lacombe than forwarding to Washington the papers in the case here. The Supreme Court will then hear arguments pro and con. The case will be argued in opposition by the lawyers who opposed Mr. Foster's motions here.

Forty-seven persons were killed last month in street-car accidents in New York according to the reports made to the Public Service Commission. This is a decrease from the number killed during September. The total number of accidents recorded for the month was 4866 as against 5202 for September, and 5500 for the last 26 days of August. The total number of serious injuries inflicted, including the fatal cases, is given as 191 for the month as against 216 for September and 189 for August. The table compiled by the commission is as follows:

Nature of Accident.	No. In October.
Car collision	221
Collisions with vehicles	791
Persons struck by car	354
Injured boarding	510
Injured alighting	593
Employees injured	603
Other accidents	1794
Total	4866

The specific cases of serious injury are given as follows:

Nature of Accident.	No.
Killed	47
Fractured skulls	15
Amputated limbs	9
Broken limbs	40
Other serious	80
Total	191

The commission has issued a final order against the Union Railway Company of the Bronx, which operates nearly all the surface lines in that borough. The order, in effect, calls for a general increase of a little over 25 per cent in the service at present being furnished by the company.

DENIALS IN THE CHICAGO SUIT

The United States Circuit Court of Appeals, in denying the petition of Charles H. Aldrich and Henry Crawford, representing minority stockholders of the West Chicago Street Railway Company, for a review of Judge Grosscup's opinion of the Union Traction reorganization plan, held that they had no legal standing; that their interests had been properly and well looked after. The Fidelity Trust Company, of Philadelphia, trustee for $3,171,000 bonds of the North Chicago Street Railway Company, has joined the other trust companies in application for foreclosure of the mortgages on the various Union Traction properties, preparatory to sale at auction, the understanding being that the Chicago Railways Company will be the only bidder. The next step will be an application to Judge Grosscup to enter an order of possession so that the new ordinance can be accepted. This will be an order on the receivers to lease the properties to the Chicago Railways Company, pending the sale under foreclosure. There may arise some new legal complication, but the Aldrich-Crawford intervention being swept away the course is left clear for the present.

FINANCIAL MEETING OF THE AMERICAN TRADE PRESS ASSOCIATION

A special meeting of the American Trade Press Association was held at the Hardware Club, New York City, on Nov. 21, in response to a call from President E. C. Brown, which said: "The meeting is called for the purpose of considering the conditions now prevailing in commercial and financial affairs and to determine what action should be pursued by this association and its members in assisting to restore public confidence, so ruthlessly shocked by the recent troubles among our local banking institutions and which is powerfully argmented by the 'currency' disturbances now prevailing throughout the length and breadth of the land. As exponents of the financial, commercial and manufacturing interests of the United States, the trade press must assume its natural position and at this critical juncture offer substantial evidence of its ability to lend material aid in stemming the tide now so strongly set against normal business operations."

Mr. Brown in calling the meeting to order emphasized the points made in the call, and stated that the subscribers and advertisers of the publications looked to them for all the assistance in their power. Their editorial columns should show independence of spirit in considering these weighty affairs, especially in dealing with the attitude of the banking community in regard to the merchant, the manufacturer and business people in general.

T. C. Martin then introduced Henry L. Doherty, past president of the National Electric Light Association, and who, he said, was now prominent in a score of public utility corporations and had made economic questions a close study. In administering these large interests Mr. Doherty, as an economist and analyst, had been led to diagnose closely the conditions noted by Mr. Brown and had addressed himself to an examination of the present state of affairs with a care more than ordinary, with results and data that would be very interesting at this juncture.

Mr. Doherty said: "If the present situation is not relieved it threatens to produce a long period of business depression. Regardless of conditions which have led up to this situation, the real condition which confronts and threatens us is the fact that the people who want money and are entitled to it, cannot get it, while a large portion of the people who have money are hoarding it through no other desire to do so than their inability to see any other means of protecting their savings. A vast sum of money has been withdrawn from circulation and has been hidden in safety deposit boxes and other less safe hiding places. A few days ago everybody was deploring the lack of confidence shown by depositors and was ridiculing their conduct as foolish and prejudicial to the country's welfare. To-day we are threatened with something even worse than an ordinary bank run —and from the very class of people who only a few days ago were criticizing others for what they are now doing themselves. Many of the banks throughout the country for their own individual protection—just as in the case of the bank depositor—are now attempting to bring up their reserves, thus removing money from circulation as effectively as though it were locked up in a safety deposit box or otherwise hidden. Many industries, threatened by their temporary inability to get money, are making wholesale retrenchments in purchases of goods and employment of labor. These retrenchments are largely advised by the bankers, in spite of the fact that every retrenchment on the part of one enterprise brings about an enforced retrenchment on the part of others.

"Retrenchment is not the cure for the condition which now confronts us, but is the result of such a condition. The correction of this condition can be summed up in a few words: Find some way, or ways, to bring the hidden money back into circulation before retrenchments have taken place to a point which will not permit re-extension to normal conditions. The main thing now is to convince the men who are leaders in industrial business affairs, first, that it is possible for them to continue, in most instances, without retrenchment with the assurance that an abundance of money will be available in the near future, and, second, to interest them in coaxing this hidden money into circulation.

"It is proposed, for example, to organize a bureau in New York in which every responsible business interest, that is willing to do so, can recommend the purchase of securities, provided it is willing to make this recommendation to its employees and friends as well, and make the communication so read. It is proposed to notify all people seeking investments that this bureau is at their disposal. It is also proposed to give out this information to the other cities throughout the country and invite their co-operation with the New York bureau."

At the close of Mr. Doherty's remarks addresses were made by John A. Hill, John R. Dunlap, James H. McGraw and C. T. Root. Upon motion, President Brown appointed a committee to act in behalf of the association, to be known as the "Committee on Public Relations" and consisting of Messrs. McGraw, Root, Hill and Williams with the president ex-officio.

At a full meeting of the special committee on Nov. 22 the following resolutions were adopted:

Resolved, That the so-called business depression now paralyzing the industries of this country is due principally to a want of confidence which is unwarranted by agricultural and industrial conditions, and that one of the worst results of the panicky feeling that prevails is the hoarding of money, in which many banks are principal offenders—many holding much more cash than the reserves called for by the banking laws, and setting a most hurtful example to individuals.

Resolved, That bank reserves are for just such emergencies as now exist and should be used rather than increased.

Resolved, That it is the duty of the trade press and the business men of this country to make every honest endeavor to find such hoarded money and bring pressure to bear upon its holders to put it back into circulation.

Resolved, That any bank holding more currency than its legal reserve is doing great harm to every business interest and merits no consideration whatever at the hands of merchants, manufacturers or labor.

Resolved, That the trade press be urged to organize business men's meetings in every city to present to the small hoarder of money a means of investing it in safe securities paying good interest, guaranteed if need be by such associations themselves.

Resolved, That money thus released be deposited only in banks that agree to put it back into legitimate channels of trade forthwith, and that manufacturing and mercantile interests be asked to do business with such banks and with them only.

Resolved, That the countermanding of orders, the closing of factories and the laying-off of thousands of wage-earners is uncalled for by any underlying condition of business itself, and that immediate steps to check the senseless scare is demanded of every conservative and politic American.

AWARDS TO EXHIBITORS AT JAMESTOWN EXPOSITION

The report of the Jury of Awards of the Jamestown Exposition to the governor of the Exposition has just been presented. This jury consisted of sixty-four gentlemen, all of whom were prominent authorities upon the apparatus in industries included in the Exposition at Jamestown. Albert Shaw, editor of the *Review of Reviews*, was president. Some other members were: R. Clinton Carpenter, M.S., LL.D., professor of experimental engineering, Cornell University, Ithaca, N. Y.; James Mapes Dodge, chairman Link Belt Company, Philadelphia, Pa.; Carl Hering, B.S., M.E., professor of electrical engineering, Franklin Institute, Philadelphia, Pa.; Gaetano Lanza, C.E., M.E., professor applied mathematics and mechanical engineering, Massachusetts Institute of Technology, Boston, Mass.; Thomas Commerford Martin, editor *Electrical World*, New York City; Joseph Struthers, Ph.D., assistant secretary American Institute Mining Engineers, New York City, and B. V. Swenson, secretary American Street and Interurban Railway Association, New York City.

The following were some of the awards to manufacturers whose apparatus is particularly identified with electric railway work:

DEPARTMENT OF MANUFACTURE AND LIBERAL ARTS

Gold Medals

Carborundum Company, Niagara Falls.—Metallic silicon.

General Electric Company, Schenectady, N. Y.—Arc and incandescent lamps and electric cooking appliances.

Silver Medals

The Bristol Company, Waterbury, Conn.—Bristol's recording voltmeters.

Walworth Manufacturing Company, Boston, Mass.—Steam, gas fitters' and water users' tools and supplies.

In Georgia Collective Exhibit

Acme White Lead Company, Detroit, Mich.—Paints and pigments.

Berry Brothers, Detroit, Mich.—Paints.

Bronze Medals

A. Buch's Sons Company, Elizabethtown, Pa.—Eagle steel lawn swing.

Benjamin Electric Manufacturing Company, Chicago, Ill.—Wireless clusters for incandescent lamps.

DEPARTMENT OF MACHINERY

Gold Medals

Alis-Chalmers Company, Milwaukee, Wis.—Electric generators and motors.

The Goulds Manufacturing Company, New York City.—Power pumps.
General Electric Company, Schenectady, N. Y.—Motors.
General Compressed Air & Vacuum Machinery Company, St. Louis, Mo.—Compressed air and vacuum house-cleaning machinery.
The Pittsburg Automatic Vise & Tool Company, Pittsburg, Pa.—Vises.
Richardson Scale Company, New York.—Automatic weighing scales.
Shelby Steel Tube Company, Pittsburg, Pa.—Seamless steel tubing.
S. A. Woods Machine Company, Boston, Mass.—Woodworking machinery
Babcock & Wilcox Company, Bayonne, N. J.—Water tube boiler, semi-marine type.
S. F. Bowser, Ft. Wayne, Ind.—Measuring pumps and storage tanks.
De Laval Steam Turbine Company, Trenton, N. J.—Steam turbines.
Heine Boiler Company, St. Louis, Mo.—Water tube boilers.
Robbins Belt Conveyor Company, New York.—Belt conveyor.
Westinghouse Machine Company, Pittsburg, Pa.—Gas producer engines and stoker.
R. D. Wood & Company, Philadelphia, Pa.—Gas producers.

Silver Medals

Advance Pump & Compressor Company, Battle Creek, Mich.—Duplex steam pump.
Atlas Engine Works, Indianapolis, Ind.—Gasoline engines.
Bullard Automatic Wrench Co., Providence, R. I.—Automatic wrenches.
Gibson Iron Works Company, Jersey City, N. J.—Dumping grates.
Jordon Brothers, New York City.—Jordon commutator truing device.
Kelly-Springfield Road Roller Company, Springfield, Ohio.—Road rollers used on Exposition grounds.
Moran Flexible Steam Joint Company, Louisville, Ky.—Flexible joints.
New York Leather Belting Company, New York City.—Leather belting.
Wagner Electric Manufacturing Company, St. Louis, Mo.—Single-phase generator set.
Under Feed Stoker Company of America, Chicago, Ill.—Under feed stoker.

DEPARTMENT OF TRANSPORTATION

Gold Medals

American Locomotive Company, New York City.—Locomotives.
Atlantic Equipment Company, New York City.—Atlantic steam shovel.
Baldwin Locomotive Works, Philadelphia, Pa.—Locomotives.
The J. C. Brill Company, Philadelphia, Pa.—Semi-convertible and full convertible cars and equipment.
Dayton Motor Car Company, Dayton, Ohio.—Stoddard-Dayton automobiles.
Pennsylvania Railroad System, Philadelphia, Pa.—Full section of tunnel under Hudson River and models and maps and drawings.
The Standard Steel Works, Philadelphia, Pa.—Steel tires and steel-tired wheels, solid-forged and rolled-steel wheels, open-hearth steel springs of various types.
Studebaker Brothers Manufacturing Company, South Bend, Ind.—Automobiles, street sprinklers, garbage and dump wagons, contractors' wagons and trucks.

Silver Medals

Chesapeake & Ohio Railway Company, Richmond, Va.—Complete vestibuled, steam-heated and electric-lighted F. F. V. train.

In Norfolk & Western Railway Collective Exhibit

Norfolk & Western Railway Company, Roanoke, Va.—Collective exhibit of transportation appliances manufactured along line of railway.

Bronze Medals

Kilbourne & Jacobs Manufacturing Company, Columbus, Ohio.—Steel wheel barrows, wheel scrapers, drag scrapers and four-wheel baggage truck.
Taylor Iron & Steel Company, High Bridge, N. J.—Panama dipper tooth.

DEPARTMENT OF FORESTRY

Gold Medals

Yellow Pine Manufacturers' Association, St. Louis, Mo.—Interior finish of yellow pine.

In Norfolk & Western Railway Collective Exhibit

The Central Manufacturing Company, Roanoke, Va.—Quartered oak stairway.

DEPARTMENT OF MINES AND METALLURGY

Gold Medals

Aluminum Company of America, Pittsburg, Pa.—Manufactured products of bauxite and alumina.
Carborundum Company, Niagara Falls, N. Y.—Carborundum and manufactured products.
Ingersoll & Rand Drill Company, New York City.—Ingersoll-Temple electric air rock drill.
Norton Company, Worcester, Mass.—Alumdum.
Standard Oil Company, Baltimore, Md.—Capital cylinder oil and renowned engine oil.

Silver Medal

In Norfolk & Western Railway Collective Exhibit

Kilbourne & Jacobs Manufacturing Company, Columbus, Ohio.—Steel and wood mining cars.

Bronze Medals

General Electric Company, Schenectady, N. Y.—Special motor used with rock drill.
Oil Well Supply Company, Pittsburg, Pa.—Model oil derrick.

COMPLETING THE BOSTON & WORCESTER DOUBLE TRACK

A location for the stretch of second track through the central part of the town of Framingham, Mass., just granted by the Massachusetts Railroad Commission to the Boston & Worcester Street Railway under the so-called "missing link" law, will give the company a chance to close the final stretch of about 2 miles where the road is still obliged to depend on a single track. Completion of the double-tracking, in the opinion of President James F. Shaw, will mean a considerable increase in the volume of through travel and will increase the safety and frequency of the service. The company has been making other improvements in conjunction with the work of double tracking. It has done a good deal toward removing some of the sharp curves between Framingham and Worcester. At one point an extensive cut and fill has been made to broaden the roadbed and straighten the line where it skirts one of the lakes in the reservoir district through which it passes, and the result will be to give the company a chance to cut the running time from Boston to Worcester by several minutes. It is now about two hours and ten minutes, slightly more than twice the schedule time by steam railroad. The double-tracking will be completed next spring. It will count in the working out of trolley express plans for this road, although the company still awaits a right to get express cars in and out of its terminal cities. The grant of trolley express privileges to the Worcester Consolidated Street Railway by the Worcester City Council recently has been vetoed by the mayor, and is thereby nullified. Regarding the prospect President Shaw, of the Boston & Worcester, says in his annual report:

"I am much disappointed that we have been unable as yet to establish the freight and express service which we have been trying to install, but the Boston Elevated Railway up to this time has been unable to obtain the necessary rights to allow it to take our cars from Chestnut Hill to the center of Boston. We are sure to receive a very handsome net revenue from this business as soon as it can be put into operation. The company is supplied with ample power and equipment to handle the increased business which will come with the completion of the property."

BOSTON & NORTHERN SECURES ALL BUT ONE FREIGHT GRANT

Negotiations for trolley freight and express rights for the Boston & Northern Street Railway lines north from Boston have been carried on so successfully that the company has now secured its local grants in all the separate communities needed to reach from the end of the Boston Elevated Railway Company tracks in Malden, as far as Lowell, excepting in Wakefield. As Wakefield thereby constitutes a missing link, under the Massachusetts law the company may apply for a grant there over the heads of the local officials to the Railroad Commissioners, if the petition remains ungranted for sixty days. The grants already secured are for the company's tracks in Melrose, Reading, North Reading, Wilmington, Tewksbury, Lowell, Dracut, Methuen, North Andover, Middleton and Lynnfield. Some of these are on the line to Lawrence from Reading, but Lawrence itself has not yet been secured. A few other towns are pending. While no through service between Boston and Lowell can be projected until the Boston Elevated Railway Company gets trolley express rights, there is some indication in the grants now obtained that the Boston & Northern Company may consider the advisability of starting an inter-city service in the district north of Boston without waiting for the rights to enter Boston itself. The original Lynn & Boston Railroad was chartered as a railroad and had many privileges not ordinarily accorded to street railways nowadays; and as the Boston & Northern now operates in Lynn and Salem, and a few of the small places west of there under the old Lynn & Boston rights, it is possible that a service might be established out of Lynn or Salem, westward and northward, entering the district where rights have just been secured locally by way of Lynnfield or Middleton, and running thence by way of Reading to Lowell. Such a route would be less valuable to the company and to its patrons, no doubt, than a direct route into Boston, but the line suggested is a busy one, and the express traffic between a mill city like Lowell and a shoe center like Lynn might prove considerable, especially as Lynn has harbor facilities and connection with Boston by water.

NEW PUBLICATIONS

Electrical Traction, by Ernest Wilson and Francis Lydall. Vol. I., 475 pages. Vol. II., 328 pages. New York, Longmans, Green & Company. Price, $4 per vol.

It requires considerable courage in these days to publish a book on electric railway engineering, because the industry is constantly developing, and any publication of this kind is likely to become antiquated, in some parts at least, before it can reach the readers. Nevertheless, there is a demand for a book of this kind, and the authors have been very successful in their treatment of the subject. The latter might be said to be considered from the standpoint of the construction in distinction from the recent treatise of Messrs. Parshall and Hobart in which matters of design have been made more prominent. Both books are written for the engineer and not for the operator.

Volume I. is devoted to direct-current traction and the first part is given up to tramways, the latter part to heavier traction. In neither case is the subject carried further back in the system of distribution than the switchboard. The tramway portion is perhaps the least interesting part to the American reader, although it is thoroughly well done. It is this portion of the subject that British practice differs most from our own. It is necessarily larger than would be a corresponding section in an American book, on account of the variety of practice in Great Britain. This is exemplified by the discussion on types of pole standards, the large number of brakes considered and the space given to surface-contact systems, regenerative control and Board of Trade regulations with their return boosters and other requisites. These are not catalogue descriptions, but the difficulties as well as the benefits are mentioned. This is illustrated in the case of the chapter on surface contact systems, which, although possessing theoretical interest only to an American reader, is interesting from the fact that particulars are given of the actual working of the systems, including short circuiting, wear of she skates and other data. Following the tramway section, which occupies the first twelve chapters in Vol. I., the authors consider heavier work where the practice corresponds more closely to that in America.

Vol. II. is devoted entirely to alternating-current traction, an indication of the extent to which this system is considered favorably in Europe. The first four chapters, or somewhat over 100 pages, are taken up by a treatment of the polyphase motor and include the theory of the motor and a discussion with examples of its practical design and chapters on control and overhead construction. The single-phase motor is discussed in the following 200 pages of the volume. It is treated in the same general way as the polyphase motor, that is, by a discussion of the general theory, followed by chapters on design and calculations for specific sizes of motors of various types. The different methods of control and the practical application of these methods are described in detail for the compensated repulsion and the compensated series motors, with combinations of the two methods of interlocking the various apparatus, etc. In the chapter on overhead construction the authors give a reference to the first printed suggestion in favor of the catenary as having appeared in this paper during 1901, in the form of some reminiscences of the proposed Wellington Adams high-speed road between Chicago and St. Louis. This chapter itself will be found particularly interesting to American readers, owing to the attention which has been given abroad to special problems of overhead catenary construction, such as apparatus for low bridges and tunnels, with bifurcated conductors, to avoid the action of locomotive gases and protective shields to avoid short circuiting of the high-tension conductors. Both volumes have valuable chapters on feeder systems and methods for their computation.

"Städtische Verkehrsfragen" (City Traffic Questions), by Dr. Eng. Wilhelm Mattersdorff. Berlin, Julius Springer, 42 pages, bound in paper with four insets containing thirty-four curves. Price M2.40.

This book is based on the author's endeavor to find the comparative value of the influences that determine city traffic and in its treatment is an elaboration of the article contributed by Mr. Mattersdorff in the Street Railway Journal of June 2, 1906. The writer evidently has made an exhaustive study of traffic conditions in German cities of all classes to find what definite relations, if any, exist between the population of a community and its trackage, car-miles, passenger-miles, seat-use and other units of comparison. Similar data are presented with reference to the principal systems of England and the United States. While the points brought out by Mr. Mattersdorff may be of little practical value toward the solution of the numerous special problems that arise in urban transportation, his methods of comparing results in different cities to find the highest possible limit of various factors should prove of value to those desiring to compare their own traffic possibilities with other cities similarly conditioned.

ANNUAL REPORT OF THE BOSTON & WORCESTER STREET RAILWAY

The annual report of the Boston & Worcester Street Railway Company, for the year ended Sept. 30, 1907, has been issued. The income account compares as follows:

	1907	1906
Gross Receipts	$531,560	$514,464
Operating Expenses	273,365	269,391
Net	$258, 95	$245,073
Charges and Taxes	151,661	132,675
Balance	*$106,534	$112.398
Dividends	103,500	103,500
Surplus	$3,034	$8,898
Previous Surplus	25,238	20,679
Total Surplus	$28,272	$29,577
Old Accounts Charged Off	13,321	4,339
Profit and Loss Surplus	$14,951	$25,238

*Equal to 4.81 per cent on the $2,200,000 capital stock.

The balance sheet as of Oct. 1, 1907, compares with the two previous years as follows:

ASSETS.

	1907	1906
Traction and Construction	$2,897,908	$2,568,826
Power Stations	634,092	632,083
Car Houses, Lands	244,401	206,788
Rolling Stock, Etc	655,989	612,092
Suspense Account	.....	.....
Bond Discount	.....	.....
Cash and Miscellaneous Assets	183,592	112,637
Total	$4,615,984	$4,132,426

LIABILITIES.

	1907	1906
Capital Stock	$1,725,000	$1,725,000
Funded Debt	1,716,000	1,717,000
Notes Payable Held By Boston & Worcester Electric Company	600,000	600,000
Notes Payable	462,204	5,070
Interest Accrued	16,577	13,412
Taxes Accrued	37,796	37,643
Sinking Fund	.....	888
Profit and Loss	14,951	25,238
Accounts Payable	43,453	8,172
Total	$4,615,984	$4,132,426

President James F. Shaw, in the annual report, says in part:

"Notwithstanding that the past year has been a very poor one for street railways all over New England, the business of the Boston & Worcester Company has shown a healthy increase in its local traffic. The through business from Boston to Worcester has not increased during the year, and I do not look for any increase of importance until our through line is completely double tracked, which will permit of a reduction in the running time between Boston and Worcester. There are now less than two miles of double tracking to be completed and we hope to finish this work by early spring.

"I am much disappointed that we have been unable as yet to establish the freight and express service which we have been trying to install, but the Boston Elevated Railway Company up to this time has failed to obtain the necessary rights to allow it to take our cars from Chestnut Hill to the center of Boston. We are sure to receive a very handsome net revenue from this business as soon as it can be put into operation.

"A total of 10,571,065 fares were collected during the year as compared with 10,279,303 fares the preceding year, and these were received on a car mileage of 1,820,905 miles, as compared with 1,862,136 miles last year. A table of earnings per car-hour and per car-mile follows:

Route	Earn. per car-hour 1907	Earn. per car-hour 1906	Earn. per car-mile 1907	Earn. per car-mile 1906
Boston & Worcester	$7.08	$6.56	$.342	$.316
Boston & So. Framingham.	4.23	3.97	.226	.210
Local Lines	2.31	2.32	.225	.229

"The company is supplied with ample power and equipment to handle the increased business which will come with the completion of the property.

"The population of both Boston and Worcester, our terminals, is increasing rapidly, and the territory between these two cities is showing a remarkable growth."

CHANGES IN THE PERSONNEL OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY

Formal announcement has been made by the Public Service Corporation that two of its vice-presidents, A. B. Carleton and Col. Charles A. Sterling, have resigned and that their places will be taken by officers of the United Electric Company, one of the subsidiary concerns. Fred Evans, secretary of the corporation, also resigns, and his place will be taken by Col. E. W. Hine, assistant to the president.

REROUTING CARS IN CLEVELAND

J. J. Stanley, general manager of the Cleveland Electric Railway, has completed plans for rerouting cars permanently to avoid congestion at the Public Square during the rush hours of the day. It will be some time, however, before this can be put into effect, as quite a little special work will be required for the new loops that will be necessary. All through lines with the exception of Broadway and St. Clair will continue as such. The Euclid Avenue line will be the only one to operate through to the Union Station. However, the cars on other lines which have been going to that point and turning will be turned at the square. The new plan includes loops about the northwest quarter of the square which has not been used in the past for railway purposes. Euclid and Wade Park cars will turn on the loop around the southeast section of the square, while Woodland, Scoville, Broadway, Union and West Fourteenth Street cars will turn about the southwest section, passing the Forest City House. All West Side cars will turn about the northwest section. Cars coming down Ontario Street from the south will turn on a new loop around East Fourth, Prospect, East Second and High Street. Payne and Superior Avenue cars will turn on a loop around Superior, East Fifth, Rockwell Street and Ontario, which will be a new loop. St. Clair Avenue cars will turn on another new loop around East Ninth Street, Rockwell Street, Ontario and St. Clair Avenues. Through cars on the Woodland and Lorain and on Scovill and Clark lines will pass from Ontario Street to Champlain to West Third and Superior, instead of passing through the Public Square.

The fact that the Public Square is divided into four sections by Ontario Street and Superior Avenue makes it possible to make the new routings without much trouble, with the exception that pedestrians will probably find a little more trouble in crossing it than at the present, since an additional section is to be used. Cars will also cross other streets in forming the new loops where there are no lines at present. Fewer cars will reach the Union Station and the transfers will therefore be much heavier in order to accommodate the traveling public. With the addition of the cars of the Forest City Railway Company all reaching the square, the possibility of operating cars over the old route had become very small and something had to be done to avoid the delays that occurred several times a day through blockades.

Meetings of the directors of the Cleveland Electric were held both Wednesday and Thursday afternoons, President Andrews having hurried back from a trip to New York and Rochester to be present. Nothing, however, was given out as to the proceedings and the officers would not even intimate what the subject was of their deliberations in advance of a possible meeting with the City Council, which had delayed further low-fare proceedings pending a reply to the semi-arbitration proposition made to the board. Some of the directors have proposed to fight the matter out along the original lines, it is said, but the more conservative element of the board has been willing to wait until there was a tendency on the part of the administration toward a more reasonable settlement than it has yet been willing to consider.

OPERATING CHANGES AT MANSFIELD, OHIO

On Dec. 1 the operating departments of the Mansfield Railway, Light & Power Company's city lines and the interurban road between Mansfield and Shelby and Bucyrus will be consolidated. Sidney A. Foltz, general manager of the city lines, will become division superintendent of the interurban lines forming the Ohio Central division of the Cleveland, Southwestern & Columbus Railway Company. Mr. Foltz succeeds D. H. Lavenberg, of Galion, who resigned his position because of ill health. This change adds 30 miles of road to this division, making 50 miles in all. J. K. Gray, who has resigned as superintendent of the Western Ohio, will be assistant superintendent of this division and the headquarters will be moved from Galion to Mansfield. The Cleveland, Southwestern & Columbus is getting its operating departments centralized and in shape to take care of the extensive lines that it has acquired and is building at the present time. When the Cleveland, Ashland & Mansfield line is completed the system will be a large one. There are still prospects for a Columbus extension which will place it in a still more commanding position.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED NOV. 12, 1907.

870,564. Third-Rail Electric Railway System; Charles Kozesnik, New York, N. Y. App. filed June 16, 1904. Relates to that class of third-rails composed of separate sections which are in circuit only when the contact shoes of the cars are bearing thereon.

870,590. Dust Preventer; Baldwin F. Schirmer, Indianapolis, Ind. App. filed Nov. 4, 1905. A shield mounted under a car or other vehicle slightly above the roadbed to prevent the dust rising.

870,591. Street Railway Curve Sweeper and Lubricator; David P. Small, Mount Oliver Borough, Pa. App. filed Sept. 6, 1907. Relates to a device for sweeping and lubricating the groove rails at curves, crossing and intersections on street railway tracks.

870,618. Underground Railway System; Jacob H. Farrar, Chicago, Ill. App. filed March 18, 1907. An underground railway system utilizing space underneath sidewalks instead of under the streets.

870,621. Electric Railway Signaling System; Norman P. Fraser and William Gribben, Carsonville, Mich. App. filed May 17, 1907. Means whereby trains may receive warning when they approach within a danger limit. Make use of special section third-rails.

870,622. Electric Signaling System; Willard H. Gilman, Medford, Mass. App. filed Oct. 31, 1906. A railway signal system of the type in which communication is had to various points along the roadway over a signal wire. A particular station of the line is responsive by mechanism acting with current pulsations of a certain character.

870,755. Trolley-Pole Guide; Lewis A. Allen, Passaic, N. J. App. filed Aug. 14, 1907. A roller of hour-glass shape is impelled into position to guide the trolley wheel on the wire by tension on the operation cord.

870,802. Vehicle Control System; Norman W. Storer, Pittsburg, Pa. App. filed Jan. 3, 1906. Means for maintaining an equal distribution of weight upon the several pairs of vehicle truck wheels during the starting period.

870,806. Fluid Pressure Brake; Walter V. Turner, Edgewood, Pa. App. filed April 12, 1907. A double check valve device comprising a casing containing a double head valve piston and having an inlet port intermediate the piston heads, and an outlet port communicating with each check valve and controlled by the respective piston heads.

870,816. Vehicle Motor Control System; William Cooper, Wilkinsburg, Pa. App. filed Jan. 3, 1906. Provides means for regulating the torque applied to the several pairs of wheels that a maximum accelerating force is insured.

870,842. Anti-Rail-Spreading Device and Gage; Zachariah L. Pierce, Hanna City, Ill. App. filed Oct. 29, 1906. A pair of thrust-plates engage the opposite ends of two ties and have rail-engaging bars adjustably attached thereto.

870,889. Paving Block; Alexander Kelley, Wilmington, Del. App. filed Jan. 23, 1907. A paving block having a tongue adapted to fit between the base and head of a street-railway rail. The block is reversible so that when one surface has worn away, it may be reversed and relaid.

870,992. Railway Switch; Joseph F. Reese and Court L. Miner, Lucerne, Ind. App. filed March 6, 1907. Details of construction of a switch adapted to be tripped from a moving car.

870,999. Trolley Harp; Samuel T. Simmons, Columbus, Ohio. App. filed April 16, 1906. The trolley wheel swings on an axis in vertical alignment with that of its pivoted support through a limited angle.

871,065. Metallic Railway Tie; Albert L. Moorhead, Telluride, Col. App. filed March 23, 1907. Comprises a cast metal body having large end blocks united by a reduced connecting portion, said end blocks having seats in their upper faces for the reception of track rails and upon their lower or bottom faces longitudinally extending depending ribs to prevent them from slipping or creeping.

PERSONAL MENTION

MR. R. MEIGHEN was elected a director of the Montreal Street Railway Company at the annual meeting of the shareholders, which was held last week.

MR. ROBERT E. WATSON has resigned the presidency of the Columbus Railway, Light & Power Company, of Columbus, Miss., to take effect immediately, and Mr. C. F. Sherrod, a local business man, has been elected in his stead.

MR. J. W. McFARLAND has been appointed general superintendent of the Macon Railway & Light Company, Macon, Ga. Mr. McFarland is well known in electric railway circles, having formerly been general superintendent of the Chattanooga Electric Railway Company, of Chattanooga, Tenn., for ten years. Previous to that he was general superintendent of the Savannah Electric Company for eight years.

MR. G. C. KILLEEN has resigned as master mechanic of the New Jersey & Pennsylvania Traction Company, of Trenton, N. J. Mr. Killeen has had extended mechanical experience in both city and interurban service, having previously spent six years with the Public Service Corporation of New Jersey, during three years of which he was employed as foreman of the armature and controller department and one year as superintendent of rolling equipment in District No. 4, covering some of the most important territory operated by the company. Mr. Killeen has not yet made any definite plans for the future.

MR. BERNARD CORRIGAN, JR., son of Mr. Bernard Corrigan, president of the Kansas City Railway & Light Company, of Kansas City, Mo., is dead, aged 26 years. Mr. Corrigan, Jr., succumbed to typhoid fever, and the father is nearly prostrated at his loss. The young man graduated about four years ago in law at Michigan University, but had never practiced. Instead he turned his attention to purely business affairs, becoming connected with the Midland Mining Company, with coal properties at Novinger, Mo. Quite recently he had been elected president of the company. Mr. Corrigan is survived by a widow, who was formerly Miss Gladys M. Jones, to whom he had only been married about five months.

MR. WM. J. SMITH, general manager of the Titusville Electric Traction Company, of Titusville, Pa., was elected president and a director of the company at a meeting held Nov. 22, 1907. Mr. Smith is also president and a director of the Federal Gas Company and of the Titusville Gas & Power Company, of Titusville. In 1884, as a boy of twelve, he entered the service of what is now known as the Public Service Corporation of New Jersey, acting in various capacities until 1894 when he became connected with the Staten Island Electric Railroad. Later, Mr. Smith became superintendent of the Staten Island Midland Railroad, and in 1903 was appointed general manager of the Titusville Electric Traction Company.

MR. WARREN S. HALL, vice-president and general manager of the Lehigh Valley Transit Company, of Allentown, Pa., has resigned, the resignation to take effect Dec. 1. Mr. Hall has also resigned as director of the Allentown Electric Light & Power Company, the resignation to become effective at the convenience of the board of directors. The duties of vice-president and general manager of the Lehigh Valley Transit Company will be assumed by President R. P. Stevens. Mr. Hall became general manager of the Lehigh Valley Transit Company May 10, 1904, when the company was still under the control of the Lehigh Valey Traction Company. When still a young man Mr. Hall assumed control, as general manager, of the street railway lines in Hudson County, N. J. This was in 1892. In New Jersey he served under Mr. David Young, a director of the Lehigh Valley, and was appointed to the latter company from the North Jersey Street Railway.

MR. WILLIAM WHARTON, JR., president of William Wharton, Jr., & Company, of Philadelphia, died at his home in Germantown, Nov. 26, at the age of 78 years. He had been ill for some eight months and the immediate cause of his death was heart trouble. Mr. Wharton has long been prominently associated with the street railway business and has contributed greatly to its success by his inventions connected with track construction, many of which date back to horse car days. During the period of cable development William Wharton, Jr., & Company built, as contractors, a number of the important roads in the East. Mr. Wharton was one of the first to recognize the value in this country of manganese steel for points subject to great wear, and a considerable part of his later business life was devoted to improvements in maganese steel rails and special work. He belonged to an old Philadelphia family and was a brother of Mr. Joseph Wharton, who has also been prominent in the iron and steel industry in Pennsylvania and is president of the board of managers of Swarthmore College. Mr. William Wharton has attended a great many meetings of the American Street and Interurban Railway Association, and has been a member of the executive committee of the Manufacturers' Association since its organization.

SIR J. CLIFTON ROBINSON, accompanied by Lady Robinson, was a passenger on the steamer Mauretania, which arrived in New York last week. Sir Clifton is managing director of the London United Electric Tramways Company and is on a trip around the world. He expects to be away five or six months on the trip. This is not his first visit to the United States as during the eighties he was engineer for The Los Angeles cable railway and presented a comprehensive paper on cable railways at a meeting of the American Street Railway Association, at Pittsburg, in 1891. During an earlier visit he built a number of horse railways and for some time was connected with the Broadway & Seventh Avenue Railway Company. His work in England commenced in 1860, when he became associated with the late Mr. Charles Francis Train in the construction of the first tramway in Europe, at Birkenhead. Later Sir Clifton came to America with Mr. Train and remained here for five years engaged in street railway construction. In 1871 he returned to Europe, where he became associated with the Cork tramways; in 1875 he was appointed general manager of the Bristol tramways, and later manager and secretary of the Edinburgh tramways. In 1884 he built the first cable line in England, the Highgate Cable Tramway of London. Later he spent several years again in America in connection with cable construction, as mentioned above, but in 1891 returned to England to instal the electrical equipment of the Bristol tramways, the first line in Great Britain to be so equipped. Other lines of which he has been engineer and manager are the Dublin Southern, Stockton, Middlesbrough and London United. He is now managing director for London United Electric Tramways Company and Imperial Tramways Company, a director and engineer of the Bristol Electric Tramways Company and a director of the Metropolitan District Railway Company, the Underground Electric Railways Company, Ltd., of London, and the Corris Railway. He is a member of the Institution of Electrical Engineers, an associate member of the Institute of Civil Engineers and was knighted in 1905 by King Edward for his public services in tramway construction. Sir Clifton is also chairman of the transportation section of the coming Franco-British Exposition, which is to be opened at Shepherd's Bush, London, next May.



SIR CLIFTON ROBINSON.

In an interview on the subject of municipal ownership of street railways during the present trip, Sir Clifton said: "Municipal ownership is a good thing if the transportation systems, while owned by the city, are operated by a private concern. If the operation of the system is left in the hands of the city there is danger of political influence and social pull. It is the facility with which municipalities can get money, and their utter lack of responsibility in spending it, that causes them to carry passengers in England at 1-cent fares without regard as to whether the year's work results in a loss or a profit."

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DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

Of this issue of the Street Railway Journal 8300 *copies are printed. Total circulation for* 1907 *to date,* 403,250 *copies, an average of* 8229 *copies per week.*

Handling Traffic in Confined Areas

The problem of handling large crowds of people in confined areas at stations, terminals, parks, tunnel entrances and other points where direct connection is made between tracks and streets is always a serious one, and in New York at present is especially acute. Two phases are represented in this city to a greater extent than in any other place in the world; the terminal problem as illustrated at the New York end of the Brooklyn Bridge and the station problem of the New York Subway. The latter has been made the subject of a report by B. J. Arnold to the Public Service Commission of the First District of New York State. This report, which is published in abstract elsewhere in this issue, represents the result of a preliminary study only of the subject by Mr. Arnold, and the suggestions contained in it are intended to effect improvements which can be put immediately into force. Others which should result in a more radical amelioration of the conditions now existing will be taken up later.

In his analysis, Mr. Arnold confines his attention practically to a single point: that is, the means for expediting the discharge and receipt of passengers at the stations. It is well known that the number of persons who transfer between local and express trains at express stations far exceeds any estimates which were made at the time that the subway was designed. Much of this is unnecessary, but it is by no means uncommon for a considerable percentage of the passengers on a local train to transfer to an express train at one express stop and transfer back to a local train at the next express stop, hoping thereby, but usually in vain, to economize a minute or two. This practice cannot be prevented without interfering with the ease of transfer of those who have a legitimate reason for doing so, but it adds very much to the complications and delays at the stations.

Mr. Arnold's first suggested remedy is the employment of special attendants, clothed with police power, at the principal express stations, to control the entrance and exit of passengers and, if necessary, enforce order among the unruly. This plan has been followed in Boston for some time, and has recently been put into force in New York.

Although, so far as we know, no accurate measurement of the increase in "passenger station output" on either of these rapid transit systems, during periods of heavy travel, by the help of these men has been made, it is remarkable how much a few alert platform men can do to shorten station stops. Each passenger who remains on a small platform a moment longer than is absolutely necessary in times of heavy travel is a contributory cause toward congestion and possible costly accident. Strangers who are uncertain how to select the train they desire, and other hesitating patrons, can be directed into their proper channels by the station men, who can also often greatly accelerate the train movement by distributing waiting passengers evenly between the points at which the train must be boarded. The men can be greatly assisted in their duties, however, by the presence of plainly lettered directions in the stations and destination signs on the trains. Everyone cannot be expected to know the meaning of the marker lights, and the character of each train should be quickly evident, from signs at its front end and also on its side, to those waiting in the stations.

It is believed that with the help of these men and the adoption of strict rules in regard to the length of station stops, the latter can be reduced by arbitrarily closing the doors at the end of 45 seconds after they have been opened. This may occasion a short delay to some of the laggards,

but will greatly increase the number of cars passing each station within a given time.

Mr. Arnold's second recommendation is, briefly, that a reduction can be made in the length of the block between trains entering and leaving the stations. His third suggestion for improvement is the introduction of side doors, which will greatly assist in the facile movement of passengers, but would also necessarily reduce the seating capacity of the cars, as the side doors would have to take the place of the present cross seats. The desirability of adopting this plan is a question, as Mr. Arnold expresses it, of policy and not of engineering, so that he thought it better for the Commission first to express a wish as to which result it prefers. Under the conditions which exist, it is impossible to secure both the maximum seating capacity and the quickest transit, but, as the report points out, a large number of the passengers in the rush hours stand now; moreover, owing to the large number of people who transfer, it is usually possible for one who continues in the same car to secure a seat after an express stop, and the distances as a whole are short. In other words, immediate reform can be made in the length of stops, and this question is one largely of public education and preference. We trust that the Commission will act upon the suggestions to secure an increase in carrying capacity of the subway, and will also push forward other plans for immediate relief, such as increasing the capacity of the elevated structures, until additional transit lines in New York City are available.

Competition in Electric Railway Traffic

The influence of competition in determining the volume of traffic on an electric railway system is often overlooked by managers closely occupied in taking care of the business which naturally comes to their roads. So rapid has been the growth of many American communities that the local and interurban facilities provided in thickly settled territory have been hard pressed to keep up with the yearly increase of passenger travel, and in places where freight and express service have been inaugurated, vigorously advertised and energetically handled, there has been even less incentive to go down into the roots of the passenger traffic question with the hope of analyzing competition sufficiently to secure a greater volume of business. This is shown by the service given on many suburban and interurban lines, which is little faster than the same lines provided five or ten years ago. It seems as though many companies do not yet appreciate the magnitude of the competition which they are facing in passenger service, though plenty of half-formed ideas may be lying dormant.

If rush of business can be accepted as a legitimate excuse for overlooking this question of passenger competition during the past few years, the present temporary breathing time in the financing of new construction projects is certainly an admirable interval to devote in part to these considerations. The edge of competition is becoming sharper, especially in the old-established communities provided with several parallel or semi-parallel transportation services in the same territory. The manufacturer who is offered more business than he can handle devotes a large share of his energy in times of easy money to the extension of his physical plant to meet the demand for excess output; but when the time comes for going after business to keep the existing equipment fully at work, he realizes as not before the influence of tangible and intangible competition, and if far-sighted, sets himself at work to overcome it. The same policy can be followed with good results in the electric traction field when the conditions permit the expenditure of the necessary time and study.

Like the steam road, the trolley system is reasonably certain of a large patronage regardless of general business conditions, given the character of service which will attract travel. Gross earnings may be greater when the entire country is working overtime on production, but net profits are not entirely a function of gross income. The ideal of the traffic manager or division superintendent, whatever may be his title in specific cases, must be to work his rolling stock and track to the saturation point represented by maximum profit; and at times when the full resources of an operating organization are not demanded, every passenger who can be made to patronize a particular line instead of a rival route, whether that route could have been covered by a steam, electric, automobile, horse operated or pedestrian trip, is worth far more to the enterprising and progressive railway organization than in times when it has more business offered than it can profitably handle. The traffic load factor is quite as much worth pushing up to a high percentage as the load factors of individual engines and generators in the power plants, and the stimulation of shopping travel during the light hours of the day by deflecting riders from a competitive steam service, for instance, is far more desirable than the expenditure of the same energy on the rush hour patronage.

Additional facilities create traffic where none existed before, but if an electric road could only handle the new business resulting from its installation it is doubtful if it would be a paying proposition. The use of electric power enables giving to the public quick, frequent service at a lower operating cost, and total expense for transportation than can be offered by steam locomotives, and it is this quicker and more frequent service which causes the usual large increase in passenger traffic. While it is true, and a blessing to the steam road that in many cases existing trolley parallels have not so much captured traffic from the former as they have developed a new class of business, it remains a significant fact that every passenger who rides between his origin and destination by steam when he might be induced to go by trolley, is so much a loss to the competing trolley line, and axiomatic as this might appear, it is not always appreciated by interurban and suburban electric roads, if the character of service offered is any index.

The selection of a given route by a passenger depends upon several factors, which vary in influence according to the personal equation and circumstances of each prospective patron. The total time from origin to destination, the total cost from point of departure to destination, the accessibility of the line at each end, frequency of the service, character of rolling stock and stations, comfort of the roadbed and track, terminal facilities and transfer privileges, all carry weight. Consciously or unconsciously many a patron sums up these points before deciding quickly what route to take. No proper study of competitive routes

can therefore be made until these points are lined up for each method and facility of transit offered. Seldom will it be found that a single route combines all the principal advantages. House-to-house service inevitably means slower schedule speeds, while, on the other hand, a frequent service means less total time consumed in the complete journey. A tendency of a fast line to give a tardy service with delayed trains may be offset by the slower, yet more frequent and reliable service of a competing trolley route. If commutation traffic is desired on a suburban or interurban line, the special factor which appeals to this class of service must be accentuated. If fast through traffic in limited service is the object, all needless local stops must be cut out. The practice of stopping through interurban cars outbound to receive passengers only, and inbound to deliver only, between city limits and urban terminals, is a recent wise step to accomplish the separation of local short distance traffic from through business. The data which one accumulates in traffic analysis are certain to be suggestive in studying how to meet competition, and are well worth taking trouble to secure on every growing road.

Electric Traction and Civic Betterments.

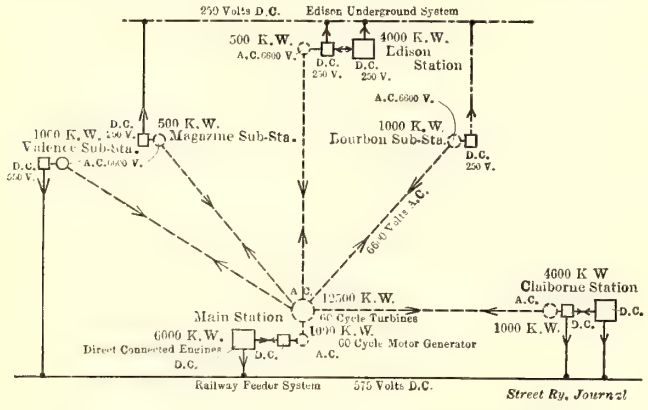
In the movements now under way to promote the appearance of large cities, from the æsthetic standpoint, it is gratifying to note that electric traction is receiving more and more consideration from civic committees and landscape architects charged with the duty of making specific recommendations toward municipal betterments. We hear little in these days about the erstwhile ugliness of the overhead trolley, for it has been demonstrated time and again that poles and fittings can be designed in an attractive form as easily as in crude, inartistic shapes; and if properly maintained by operating companies, they need be no more objectionable than gas and electric light posts, patrol boxes and other public utilities. Mr. Wilson, of the Twin City Rapid Transit Company, sounded a note worth listening to at the recent Atlantic City Convention when he urged the importance of maintaining a clean and attractive roadbed, and it is equally true that public sentiment appreciates efforts to keep the overhead construction taut, ragged ends cut short, frayed insulation replaced, and poles painted and erect. It costs money to do this, but there is a direct connection between a refusal of a valuable franchise in a residence section and the failure on the part of a company to realize the importance of meeting legitimate demands for neat and workmanlike construction on all its routes.

In this connection the close of the recent park season suggests the wisdom of paying more attention next year to the appearance of engineering features along the routes leading to the open-air resorts. There is no doubt that some of the money expended on the park proper might in some cases be more effectively applied to the straightening out of overhead feeder lines either at the park or near-by. To avoid the appearance of crude, temporary work is a great gain. It is certainly incongruous to spend thousands of dollars upon lawns, sylvan paths, flower beds and conservatories and to fail to maintain a high standard of appearance in the feeders and service wires which must enter or pass the park. Sometimes a sub-station or a power plant has to be located near or in a park property, and in such cases too much care cannot be taken to avoid the frame structure, galvanized-iron type of building and to carry the feeders and transmission circuits on the poles with mathematical precision as to spacing and sag. At modest expense the walls of an otherwise unsightly building can be gradually covered with ivy, and in designing new fireproof structures for the housing of transformers and other apparatus the use of concrete or stone walls with red-tiled roofs enables the building to be set down in the most attractive part of the reservation without detriment to the natural beauty of the spot. Anyone who has ever seen the Metropolitan Water Board's pumping stations in the Chestnut Hill and Middlesex Fells districts near Boston will realize the truth of this statement.

The influence of the extending trolley lines from urban centers into the suburbs has often been cited as a force for good in relief of congested population, and now that steam railroad electrification is well under way it is worth noting that in this latest development of electric traction we have a still more interesting example of a revolution in transportation methods working for civic betterment. This has been appreciated recently by the Hamilton Club of Chicago, an influential organization which has formulated a civic programme for promoting the beauty of the Western metropolis. It gives first place to the abatement of the smoke nuisance, sensibly urging it "so far as may be practicable and consistent with the maintenance of industrial prosperity and without unnecessary hardship to owners of factories and office and apartment buildings. To promote the reduction of the smoke nuisance the club proposes the diffusion of knowledge concerning the best practical means for the consumption of fuel, the use of better grades of coal and the instruction of engineers and firemen in the management of steam plants, and the substitution of electric power for steam on all locomotives employed in suburban traffic, bringing with it, so far as possible, the elimination of all steam locomotives within the city limits." Unnecessary noises and odors are also objects of attack. It is significant that the use of electric power on the railroads and industrially is in entire accord with these progressive ideas. The indications on every hand are that the cost of handling heavy traffic per unit by electricity will not exceed, and may be less, than with steam, and in the general field of industrial power there is a most marked saving by electricity. Perhaps the most striking instance of the increasing economy of electricity at hand at this moment is found in the recent report of the Canadian Civil Service Commission, which has been investigating the increased cost of living in the Ottawa region during the past ten years. While rentals advanced from 25 to 36 per cent, and staple foods and fuels some 30 per cent, electricity has been cut 52 per cent in rates; and it is well known that large reductions have also been made in the important cities of the United States. By the extension of routes and multiplication of transfer points the trolley systems also have virtually decreased their prices per mile traveled. These improvements are of enormous benefit to the public through the power of electric traction to bring city and suburbs closer together, no less than from the standpoint of æsthetics. They should be given due weight when operating companies are subjected to the attacks of unscrupulous politicians and reformers who play to the gallery alone.

THE RECONSTRUCTION OF THE POWER SYSTEM OF THE NEW ORLEANS RAILWAY & LIGHT COMPANY

The electric railways and the gas and electric lighting properties of New Orleans were until a few years ago operated by a number of separate companies with independent generating and power plants. Since the consolidation of the companies into the New Orleans Railways



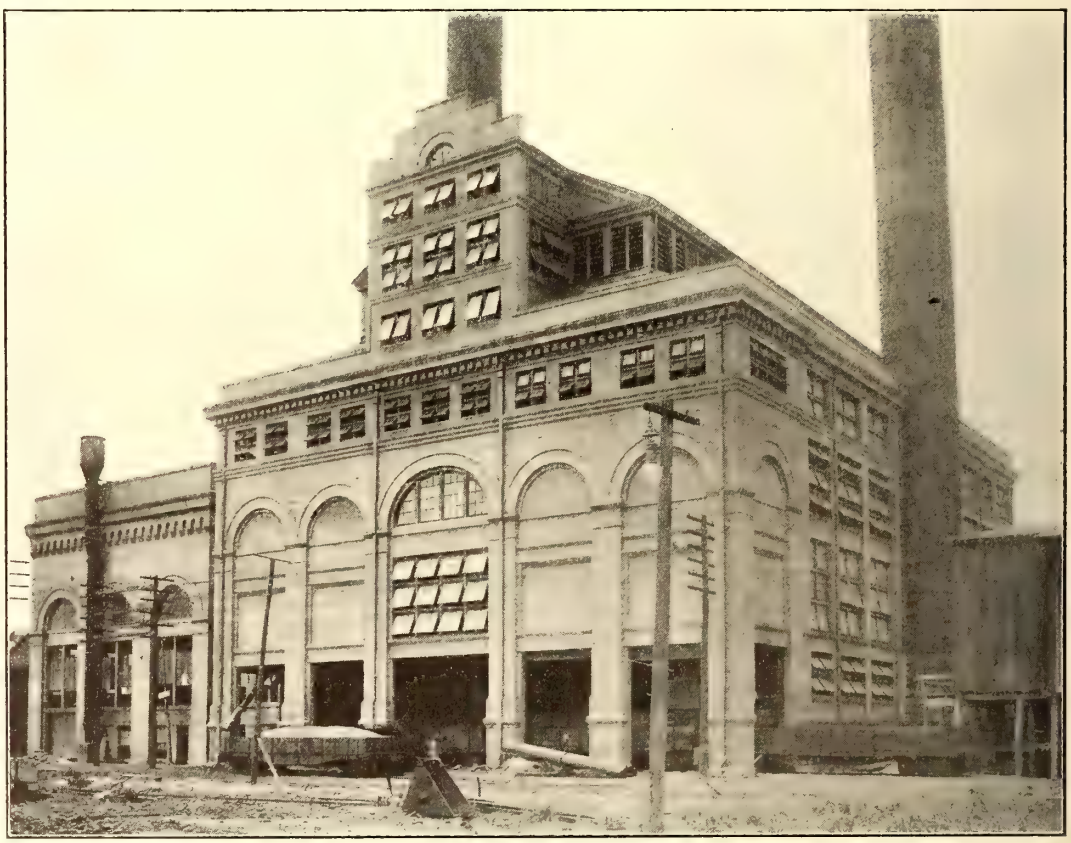
PLAN OF POWER DISTRIBUTION IN NEW ORLEANS

Company—changed later into the New Orleans Railway & Light Company—steady progress has been made in the elimination of the smaller and less economical stations and in centralizing the work of producing energy for railway, lighting and power in large new generating plants. The New Orleans Railway & Light Company engaged, in 1903, the firm of Sanderson & Porter, New York, as consulting and designing engineers and subsequently placed with them as constructing engineers the work of executing their comprehensive plans for the enlargement and reconstruction of the power generating and distributing systems. In carrying out these plans the station capacity on the sites of two of the former stations has been greatly increased, sub-stations have been erected preparatory to abandoning small generating stations, over 100 miles of underground duct have been constructed and a complete new street lighting system of 3000 series alternating arc lamps, specified by the city of New Orleans when inviting bids for the city lighting, has been installed.

The single central station plan was not adopted for the reason that such would have necessitated the abandonment of two modern generating stations, and because in some areas the distribution of the railway load made it more economical to generate direct current near the points of heavy consumption rather than to produce alternating current in one central station with high tension transmission and conversion to direct current in sub-stations located at the points of consumption. The lesser likelihood of complete shut-downs in cases of station troubles was another consideration.

The system as reconstructed comprises one direct-current commercial lighting station and one direct-current railway station in the congested districts, and one large alternating-current station to feed the balance of the territory and the outlying districts. This station also contains 6000 kw of direct-current generators for feeding the railway lines in its vicinity. The three stations have an aggregate capacity of 25,000 kw. As the load increases and the system is extended additional sub-stations are to be built and the capacity of the main or alternating-current power station is to be increased up to 50,000 kw. It is not necessary that new generating stations be built until this capacity is reached.

Both 2300-volt and 6600-volt, 60-cycle alternating current and 250-volt and 600-volt direct current are now generated. By means of static transformers between the two alternating-current voltages and motor-generator sets between the alternating and direct current systems, the generators in any station may be used to supply current for the commercial, arc lighting or the company's railway services.



EXTERIOR OF THE CENTRAL POWER STATION, SHOWING THE TYPE OF CONSTRUCTION AND COAL RECEIVING ARRANGEMENTS

The magnitude of the initial and ultimate investment involved for apparatus and the importance of handling the varied services in the most reliable and economical manner were governing factors in settling upon the frequency and voltage characteristics of the generating and distributing systems. The far-reaching importance of correctly

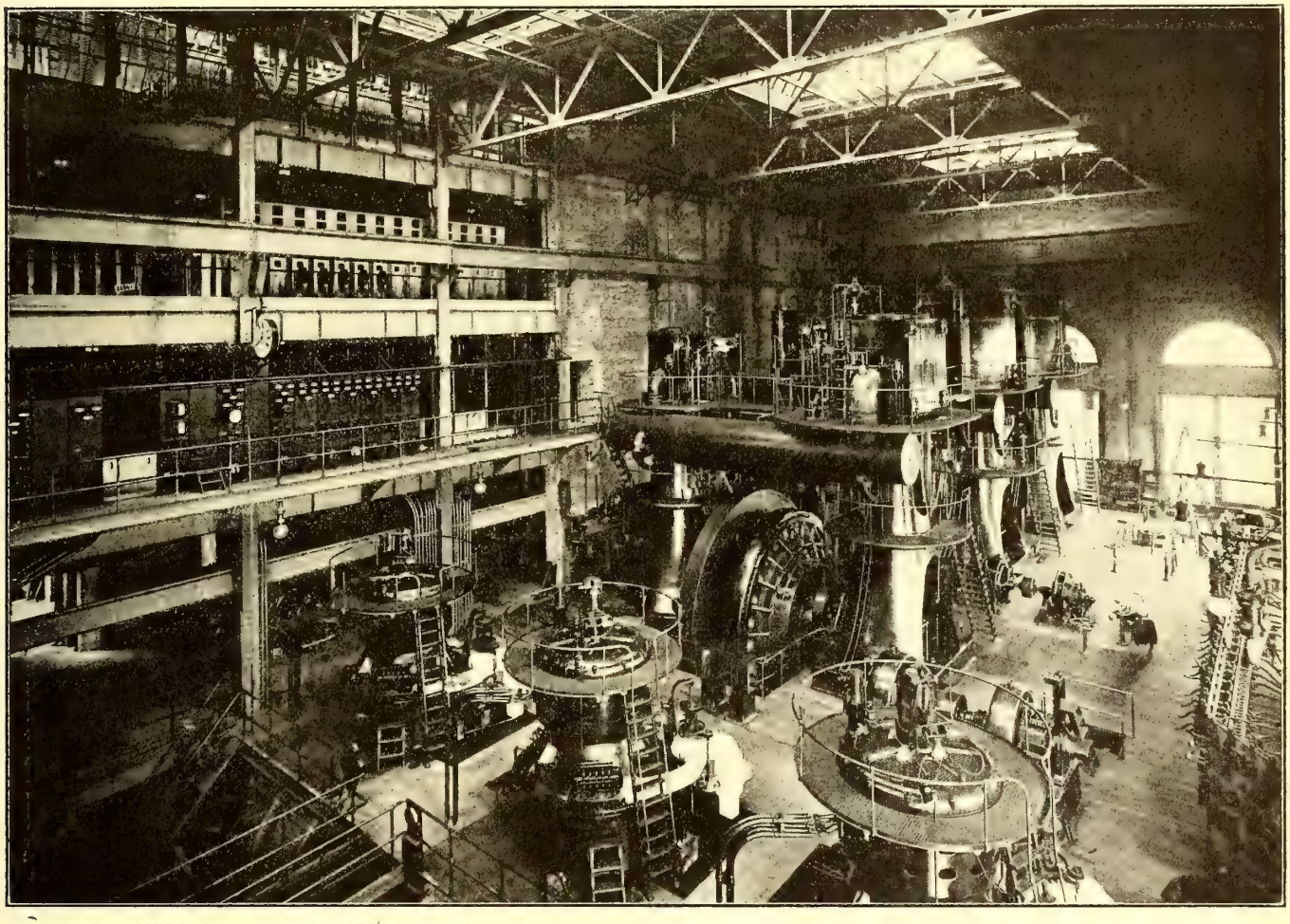
establishing these essentials was early recognized and the decision to adopt a frequency of 60 cycles for the alternating service was finally made as a result of careful deliberation and study of all possible methods. This frequency has been made standard for alternating power required for lighting and railway service.

The decision against 25-cycle frequency was based upon the much greater cost of such installation, which would have involved heavy expense for frequency changing apparatus for the large amount of the service requiring 60 cycles, and the unsuitability of 25 cycles for the operation of incandescent and arc lamps.

By using only one alternating-current generating frequency the load factor on the station and on the generating units was much improved, with resulting large savings in the cost of generated power, and the idle investment in reserve apparatus was minimized. The large sub-station energy loss which would have resulted from the use of such frequency changes as would have been necessary had 25-cycle generation been adopted was saved by the adoption of a uniform 60-cycle frequency.

It is believed that the higher frequency standard more nearly satisfies all of the present and future requirements and that it will show a decidedly higher all-round efficiency, everything considered, than 25 cycles or a combination of 25-cycle and 60-cycle generation. Furthermore, increase in business is largely dependent upon adopting a system which will involve the least first cost of installation to the consumer. The lower cost of 60-cycle motors constitutes an important factor viewed from the standpoint of the operating company.

Sixty-six hundred volts was adopted as being a thoroughly standardized commercial voltage, for which motor generator sets of 500 kw and upward could be readily wound, so eliminating sub-station transformers. The transmission distances, being relatively short, did not call for a higher voltage than 6600, which would permit sending the maximum desired amount of energy through any individual feeder with small energy loss. The frequent flooding of the underground conduits by heavy rains, which, for short periods, may overtax the capacity of the drainage system, rendered expedient the adoption of a moderate voltage, involving no particular difficulties for insulation under these conditions.



PART INTERIOR VIEW OF CENTRAL POWER STATION, SHOWING RECIPROCATING ENGINES, TURBINES, SWITCHBOARD GALLERIES, ETC.

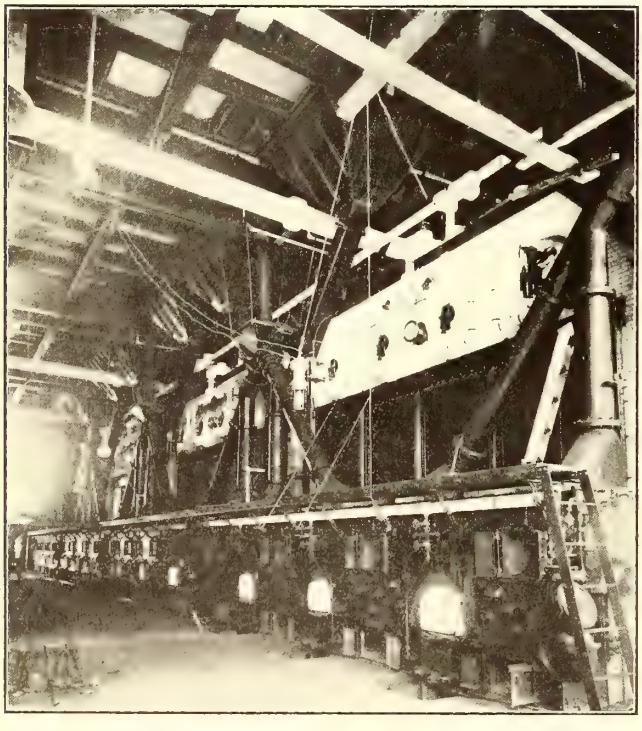
THE CENTRAL STATION.

The recent work has involved the construction of practically an entirely new station at Market and South Peters Streets, on the Mississippi River, about two miles upstream from the business center of the city. The station now contains 17,800 kw and provisions have been made for an ultimate capacity of 50,000 kw. In the STREET RAILWAY JOURNAL of Sept. 18, 1904, a description of the then existing plant stated that it contained two 2250-kw Westinghouse and one 1500-kw General Electric railway generating units driven by Allis-Chalmers vertical compound engines, contained in a new building and supplied with steam from boilers in an adjacent old station. The building now forms a portion of the generating room of the new station.

THE BUILDING FOUNDATION

The new station building is a brick, steel and concrete structure. The portion built measures 181 ft. by 212 ft. and is 122 ft. high. When extended 92 ft. or to full length as planned it will be 273 ft. long. It is supported on approximately 4000 round piles driven on about 3-ft. centers. The piles are 50 ft. long and some were set 30 ft. below the surface or were driven to a total penetration of 80 ft. In excavating for foundations and trenches for pipes the surrounding earth was assumed to be of liquid form weighing 120 lbs. per cu. ft. Excavations were protected by 6-in. grooved piling 30 ft. to 50 ft. in length with splines measuring 2 ins. by 4 ins. to insure alignment and tight joints. Where possible excavating was done by means of an orange peel digger and the earth was removed by a tramway. The piles were capped with a reinforced concrete mat approximately 6 ft. thick.

The average load over the entire foundation is something less than 2000 lbs. per sq. ft., but at points the load concentrates and is very much above this figure. At such points twisted steel rods, varying in number with the leads, were used to reinforce the concrete mat.



BOILER ROOM OF THE MAIN OR MARKET STREET STATION

CONDENSER INTAKES

Plans provide for the ultimate installation of four 72-in. pipes to serve as condenser intake and discharge pipes. All four pipes have been extended through the levee, three have been installed under the boiler room and one intake and one discharge pipe have been placed under the railway tracks between the boiler room and the levee. The pipes are made in 30-ft. lengths of ½-in. riveted steel. A protective coating 1/16 in. thick was applied to them by dipping the sections into a hot compound. Lead gaskets are used between the flanged joints and the sections are fastened together with galvanized bolts.

Special provisions have been made for removing sand and silt from the pipes. Water jets supplied with water from a fire pump have been installed at 10-ft. intervals in the bottom of the pipes and by a system of valves the intake and discharge pipes may be connected at the station end with an Allis-Chalmers propeller circulating pump so located in the connection that a flow of from 8 to 10 ft. per second can be produced through the pipes. The pump is driven by a 700-hp, 550-volt G. E. motor. When the pipes are to be cleaned the jets are first operated to loosen the deposit, and this is then washed out by the flow from the pump. The pipes terminate at the river end in concrete wells, that for the intakes being provided with three sizes of screens.

THE BUILDING

The building is constructed with a steel frame work with brick walls built in. The roof is of Ludowici and of book tile with a composition top coating. Bunkers and floors are of reinforced concrete. With regard to steel and roof construction the building may be said to consist of three parts, the generator room, the double-deck boiler room and an intermediate section occupied by switchboard apparatus, shop and offices and toilet rooms. The adoption of this arrangement of buildings permitted the successful execution of the new construction without interference with the operation of units which were required in service by the haevy increases of load. Through monitors and pivoted windows ample facilities are furnished for proper ventilation. The accompanying inset opposite page 1094 of this number shows a complete cross-section of this station.

STACKS

The two steel stacks erected are 15 ft. in diameter and extend 273 ft. above the street level. Both are brick lined to the roof line. Plans provide for the later erection of two additional similar stacks when building is extended.

THE BOILER HOUSE

The present building provides for sixteen 900-hp boilers. Twelve such units of the Babcock & Wilcox Company's make are now installed. They are located on two decks in double rows facing each other and parallel to the generator room wall. They are of forged steel header type constructed for 200 lbs. pressure and are fitted with B. & W. bent tube superheaters designed for 150 deg. superheat. Behind them are Sturtevant economizers, there being one economizer with 4900 sq. ft. of heating surface to each two boilers. The scrapers of the economizers are driven by induction motors.

The boiler plant is equipped with thirty-six 300-hp Murphy smokeless furnaces and stokers, set three in a battery under each boiler. Coal is fed to the furnaces through down spouts extending from the overhead bunkers. Provision has been made to later install scales in each down spout. Ashes from the furnaces fall direct into a hopper underneath, while the fine ashes drawn over the bridge wall and the soot accumulations are carried into this hopper by a motor-driven screw conveyor.

FEED WATER

Boiler feed water is obtained from two 750-ft. wells, one 6 and one 8 ins. in diameter, having a combined capacity of over 1800 gals. per minute. Water is raised with air furnished by two Ingersoll-Sergeant air compressors installed in a compressor room in the boiler room basement. The water is discharged either into tanks in the basement of the boiler room or into a stand pipe of 60,000 gals. capacity located near the building. The boilers are fed by one 1000-gal. per minute D'Olier steam turbine-driven centrifugal pump and three Epping Carpenter pumps with cylinders 16 ins. by 10 ins. by 16 ins. These pumps are of the pot

valve type with outside end packed plungers designed for a working pressure of 250 lbs. and are fitted with automatic pressure regulating governors. Connections are arranged so that the water may be forced either through the economizers or direct into the boilers. All of the boiler feed piping is of cast iron or brass.

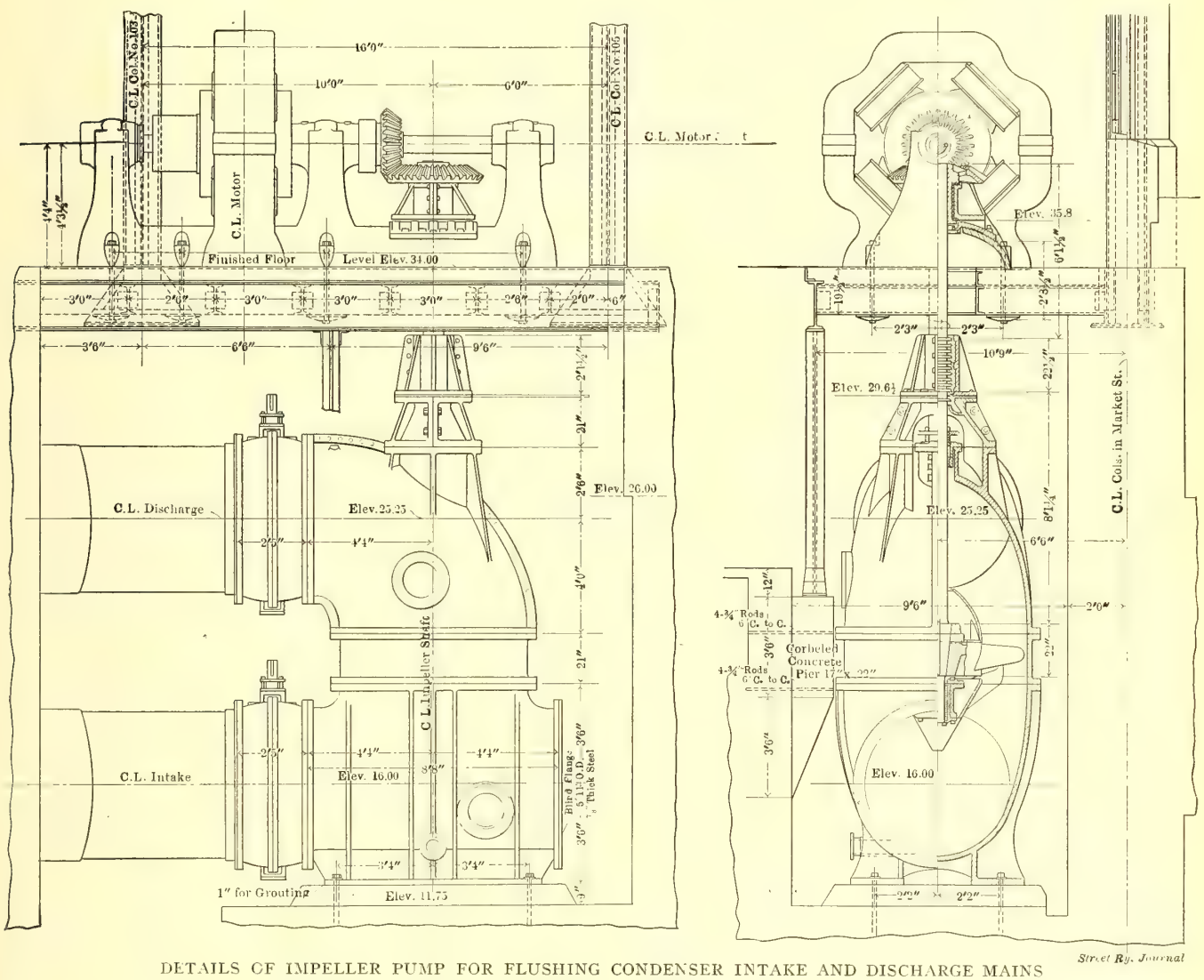
COAL AND ASH HANDLING APPARATUS

A switch extending along the east end of the station contains a 100-ton track scale and all cars are weighed before and after being unloaded. The cars are run on a sheltered track under the ash bunker at the end of the boiler house and unloaded into a hopper beneath the track. After passing through a crusher provided with an adjustable positive feed the coal is carried by a bucket elevator to the top of the boiler house structure where it is discharged on a belt conveyor and distributed to any predetermined part of the coal bunkers by an automatic unloader. A 35-hp, 550-volt, direct-current motor drives the crusher and both belt and bucket conveyor.

The initial coal-handling plant has a capacity of 100 tons per hour and the plans provide for a duplicate equipment of equal capacity. The initial coal bunkers hold 2000 tons and those of the ultimate building will store about 5000 tons. Additional storage capacity is provided in a vacant lot near the station, coal being conveyed to and from this storage space in electric cars. Dock privileges have been obtained from the city and a portion of the plant for unloading river coal from boats has been erected. This has a rated capacity of 200 tons per hour.

Small side dump cars operating on tracks in the basement underneath the ash hoppers convey the contents of these hoppers to the east end of the building where the ashes are dumped into an automatic skip. This skip bucket of 60 cu. ft. capacity hoists the ashes to the top of the boiler room and dumps them into a bunker built over the coal switch. Ashes are discharged by gravity from bunker direct into steam or electric cars and conveyed to the suburbs to be used in track construction or filling.

The coal and ash handling conveyors, as well as the ash railway in the basement, were furnished by Heyl & Patterson, of Pittsburg.



DETAILS OF IMPELLER PUMP FOR FLUSHING CONDENSER INTAKE AND DISCHARGE MAINS

STEAM PIPING

All high pressure piping is of standard lap weld mild steel with Van Stone type of joints. All fittings and valve bodies are of cast steel. The high pressure steam valves are especially designed for use with superheated steam at 200 lbs. pressure and have extra long necks at the stuffing boxes. Large steam valves are motor operated. Most of the valves are of chapman make, and the balance was furnished by the Pittsburg Valve, Foundry & Construction Company.

The boilers on the upper deck feed through lines passing down behind them into headers running the full length of the boiler room in the rear of those boilers on the lower deck. These headers also receive the steam of the lower

deck boilers. Crossover pipes running just underneath the second floor connect the header most distant from the generator room with that one nearest to it, which may be regarded as the main steam header. Steam mains to both reciprocating engines and turbines pass through the boiler room wall and underneath the generator room floor to their respective units.

Connections from the headers behind the boilers drop through the floor to mains supplying the auxiliary apparatus. Extensions continue through the basement wall to serve the engines driving the condenser pumps, etc.

TURBINES

In the new portion of the generator room there are installed three General Electric 1500-kw, three-phase, 60-cycle, 2300-volt Curtis turbines. A 3000-kw and a 5000-kw similar three-phase, 60-cycle, 6600-volt turbine of the same make are also provided for in the initial building; the 3000-kw unit is now in operation, and the 5000-kw unit is under construction.

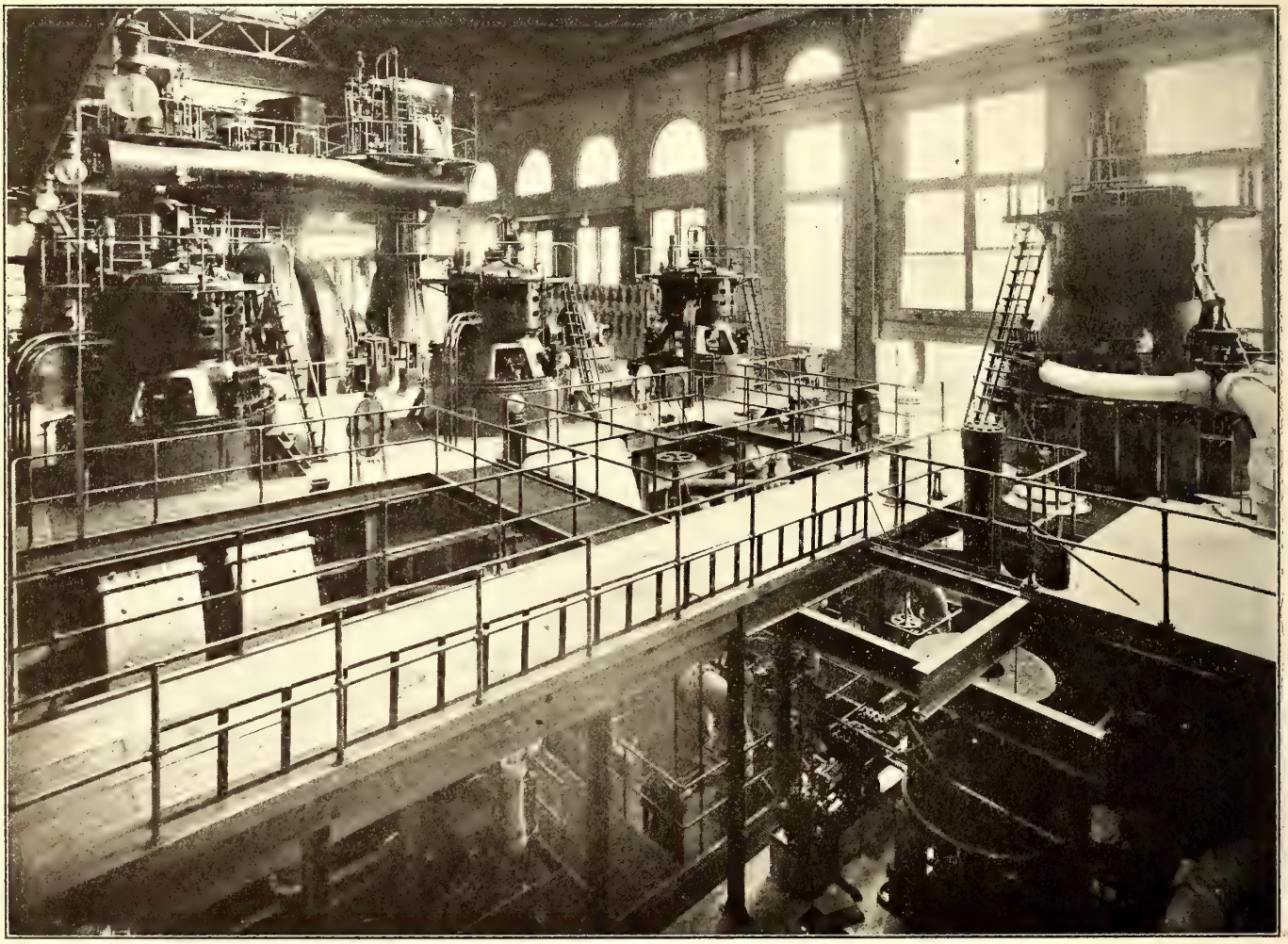
One common oiling system with one accumulator serves the step bearings of the three 1500-kw turbines. A separate oiling system with an accumulator is provided for the two larger turbines. The oil pumps and other auxiliary apparatus except exciters are located in the basement.

MOTOR GENERATORS

Three motor generator sets now operating on other service, each consisting of 500-kw, 2300-volt synchronous motors and 600-volt direct-current generators may be installed on the main floor alongside the exciters under the bus structures and will permit transferring 1500 kw capacity from either the a. c. or d. c. portion of the station.

CONDENSERS AND EXCITERS.

Past difficulties in the operation of surface condensers using the silt and clay bearing water of the lower Mississippi River led to the initial adoption of Dean and Allis jet condensers on the engines and Alberger jet condensers on three of the turbines. One 1500-kw turbine was provided with a corresponding specially designed Alberger surface condenser. The jet condensers of the 1500-kw turbines are connected to 12-in. centrifugal pumps and of the 3000-kw condenser to a 16-in. pump. All the circulating pumps are driven by single cylinder Buckeye engines. The turbine condensers are each served by Alberger dry vacuum pumps which may be run separately or on a common vacuum system, by sectionalizing valves and cross connections.



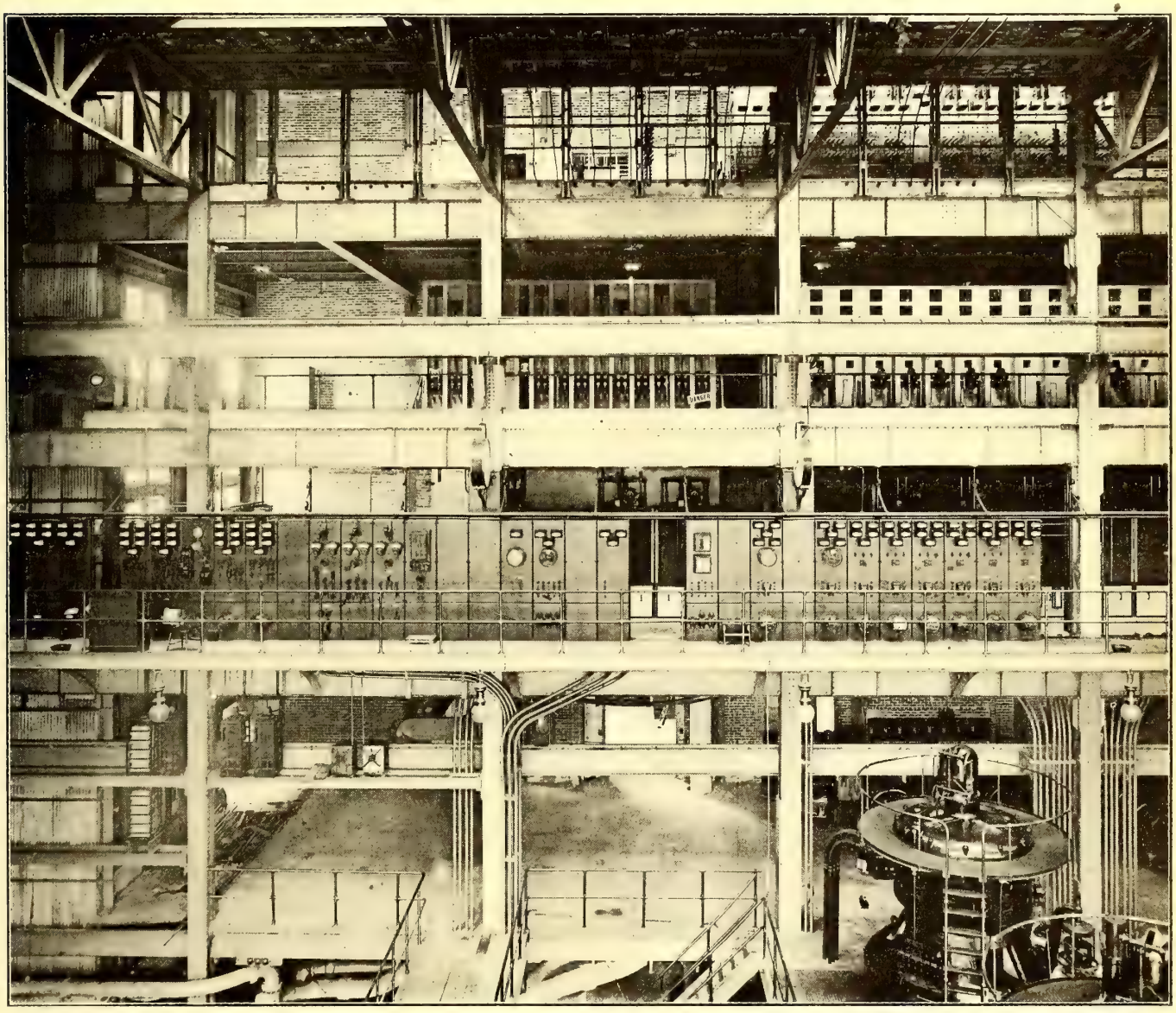
INTERIOR OF CENTRAL STATION, SHOWING TURBINES AND AUXILIARY CONNECTIONS BELOW MAIN FLOOR

The exciter equipment installed consists of an 80-kw induction motor-driven exciter and a 75-kw exciter driven by a two-stage horizontal Curtis turbine. The exciters are connected to a double bus system and voltage regulation is effected by a Tirrill regulator built for four exciters. Plans provide for two additional 150-kw exciter sets which will be installed near those already in operation on the main floor underneath the switch structure.

SWITCHBOARD AND CONTROL APPARATUS

The switchboard proper is located on an overhanging balcony at the same height as the second floor of that

section of the building between the boiler and generator room. From his position on the balcony the operator has a general view of the entire operating floor. Behind the switchboard are the generator switch and bus structures. On the floor above are similar structures for feeder busses and switches and there is also located on such floor 2300-volt regulators for the commercial feeder circuits. On the fourth or top floor is an arc light sub-station. All main and high-tension switches are of the oil break type con-



A VIEW ALONG ONE OF THE WALLS OF THE CENTRAL POWER STATION, SHOWING THE GALLERIES FOR CARRYING THE TRANSFORMERS, SWITCHBOARDS, ETC., TOGETHER WITH THE CABLE ARRANGEMENT

trolled from the main switchboard by pilot switches. Both generator and feeder bus-bars are in duplicate and all may be sectionalized.

The floors on which the switch-control apparatus is located are constructed with a view of facilitating repairs should it ever become necessary to get at the cable or conduits. The I-beams support a 6-in. solid concrete floor. On this is a 11-in. loose filling, in which the conduits are laid, this being covered with a 4-in. concrete floor.

The bus and cell structures are built in groups with the main and auxiliary bus structures flanking a common passageway on the second floor and the feeder bus structures similarly arranged on the third floor. The structures are of concrete with the exception that the tops and bottoms of the generator and sectionalizing switch compartments are of Alberene stone. The structures are reinforced by iron rods running through the barriers from top to bottom. The generator leads are carried down under the generator room floor from the generator terminals to junction boxes and then up the building columns in brass conduit direct to the type H generator switches of the main generator and auxiliary busses. A group switch connects the 2300-volt main generator bus to a main feeder bus on the floor above and a similar switch connects the generator auxiliary bus with an emergency feeder bus. The 6600-volt generator and auxiliary busses are permanently connected to extensions of these busses in structures on the floor above and from which the feeders are taken off. The 6600-volt and the 2300-volt bus systems are connected by two 1500-kw oil-insulated, water-cooled, three-phase transformers, located in the basement.

CONTROL PANELS

The generator control panels are located at the west end of the initial switchboard, the plans providing for the installation of 6600-volt feeder panels west of them, so that they will be centrally located with respect to the ultimate swichboard. To the east of the generator panels are ex-

citer and house service panels and space for three synchronous motor and three railway generator panels.

FEEDERS

The construction permits feeders leaving the station in underground conduits. They now leave overhead connecting with pole lines, those for the down-town district continuing overhead to a terminal house located about a mile distant from the station at the edge of the underground district.

From the feeder busses the arc light lines pass to the constant-current alternating-current arc regulators on the top floor, there being provision for 22 feeders in the substation. The 2300-volt feeders for the commercial lighting load pass through I. R. T. oil-insulated, water-cooled regulators manufactured by the General Electric Company.

built in line with the original station, the old plant reconstructed and 3200 kw of engine-driven, direct-current railway units, 1000 kw of railway motor-generator sets, with the requisite switchboard and steam generating plant, have been newly installed as below described.

THE BUILDING

The building as reconstructed is shown in an accompanying reproduction. The exterior walls and the interior walls of the engine room are of salmon pressed brick laid in cement mortar. The walls of the engine room, which are entirely of brick, support the crane runway and the roof trusses. A steel framework, into which the brick walls of the boiler room are built, support the coal bunkers and the economizers. The floors are of slate-colored concrete and the roof consists of 2½ ins. of concrete with a 1-in. top coating. Free circulation of air is provided in the



VIEW OF FRONT OF THE CLAIBORNE POWER HOUSE

OFFICES AND MACHINE SHOP

The space east of the switchboard and bus structures is devoted to offices, a machine shop, toilet and wash rooms, which contain needle baths and porcelain finish wash troughs supplied with hot and cold water and are furnished with expanded metal lockers. Separate toilet and wash rooms are provided for the colored firemen.

LIGHTING

General lighting of the generator room is effected by arc lamps supported on wall brackets. The boiler room and switchboard structure are lighted with incandescent lamps.

THE CLAIBORNE STATION

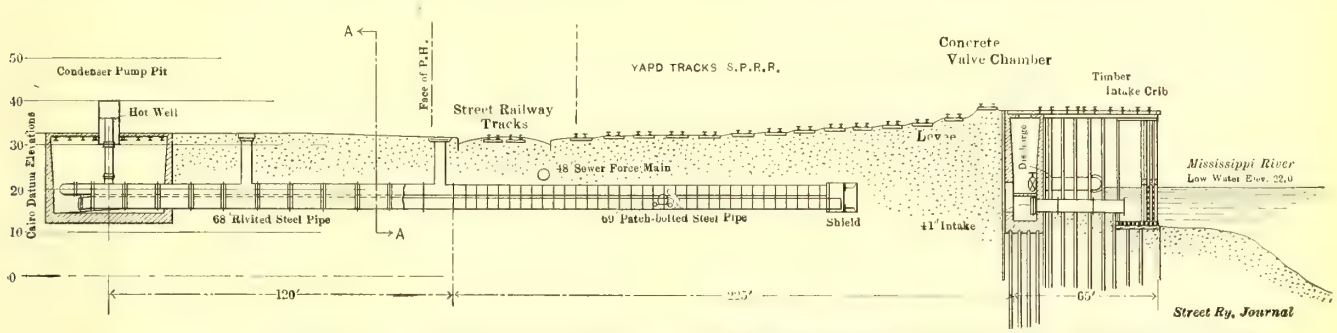
The Claiborne station is located at Elysian Fields Street and the river, about two miles below the Main or Market Street station. It is essentially a direct-current station. The original portion, built about nine years ago, contains two 300-kw and one 850-kw General Electric railway generators direct connected to Allis-Chalmers compound engines, and four 350-hp Edgemoor boilers. A new station has been

building by liberal window openings and by monitors in the roof, which extend the full length of the building over both the engine and boiler rooms. The building is constructed on piles placed approximately 4 ft. apart except where the loads did not warrant such spacing.

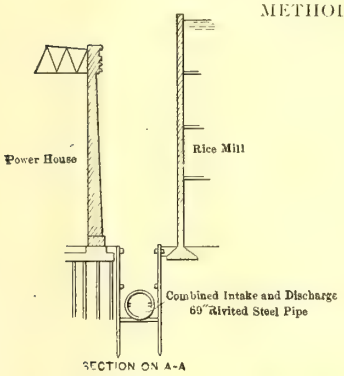
CONDENSER INTAKE

The construction of the condenser intake and discharge is worthy of note. They are combined in one riveted and patch-bolted steel pipe or tunnel 69 ins. in diameter in which a horizontal separator or diaphragm is placed across the middle. The diaphragm is of creosoted pine 6 ins. thick. The lower and upper halves of the pipe serve respectively as the intake and discharge passages. This tunnel was run under seventeen railroad tracks, it being necessary that the traffic over these tracks should not be inconvenienced. Excavating was done from the interior by the tunnel shield method without surface openings and without interruption to traffic. The pipe terminates at the river and in a concrete well built just outside the levee.

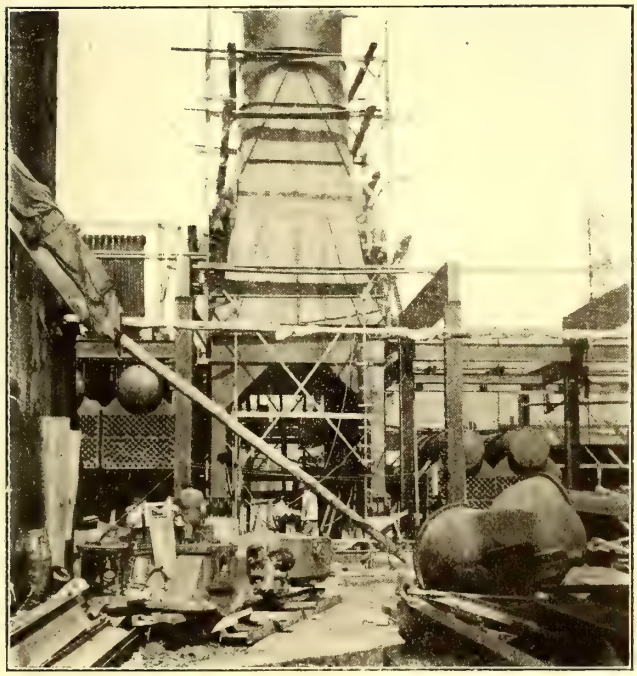
The well has a horizontal partition to separate the incoming from the discharged water and is used as a valve chamber to shut the water off from the pipes. In this installation the plan described in connection with the main station for washing silt out of the pipe has been followed. At the station end a valve controlled connection between



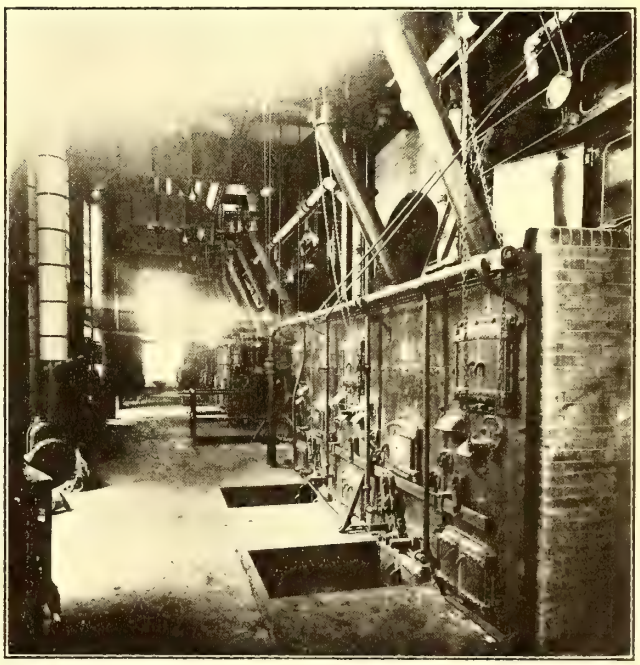
METHOD OF PLACING 69-IN. STEEL PIPE FOR CONDENSING WATER FOR CLAIBORNE STATION



gives considerable additional floor space in the boiler room. The stack is supported on four steel columns, which extend from the boiler room floor to the base of the stack at about the height of the top of the boilers. The columns are stiffened with concrete and the lower portion of the structure is arched over with salmon-colored brick. The stack is of steel 11 ft. in diameter and 175 ft. high. The base is square and has no base ring. The side sheets are riveted directly between channel framing at the base.



STEELWORK OF CLAIBORNE POWER HOUSE STACK



IN THE BOILER ROOM OF THE CLAIBORNE STATION

the intake and discharge sections contains a 36-in. centrifugal pump operated by a 300-hp motor to draw water in through the upper half and force it through the lower half of the pipe tunnel. The intake pipe was made by James McNeil & Bro. Company, of Pittsburg, and the protective coating by the American Asphaltum & Rubber Company, of Chicago.

THE STACK

The method adopted for supporting the one steel stack which extends through the central portion of the room

THE BOILER ROOM

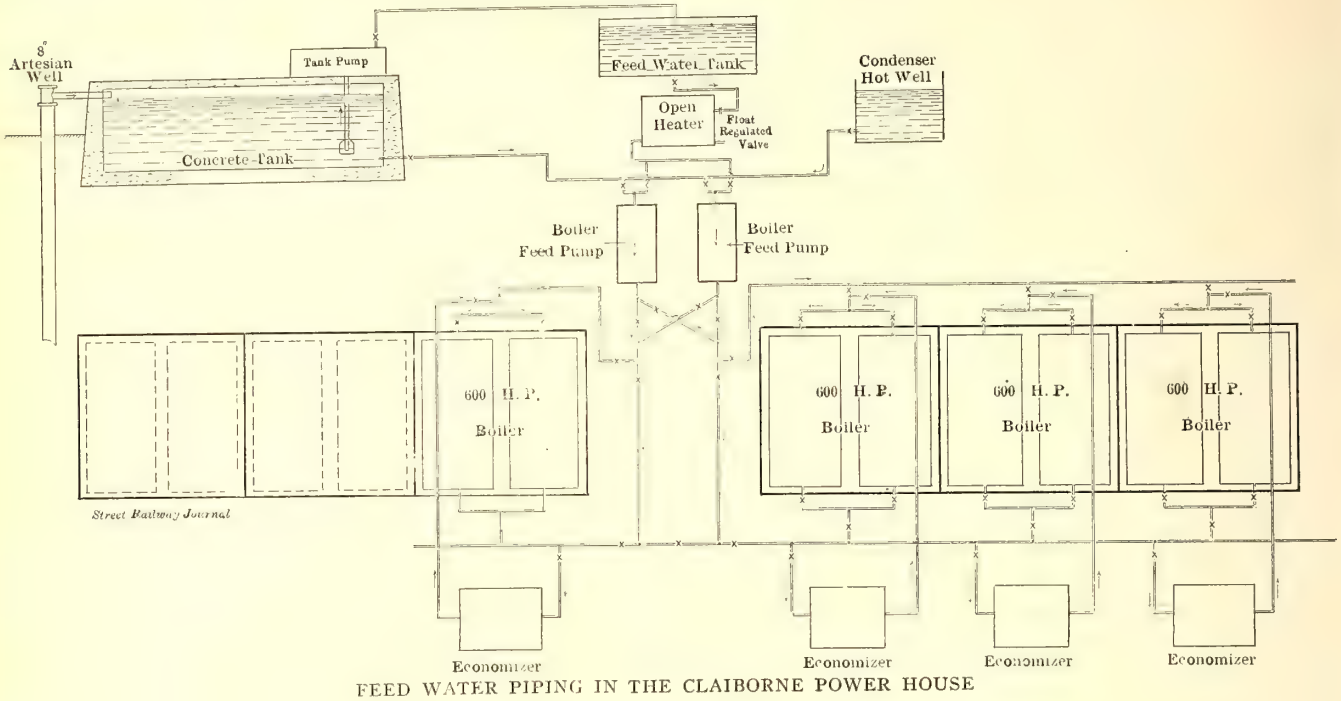
The boilers are installed in one row parallel to the engine room wall. For ventilation the wall opposite the furnaces is open to a point 8 or 10 ft. above the floor. The four 600-hp Heine boilers are each equipped with two 6-ft. by 8-ft. Murphy automatic furnaces and stokers of a design similar to those in the main station. The concrete bunkers located above the open space in front of the boilers have a capacity of six tons per running foot, or a capacity of 100 tons per boiler. Over the rear of the boilers in the new section are installed four Sturtevant economizers. They are so set and piped that a boiler and an economizer constitute a single unit, but the flue connections are such that any one economizer may be cut out without interfering with the use of the corresponding boiler. When one is cut out the water for all of the boilers may be passed through those economizers remaining in service. The economizers are cut out by means of an interlocking

mechanism operated by a lever from the boiler room floor.

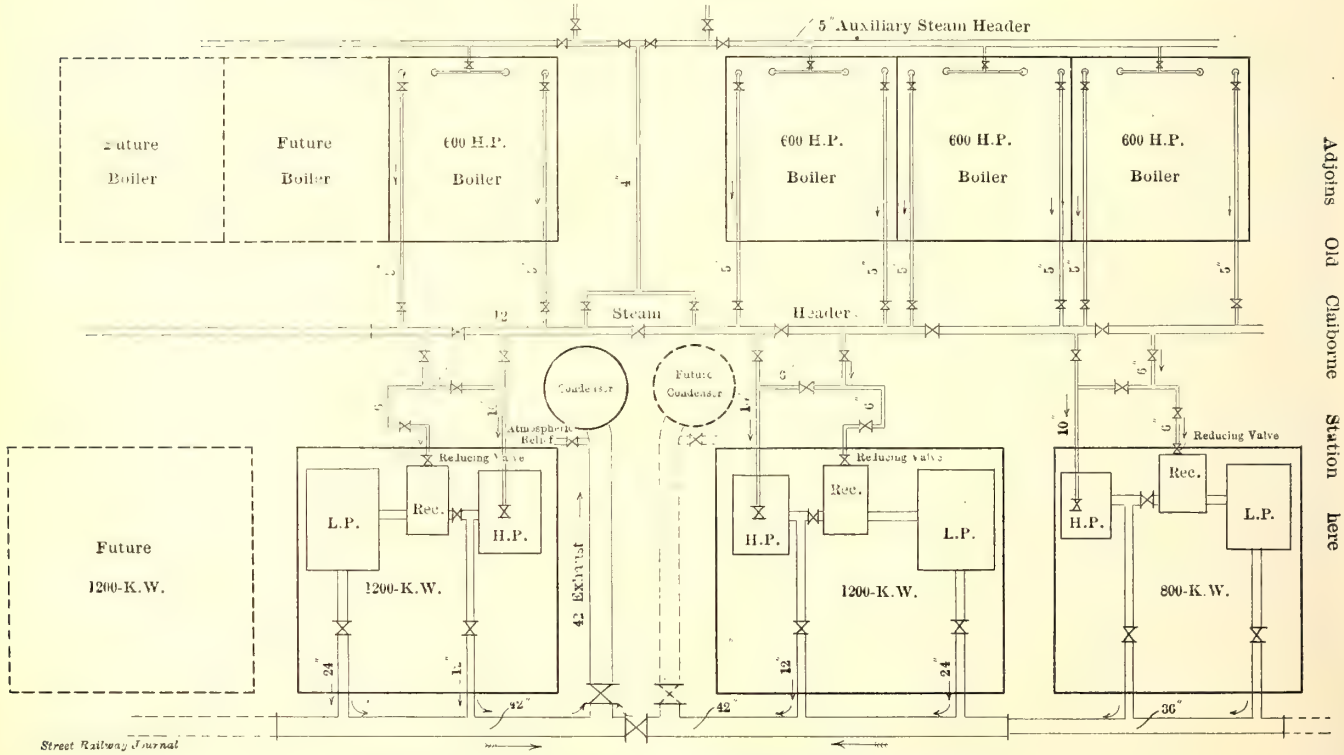
BOILER FEED

Feed water obtained from an 8-in. artesian well 500 ft. deep is forced into a concrete storage tank 12′ x 40′ x 4′ deep, located under the floor at the northwest corner of the building. A low pressure pump raises the water into an elevated tank from which it flows by gravity through the Cochrane open heaters. The boiler feed pumps then force it through the economizers into the boilers. If desired the heater may be passed and the water pumped direct from the concrete tank into the economizers.

Duplicate feed lines run in front and in the rear of the boilers, and each line has two connections to each boiler. By opening and closing proper valves each feed line may be fed by separate pumps so that it is possible to supply hot and cold water to separate boilers simultaneously. The air compressor equipment for supplying the artesian wells consists of two Ingersoll-Sergeant single-stage machines. Both are installled in the boiler room basement adjacent to the Dean Bros. low duty pump, and the two 10-in. x 17-in. x 7¾-in. x 15-in. compound duplex direct acting Worthington boiler feed pumps.



FEED WATER PIPING IN THE CLAIBORNE POWER HOUSE



MAIN ENGINE PIPING IN THE CLAIBORNE POWER HOUSE

COAL AND ASH HANDLING APPARATUS

At present coal is delivered to the station in wagons and dumped into a crusher hopper outside the building. A siding is planned along the boiler room wall for the delivery of coal in cars. The coal handling plant is similar to

the one at the main station, in that a bucket conveyor elevates the crushed coal to a point above the bunkers, where it is discharged on a belt conveyor. This belt distributes the coal to the several bunkers. The coal crushing and handling plant has a capacity of 50 tons per hour. The ash handling plant is also similar to that one at the main station. The arrangement of ash hoppers and screw conveyors under the boilers is practically the same, and a car and a skip bucket convey the ashes to an overhead bunker. The conveying apparatus was made by the Minneapolis Steel & Machinery Company.

STEAM PIPING

The high pressure steam lines are of standard lap-welded steel, with Van Stone type of joints for sizes 7 ins. and above. The main header is 12 ins. in diameter, and runs along the rear of the boilers about six feet from the floor. In order to clear the passageway between boiler and engine room under the stack and to provide for expansion, the header is broken into two 8-in. pipes which arch in a semicircle above the opening in the wall at this point. Valves in the header permit it to be sectionalized at every boiler. A section of the main header may be removed entirely without interfering with the operation of the plant. Two boiler lines which drop down from each boiler are connected one on either side of the sectionalizing valves, and each engine may be supplied with steam from either of two adjacent engines. With one section of the main header cut out, the pressure in the two disconnected sections would be equalized through a 5-in. auxiliary header, which runs in front of the boilers, and which has connections to each boiler and to the main header at the central point. Steam for all of the auxiliary apparatus in the boiler-room is taken off this smaller header. The engine mains pass directly through the boiler room wall to the separate units. Valves located in the boiler room are controlled through extended stems from the engine room.

GENERATING UNITS

The two 1200-kw units installed in the new portion of the building consist of Filer & Stowell horizontal cross compound condensing engines and Westinghouse 600-volt generators. The 850-kw unit is an Allis-Chalmers cross-compound engine with General Electric similar generator. Plans provide for the installation of an additional 800-kw unit now in another station.

CONDENSER

A 42-in. header in the basement of the engine room receives the exhaust steam from all of the engines in the new portion of the plant, and it will eventually take the exhaust of the old engines. This header is connected with a 42-in. Alberger barometric condenser located just above the north wall of the boiler room. Condenser water is furnished by either of two centrifugal pumps, each driven by a Buckeye simple engine, and located in a pump pit in the basement. One 10 x 24 x 24 Alberger dry vacuum pumps are located on the boiler room floor under the smokestack. The exhaust mains are provided with atmospheric relief valves designed by Sanderson & Porter.

OILING SYSTEM

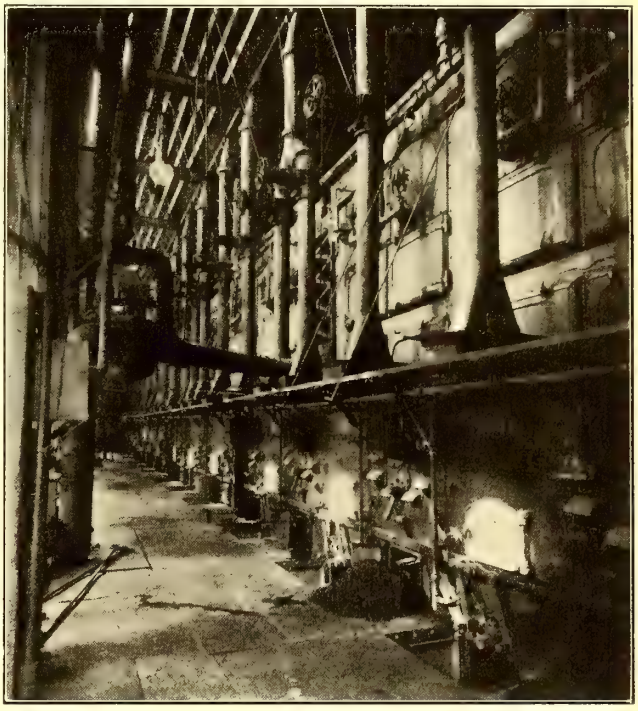
Oil is supplied to engine bearings by mains of a central gravity system which consists of an elevated tank located near the smokestack, a White Star filter and cooler in the basement, and two 5-in. x 2¾-in. x 3-in. Worthington duplex oil pumps.

MOTOR GENERATOR SETS

The station is tied electrically to the other stations of the system through two 500-kw motor generator sets consisting of 6600-volt synchronous motors and 600-volt d. c. generators.

CONTROL APPARATUS

In addition to direct current, both 2300-volt and 6600-volt alternating current are handled in the station. Two 6600-volt 3-conductor 4-0 cables enter the station underground from the main station, and two outgoing 2300 circuits extend under the river to Algiers. An arc light substation of 770 lamps capacity, using 2300 volts primary, is located in the station. All apparatus is controlled from a switchboard on a gallery alongside the front wall of the building, and opposite the tower already referred to. The gallery, which is partly supported on steel posts, has a concrete floor, and is reached by an iron stairway. The switchboard panels are well lighted by lamps in a trough reflector,



BOILER ROOM OF BARONNE STREET STATION.

which also serves to protect the board from the crane cables.

The direct-current portion of the switchboard contains eight d. c. generators and twelve feeder panels. The positive d. c. switches are located on the board, but the negative and equalizer bus switches are installed on pedestals on the main floor, near each generator, and are motor-operated through control switches on the switchboard panels. A storage battery of fifty-five 10-ampere Chloride Accumulator cells, operates the remote control switches. This battery is charged by a 125-volt generator driven by a small Westinghouse standard engine. Current for station lighting is obtained from two 2300 to 110 volt step down transformers, the three-wire system of circuits being used. Provision is made for later supplying the 60-cycle lighting of this section of the city from a distributing switchboard in this station.

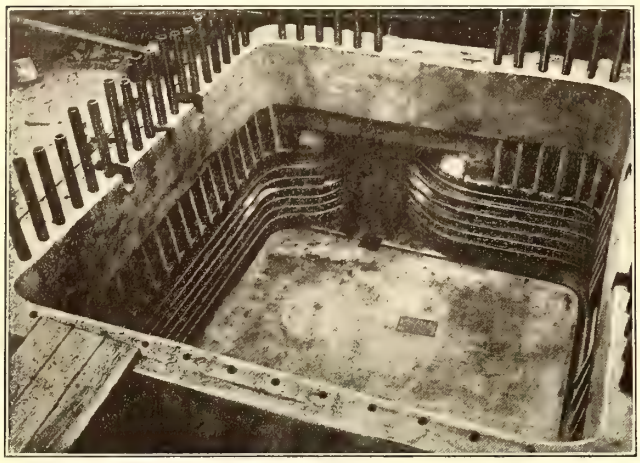
BARONNE STREET STATION

Practically the only important changes made in the 250-volt d. c. Edison station, known as the Baronne Street station, has been to equip the boilers with Murphy furnaces and mechanical stokers. In order to provide sufficient stoker capacity it was found necessary to install three stokers under each battery of two boilers, and this required

that a portion of the center wall between the boilers be specially supported from the boiler room girders.

VALENCE SUB-STATION

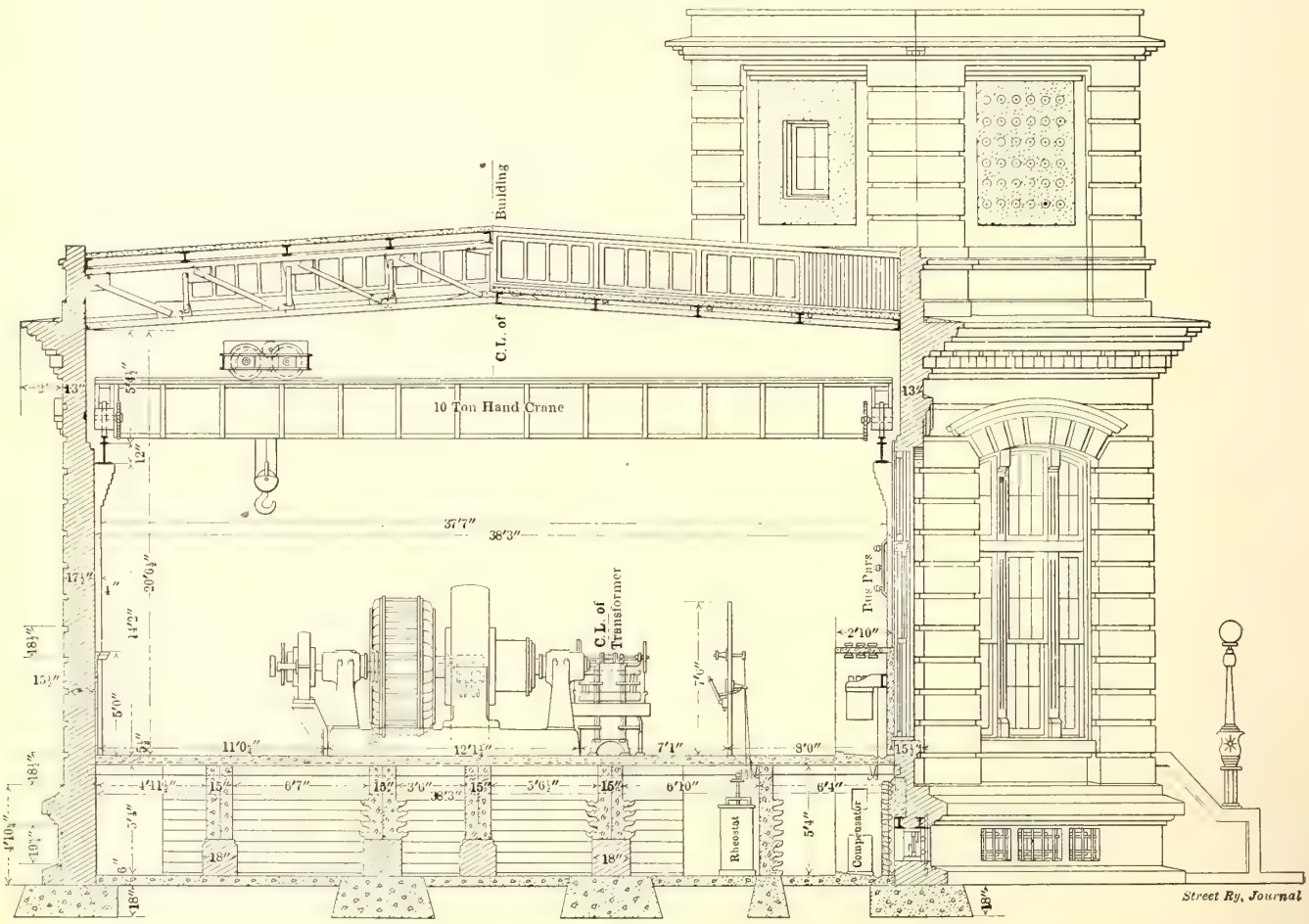
This is the first recently constructed permanent sub-station, and the only one yet finished excepting those in the power stations. It is located in the western portion of the city, at Valence and Franklin Streets, and about three miles northwest of the Market Street Station. It is a combination arc lighting and railway sub-station, and at present contains six 110-lamp arc-light transformers and two 500-kw motor generator sets. Provision is also made for its future use as a commercial lighting sub-station. The building is a brick and concrete and steel structure. It is rectangular except for an extension at one corner, the lower portion of which serves as an entrance and the upper portion as a cable tower. The exterior is of salmon pressed brick, with cement trimmings. A temporary rear wall was built with a view to future extensions.



BASEMENT OF THE HOWARD AVENUE TERMINAL HOUSE



CONCRETE BLOCKS AND CABLE SHELVES USED IN SUB-STATION MANHOLES AND TERMINAL HOUSES



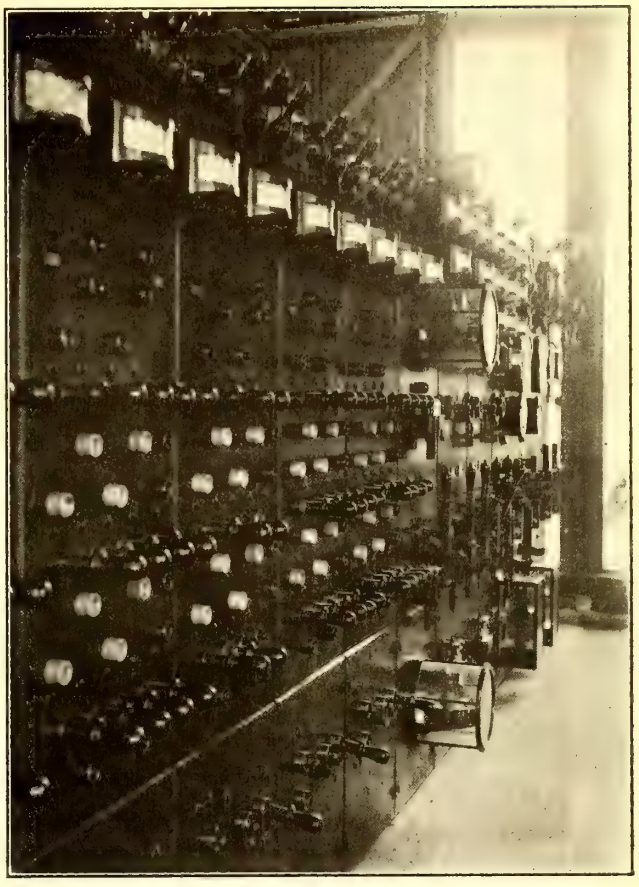
SECTION THROUGH LINE A-B-C-D FLOOR PLAN

CROSS SECTION, SHOWING ARRANGEMENT OF APPARATUS AT VALENCE STREET SUB-STATION

A three-conductor 4-0 6600-volt and a 2300-volt feeder from the Market Street station enter one side of the tower already referred to. On the opposite side are the outgoing feeders. Disconnecting knife switches and lightning arrest-

ers are installed on iron framework on the walls. From the tower the high-tension feeders drop to bare busses on the wall behind the switchboard. They then go to hand-operated oil switches installed in cement cells just under the busses. The leads are then carried under the floor to the synchronous motor generator sets. Excitation for these is obtained from small generators mounted on the end of the shaft of each machine. Either exciter is of sufficient capacity to serve both machines. The units are arranged to be started from either the a. c. or the d. c. end.

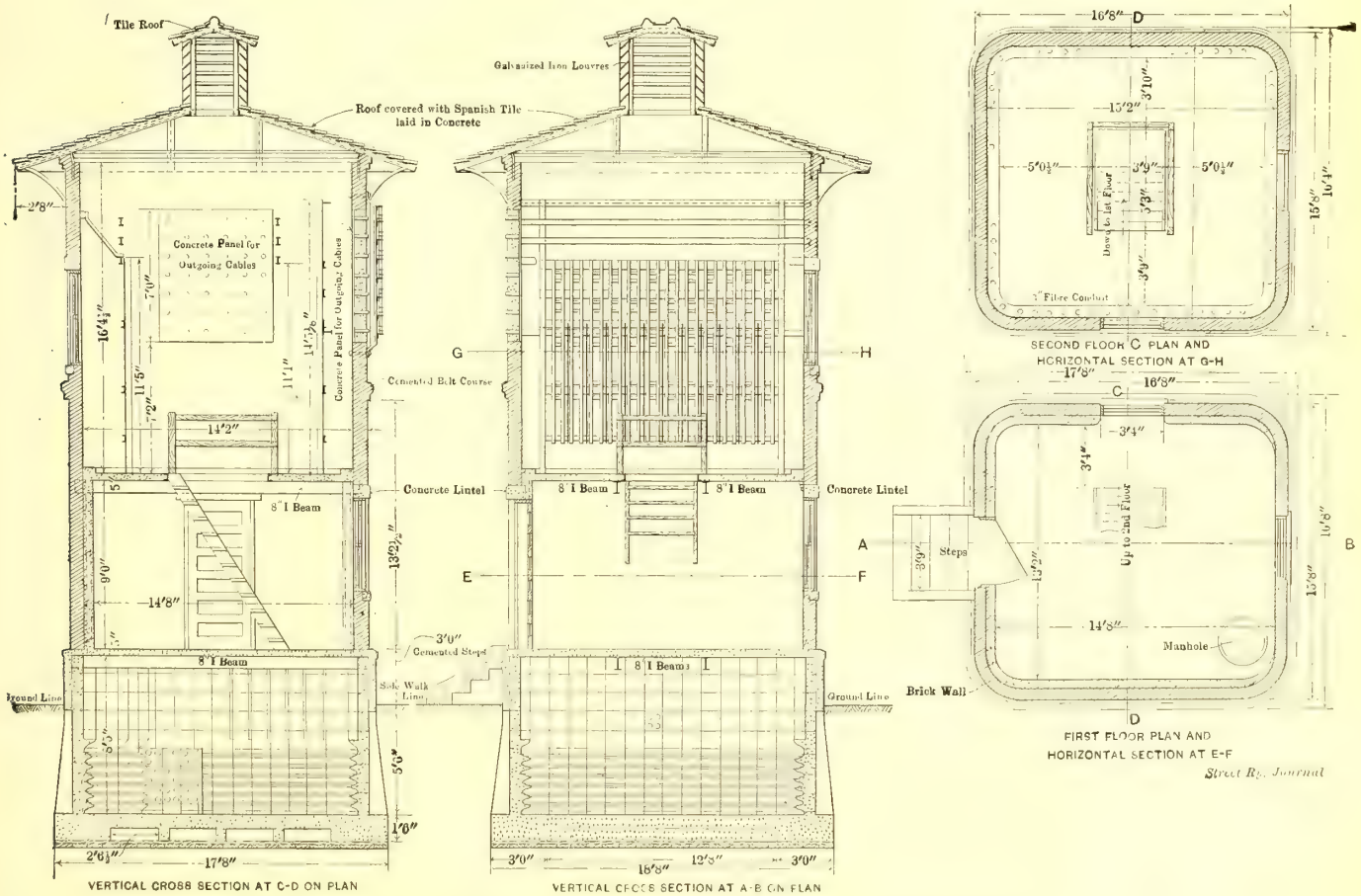
The railway switchboard contains two feeder and two generator panels. On it are installed high tension time limit relays, ammeters for each leg of the incoming lines and a synchronism indicator. Rheostats and compensators are located in the basement under the switchboard. The panels of the arc light switchboard located alongside the railway board carry time limit relays. Two wattmeters are installed in series on the incoming 2300-volt lines, one wattmeter checking the other. All cables in the basement are carried on cable rocks made of concrete blocks about one foot long and containing two shelves, which are wide enough to carry two 1,000,000 c. m. cables. A 4-hp Allis-Chalmers air compressor installed in connection with two storage tanks in the basement is used for cleaning machines. A 15-ton hand-operated crane built by the Brown Hoisting Company spans the room. Lighting is effected with arc lights.



SWITCHBOARD IN THE VALENCE SUB-STATION

MAGAZINE STREET SUB-STATION

A temporary sub-station for commercial lighting has been installed in an existing building on Magazine street, near Poydras. This sub-station contains a 500-kw motor genera-



PLANS AND SECTION OF THE HOWARD AVENUE TERMINAL HOUSE

tor set, consisting of a 6600-volt synchronous motor and a 250-volt d. c. generator, which feeds across the outside wires of the Edison three-wire power and lighting system covering the downtown district.

BOURBON SUB-STATION

There is now being installed in this sub-station a 1000-kw synchronous motor generator set, 6600 volts A. C. to 250 volts D. C., for supplying a section of the underground system. The present sub-station building is temporary, but the foundations and sub-grade work is of permanent character, and will constitute a part of the ultimate sub-station construction aggregating some 5000 kilowatts capacity.



CORNER VIEW OF THE VALENCE SUB-STATION

DRYADES SUB-STATION

This sub-station is an installation containing arc light constant current transformers aggregating 660 lights; also one 500-kw motor generator set operating in conjunction with the steam-driven generator in the Edison Station.

CONDUIT SYSTEM

In the downtown district the high-tension connections between all the power stations and sub-stations are underground. The recent work by Sanderson & Porter has included the construction of about 600,000 duct feet of conduit, and approximately 150 manholes. This was necessitated by the extension of the underground district to about double its former area.

The ducts are of 3-in. fiber conduit laid with one inch of gravel concrete between ducts, and with approximately four inches on all sides. The larger portion of the system was of four duct runs and ranged up to thirty-six ducts.

The manholes were usually located at street corners, but additional ones were occasionally built in the middle of long blocks. The manholes are made largely of molded concrete blocks, which, in addition to forming walls, carry projections which serve as shelves for the cables, and act as barriers between adjacent cables. The blocks are practically watertight, and it was found that manholes could be built quicker with them than with brick. The manholes are drained, and in some instances 4-in. glazed tile were used under the ducts to serve as drains from one manhole to another. All drains are provided with rubber ball check valves, which prevent water backing up.

THE TERMINAL HOUSE

The overhead lines from the main generating station, extending into the underground district, are carried into a terminal house about one mile from such station. This is a two-story and basement fireproof brick and concrete structure 15 ft. 8 ins. square. The overhead lines enter the upper room, on the walls of which disconnecting knife switches are installed on frames with slate barriers between them. The arrangement for the arc light circuits is such that one incoming line may be split into two outgoing circuits. The lines pass down to the basement in lead-covered cables. The basement is built of the concrete blocks used in manhole construction, and on the shelves formed by these the lead cables are distributed to their respective outgoing conduits.

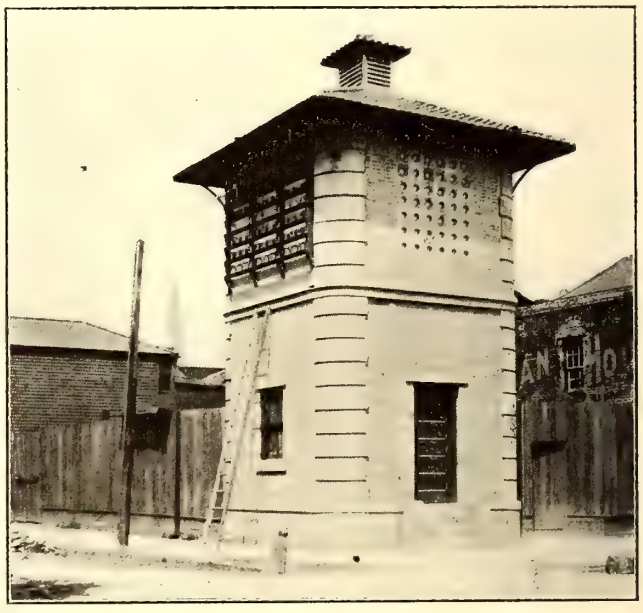
ALGIERS FEEDERS AND SUB-STATION

Reference has already been made to the 2300-volt a. c. submarine line extending from the Claiborne station to Algiers, a suburb of New Orleans, on the opposite side of the Mississippi River. In addition a 2300-volt submarine line is run under the river from the main station at Market Street. All are 2-0, three-conductor, stranded, rubber insulated cables protected by an armor of galvanized wire, and are anchored at three points in the river bed.

On the Algiers side of the river the cables are brought up into a terminal house, and are then carried overhead to the sub-station of the Algiers Railway & Light Company.

ARC LIGHT CIRCUITS

The arc light sub-stations are used with the new arc system of street illumination installed by Sanderson & Porter. This includes approximately 3000 series alternating inclosed arc lamps especially designed to meet the city specifications.



HOWARD AVENUE TERMINAL HOUSE

The above described improvements in New Orleans have been designed and executed by the engineering and construction organization of Sanderson & Porter, New York. Their New Orleans office—W. A. Haller, resident engineer—has substantially completed all the work herein described in such manner as will readily permit enlargements from time to time.

The work has benefited greatly by the cordial co-operation which has existed between the representatives of the constructors and the officials of the New Orleans Railway & Light Company, the latter, particularly, including E. C. Foster, president; J. H. DeGrange, vice-president; A. L. Black, engineer, and E. B. McKinney, supt. of power.

MAIN POWER STATION

OF

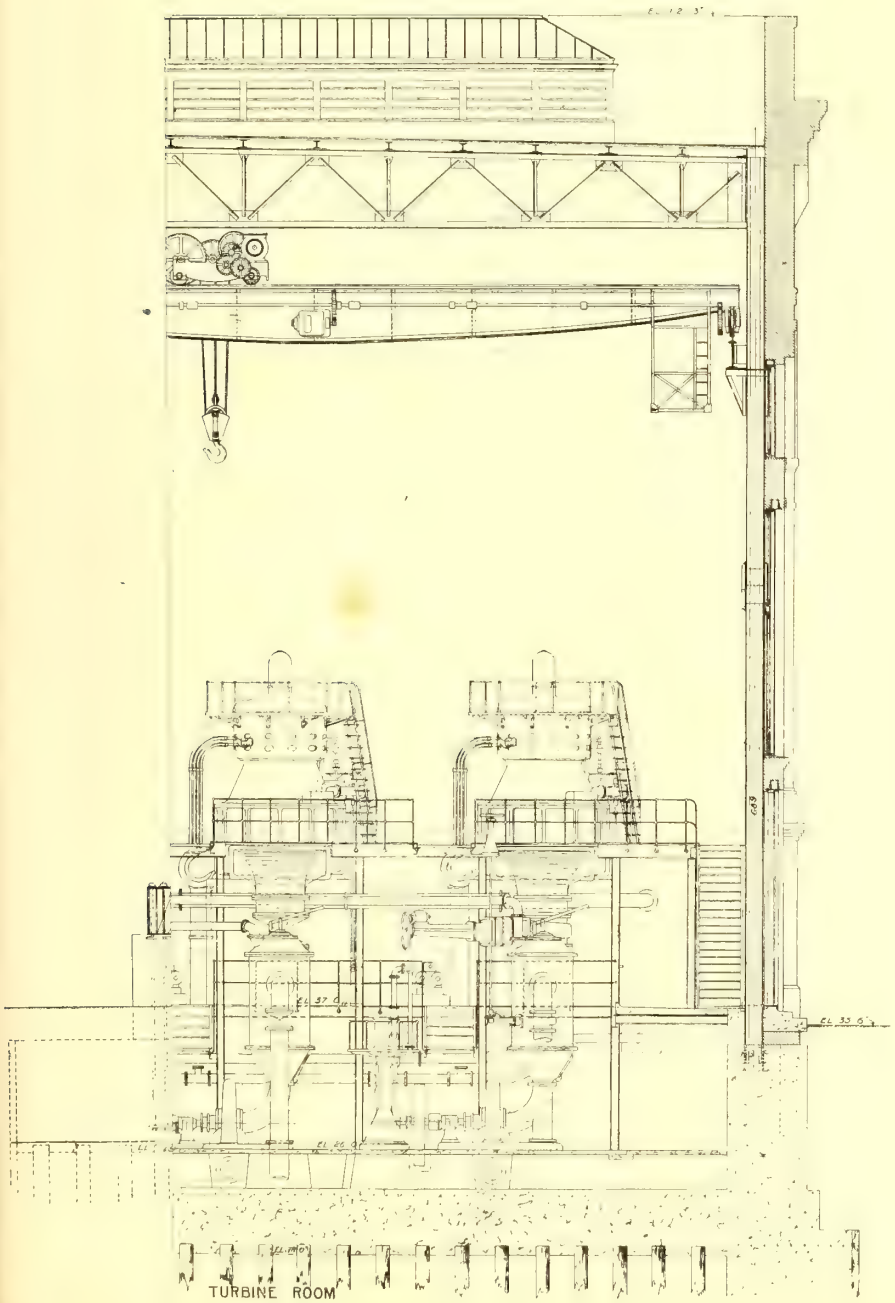
EW ORLEANS RAILWAY & LIGHT CO.

NEW ORLEANS, LA.

DESIGNED & BUILT BY

SANDERSON & PORTER

NEW YORK

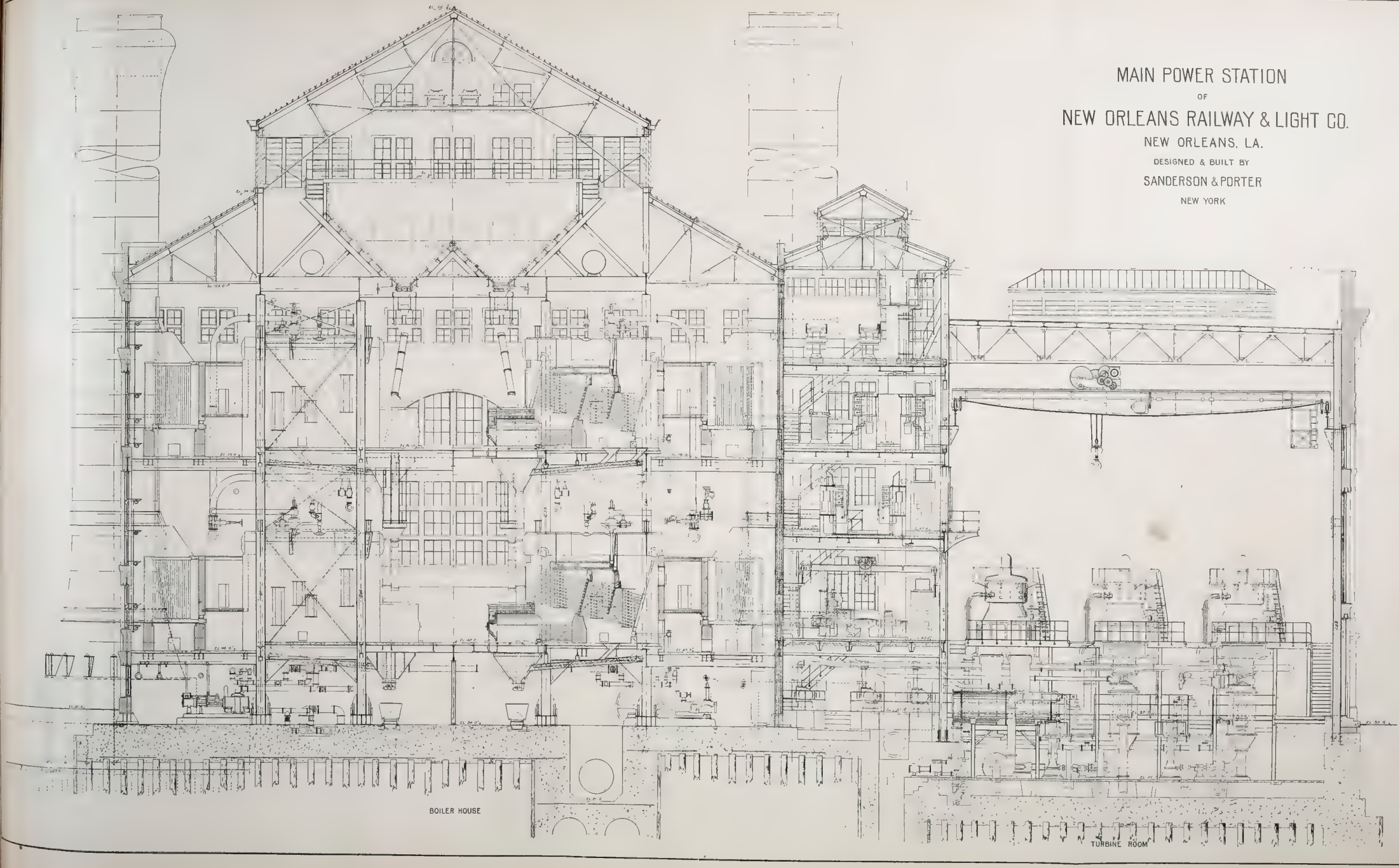


MAIN POWER STATION
OF
NEW ORLEANS RAILWAY & LIGHT CO.
NEW ORLEANS, LA.

DESIGNED & BUILT BY

SANDERSON & PORTER

NEW YORK



THE TOKIO ELECTRIC STREET RAILWAY COMPANY

BY HENRY K. BRENT

The deepest impression acquired from reading about this new-old country, Japan, is that, in all phases of its social, civil and economic life, it is undergoing a rapid and wonderful transition. Actual observation transforms the impression into conviction, for on every hand are mingled traces of the old and evidences of the new, made possible by and after the visit of Commodore Perry in 1853. The next fifteen years, though replete with important treaties with foreign nations, were marked primarily by internal upheavals, and it was not until 1868, when the Shogunate was overthrown and the Mikado became Emperor in fact as well as in name, that the seeds were planted from which have been reaped year by year Japan's rich harvest of social, civil and economic progress. In 1871 feudalism was abolished, and in 1889 a constitution was adopted. That Japan has within the past forty years perfected many of her natural native products her large exports bear witness. That she intends to develop her hitherto latent potentialities is illustrated by her great importation of wheels, both mental and mechanical, from all parts of the globe, analyzing and discarding, retaining and applying those suited to her peculiar needs. So far she has combed with a very fine comb American and European ideas, originating little but selecting masterfully. And consequently in the Tokio Electric Railway Company are found many American and many European ideas carefully chosen and excellently practiced by Nippon.

Street cars drawn by horses were introduced in Tokio in 1882, but, although there were several companies, only a small part of the city was covered. In 1903 the number of companies was reduced to three and all the roads electrified. These roads were united under one management in September, 1906, and now constitute the Tokio Tetsudo Kaisha, or Tokio Electric Street Railway Company. It is a joint stock corporation operating under a perpetual franchise from the city, and managed by a board of directors chosen by the stockholders. The company was organized by Japanese, and likewise is managed by them in all its departments.

The capitalization of the company is yen 33,000,000, or $16,500,000, consisting entirely of common stock, without either bonds or preferred stock, upon which there is an annual dividend of 9 per cent, paid twice a year. Practically the entire amount is held by local investors. It is quoted on the Tokio Exchange at 64, par value yen 50. The management and operation expenses are 50 per cent. Of the net receipts 10 per cent annually must go to the reserve fund, and one-third of the remainder to the city for the use of the streets. The amount so paid to the city for the last fiscal twelve months was yen 330,000; gross receipts yen 5,000,000.

The total length of the system, exclusive of suburban connections, is 90 miles with proposed extensions of 80 miles. On account of the width of the streets the track is narrow-gage, but the body of the cars is almost as wide as broad-gage cars, and in this respect the cars resemble those used in Denver. Although the rails are light the track is kept in splendid condition by a large number of inspectors



MAP OF TOKIO, SHOWING THE PRESENT AND PROPOSED ELECTRIC RAILWAY FACILITIES, LOCATION OF IMPORTANT BUILDINGS, PARKS, ETC.

and workmen. All the cars (there are no open ones and about seven hundred in daily use), were constructed in Japan, and in size range from the dinky seen in our smaller cities to the large cars of metropolitan type. A noticeable feature is the frequency with which cars run, which shows not only their popularity with the public, but also the regard of the company for the comfort of its patrons, for, though the cars are often crowded, strap hanging is the exception instead of the rule. As one result of this popularity, the number of jinrickshas has decreased within a few years from 40,000 to 20,000 vehicles, and the number of men so engaged from 50,000 to 25,000. This example of the displacement of human motive power by machinery is a typical illustration of the conditions of modern Japan, and the resulting idleness of many thousand workers is the great reason for the large emigration now going on. It is fortunate for Japan that Korea, her nearest neighbor, has remained for so many centuries a Hermit Kingdom, undeveloped from within and unexploited from without. The great natural resources and fertility of that peninsula offer an outlet for the energies of her ever increasing number of unemployed, which most likely accounts for Japan's present not entirely altruistic interest in that country.

The popularity of this comparatively new method of transportation is shown in a practical and desirable manner by the average daily number of passengers carried, about 300,000. The busiest months are March and April, the flower months, when thousands and thousands of people go daily from park to park to see the cherry blossoms and other plants in bloom at that season: a manifestation of Japan's aesthetic temperament, which at the same time redounds to the benefit of the coffers of the traction company, a source of revenue not found in American cities, even in Chicago. During this period cars are transferred from other divisions to accommodate the increased park traffic. Conditions of congestion similar to these, but due to dissimilar causes, in our American cities are being carefully studied by Traffic Manager Nambu and his associate officers. On account of its topography New York City offers an unlike problem, and more attention is being given to the methods of such cities as Boston, St. Louis and New Orleans. A study of the traffic conditions of the latter city, with its splendid loop system centering on Canal Street, would probably assist in solving Tokio's difficulty. With the increasing traffic and additional mileage under construction and proposed, the company must soon make a new arrangement of its lines by divisions. One of the greatest obstacles encountered in this matter is the lack of trained men for division superintendents. This difficulty has thrown upon the present traffic superintendent not only the ordinary duties incumbent upon the position, but also the care of the details of operation. But already the merits are known of placing the responsibility of operation upon division superintendents subject to such general supervision as may be necessary, and it is only a matter of time before the company will put into practice a bonus or merit system in the form of increased pay for each employe upon the best operated division, according to the classification of the employe as to efficiency and length of service.

The crews are dressed in the customary blue uniforms with brass buttons. Two bells to start and one to stop are used, but the cars do not stop at every corner, since, on account of the inequality in the length of the blocks, such an arrangement would be unsatisfactory. Stopping places are indicated by notices painted on the trolley posts along the street, and occur at regular intervals, sometimes in the middle of a block. Following the English law of the road the cars use the left-hand track instead of the right as in America. On each car, except the very small ones, are two conductors, one inside to collect the fares, and one on the back end to look after the trolley, to start and stop the car, to assist passengers on and off, etc.

The fare from any point in the city to any other point is 5 sen, equivalent to 2½ cents in American money. Transfers are given to all intersecting lines, and a transfer upon a transfer is allowed where that is desired. Upon handing the fare to the conductor he holds up the coin, states the amount, and inquires whether one ticket, or more than one if the coin be 10 sen or more, or a transfer is wanted. This is done in order to prevent short-changing by the conductor, and should a conductor fail to name the amount of a coin received and a dispute arise as to the change, the conductor at his own loss must make good to the passenger. The money received is deposited in a small leather satchel suspended from the neck of the conductor. In appearance and size it is similar to the hand bags in such general use by the good dames of Boston. So no bold Bostonian, unanchored from the sacred precincts of Beacon Hill and the hallowed shadows of the State House, need feel homesick if he will only go to Tokio and ride in a street car.

After ascertaining that only one is desired the conductor then tears from a perforated sheet a single ticket, which he punches and hands to the passenger. This ticket is collected by the conductor on the back platform and must be produced before the passenger may alight, the ticket then being deposited in a box on the car for that purpose. The tickets are numbered consecutively, and all must be accounted for at the end of the day's run. This method, like all others yet devised, does not prevent theft by the conductors and in order to avoid the repeated use of a ticket and collusion between the conductors it is necessary to employ a large number of spotters. A conductor detected of theft forfeits the entire amount of his deposit, yen 7, and is discharged, but not prosecuted. As no fare register is used the company does not have the advantage of that mechanical assistance, and must depend in calculating its daily receipts solely upon the number of tickets issued and collected.

If placed unexpected on a street corner with ears closed and gaze concentrated upon a passing car, an American would not realize he was in Tokio. But with open ears and gaze diverted for only one second he would know he was in the Far East. The shrill whistles which he so often hears are not those of policemen or wheelmen, but are the signals of blind shampooers soliciting attention. The click, click, click on the hard road (there are few side walks) is the noise made by the wooden clogs (stilt-like shoes) of pedestrians, a sound resembling the sabots in a Dutch city, but not so loud.

When the car comes to a standstill it may be necessary to wait until a woman gets aboard; a long process in any country regardless of nationality, but especially long in Japan on account of the awkward shoes worn. Upon entering the car, if she intends to ride only a few blocks, she rests merely on the edge of the seat, for with her baby strapped to her shoulders she cannot lean back. But if she is to go some distance the child is swung around on her lap, nursed and otherwise attended to as occasion may require. There are generally a number of European-dressed natives in the car, but most of the passengers wear kimonos, and as the men sit with their knees crossed their bare legs are exposed in a way which to us seems very unconventional. Some passengers prefer to sit on the seats tailor-

fashion, while others prefer to kneel on them and look out of the windows. Of course in modern Japan one expects, and does find advertisements in the top sides of the cars. But instead of leather straps for support when the cars are crowded, bamboo loops are used, and as the people are small in stature, especially the women, these loops come only about to the chest of an American or European of ordinary height. Although the cars have glass windows very few of the houses, except the official buildings and Europeanized shops along the Ginza, the Broadway of Tokio, have them. Paper still serves the purpose of glass in this respect, and, as paper is not visually transparent, the fronts of the shops in order to display their wares are open to the street. At night the electric lights of the cars compete with myriads of paper lanterns along the way; paper lanterns everywhere, one being carried even by the mounted policeman at the end of the line in the suburbs. The floors are not covered with gratings as with us, since the clogs worn would catch in the cracks and make walking in the cars almost impossible.

Although the Tetsudo Kaisha is an up-to-date street car company in most particulars, it does not offer to the tourist the facilities of a sight-seeing car. Yet Seattle does, and both Tokio and Seattle are equally on the Pacific. Maybe the difference is because Seattle claims that within a short time she will also be on the Atlantic, and in advance has already adopted some of the methods of her future neighbors. But whatever the reason, the tourist who would see Tokio by street car must do so independent of the company's assistance, and consequently make many changes and many mistakes. But search as he may in every quarter of Tokio's one hundred square miles, the sightseer will not discover so queer a car as the one in Denver which goes up hill by horse power, and down hill by gravity with the horse on the rear platform. Nor will he find so great a fraud as the one in one of the western cities in the United States, where at the bottom of a steep inclined track in the center of the city the gullible Easterner is invited to enter a car, and, free of charge, ride to the top to view the wonderful new city below; though no fare is charged for the ascent, ten cents must be paid in order to descend. Curious and interesting as are these two street car novelties, they fade into insignificance compared to the surprise felt at hearing a delinquent Chinaman and a conductor disputing in Pigeon-English, the only language common to them. And indeed, whether the passenger be an Asiastic or European, unless he speak Japanese, he must in all cases resort to English, which, aside from the native tongue, is the only language widely understood in the Empire. Take courage, Americans and Missourians who visit Japan, and have no hesitation about riding on the street cars in this great capital where your own language has already preceded you.

The visitor to a Tokio shop is surprised at the large number of clerks, but when he visits a native factory surprise develops into amazement at the swarms of workmen seen. The same conditions exists in the street car company, for, including its office force, the number of employes is about seven thousand, divided as follows:

246 Inspectors.	583 Yardmen.
1873 Motormen.	376 Linemen.
73 Apprentice Motormen.	277 Trackmen.
1910 Conductors.	57 Power Station Men.
116 Apprentice Conductors.	30 Lighting Station Men.
152 Barn Mechanics.	274 Construction Men.
337 Switchmen.	445 Painters and Carpenters.

With the exception of the motormen and conductors, whose hours depend upon the number of miles in their respective runs, the average work day is ten hours. Motormen and conductors are expected to do about sixty miles in a day of eleven hours. For more than eleven hours they are paid for extra time. Twenty minutes only are allowed for lunch, but at the end of each round trip six minutes are permitted for smoking. The runs are continuous, and are not broken by the two hours' relief crews as in America.

Motormen and conductors receive the same wages, which are founded upon a minimum basis of yen 12 per month. But the amounts differ, and depend upon which one of the six classes they belong to, the classification being made according to efficiency and length of service. The amounts average from yen 16 per month for class one, to yen 21 for class six, a difference of yen 1 per class. The wages, aside from the guarantee of yen 12, are regulated somewhat upon the co-operative plan, and are governed by the daily receipts of the company, 9 per cent of the net receipts being set aside by the company to be distributed as wages. After deducting the total aggregate of the guaranteed sum, the remainder is distributed in the form of a bonus, the amount of bonus to each conductor and motorman being apportioned according to his classification. But before becoming a motorman or conductor the applicant must undergo examinations similar to those in the United States, viz., as to character, general intelligence and good health. If satisfactory he becomes an apprentice for six weeks at yen 9 per month and no bonus, and then a first-class employe.

The average living expenses for an employe per month are: yen 3 house rent, yen 9 food, yen 3 clothes and yen 1 incidentals, a total of yen 16, the same amount as is received by a motorman or conductor of the first class. It does not require the aid of an abacus, the Japanese calculating machine, to determine how much is left for savings at this ratio of living expenses to wages. But, nevertheless, in order to create the spirit of saving among those who now have nothing to save, and to encourage the spirit among those who are so fortunate as to possess a little surplus, the company has under consideration and will probably establish a savings department similar to those in some of the European companies. Already it is beginning to realize the advantage of taking an interest in its employes in addition to its merely official relation to them. It retains its own physicians who, for a very small fee, are at the service of its employes, and in case of bona fide illness the wages are continued until the employe is able to resume work. Where permanent injury occurs a lump sum is given to the man, or to his family in case of his death. Usually, however, the amount is very small, seldom exceeding yen 250 or yen 300.

Although there are at present no labor organizations, such as unions, in Japan, the discontent of laboring classes throughout the world has made its appearance even here. In May of this year occurred the violent strike and rioting at the great Ashio copper mine, about twelve hours distant from Tokio. The strike was the result of a demand for increased wages, and during its progress much valuable machinery and other property were destroyed. The leaders were severely punished, and three hundred participants were imprisoned for longer or shorter terms according to their activity. Industrial disturbances of similar but less violent character have occurred elsewhere. As yet the railroads and traction companies have been free from them. The mental attitude, however, of all working classes is changing. Fifteen years ago the watchword for them in Japan was, not rights, but duties. To-day it is different. With the new spirit of enterprise and combination among her capitalists, will there also appear the corresponding spirit of organization among her laboring people? Will

Japan be able to devise a means of preventing conflicts between employers and employes? Or is she so far committed to her policy of imitation and adoption that she must take what is bad as well as what is good in the industrial progress of foreign nations? Her labor history will be watched with interest, and in no department of her industrial life will the relations between employer and employe be of greater importance than in her traction companies, both on account of their semi-public character, the large number of men engaged in them, and because of their vital importance to the comfort of their respective communities.

INDIANAPOLIS & NORTHWESTERN TRACTION COMPANY.
STANDARD TIRE. No. 21105B.

PUT IN		REMOVED							
Car No.	Date	Measurement	Date	Cause	Measurements	No. Days in Service	No. Miles	Tire Loss	Work Done by
52	July 3, 1905	33.82	December 12, 1905	Sh Flg.	33.03	141	42,000	.39	
52	December 20, 1905	33.03	May 3, 1905	Change	32.15	105	29,000	.39	
52 (1)	May 13, 1905	32.15	June 30, 1906	Sh. Flg.	31.43	35	9,000	.31	
52	June 30, 1906	31.43							

STEEL TIRE PRACTICE IN THE SHOPS OF THE INDIANAPOLIS & NORTHWESTERN TRACTION COMPANY

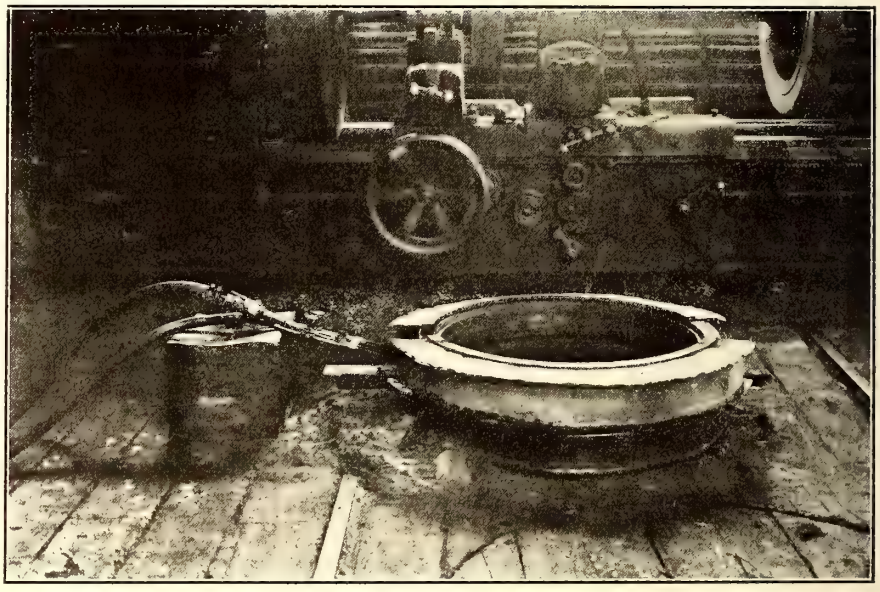
Practice regarding steel tires as followed in the shops of the Indianapolis & Northwestern Traction Company at Lebanon, Ind., is especially good, and some of the details may be of interest to others. The method of removing tires from and replacing them on their centers which was devised by Leverett M. Clark, formerly master mechanic, who is now with the Indianapolis Traction & Terminal Company, and L. W. Hayes, the present master mechanic, and the manner in which record of the turnings and mileage of the tires is kept, are well worth noting. Comparatively new tires are removed in about eight minutes at a total cost of 13 cents for both labor and fuel. A shorter time is required to remove thin tires. As about one-half gallon of crude petroleum at 3¾ cents per gallon is used in removing a tire, the cost of fuel for the operation is less than 2 cents.

The apparatus necessary consists of two tanks for the storage of oil, a double burner, as shown in the illustration, and two asbestos-lined, semi-circular, sheet-iron troughs, which are put around the wheel. The wheel centers are fitted with 3-in. tires fastened with riveted double-lipped retaining rings. When tires are to be removed, the rings are taken off, and usually it is necessary to put the wheels in a lathe and turn off the inner edge of the tire, which overhangs the center. The semi-circular covers shown in the illustration are then put around the tire. These covers are so made as to prevent to a great degree the dissipation of heat. Each encloses somewhat less than half the diameter of the tire, so that when they are in position there is sufficient space between them to permit the burner to be inserted, as shown in the illustration. This burner is supplied by means of a hose with oil from the storage tanks and a hose for the compressed air. Globe valves and angle cocks permit the supply of both oil and air to be controlled.

The intensity of the heat expands the tire the proper amount in a very few minutes.

The two tanks in which the oil is stored are similar to the tanks used in connection with air-brake systems on cars and are of about 5 cu. ft. capacity each. Because of the small expense and trouble occasioned by the removal of tires, it is the custom when flanges wear sharp on one side of the truck to remove each tire and mount it on the mate center. This practice removes the necessity of turning as much metal off the wheel as would otherwise be necessary.

A careful record of each tire is kept. As all the tires in use on the system are of the same dimension, the cards on which the record is kept were much simplified by leaving off all blanks regarding dimensions. The data kept on the cards may be observed in the reproduction presented herewith. The data on this card, however, show a tire of average wear. The cause for removal is frequently sharp flanges. The cause "change" shows that the tire was changed from one center to the mate one because of sharp flanges of the mate center. Wherever possible, the tires are kept on the same pair of wheels and the wheels in the same truck. By so doing the manner in which the wheels wear often indicates trucks faulty in alignment or otherwise. New tires are 34 ins. in diameter and 3 ins. thick. They are worn down to a diameter of 31 ins., or to a thickness of 1 in., before being discarded. When kept in service beyond this point there is a tendency for the outside corner of the tire immediately over the retaining ring to break off. The average mileage obtained is from 16,000 to 20,000 miles per turning. The turnings are from ¼ to ⅜ in. thick, so that the life of the tire is from 80,000 to 150,000 miles.



EXPANDING TIRE ON INDIANAPOLIS & NORTHWESTERN TRACTION COMPANY

THE RESULTS WITH THE PAY-AS-YOU-ENTER CARS IN CHICAGO

The STREET RAILWAY JOURNAL is able to present this week the first pictures that have thus far appeared in the technical press of the workings in operation in Chicago of the new pay-as-you-enter cars, placed in service for the first time in that city on the Cottage Grove Avenue line on Sunday, Nov. 24. Supplementing, as they do, the previous particulars of operation of this type of car in Montreal, as given in the STREET RAILWAY JOURNAL, they more than bear out the record for service previously established in Montreal, this despite the fact that the conditions in Chicago are much more severe. It is not meant by this that there are not difficulties still to be overcome in the operation of the cars. Rather is it to reiterate the statement made by President Mitten, of the Chicago City Railway Company, that the inauguration of the service was attended with even a greater measure of success than was anticipated, and that the drawbacks are not inherent, but remediable when the traveling public still further realizes the significance of the change.

The preparation by the company for the service has been reviewed in these columns. One feature of this work, however, deserves further consideration, because of its bearing on the success that attended the beginning of service. This was the effort made by the company thoroughly to acquaint the public with the workings of the system before putting the cars into operation. In this work a four-page illustrated circular was made to play an important part. This circular, distributed among the company's patrons, contained on the first page a picture of a complete car, on the second and third pages pictures of the rear platform empty, except for the conductor, and the rear platform with conductor effectually blocking the entrance and requesting passengers on the street to take the next car. On the fourth page was a floor diagram of the car showing, by means of arrows, the movement of passengers when entering or leaving cars, with the place distinctly marked on the front platform that is intended for smokers. There is also no dearth of signs on the cars, this means being taken advantage of especially to bring to the attention of patrons the desirability of having their fare ready when boarding the cars. Later, when the public becomes better acquainted with the operation of the cars it is proposed to limit the number of passengers to a car to eighty.



PAY-AS-YOU-ENTER CAR LOADING AT SIXTY-THIRD STREET AND COTTAGE GROVE AVENUE ON FIRST DAY OF OPERATION.

The Chicago press in general has made favorable comments both editorially and in the news columns. The "Union Leader," the official journal of the Chicago car men, declares itself as favorable to the cars, and commends the closed vestibule feature and the heaters for the benefit of the motorman and the conductor.



PAY-AS-YOU-ENTER CAR LOADING AT A TRANSFER POINT.

President Mitten reports increased returns from the Cottage Grove Avenue line since the cars were put into operation, but at present he is unable to determine to what the increase is due. It may be due, to some extent, at least, to curiosity. On the Wabash Avenue line the new cars are sandwiched in with those of the older type, but seem to load and unload at least as rapidly as the latter, if not more so.

Within the next sixty days the Indiana Avenue line, which parallels the Cottage Grove line, will be supplied with cars. There will then be a total of 300 pay-as-you-enter cars in operation in Chicago.

The Illinois Traction Company has announced a number of changes in its personnel. The office of assistant general superintendent, which has been filled by A. C. Murray, has been abolished, and Mr. Murray has been appointed assistant to General Manager L. E. Wischer, in charge of the executive office at Springfield. W. W. Street will continue at Staunton as superintendent of the Springfield & Northeastern and the St. Louis & Northeastern, as the southern lines are known. Mr. Street will appoint A. P. Monroe assistant superintendent. Master Mechanic F. T. Thomas will sever his connection with the company and will go to the Cleveland & Southwestern Traction Company, with headquarters at Elyria, Ohio. He will be succeeded by W. O. Plunkett, who was formerly in charge of the shops at Riverton, Ill. The auditing department will be concentrated at Champaign, and the branch offices abolished. L. A. Rodger, auditor for the southern division, has been assigned to the main office.

IMPORTANT ELECTRICAL CONSTRUCTION AT BUENOS AIRES

Buenos Aires, which was founded in 1535, had, in the year 1870, a population of some 180,000 inhabitants. To-day, according to official statistics, the population within the city limits exceeds 1,100,000. The rate of increase, due to natural causes and to emigration, amounts to doubling every thirteen years. In a period of five years, the increase is equivalent to the whole of the population of a large capital like Lima. After Paris, Buenos Aires is the largest Latin capital of the world, and by reason of its many fine buildings, its splendid avenues and parks, and the organization of its public services, lays a very strong claim to be called the "Paris" of South America.



CHAIAISTA STATION AND CEMETERY FROM EAST

Like most cities of relatively recent creation in the new hemisphere, Buenos Aires has had the advantage over older historical European cities, inasmuch as it has benefited, free of all experimental costs, by the latest improved inventions connected with public works. At the same time, however, it must be recognized that the citizens of the Argentine capital have been very much alive to the possibilities of modern engineering and modern business methods, and the marvelous progress of the city is due to their foresight and energy. One of the greatest difficulties has been the meeting of the constantly increasing requirements of the rapidly growing country, and capital for all kinds of public services.

An account was published in the Street Railway Journal for June 1, 1907, of the general tramway situation in Buenos Aires, but no attempt was made to describe in detail the system of any individual company. Nevertheless, many of them will bear study owing to the special conditions existing in Argentina. One of the most interesting is that of the Buenos Aires Lacroze Tramway Company, the only native Argentine tramway company in the city, and the only line running a high-speed suburban service on American lines, with private right of way and cars equipped for a maximum speed of fifty miles per hour.

This was originally organized by one of the pioneers of tramway traction in Buenos Aires, Federico Lacroze. The first line which he built he afterward sold to the Anglo-Argentine Company, and has been the nucleus of the very large system now operated by that company. He then organized the "Rural Tramways," and, in addition, extended his lines many miles into the country, at a time when the other companies did not realize the importance of possessing adequate suburban communication. The whole undertaking grew to a point when it became necessary to form two different systems, viz., the city tramway lines, now known under the name of the Buenos Aires



TERMINAL STATION OF THE LACROZE TRAMWAYS AT MEDRANO AND CORRIENTES STREETS, BUENOS AIRES

Lacroze Tramways, and a steam railway line 220 km in length, long known as the Tramway Rural à Vapor, but recently organized into a new company called Ferro Carril Central de Buenos Aires, Limitada.

One interesting point in connection with the original franchise was, that it was granted to the concessionaire under the obligation of the exclusive use of horse traction. The reason given by the authorities for this stipulation was, that it was necessary to develop the national industry of the country, which at that time depended almost entirely upon horse breeding. The tramway was extended by degrees under the old concession for a distance of upward of 100 miles into the country, and there can be no doubt that it holds the record for long distance horse railway, as well as the first tramway to run a sleeping car over its lines. At a later date the authorities recognized that, for the purpose of giving an efficient service, it was necessary to grant a permission to use mechanical traction, and steam locomotives were employed.

The development of the business of the Tramway Rural in the hands of Federico Lacroze, became, at his death, still more important in those of his active and energetic sons. Their first step was to enter into a contract, in the year 1905, with J. G. White & Company, of London, for the reconstruction and electrification of the old city lines, which were double track. The work was commenced in March, 1906, and before the end of that year the new power house, with a capacity of 2,250 kw, was in running order—an achievement which, considering the labor troubles and the port congestion, may well be considered a record for rapid construction. Part of the lines was opened formally to public traffic on March 10, 1907. The original lines consisted of 40 km of track, owned by the company, and 10 km held jointly with other companies and on lease. J. G. White & Company are now engaged in extending these lines a further 40 km, and for the purpose of serving these new lines, another 750-kw set is being added to the station.



GANG AT WORK TRANSPORTING EARTH FOR AN EMBANKMENT



THE LACROZE TRAMWAY COMPANY'S STATION AT CUYO AND MEDRANO STREETS, BUENOS AIRES

TRACK AND OVERHEAD EQUIPMENT

All the lines are standard gage and laid with 87-lb. rails. The first shipments of rails were 45 ft. in length, but on account of shipping difficulties, the length was reduced to 40 ft. The rails are laid on concrete stringers, 6 ins. in depth and 18 ins. in width. Tie-bars, placed at intervals of 3 ft. 9 ins., are used, with continuous joints. All the special work was supplied by Hadfield's Steel Foundry Company, Limited, and the United States Steel Products Export Company.

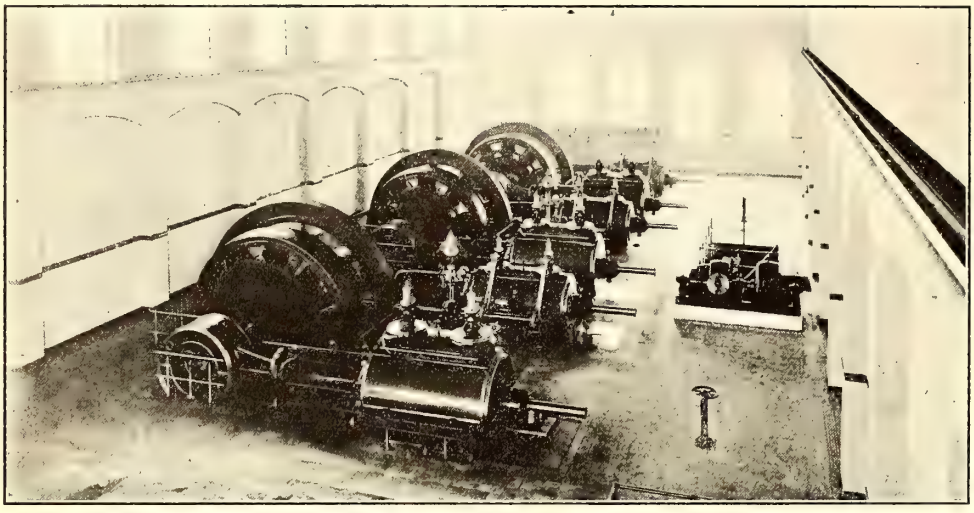
The overhead equipment consists of side poles with span wire construction, center poles, side-pole construction with bracket arms, and a few rosettes. The trolley wire is No. 00 B. & S.

POWER STATION

The power house is of brick, with an exterior plastering usual to the country. The buildings comprise an engine room, 58 m x 17 m; a boiler room, 40 m x 9½ m, and a coal storage of the same size. The brick chimney is 47.50 m in height.

The engine room contains three 1100-ihp horizontal cross-compound engines by Carels Fréres, Belgium, constructed after the Sulzer patent; these coupled to a 750-kw General Electric generator. The consumption of the engines averages 22 lbs. of steam per kw-hour, with a load factor approximately 40 per cent. Each engine has its

own condenser. The air pumps are of the Edwards type, independently driven by steam engines supplied by Allen & Company. Worthington centrifugals are used for circulating pumps, each capable of dealing with 1000 gals. per minute, and are driven direct by electric motors. The switchboard was supplied by the British Westinghouse Company. A Board of Trade panel is used with a 60-kw



INTERIOR OF POWER STATION OF THE LACROZE TRAMWAYS

negative booster of the Electric Construction Company's make. A 25-ton crane traverses the engine room.

The boiler room contains five marine type boilers by Babcock & Wilcox, fitted with their well-known superheaters, having a heating surface of 630 sq. ft. Each boiler is capable of evaporating 12,000 lbs. of water per hour, the grate area and heating surface being 49 sq. ft. and 2480 sq. ft. respectively. The three feed pumps installed are of the Worthington duplex type. A Wheeler feed-water heater and two cooling towers are used.



FOUR-MOTOR, DOUBLE TRUCK CAR FOR THE LACROZE TRAMWAYS

The feeders were supplied by Callender's Cable & Construction Company, and are paper insulated, lead covered, and are drawn into Sykes' stoneware conduits.

ROLLING STOCK

The rolling stock for city purposes will consist of 140 cars of the semi-convertible type, supplied by the J. G. Brill Company, and with seating accommodation for thirty-two persons. The interior fitting is mahogany; the exterior coloring is green and cream. Each car is equipped with two 40-hp motors supplied by the British Westinghouse Company. In addition to the city cars, there will be at first ten interurban cars, which will seat forty-four people, and will be fitted with four 50-hp motors.

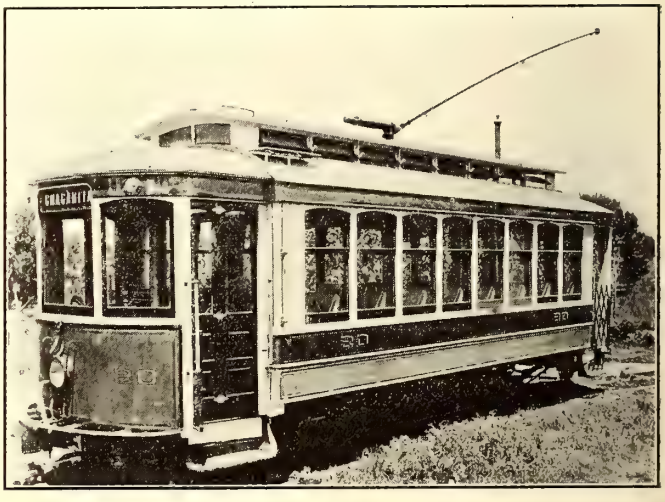
Electric locomotives will also be used for hauling freight trains. They are being supplied by Dick, Kerr & Company, and will be equipped with four 50-hp motors.

C. E. d'Ornellas acted as superintendent in charge of the above work for J. G. White & Company, Limited.

FERRO CARRIL CENTRAL DE BUENOS AIRES

This is the steam railway already mentioned, which extends westward and northwestward in the Province of Buenos Aires, a distance of 174 km, with one branch 44 km and another 3 km long. It traverses one of the most fertile districts in the Argentine.

The history of the railway is believed to be quite unique, in that it was constructed as an extension of an urban horse tramway from the surplus earnings of the latter, and was operated as a horse tramway for goods and passengers for a considerable distance in a then thinly settled country. Buenos Aires province is one of those regions where it is cheaper to build a railway than a good road. Construction proceeded as fast as earnings became available for that purpose. From 1885 to 1892, 144 km were built. By 1897 the present system of 221 km was entirely in opera-



STANDARD SINGLE TRUCK CAR FOR LACROZE TRAMWAYS

tion. The early type of construction was necessarily very economical, the rails weighed 30 lbs. to the yard, the sleepers were creosoted yellow pine 2 m long, and the bridges were supported by wooden stringers. Earthwork was avoided as much as possible, the track being laid practically upon the ground.

It became evident as early as 1891 that it would be necessary to introduce steam traction in order to cope with

the traffic. Accordingly, eight 16-ton saddle-tank engines were bought from the H. K. Porter Company, of Pittsburg, and the bridges were strengthened to receive them. With the earnings of these eight locomotives, supplemented in 1896 by three 18-ton passenger locomotives, the railway was rapidly developed, grades were reduced, rolling stock purchased, a handsome new passenger station built at the Buenos Aires terminus, and 97 km of track were relaid with 50-lb. rails. Other important improvements are being made.

Partly in connection with this general plan of reconstruction, partly as an outgrowth of the recent electrification of the Lacroze City Tramways, the company is equipping about 11 km of double track at its Buenos Aires terminal for a high-speed electric service, which will be operated by the Tramways Company. This engineering and construction work is also being done by J. G. White & Company, of London.

THE MILWAUKEE NORTHERN RAILWAY

On Monday, Oct. 28, the Milwaukee Northern Railway, one of the best constructed and efficiently operated lines in the West, sent the first cars over its tracks from the town of Cedarburg, 19 miles north of Milwaukee, into the city on a regular hourly schedule, and a few days later the entire road was in operation as far as Port Washington. This system, which has Milwaukee as its southern terminal, is designed to bring Port Washington, Sheboygan, Fond du Lac, West Bend and numerous other towns and villages into closer communication with the metropolis of the State; and the district thus thrown open to traffic, as shown in the accompanying map, is extensive, rich and populous. Milwaukee merchants, through the agency of the new road, are placed directly in touch with fully 100,000 people more than those whom they have heretofore supplied. In addition to the places above mentioned, constant and rapid communication is established between this large central market and the towns of Thiensville, Grafton, Cedar Grove, Barton, Kewaskum and Campbellsport, as well as the rural communities lying between and adjacent to them.

ROADBED AND CROSSINGS

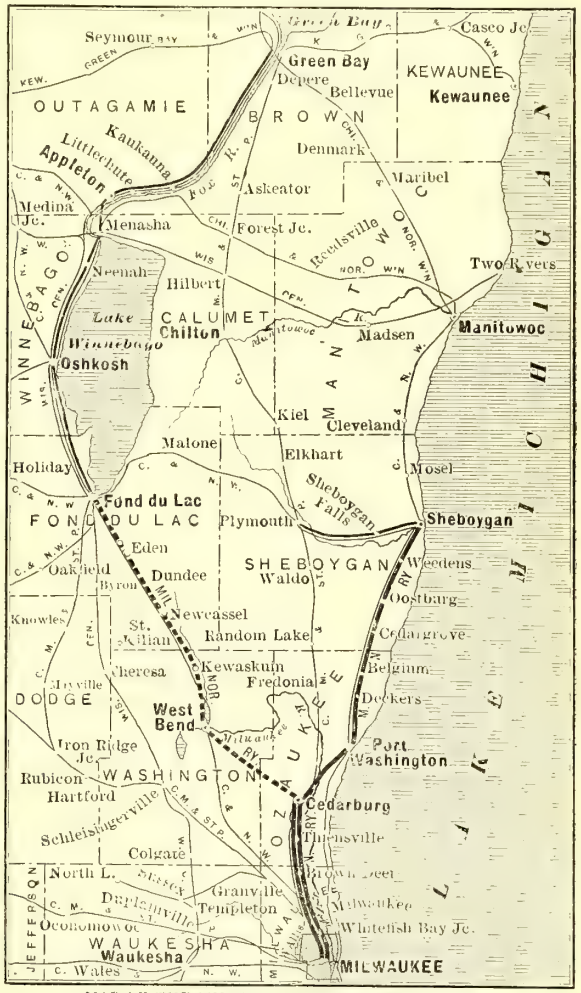
Except for the short distances in the centers of some of the larger towns, the Milwaukee Northern roadbed is located on its own right of way. The general absence of grade crossings and curves is a feature which goes far to insure safety from accident and to permit a high speed schedule. Where the right of way crosses the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railroad tracks, subways, steel bridges with masonry abutments, or viaducts are used. Just south of the depot at Port Washington the line runs under the Chicago & Northwestern Railroad, through a subway spanned by a steel and concrete bridge, and the same road is similarly crossed about a mile and a half from the Milwaukee city limits. A steel viaduct 765 ft. long has been built over the St. Paul tracks at Grafton and another 654 ft. long in the town of Mequon, about 4 miles south of Cedarburg.

TRACK AND ROADWAY

The total initial trackage is 30 miles, while the line still to be completed will have 112 miles of track. The right of way is 66 ft. wide, and, except in the limits of the towns along the route, is owned by the Milwaukee Northern Company. The type of rail used is A. S. C. E. 70-lb. T-rail outside of cities, and Pennsylvania Steel Company 7-in., 95-lb. T-rail in cities. The rail bonds are soldered in the web of the rail under the standard 6-hole angle bars, used to join the rails.

The roadbed is ballasted with gravel, using 3000 yds. per mile. Cedar ties are used on the straight-line construction and oak ties for the curves. Cedar poles, with side-arm construction, are used on the private right of way; and wrought-iron posts, with span construction, in the cities. Spans are 105 ft. long on straight line. The general plan of the overhead construction may be clearly seen in the accompanying illustrations. Outside of cities the maximum curve is 4 degs. and the maximum grade 3 per cent.

Telephone wires are also strung along the right of way and communication with stations can be opened directly



MAP OF THE MILWAUKEE NORTHERN RAILWAY AND TRIBUTARY COUNTRY

Scale of Miles

Milwaukee Northern Railway

Operating Interurban Railways

Street Railway Journal

ROUTE AND CONNECTIONS OF THE MILWAUKEE NORTHERN RAILWAY

from any car by means of pole and hook connection on the Stromberg-Carlson system.

POWER EQUIPMENT

The feature of the equipment of the Milwaukee Northern Railway which has attracted especial attention from the engineering public and users of power is the fact that the motive power of the road is furnished by gas-engine-driven electric generating units of a size heretofore unknown to the traction interests of this country.

The main power plant is at Port Washington, on the harbor front, where the handling of coal, unloaded directly from Lake Michigan steamers at the company's docks, is very economical and convenient. Two buildings comprise the power plant proper, one for the producers and one for

the engines, generators, switchboards and protective apparatus. Both structures are of concrete, steel and brick construction and placed approximately 50 ft. apart. The gas-supply main is run outside of and along the entire length of the power house from the producer plant.

GAS ENGINE GENERATING UNITS

The generating units are three in number, each of 1000 kw capacity, two of which are now installed; the third



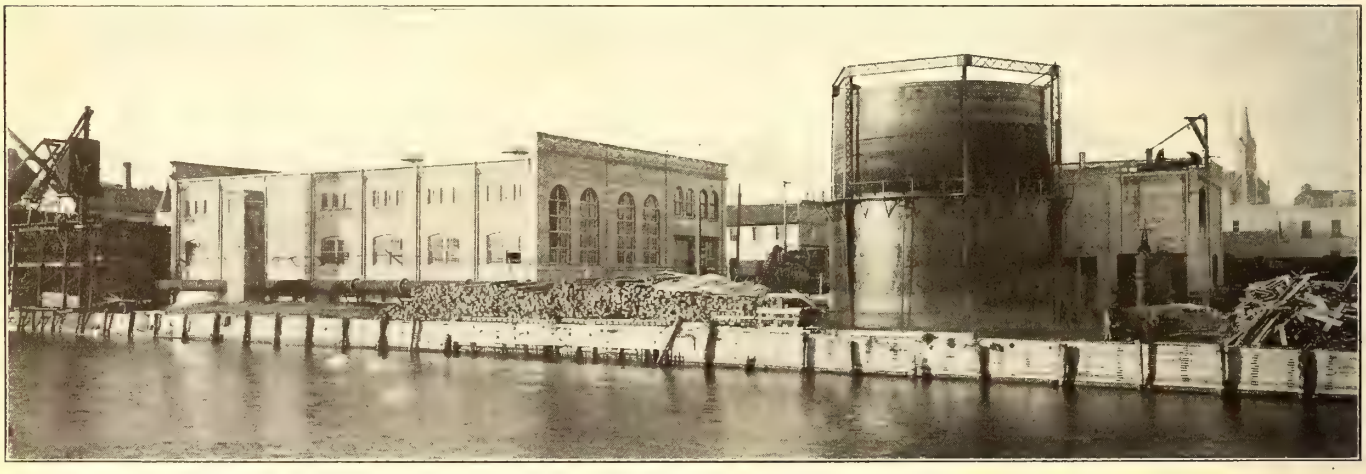
VIADUCT OVER THE CHICAGO, MILWAUKEE & ST. PAUL RAILWAY

will be set up shortly. Each unit consists of a twin tandem horizontal double-acting Allis-Chalmers gas engine direct connected to a 405-volt, 25-cycle, Allis-Chalmers alternator. Although the rating of each unit is given as 1000 kilowatts, both engine and generator were designed with large overload capacities, the engine being capable of developing upward of 2000 horse-power and the generator having a corresponding capacity. Each engine has four cylinders, 32 ins. in diameter by 42-in. stroke, and operates at 107 revolutions per minute.

The valve gear is of the engine-builder's standard cut-off type and the engine operates with constant compression, thus tending to insure smooth running under the highly variable loads to which it is subjected. The inlet gear is extremely simple, consisting of a main inlet valve of the single-beat poppet type, eccentric operated, thus insuring long life and quiet running. The mixture of the air and gas is thoroughly effected before entering the cylinder by an annular mixing chamber located under the main inlet bonnet; the design and operation of this device are such that, at the instant of closing of the main inlet valve, there is practically no explosive mixture left outside the cylinder. The gas valve is of the double-beat poppet type controlled by a variable lift rolling lever operated by a single link connection to the main inlet gear, the lift of the valve and consequently the amount of gas admitted and the time of admission being regulated by the governor. The exhaust gear is of the single beat poppet valve type, eccentric operated, and is in this respect a duplicate of the main inlet gear. A distinctive feature of this gas engine is the location of this exhaust bonnet with its valve at the bottom of the cylinder, where all the dirt is removed by the action of the exhaust gases; and the provision of a substantial jack to lower the entire exhaust mechanism out of place to allow inspection and regrinding of the valve, which also serves to swing the valve chamber, with the valve and its operating mechanism complete, out to one side, where it can be reached by the crane hoist. The removal of one pin, either in the inlet or exhaust mechanism, is all that is necessary to allow the removal of either the inlet or exhaust bonnets, with their valves and entire operating mechanism, without disturbing any adjustment whatever.

The igniters are electrically controlled and so arranged that the time of ignition may be regulated by a single hand wheel. Direct current at 60 volts is used in the ignition system. Duplicate igniters are provided at each end of the cylinder to insure prompt firing of low heat value gases and also to avoid shut downs due to short circuit.

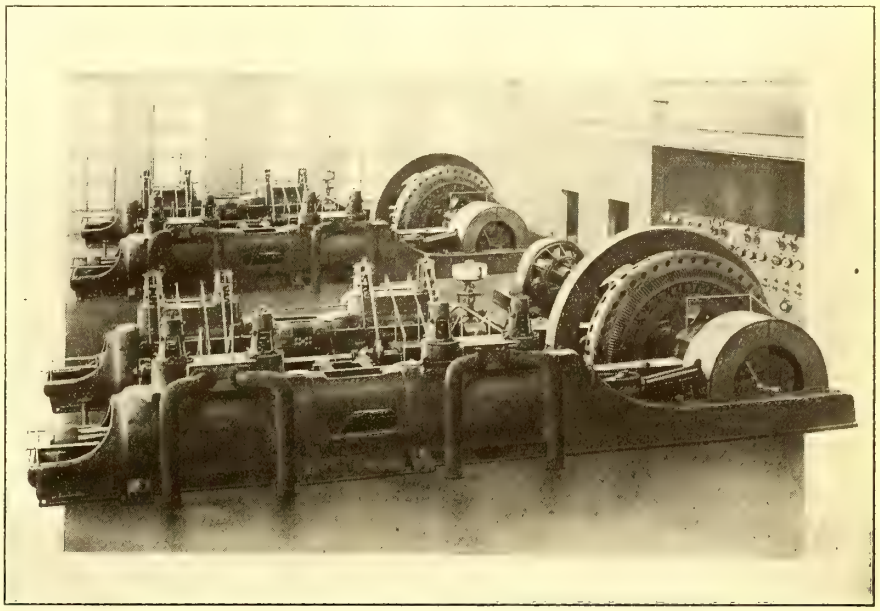
The air-starting device consists of a small poppet inlet air



POWER HOUSE AND GAS PRODUCER PLANT OF THE MILWAUKEE NORTHERN RAILWAY AT PORT WASHINGTON, WIS.

valve at each end of each cylinder, with a main distributing valve operated by the layshaft. Air is admitted to each cylinder in turn at what would be the explosion stroke. As the high compression carried prevents the engine from stopping on the dead center, this arrangement insures the prompt starting of even a tandem engine without the use of a barring gear. The Port Washington engines being twin tandem will, of course, start from any position.

The engines are said to be exceptionally heavy and rigid, the weight being concentrated in the frame cylinders and tie pieces in the direct line of the stresses to which an engine of this type is subjected. The engine frame illustrates the difference between American and European practice in gas-engine design. This frame is designed for a side crank in place of the double-throw crank, which is the standard practice abroad. The stresses transmitted to the frame in a side-crank gas engine are very great, but, even in the largest sized gas engines, they are no greater than this company has for many years successfully provided for in its steam-engine practice. This is contrary to popular belief, but the stresses cared for in the engines operating the New York Subway, for example, are as great as any that the gas engine is ordinarily called upon to sustain.



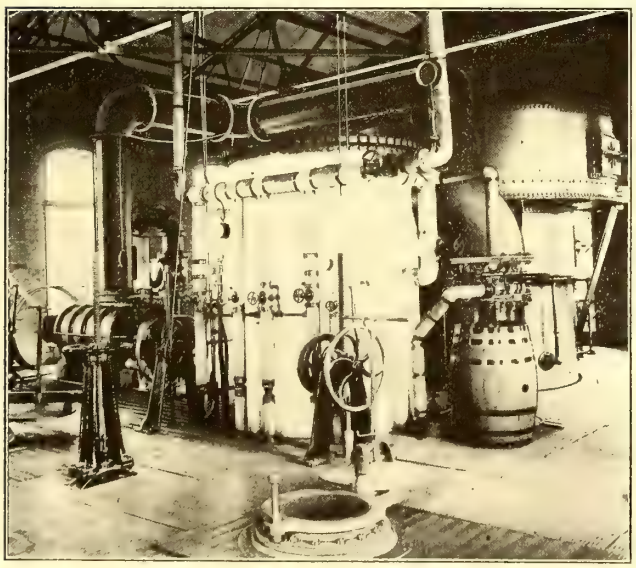
INTERIOR OF POWER STATION, SHOWING THE GAS ENGINES, MAIN GENERATORS, ONE OF THE EXCITERS, ETC.

The jaw, which is subjected to a peculiarly severe stress, is made in a form to insure maximum strength of the casting, and is further strengthened by two steel tie bolts carried above the shaft, which are made of sufficient size to carry their proportion of the load without appreciable elongation. This construction eliminates entirely any bending stresses in the frame at this point.

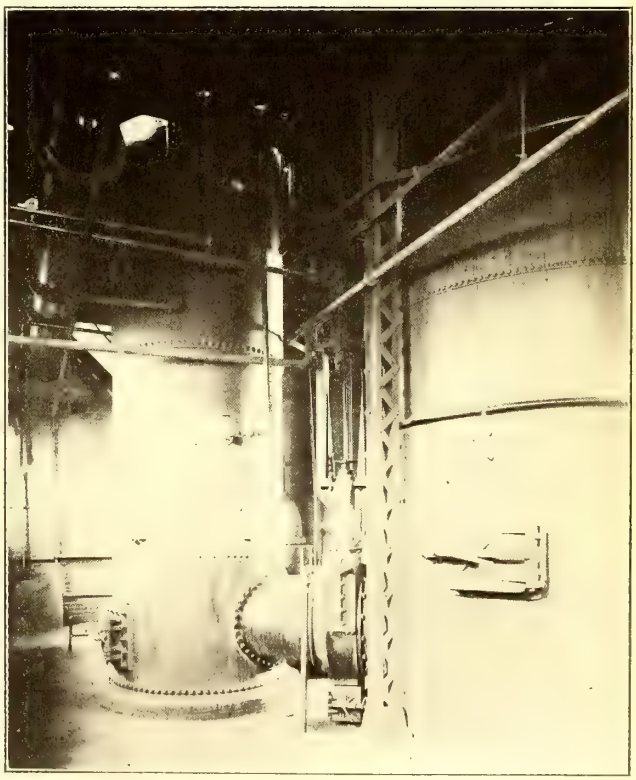
The load at the present time is extremely variable, swinging from less than one-half to 50 per cent overload, with momentary peaks greatly in excess of this. It is only by a study of the switchboard instruments, however, that this is apparent, as the engine is said to handle the maximum overloads as quietly and with the same freedom from vibration that characterizes its operation under normal conditions. To the observer there is no outward indication of the magnitude of the forces at work. The engine turns its centers as quietly as a slow-running Corliss engine, and is as indifferent to the rapid changes in load, impressing one with the tremendous reserve power possessed by each unit.

All wearing surfaces, including the main bearings, slides, crank and cross-head pins, are arranged for a continuous oiling system and the cylinders are lubricated by carefully timed admission of the cylinder oil, Richardson sightfeed oil pumps being used.

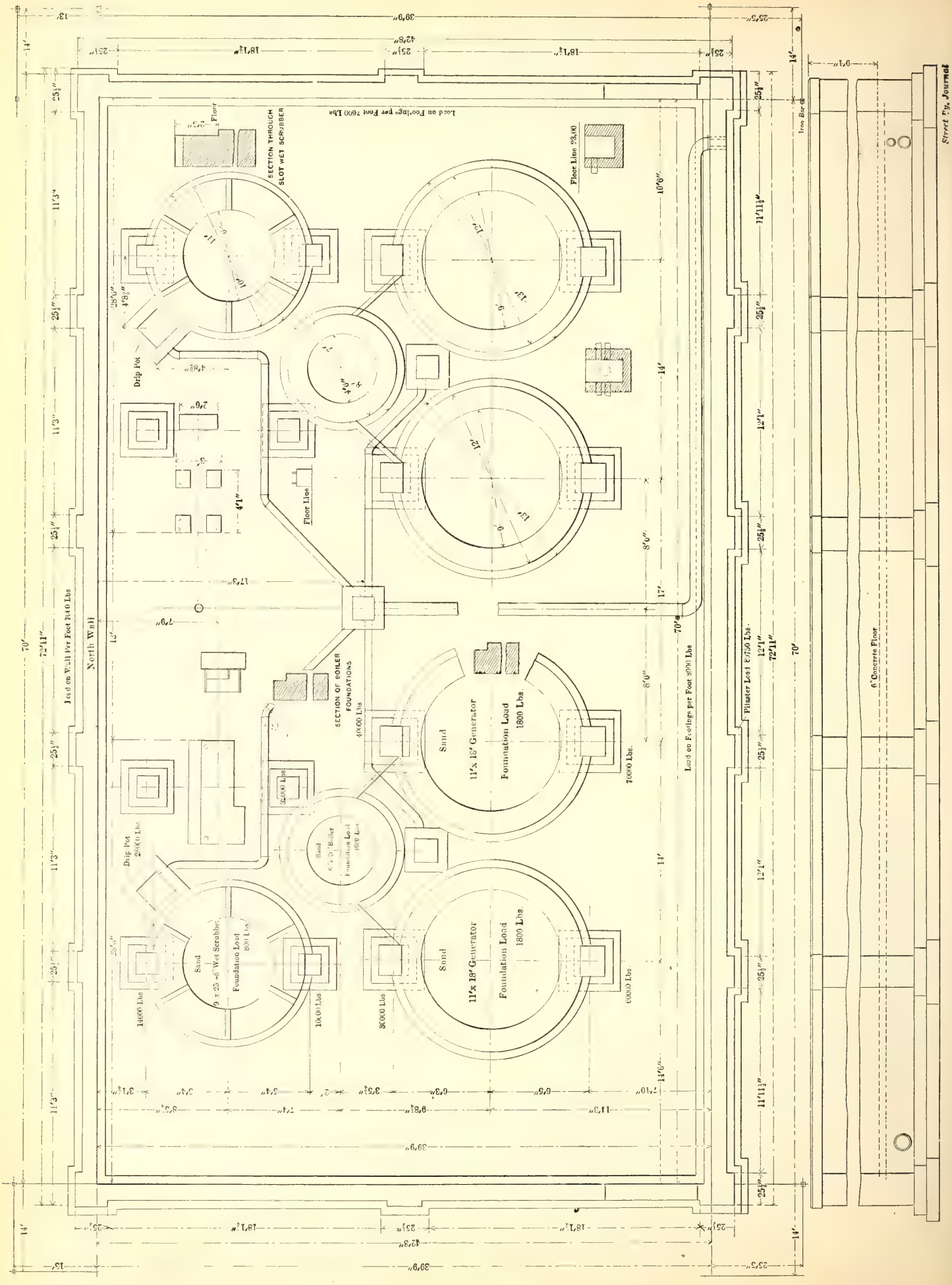
The water cooling system includes ample provision for cooling the cylinder walls, cylinder heads, pistons, piston



OPERATING FLOOR OF PRODUCER PLANT



GENERATOR ROOM OF PRODUCER PLANT



GENERAL PLAN AND METHOD OF CARRYING FOUNDATIONS IN THE PRODUCER SECTION OF THE MILWAUKEE NORTHERN RAILWAY'S POWER PLANT

rods, exhaust valves and exhaust bonnets. Water is circulated by means of two Morris and two Deming pumps, each driven by an Allis-Chalmers induction motor.

PRODUCER GAS SUPPLY

The gas for the engines is furnished by producers operating on the well-known Loomis-Pettibone system. The present installation comprises two generating units, each consisting of a pair of gas producers connected to a common economizer, wet scrubber and exhaust. The gas is delivered into a holder of 30,000 cu. ft. capacity. The normal rating of the present plant is 4000 hp, and it has a capacity of 25 per cent overload for five hours.

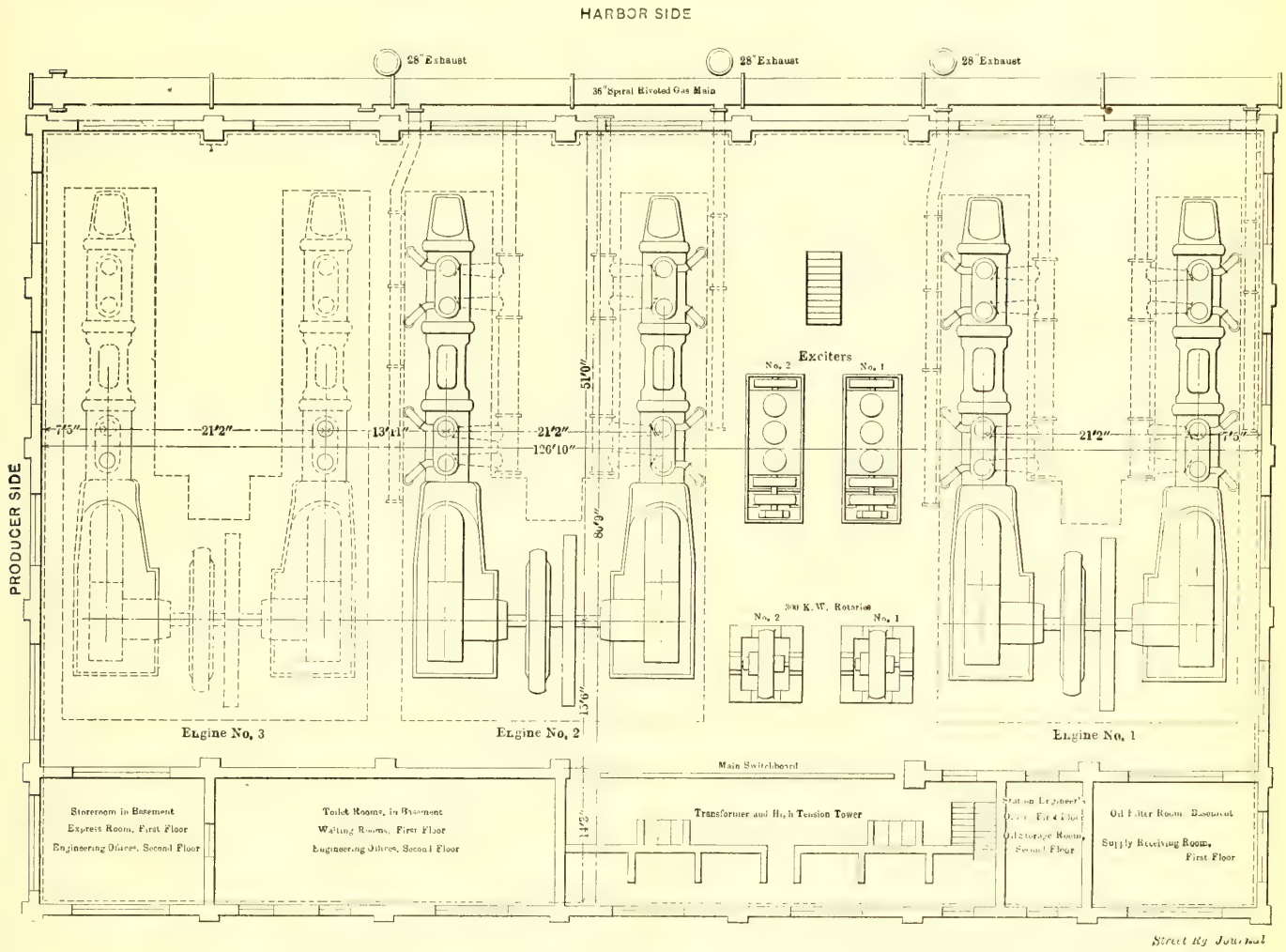
The brick building containing the apparatus is divided into a basement 19 ft. deep and a single story about 14 ft. high to the eaves. The operating or charging floor is about 6 ft. above the level of the ground outside the building. A coal tank 50 ft. long is on the operating floor, with openings in front of the charging doors of the gas producers, thus bringing the fuel to points convenient to the man operating the gas plant. Hocking Valley bituminous slack coal, containing about 11,500 British thermal units per pound, is the fuel ordinarily used.

The plant is operated on the down-draft principle, the air being admitted through the charging door at the top of each producer, the necessary suction being caused by an exhauster located beyond the wet scrubber. By this method the volatile matter and distillates are drawn through the deep bed of incandescent fuel and gasified, thus avoiding any tar extracting machinery, and enabling the system to produce gas obtaining 80 per cent of the heat units possessed by the fuel used. Reverse runs of steam, generated by the gas passing through the economizer, or waste heat boiler, are occasionally made for the purpose of breaking up the fuel bed. The water gas made by this process mixes with the producer gas in the holder and slightly enriches it. The average calorific value of the gas as delivered from the holder is 125 B. T. U. per cu. ft. The gas mains leading to the engines are equipped with Ludlow valves.

ELECTRICAL FEATURES OF THE POWER STATION

The electrical features of the equipment may be briefly described as follows: Three-phase current is generated in the power house at 405 volts and 60 cycles by direct-coupled alternating-current generators, each of 1000-kw normal capacity. These machines are of a special type developed for use with its gas engines by the Allis-Chalmers Company.

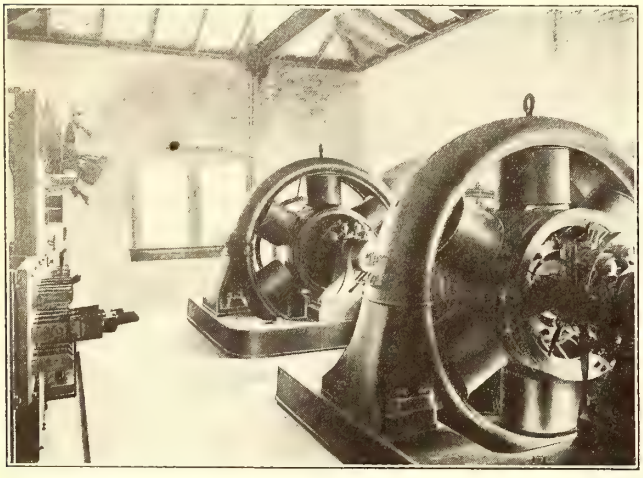
The laminated stator core is held in a heavy box yoke, designed to allow full circulation of air around all parts. The core punchings are held in place by means of dovetails, and the armature windings are placed in open slots in the inner poriphery of the stator core. The coils are held firmly in place by wedges and, on account of the open-slot construction, can be readily replaced in case of damage. The field poles are mounted on a cast-iron spider, and so arranged that they can be removed; the exciting coils are of copper, strip-wound edge. The revolving fields are of special construction. The field poles are of solid cast steel, and are bolted to a heavy cast-iron spider; they can, therefore, be readily removed in case it is necessary



PLAN OF ENGINE SECTION OF THE MILWAUKEE NORTHERN RAILWAY'S POWER HOUSE

to get at a field coil. The field windings are held in place partly by the projecting pole tips and partly by brass rings running completely around the rotor on each side and fastened to the tip of the poles by long brass screws. This construction, combined with the solid poles, gives a large damping effect, prevents hunting, and aids in securing parallel operation.

These generators will deliver their rated output of 1000 kw continuously at 90 per cent power factor with a rise in temperature not exceeding 35 deg. C.; 50 per cent greater current for two hours following a full-load run, with a temperature rise not exceeding 50 deg. C. Current for excitation is furnished by two 50-kw, 120-volt, d. c.



TWO 400-KW ROTARIES IN THE CEDARBURG SUB-STATION

generators driven by vertical gas engines. These do not appear in the engraving of the station interior, being temporarily in a different position from that shown by the plan.

The current from the main generators is delivered to a six-panel switchboard, having three generators, one exciter and two transformer panels, which contain all the necessary switches, circuit-breakers, and instruments for properly handling and regulating the equipment.

From the switchboard the current is carried to the step-up transformers and also to the rotary transformer switchboard. There are seven step-up transformers of 500-kw capacity each, arranged in two banks of three each, with one held as a reserve. These transformers raise the voltage from 405 volts to a maximum of 22,000 volts, with intermediate tap to allow the voltage to be varied if desired. The current is carried from each bank of transformers to the high-tension bus through three oil switches of 40 amp. capacity each in each circuit; in addition to plug switches at each transformer to allow for speedily cutting out any transformer in case of break-down. From the high-tension bus three transmission lines are led away, each with automatic oil circuit-breakers of 40 amp. capacity in circuit. The station apparatus is protected from lightning by an equipment of low equivalent lightning arresters and oil-immersed choke coils connected to the high-tension bus.

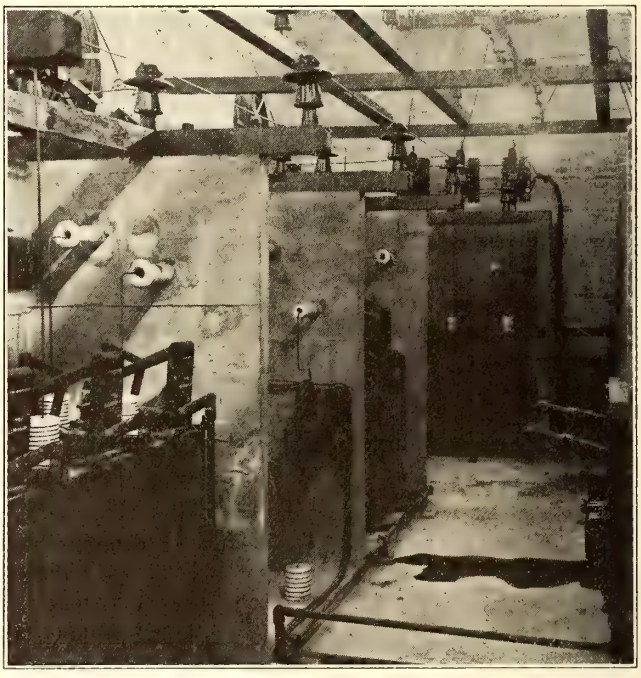
For supplying nearby portions of the line, two 300-kw rotary converters are provided in the main station. These have six poles and run at 500 r. p. m., taking three-phase alternating current at 405 volts and delivering direct current at 650 volts. The converters are connected to a six-panel switchboard having two alternating-current rotary panels, two direct-current rotary panels and two direct-current feeder panels with two feeder circuits, which contain all necessary switches, circuit-breaker, and instruments for handling and regulating the current and apparatus. The converters are protected from lightning by arresters on each feeder circuit.

SUB-STATIONS

There are eight sub-stations, located at the following points along the right of way: Burleigh, Cedarburg, Georgia Avenue, Marblehead, Brown Deer, Cedar Grove, West Bend and Campbellsport, two of which have each two 400-kw, 650-volt, rotary converters and six 125-kw, 22,000/405-volt, step-down, oil-cooled static transformers. The remaining six sub-stations each have two 300-kw, 650-volt, rotary converters and six 100-kw, 22,000/405-volt, step-down, oil-cooled static transformers of the same company's build.

Each sub-station is protected against lightning by three 22,000-volt, low-equivalent lightning arresters and auxiliary apparatus; each sub-station has an eight-panel switchboard, having two alternating-current rotary panels, two alternating-current starting panels, two direct-current rotary panels and two feeder panels except in the Cedarburg sub-station, where there are three feeder panels.

All sub-stations have 22,000-volt, 20-ampere automatic oil breakers on outgoing transmission lines and on the transformer circuits, except at Cedarburg, which has 40-ampere breakers on outgoing transmission lines. The Cedarburg sub-station has also 22,000-volt, 40-ampere oil switches on the incoming transmission lines and three 2000-



HIGH-TENSION SWITCHES IN THE CEDARBURG SUB-STATION

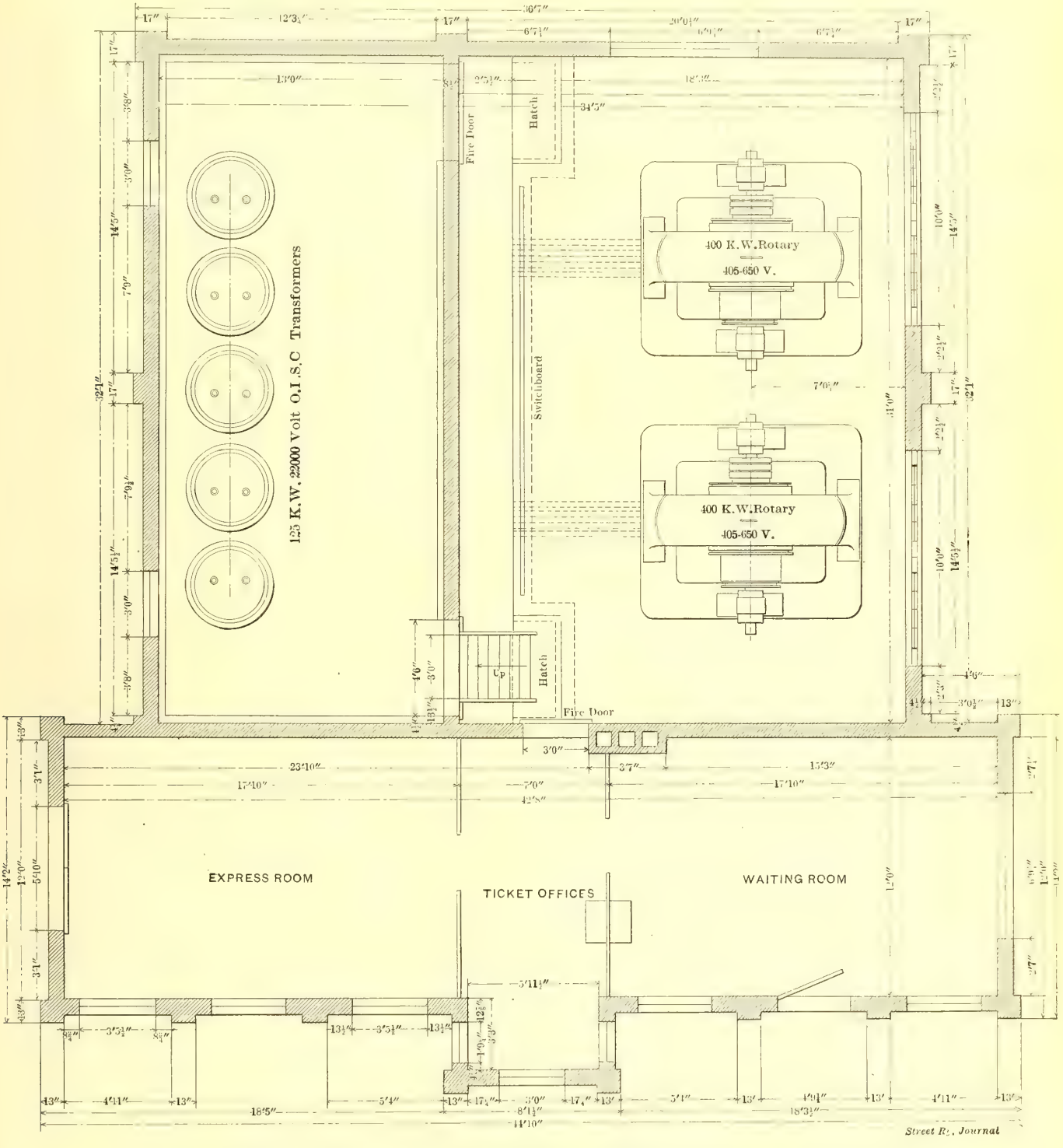
volt, 20-ampere automatic oil circuit breakers in the high-tension equalizing bus. The low-tension cables are triple-braided, weather-proof wire, supported on insulators, the insulated covering being relied upon only for protection from accidental contact and as a spacer. All high-tension wires are bare mounted on suitable insulators.

ROLLING STOCK

The present rolling stock consists of eight heavy inter-urban cars of the type known as the semi-empire Pullman, built by the Niles Car Manufacturing Company, of Niles, Ohio. They are handsomely upholstered, commodious and fitted with every means of comfort and convenience, including toilet room, electric heaters, overhead bundle racks,

coat hooks and lights of high candle-power. These cars, which have seating accommodation for fifty-two passengers, are 50 ft. 4 ins. in length and 8 ft. 10 ins. in width over all. Cars weigh, including trucks and motors, 70,000 lbs., and there are two 75-hp motors on each truck. The wheel base is 6 ft. 8½ ins. The schedule speed is 25 miles per hour, including stops, with a possible maximum speed of 54 miles per hour. The wheels are 36 ins. diameter. The cars are equipped with straight air-brake equipments manufactured by the Allis-Chalmers Company including the latter's new style "OB" pneumatic governor and type "J" emergency valve. At the forward end of each car is a spacious smoking compartment, and, partitioned off from this, directly behind the motorman, there has been left a space for trunks and express packages. On each station platform may be seen a light Fairbanks-Morse truck for handling freight and baggage.

The cars used in the local service within the city limits of Milwaukee are duplicates of the ones used in the city of Detroit, with open rear platforms divided by a railing. These cars are equipped with 40-hp motors. The cars are 41 ft. long and 8 ft. 5 ins. wide, and have rattan seats placed crosswise. They are single-ended, with the motorman's vestibule entirely segregated from the platform. Each of these cars is equipped with Allis-Chalmers air brakes. There are eight of these cars provided. The regu-



PLAN OF COMBINED ROTARY CONVERTER STATION, PASSENGER OFFICE AND EXPRESS ROOM

lar service will call for four in operation, maintaining a 15-minute headway. Schedule speed within the city of Milwaukee will be about ten miles per hour.

SCHEDULES

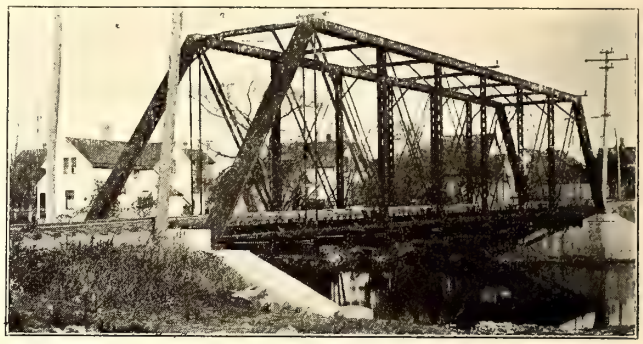
The present schedule to Cedarburg includes sixteen trips, made hourly during the day, beginning at 6 a. m. from Cedarburg into Milwaukee, and ending with the last trip at 11:25 p. m. out from the city. The line over the remaining 10 miles to Port Washington is also now in operation, cars running every hour, and the line to Sheboygan is expected to be completed by April, 1908.



ONE OF THE EIGHT SUB-STATIONS ON THE MILWAUKEE NORTHERN RAILWAY

Mileage is offered in a series of 1000, 500 and 100-mile books, fixing the minimum fee at 1.3 cents per mile for the 1000-mile books. The highest charge made is a cash fare of 2 cents per mile, and cash fare receipts are redeemable at any ticket office for 10 per cent of their value, if presented in 5-cent units. Depots are provided at all of the chief towns on the right of way in connection with substations, built of brick, steel and concrete. Shelters will be provided at all highway crossings from which cars can be signaled, and these highways are numbered consecutively and plainly indicated by sign posts. The company has provided car houses and repair shops at Cedarburg, substantially built of brick and steel, the equipment of which is thoroughly modern. Additional car sheds are now being erected in the city of Milwaukee for rolling stock used in light service on the lines of this company.

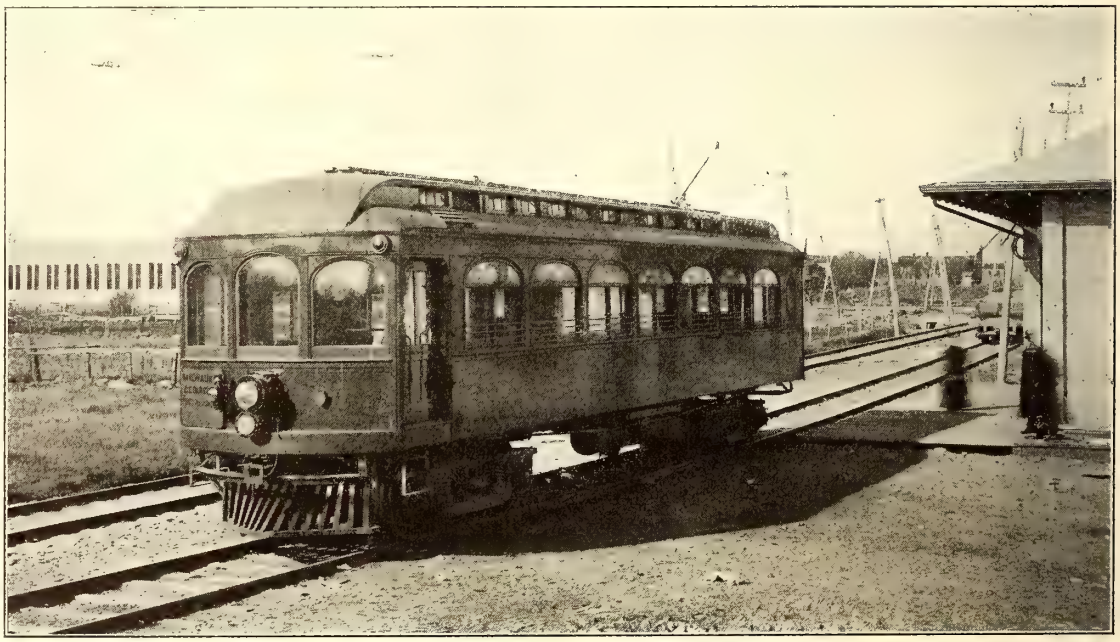
One of the provisions in the franchise granted by the city of Milwaukee to the Milwaukee Northern Railway stipulates that 3-cent fares shall be granted within the city limits of Milwaukee on the city cars. It is provided, however, that a cash fare on both city and interurban cars shall be 5 cents, and that the company shall sell strips of tickets, eight coupons to the strip, for 25 cents, good only on the local city cars, making the cost of each ride 3⅛ cents. These tickets are being sold by the company at its stations, as well as by conductors on the cars. While the franchise makes this stipulation only for transportation within the city limits of Milwaukee, the company has taken an unusual step in extending the privilege granted by this low rate. The run of the city cars includes about a mile outside of the city limits, and the company will accept these 3-cent tickets, good over the entire run of its city cars, a distance of 4.3 miles.



BRIDGE OVER THE MILWAUKEE RIVER AT CEDARBURG

ENGINEERS AND CONTRACTORS

Comstock-Haigh-Walker Company of Detroit, engineers and contractors, have had complete charge of the design and building of the system under the direct supervision of F. W. Walker as engineer. The following officials are also active in the operation of the road: W. A. Comstock, president; Henry A. Haigh, treasurer; Ernest Gonzenbach, general manager, and H. J. Pagel, operating superintendent. To each of these officials credit is due for the successful completion of the line and its present efficiency.



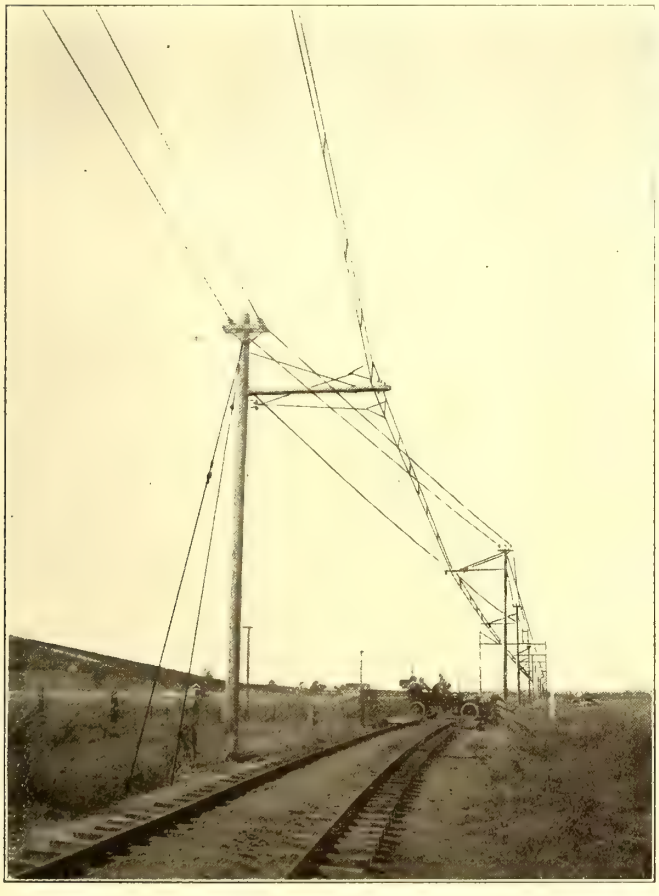
STANDARD INTERURBAN CAR OF THE MILWAUKEE NORTHE RN RAILWAY LEAVING A STATION

As will be seen from the foregoing, the greater part of the road's equipment, including all of its power and electrical machinery, was purchased either in Milwaukee or along the right of way, rendering the Milwaukee-Northern distinctively a "home-made" system. Auxiliary apparatus includes the coal-handling plant furnished by the Industrial Works, Bay City, Mich.; cranes in the power-

house and car-repair shops built by the Whiting Foundry Equipment Company, Harvey, Ill.; oil filters from the factory of Van Dyck-Churchill Company, New York City; trucks built by the American Locomotive Company, Schenectady, N. Y., and the New York Car & Truck Company, Kingston, N. Y.; sweepers furnished by McGuire-Cummings Company, Chicago; shop machinery from the Niles-Bement-Pond Company, New York City; overhead material, J. M. friction tape and Noark enclosed fuses supplied by the H. W. Johns-Manville Company, of New York.

OVERHEAD CONSTRUCTION ON A FIFTEEN-CYCLE SINGLE-PHASE RAILWAY IN CALIFORNIA

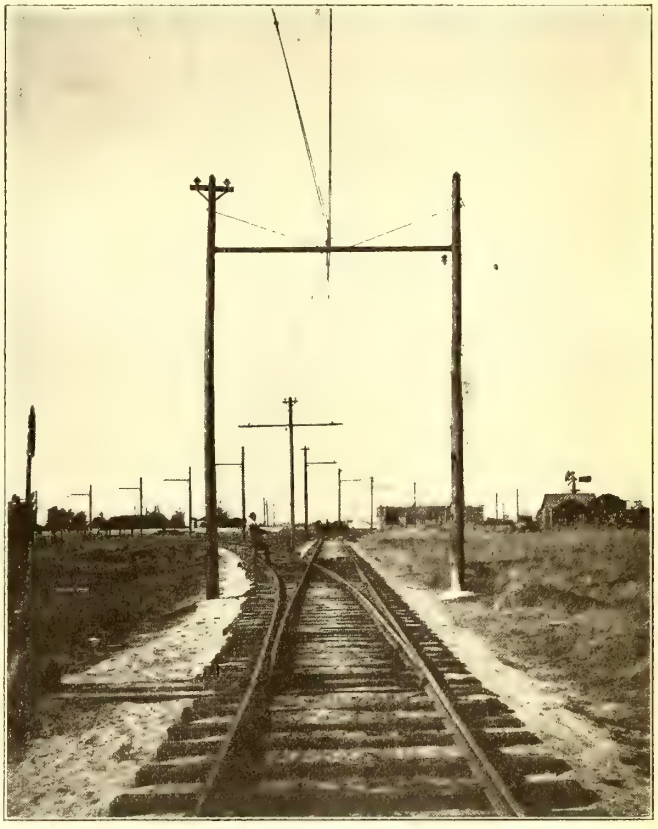
A new departure in single-phase railway operation is presented by the new line between Visalia and Lemon Cove, Cal. This is a subsidiary line of the Southern Pacific Railway Company, and is notable from the fact that it is the first application in this country of 15-cycle alternating current to railway work. The undertaking involved the electrification of 10 miles of steam road, in addition to the new construction, making in all some 23 miles of track. Catenary overhead construction is employed throughout, the current being collected by means of a pantograph trolley. The overhead material for this line was furnished by the Ohio Brass Company, and the accompanying engravings show a number of the interesting features of the work.



CURVE CONSTRUCTION, SHOWING BRIDLE PULL-OVER ON FIRST POLE AND STEADY BRACKET ON SECOND POLE.

On the main line the poles are of peeled redwood 36 ft. long, with 14-in. base and 7-in. top. They are imbedded in concrete to a depth of 6 ft. The poles are spaced 120 ft. apart on tangents and on curves of less than 4 degs. On curves not sharper than 6 degs. the spacing is 100 ft., and this is cut down to 60 ft. on curves up to 18 degs.

The messenger wire is 7/16 in. high-strength steel, extra galvanized, and is strung with a sag of approximately 11 ins. in the 120-ft. spans, the distance between messenger and trolley at the bracket being 17 ins. Ohio Brass standard catenary suspensions are used throughout, being spaced 10 ft. apart. This suspension consists of a ½-in. rod carrying at the lower end a three-screw Detroit clamp, and at the upper end a double-hook messenger clip. When in position the suspension rod is threaded through the messenger clip boss, the end of the rod firmly engaging the messenger and locking the suspension in place.

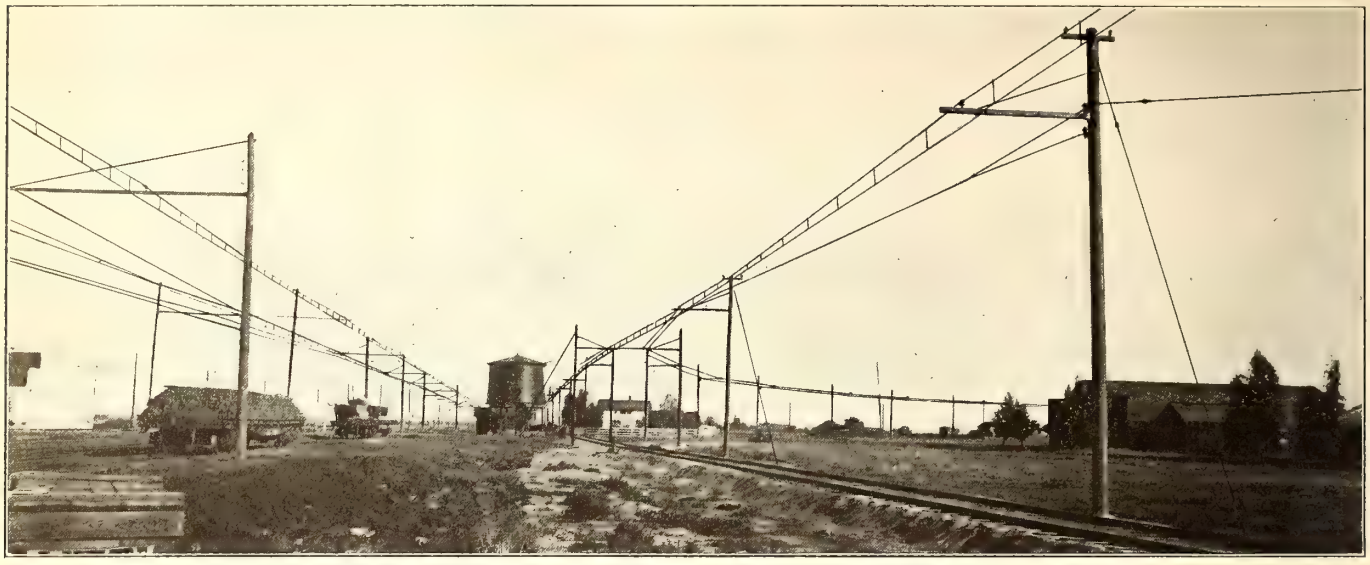


SPECIAL CONSTRUCTION AT BRANCH IN LINE, SHOWING DOUBLE-POLE BRACKET AND BRIDLE PULL-OVERS.

Brackets are made up with a 4 in. x 4 in. x 10 ft. Oregon pine arm attached to the pole by a malleable casting, a ⅝-in. rod serving to support the outer end. The messenger is carried on top of the arm on a porcelain cable insulator. At intervals of about 120 ft. a steady bracket is installed to prevent swinging of the trolley. This bracket differs from the standard type in that the messenger is carried below the arm on a strand supported from two skirted insulators, the trolley wire being steadied from the same insulators.

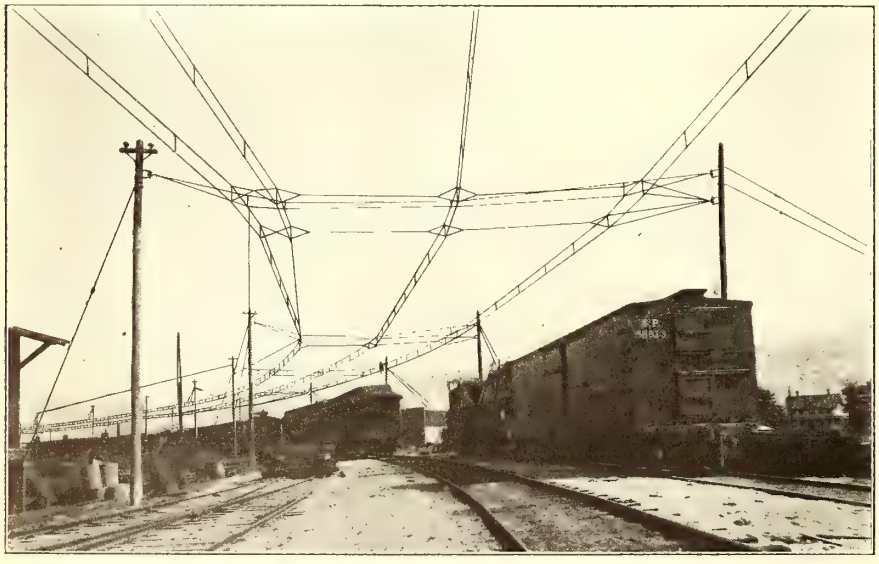
At curves both the trolley wire and messenger wire are pulled over by bridle guys extending from the nearest trolley suspension on each side of the bracket to a porcelain strain insulator fastened to the pole by ⅝ in. x 15½ in. eyebolts. This construction is shown at the nearest bracket in one of the accompanying engravings. The insulators are of the skirted type, 10,000 volts working capacity. They are 5¾ ins. in diameter and 6 ins. in height. Strain pins used in connection with these insulators are of cold-rolled machine steel, and are provided with flexible fiber sleeves which act as a cushion between the pin and the porcelain insulator.

Bracket construction is used on both the single and double track sections. There are, however, certain sections with three and four tracks, where the overhead work is carried on cross spans. These spans, as shown in the illustrations, are supported from skirted type porcelain strain insulators which are mounted on steel tubing pins and are attached to the poles with heavy eyebolts, similar to those used on curve pull-overs. A test of one of these spans, covering four tracks, showed that a tension stress of 2400 lbs. was developed in the span wire.



VIEW SHOWING BRACKET AND CURVE CONSTRUCTION

The poles are guyed by means of 7/16 galvanized steel wire strand, the lower end of which is secured to a ½ in. x 6 ft. anchor rod. A 12 in. x 12 in. x ½ in. steel anchor plate is used in combination with the anchor rod, the rod being buried for practically its entire length. At certain points where the ground is soft these anchor plates were imbedded in concrete. Within the city limits of Visalia an ordinance prevents the use of guys, and it was, therefore, necessary to erect steel poles of sufficient strength to be self-sustaining. Throughout the line, ample insulation has been provided to insure successful operation at 3300 volts, which is the trolley potential. Originally the road was bonded with beveled terminal foot bonds which have since been reinforced by Ohio Brass Company 34-in. "all wire" cable bonds installed around the joint plates. Westinghouse 15 cycle a. c. motors will be used on the cars.



CROSS-SPAN SUSPENSION FOR THREE TRACKS

Local conditions presented a number of complex problems, but James H. Crosett, superintendent of the Visalia Electric Railway, has solved them all very successfully.

CHANGES IN THE PERSONNEL OF THE LEXINGTON & INTERURBAN COMPANY

At the meeting of the board of directors of the Lexington & Interurban Railway Company, held last week, a number of changes in the operating and executive staff was announced. Louis Des Cognets resigned as vice-president to give his attention to private interests, and John Blair Macafee, representing Chandler Bros. & Company, of Philadelphia and New York, was chosen to succeed him and to have charge of the operation of the company's lines. Mr. Des Cognets will remain on the board of directors. Robert T. Gunn, who has accepted a position with the Fort Wayne & Wabash Valley Railway, presented his resignation as general manager. J. B. Crawford, until recently superintendent of transportation of the Fort Wayne & Wabash Valley, was chosen to fill the place vacated by Mr. Gunn. O. R. Bilbrow, for some time with the Central Mississippi Railway, was chosen auditor. While the financial condition of the company and its operation were found satisfactory, the executive officers, following the general idea of retrenchment, are said to have agreed to waive their salaries for the present. No further construction work will be considered at this time, but the service to Frankfort will be increased, and the running time of the cars decreased in order to take better care of the growing business.

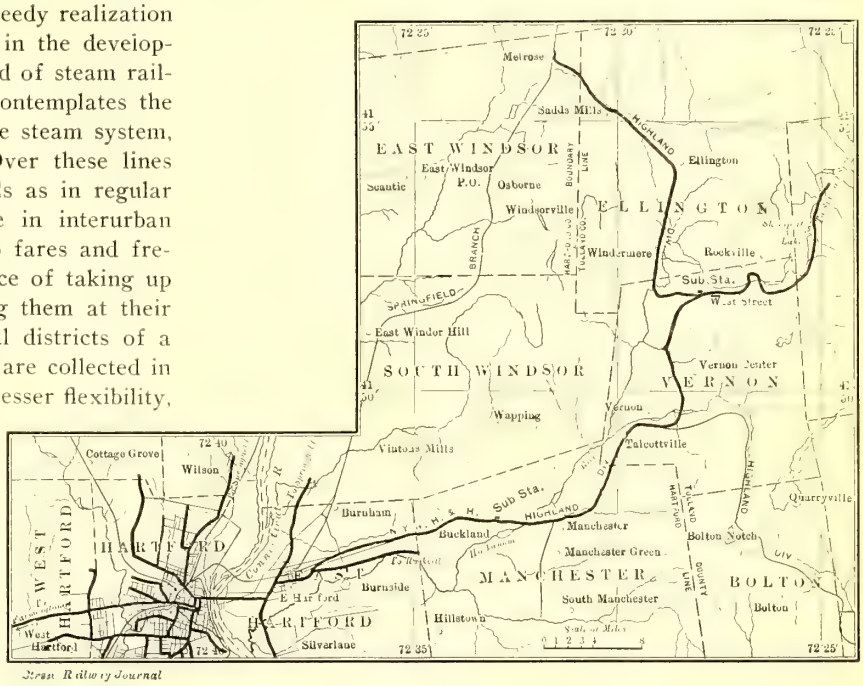
The new school for instruction which has been instituted under the auspices of the Utica & Mohawk Valley Railway Company at the Utica & Mohawk Valley Railway Employees' Association rooms promises to be very successful.

THE HARTFORD, VERNON AND MELROSE ELECTRIFICATION

The plans for handling local, suburban and interurban traffic centering at Hartford now in process of development by the New Haven interests indicate the speedy realization of a new stage of the highest importance in the development both of more efficient local transit, and of steam railroad electrification. The general scheme contemplates the electrification of various branch lines of the steam system, together with parts of the main lines. Over these lines single cars will be run at frequent intervals as in regular interurban practice. The great advantage in interurban practice has been the combination of cheap fares and frequent service with the increased convenience of taking up passengers near their homes and delivering them at their destinations in the shopping and residential districts of a city. Correspondingly, outward passengers are collected in the same way. The steam lines with their lesser flexibility, have been heavily handiccaped in meeting such competition.

In the work at Hartford, the desired flexibility is to be secured by electrification. Instead of terminating their routes at the local steam railroad station, cars will leave the steam tracks at a convenient point and enter upon the city streets, taking their passengers directly into the heart of the shopping section and transferring to the local lines to all parts of the city. The unified electric system contering at Hartford will include various interurban lines that have been acquired, and will extend to Springfield on both sides of the Connecticut River. The promise that the importance of Hartford as a shopping and business center will be greatly increased by these new transit facilities can hardly fail to be realized, and an admirable aspect of the plan is the economy effected by utilizing existing steam car tracks for interurban traffic, thus saving the construction of expensive parallel lines that easily and inexpensively can be met by the simple expedient of connecting with the local trolley tracks. Much the same plan is now in service on the West Shore lines between Utica and Syracuse, as described in the Oct. 12 issue of the STREET RAILWAY JOURNAL.

The Hartford, Vernon & Melrose electrification is the latest step taken in the carrying out of the foregoing policy. This



Street Railway Journal

MAP SHOWING THE HARTFORD, VERNON & MELROSE ELECTRIFICATION OF THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD SYSTEM



DOUBLE TRACK CURVE SPAN CONSTRUCTION

work is being done by the Connecticut Company under the general direction of Vice-President E. H. McHenry, of the New York, New Haven & Hartford Railroad, and the line is nearly ready for service. The route begins in Hartford and follows the tracks of the Hartford Street Railway Company for 2.5 miles to East Burnside. At this point the cars will be deflected to the steam railroad right of way connecting Hartford, Manchester and Willimantic, and forming a part of the New Haven Company's Poughkeepsie Bridge to Boston line. From East Burnside the cars will be operated on steam railroad rules through Buckland, Manchester and Talcottville to Vernon Jc., a distance of about 10 miles. At Vernon Jc. the line swings to the north and passes to Rockville and Melrose over a single-track branch 13 miles long. Electrification is under way on the 10 miles of double-track line between East Burnside and Vernon Jc., and on the single-track branch to Melrose. The city of Manchester, population 10,000, is served by the double-track route, and is located 6 miles east of East Burnside. Rockville, population 8000, is located on the branch 4.5 miles north of Vernon Jc.



TYPICAL CATENARY CONSTRUCTION IN TOWNS

Power is at present supplied to the line from the Commerce Street plant of the Hartford Electric Light Company through an 11,000-volt three-phase transmission line composed of two No. 4 circuits which deliver current to sub-stations at Buckland and Rockville. At present this is a 60-cycle supply, but the company contemplates changing its source of power to its own 25-cycle plant in Hartford in the near future. Step-down transformers and rotary converters are located in each sub-station, and the distribution of power to the rolling stock is carried out at 600 volts direct-current by standard General Electric Company catenary construction, as shown in the accompanying illustration. About 33 miles of catenary are erected in toto. Work was started in the spring of 1906.

The catenary construction is erected with 150-ft. spans and three-point suspension, the poles being spaced 10 ft. from the center of the nearest track. The tracks are 12 ft. apart on centers and the minimum double-track span is 35 ft. The messenger wire is a 3/8-in. steel cable, and the poles are of chestnut, 35 ft. long on the average and 7 ins. in tip diameters. The ears are soldered at the anchors to prevent slipping, and the erection was carried out by a tower train with caboose, flat and tower cars. The wires of the transmission line are spaced on 28-in. equilateral triangles. The rails on the line are mainly old 78-lb. sections with 4-bolt fish plates too tight for concealed bonds. The bonds have therefore been strapped around the outside of the fish plates and painted black for inconspicuousness. Two No. 0000 cable bonds are used at each joint. The track is cross bonded every 2000 ft. with a No. 0000 jumper.

The cars used are similar to those employed on the Middletown-Berlin electrical division of the company and described in the Street Railway Journal for Sept. 21.

The Buckland sub-station is a one-story brick building 42 ft. long by 22 ft. wide. It contains at present one 60-cycle 200-kw Westinghouse rotary converter and a General Electric 25-cycle machine of the same capacity, which latter is not yet operated. The Westinghouse unit is supplied with power by three 75-kw oil insulated transformers which are to be removed, together with their rotary, when the change is made to 25 cycles. This unit will be replaced by three 75-kw General Electric transformers and a second General Electric 200-kw rotary. The transformers for the first General Electric rotary are already installed. At Buckland the direct-current feeders of the road are brought to a common bus through knife switches, so that any section can be cut open in either direction.

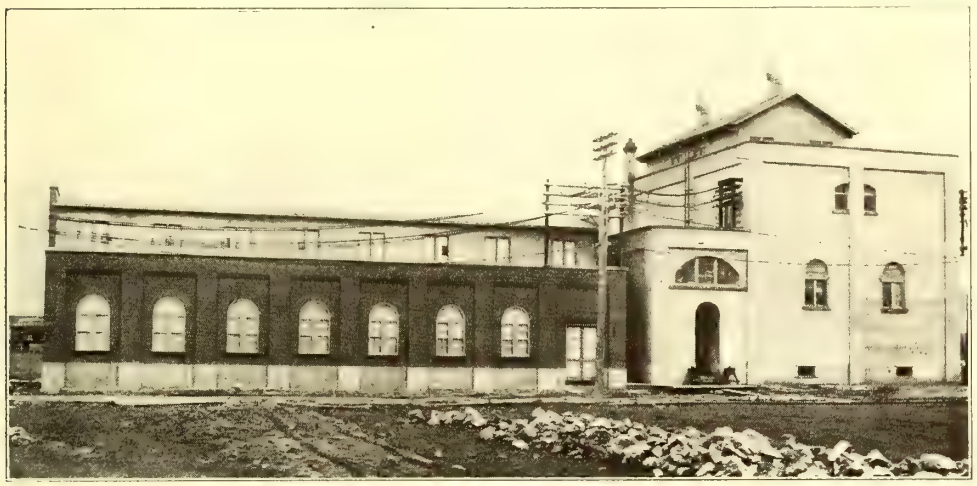
The Rockville or West Street sub-station is also a one-story brick building, 63 ft. x 22 ft., located about 3 miles east of Vernon. It operates at present a 300-kw and a 200-kw, 60-cycle Westinghouse rotary with six step-down transformers. These are to be replaced by a 200-kw General Electric 25-cycle converter, and space is provided for two more 200-kw rotaries of the same style. An 80-kw Westinghouse booster is in service at this sub-station to supply a proper working voltage at various points on the Strafford Springs trolley line outside of Rockville. The entire electrified section of the Hartford, Vernon & Melrose is fed from the sub-stations by two 500,000 circ. mil. feeders.

The coupons on the Underground Railways of London 5 per cent profit-sharing notes, due on Dec. 1, it is formally announced, will be purchased at their face value by Speyer & Company in New York, and by Speyer Brothers, of London, and Lazard Speyer-Ellissen, of Frankfort. It is also announced that the directors have practically completed plans for the extension and conversion of this note issue, and for providing further moneys for the requirements of the company. The plan will be published and submitted to the approval of the note and shareholders as soon as the necessary arrangements have been made. Meanwhile, Speyer & Company invite the deposit of the notes of the company with the Guaranty Trust Company under an agreement of deposit dated Dec. 1. The step is taken, it is said, to assure continuity of policy of management, to the end that the company may be in a position of greater strength.

MONTREAL SUB-STATIONS AND OTHER POWER SUPPLY

In addition to the large direct-current power station, described in the STREET RAILWAY JOURNAL of Nov. 9, the Montreal Street Railway Company has erected three sub-stations during the last two years to operate motor-generator sets driven by alternating current transmitted from Shawinigan Falls and other points. All of the sub-stations are conveniently located at the terminals of city lines.

The first station is on Glen Avenue, near St. James Street, opposite the St. Henry car houses, and supplies the western section of the system; the second station is at the corner of St. Denis and Comte Avenue, north of the company's St. Denis car house, and supplies lines in the northern section of Montreal; and the third station adjoins the Shawinigan Water Power Company's station at Hochelaga and supplies the lines in the eastern section.



ST. DENIS BRICK BATTERY HOUSE AND CONCRETE SUB-STATION

Besides the foregoing, the company has a steam plant and sub-station on William Street, where it receives 5000 horse-power measured on the direct-current side, and a steam plant at Point aux Trembles. The latter contains one 350-kw and one 200-kw belt-driven G. E. generators, the first driven by a tandem, cross-compound engine and the second by an ordinary cross-compound engine.

THE ST. DENIS STATION

The St. Denis sub-station is a concrete structure throughout and houses four 500-kw d. c. units consisting of one Allis-Chalmers Bullock, one General Electric and two Westinghouse generators, each direct-connected to a 710-hp induction motor receiving 2300-volt, 60-cycle, three-phase current from Shawinigan Falls. The switchboard, as shown in the interior view, is mounted on a platform 8 ft. above the main floor, the space below being utilized as a closed concrete compartment for the incoming and outgoing feeders. The main room is spanned by a 40,000-lb. crane. It will be noted that provision for extra ventilation has been made by installing two chimney-vane ventilators in the roof.

The storage-battery house adjoining this sub-station is a splendid example of what such a structure should be. Like the Shawinigen battery building shown in one of the illustrations it is 20 ft. high on the sides with a wide monitor roof. As both the walls and monitors have numerous windows, the interior possesses a far more cheerful appearance than is customary. At night only is it necessary to use drop lights for illumination.

The battery fumes are effectually disposed of by motor-driven fans, while absolute cleanliness is maintained by frequently flushing the tile flooring from water connections placed in the room. The building is heated by steam pipes so arranged in racks that they may be easily removed and repainted outside the building with acid-resisting paints at the end of every winter. The steam mains are covered with an acid-proof composition and are not removed.



LOAD CURVES AT THE ST. DENIS STATION WITH AND WITHOUT THE BATTERY

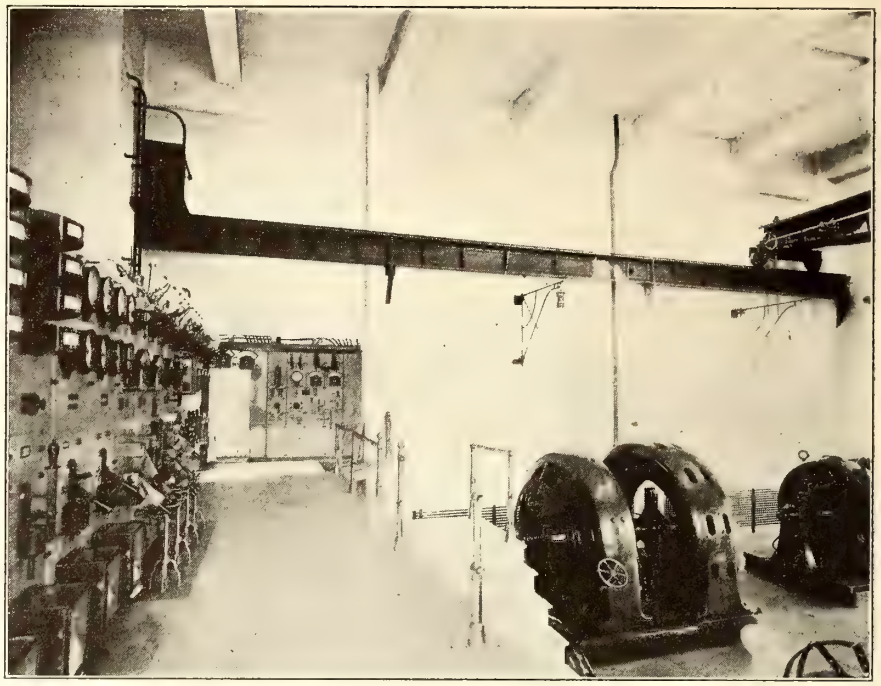
The boosters and regulating switchboard are situated in an adjacent room. The latter is separated from the battery section by a double door so connected that both cannot be open at the same time.

The battery installation consists of 280 Chloride accumu-

lators. At 550 to 600 volts, this outfit will give 1400 amps. for 20 minutes, 720 amps. for one hour, 345 amps for three hours, and 180 amps. for eight hours. The accompanying load curves of this battery for July 14, 15, 16 and 17 are published to show both the usual performance of the battery and the effect of its absence for one day. In this connection, it is worth noting that the company has cut down evaporation losses about 50 per cent by using glass covers on the cells.

The Shawinigan and St. Henry stations are built of brick. The former belongs to the Shawinigan Falls Power Company, which has installed therein three 1000-kw rotary converters. The storage-battery equipment belongs to the Montreal Street Railway Company, and is a duplicate of the St. Denis installation.

The St. Henry sub-station contains a storage battery like that at St. Denis. The machinery installed consists of three 500-kw induction-motor sets, operated by alternating current from the 2300-volt, three-phase, 60-cycle transmission line from Lachine Rapids.

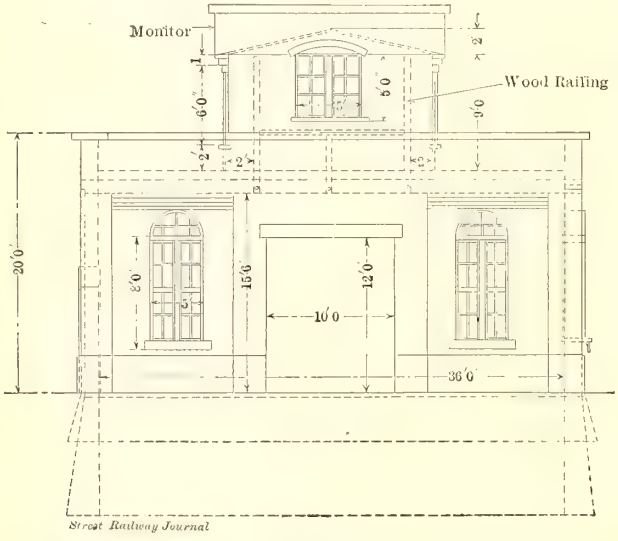


INTERIOR OF ST. DENIS SUB-STATION, SHOWING SWITCHBOARDS ON PLATFORM

MEETING OF WISCONSIN ASSOCIATION

The first annual convention of the Wisconsin Electric & Interurban Railway Association was held in the Stephenson Building, Milwaukee, Nov. 13. The organization is composed of twenty-five railways and is represented by 100 members. The following officers were elected: B. L. Parker, secretary Green Bay Traction Company, president; Ernest Gonzenbach, vice-president Sheboygan Electric Railway & Light Company and general manager Milwaukee Northern Railway, vice-president; George B. Wheeler, secretary and manager Chippewa Valley Electric Railroad Company, second vice-president; P. H. Korst, secretary and manager Janesville Electric Company, third vice-president; Clement C. Smith, president Columbia Construction Company, Milwaukee, secretary-treasurer.

The discussion following the election touched upon railway taxation, rate commission rulings, and the building and operating of electric plants and railways. None of the interurban lines have been detrimentally affected by rulings of the railroad commission, it was said. It was intimated, however, that if certain questions recently brought before the commission regarding the operation of non-paying spurs are acted upon in accordance with the wishes of petitioners, the companies will suffer. The meeting adjourned at 4 o'clock, after which the members went over the new Milwaukee-Northern line, inspecting stations and the power house at Port Washington. The association selected Milwaukee as its permanent headquarters. Efforts will be made to induce managers of municipal electric plants of all kinds to affiliate with the association, and take an active interest in its affairs. The next meeting of the association will be held in Milwaukee in November, 1908.



CROSS-SECTION OF SHAWINIGAN BATTERY ROOM



INTERIOR OF ST. DENIS BATTERY HOUSE.

ARNOLD REPORT ON SUBWAY CONDITIONS

In a preliminary report which he has submitted to the Public Service Commission of the First District of New York, Bion J. Arnold, who was engaged to look into conditions prevailing in the Subway, suggests two means of improving the service on that line. Mr. Arnold, with a corps of assistants, has been at work since Oct. 4 investigating the entire Subway, and recommends the employment of station guards and the summary closing of the doors to secure shorter stops. He also indicates in his report that he rather favors the installation of the side-door cars. He states that he has received every assistance from the Interborough management. He has to propose, he says, minor changes relating to methods of operation only, by which, in his opinion, 25 per cent more cars can be operated in the rush hours. He then reviews the present conditions, and asserts that in rush hours, so far from the two-minute express headway being maintained, not more than twenty-five express trains pass the Grand Central in an hour.

Many of the delays, Mr. Arnold asserts, are due to the time taken for loading and unloading, "and are caused largely by the policy in vogue of holding the trains at stations until all the doors are jammed full of passengers in an attempt to clear the platforms."

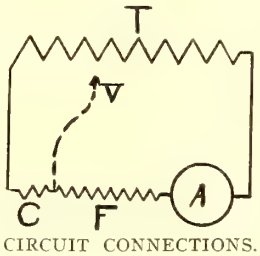
"This policy," says Mr. Arnold, "should be changed to one starting the trains within a fixed time after they have stopped." He gives this period of time as forty-five seconds, and adds that this will permit of the northbound expresses at night reaching the Grand Central only partly loaded, as some of the would-be passengers will be shut out at Fourteenth Street. At each express station, he says, there ought to be dispatchers who would sound a gong when forty seconds had expired after the train arrived, giving five seconds for the closing of the doors. Subsequently, he continues, indicators could be placed in the stations which would inform passengers how long a time remained before the train started. In addition the company should have police assistance at crowded stations to enforce these regulations and properly to control such individuals as may, from selfish motives, interfere with the prompt closing of the doors.

Suggestions as to the block signals concern simply the signals near express stations. At present the signals hold the train following a train in a station until the train ahead had completely cleared the station platform after being dispatched. Mr. Arnold thinks it would be advantageous to allow the second train to proceed toward the platform before the first train has completely cleared the platform. At present, with an eight-car train it requires from 22 to 25 seconds after a train starts to get the signal which allows the following train to proceed. It then requires a certain length of time for the following train to pull into the platform and come to a stop. At the Grand Central Station this amounts to 50 seconds for a northbound train. By making the change suggested 15 seconds could be saved. Mr. Arnold recommends that the Commission take this subject up with the company. If the latter fails to submit some feasible plan he will offer one or more which seem to him to meet the conditions.

Mr. Arnold says he cannot reach a conclusion as to the advisability of changing the type of car in the Subway in favor of the side-door variety until he has seen the effect of the minor changes he has set forth. There will always be a problem as to where to draw the line between seating capacity and standing room, and he goes on to say that the only feasible method of increasing the seating capacity is to have more cross seats in the cars, a plan that would necessitate more time for unloading and loading. He discusses at length the desirability of providing as great a number of passengers as possible with seats, but regards the plan of "a seat for everybody" as unfeasible. He continues: "If the principle of a slight reduction in the seating capacity of the present cars can be accepted as permissible and adopted, increased carrying capacity can be obtained by eliminating all or part of the present cross seats. The elimination of these cross seats makes it practicable to introduce center side doors into the present cars should this change be found necessary later. In case it is found that the traffic cannot be properly handled and the forty-five-second limit for station stops hereinbefore mentioned maintained with the present end-door cars, the use of these center doors in connection with the absence of the cross seats will make it practicable to load and unload so rapidly that this limit can be maintained." The question of a larger standing load, however, is one of public policy rather than of engineering feasibility. He thinks, therefore, that the Commission should first pass upon it and indicate their wishes to him.

ALTERNATING-CURRENT RAILWAY MOTORS

The section of the A. I. E. E. at the University of Illinois was favored on Nov. 27 with a lecture by Dr. C. P. Steinmetz on "Single-Phase Alternating-Current Railway Motors." Dr. Steinmetz first classified all motors under two heads—series and shunt motors. In shunt-wound direct-current motors the armature reaction which causes sparking at the commutator is taken care of by the shifting of the brushes if a motor always operates in one direction. If it must operate in two directions, the brushes have to be placed at the middle point between the poles. To prevent sparking in motors which must be reversed and must consequently have their brushes at a fixed position, the commutating-pole type of motor is being introduced.



CIRCUIT CONNECTIONS.

Any direct-current series motor will run with alternating current if its magnetic structure is properly constructed to prevent heating from the alternating flux. To obtain a large power-factor, the number of turns in the armature should bear as high a ratio as possible to those in the field coils; the air-gap should be small. The sparking caused by the alternating field flux has been minimized by the use of resistance in the leads between the armature and the commutator segments. Dr. Steinmetz stated that the space is too limited in a railway motor for such leads with sufficient radiating area. While good results are being obtained with them, they are not desirable, and are a source of danger when the motor is overloaded.

He then took up the theory of the repulsion motor. In an alternating-current transformer the magnetic flux is 90 time-degrees behind the primary e. m. f. and 90 time-degrees ahead of the secondary e. m. f. In the repulsion motor the stator coils are connected to the alternating-current source of supply when the brushes are short-circuited. In such a motor the stator coils act as the primary and the rotor coils as the secondary of the transformer. The rotational flux in the rotor is displaced 90 time-and-space degrees from the main flux, and acts to assist good and sparkless

commutation. When at a standstill, the repulsion type of motor acts exactly as a series motor, being no better and no worse. After it begins to rotate, the repulsion motor produces a commutating field. At synchronism the commutation is perfect, but at speeds above synchronism, the commutation becomes worse, so that when revolving at double synchronism the plain repulsion motor sparks badly. He then described what he termed the series-repulsion motor, in which controller connections are employed which make it a repulsion motor at low speeds and a series motor with compensating field coils to improve commutation at high speeds. To illustrate the circuit connections at high speed he used the accompanying circuit diagram, in which *A* is the armature of a series motor, *F* the field coils and *C* the compensating coils for securing good commutation. *T* is the secondary of a transformer supplying energy to the motor. *V* is a variable connection, by which a larger or smaller proportion of the total voltage of the transformer can be impressed on the compensating field coils.

As to desirable frequencies for railway motors, Dr. Steinmetz said that motors ranging from 75 to 200 hp can be made to commutate in a satisfactory manner at speeds between 600 and 1600 r. p. m. on 25-cycle circuits. This answers the practical requirements. On 15-cycle circuits motors commutate well at speeds as low as 360 r. p. m. A 25-cycle installation would be superior in total economy for small motors. For very heavy locomotives the case possibly may be different, but he questioned whether a frequency of 25 cycles is not a low enough frequency for all purposes.

THE PAY-AS-YOU-ENTER CAR COMPANY

The success of the pay-as-you-enter car idea in the places where it has been tried has led to the organization of a company to conduct the business in the United States, where the design, as in Canada, has been fully covered by patents. As a result, the Pay-As-You-Enter Car Company has been organized under the laws of New Jersey, with headquarters at 26 Cortlandt Street, New York. The president of the company is Duncan McDonald, general manager of the Montreal Street Railway Company, and the manager is Thomas W. Casey. Mr. Casey, who resigned his position as purchasing agent of the Montreal Street Railway Company to conduct the affairs of the new company, has been engaged in street railroading for the past sixteen years, having been connected with the mechanical, stores and operating departments of the Montreal Street Railway Company. Among the directors of the American Pay-As-You-Enter Car Company are: W. G. Ross, R. L. McDuffie, Philip Gossler and Jacob Wendell. The company does not propose to manufacture cars, but will grant licenses to build cars under its patents to car builders, operating companies and others.

STANDARD CLASSIFICATION OF ACCOUNTS

The members of the joint committee to represent the street railway companies, the Railroad Commissioners' Association and the Interstate Commerce Commission, decided upon at the meeting of these various interests at Washington, on Nov. 22, were appointed last week. The committee consists of the following:

Representing the American Street and Interurban Railway Association, Chas. O. Kruger, of the Philadelphia Rapid Transit Company.

Representing the American Street and Interurban Railway Accountants' Association, W. F. Ham, of Washington.

Representing the Street Railway Association of the State of New York, C. Loomis Allen, of Utica.

Representing the Interstate Commerce Commission, C. F. Balch, of Washington.

Representing the American Association of Railroad Commissioners, Wm. J. Meyers, of Albany, and W. O. Seymour, of Connecticut.

This committee has been engaged in conference in Washington all this week and its report was not completed in time for publication in this issue of the paper. The committee expects, however, to be able to complete its work and have its report ready for submission at the general conference, which is to be held at the rooms of the Interstate Commerce Commission, in Washington, on Dec. 10.

SEMI-CONVERTIBLE CARS FOR ASTORIA, ORE.

An article recently appeared in the Street Railway Journal descriptive of the semi-convertible cars for Portland, Ore., in which mention was made of the fact that all the important systems in Oregon operated with this type of car. The last road to receive semi-convertible cars was the Astoria Electric Company, although the builders, the American Car Company, made shipment at practically the same time as the cars for Eugene, also in Oregon, were ready to go forward. Astoria is a flourishing seaside resort



CAR FOR ASTORIA, ORE.

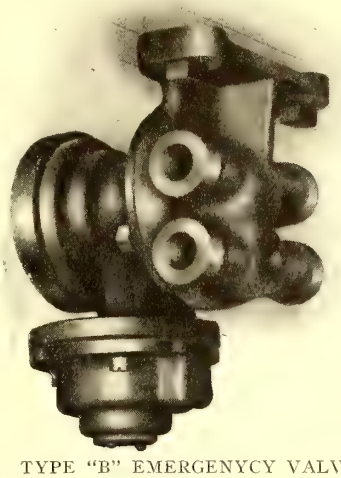
with a climate that makes the semi-convertible car particularly desirable for service, and especially during the rainy season. At present the system consists of five miles of tracks, over which nine motor cars and six trail cars are operated, aside from the three new semi-convertibles just placed in service. The dimensions of the new cars are as follows: Length over end panels, 20 ft. 8 ins.; over crown pieces, 30 ft. 8 ins.; width over sills, including panels, 7 ft. 9½ ins.; over posts at belt, 8 ft.; height from floor to ceiling, 8 ft. 4¾ ins.; from track to under side of sills, 25⅛ ins.; size of side sills, 3⅜ ins. x 5 ins.; end sills, 3½ ins. x 6⅝ ins.; sills, 6 ins. x ⅜ ins. x 3½ ins. angle iron. Inside finish of cars, cherry; ceilings of 3-ply birch. The seats are of Brill make, as are also the numerous specialties used throughout, namely, angle iron bumpers, gongs, signal bells, etc. The trucks are the No. 21-E pattern.

ACQUITTAL IN SAN FRANCISCO

Gen. Tirey L. Ford, general counsel of the United Railroads of San Francisco, was acquitted on Dec. 3 of the charge of having bribed a former supervisor to vote for an overhead trolley franchise. The verdict gave general satisfaction, and is taken as an indication that any attempt to hold other railway officials upon charges of a similar character will be equally unsuccessful.

A NEW COMBINATION AUTOMATIC AND STRAIGHT AIR BRAKE SYSTEM

An air-brake system combining the desirable features of automatic and straight air, without complicating the piping or valves to any extent, was exhibited at the recent Atlantic City Convention by the National Brake & Electric Company, of Milwaukee, and is practically identical with the ordinary straight-air systems, except that the company's new type "B" emergency valve is used in connection with the brake cylinder, and a few modifications have been made in the motorman's straight-air valve to give the necessary refinements.

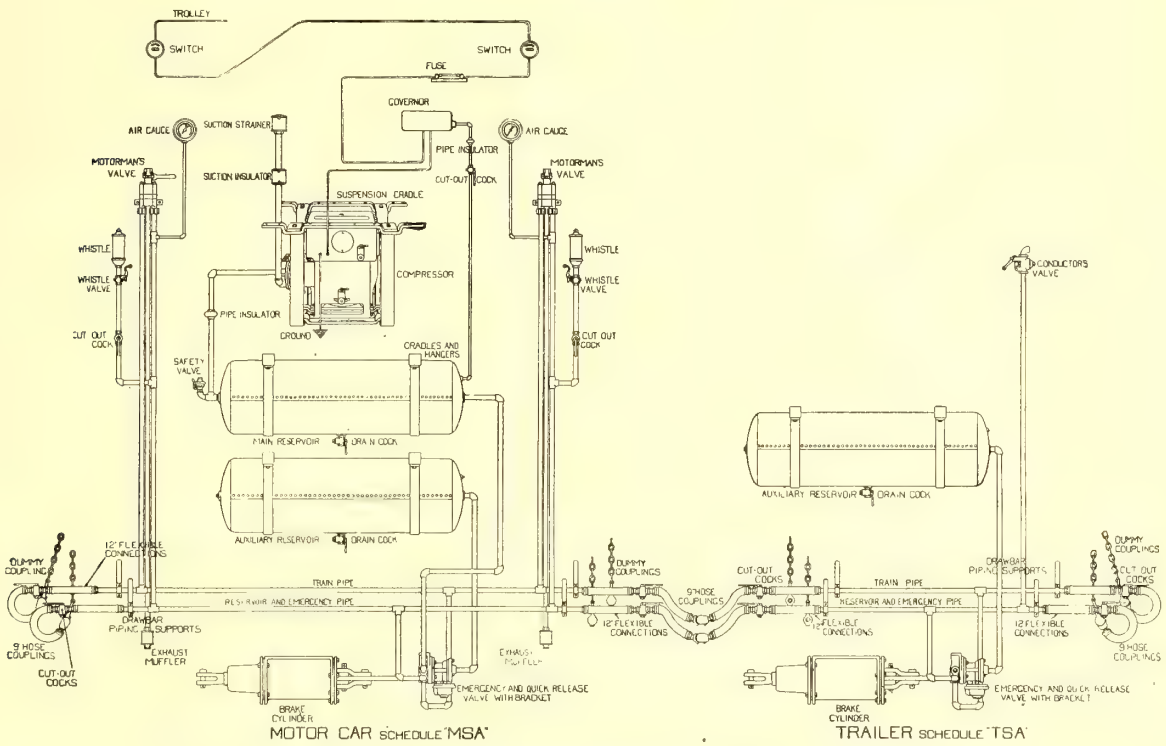


TYPE "B" EMERGENYCY VALVE

This motorman's valve has three set and two release positions in addition to that of lap position. The first position on moving the handle to right from center or lap position gives a restricted opening between reservoir and straight air train pipe, so that the brake cylinder pressure may be raised gradually. A further movement to the right uncovers the greater area of the service port, allowing the brake cylinder and the main reservoir to equalize as quickly as is possible with straight-air systems. The next position to the right of this, or the extreme position, causes a rapid reduction to be made in the emergency line, thus rapidly destroying the pressure on the emergency line side of the emergency valve piston, causing the then greater auxiliary reservoir pressure to move the emergency valve piston to full outward position, thereby disconnecting the brake cylinder from the straight-air train line and connecting the auxiliary reservoir directly to brake cylinder. In this position maximum brake cylinder pressure is reached much more quickly, due to the short distance the air has to travel from source of supply, than would be possible should all brake cylinder air have to pass through the train pipe line and motorman's valve, as when applied with the usual straight-air method.

A graduated release is obtained by moving the handle of the motorman's valve to the left of the lap position, which connects the brake cylinder to atmosphere through the exhaust port in the motorman's valve. In this way the total volume of air in the brake cylinder is allowed to pass out through the train pipe. Should a quick release be desired, the motorman's valve handle is moved to the left to the next position. This further increases the opening of the exhaust port, thus making a heavy reduction in the train pipe and causing the quick release mechanism of the emergency valve to connect each brake cylinder to atmosphere locally. This system, it will be seen, gives either a graduated set or release by straight-air operation, or a quick set and release by automatic operation. This system also possesses all the safety features of automatic air, such as automatically setting the brakes in case of train parting, or broken pipe line, etc. A feature of this system is that practically no complications are introduced other than those present in straight-air brake systems.

S. J. Hill, general manager of the Youngstown & Southern Railway, reports that since the conversion of the road from steam to electric operation the receipts have increased 250 per cent. When steam was the motive power four trains were operated each way per day. Since conversion, however, electric cars are operated hourly from 5 a. m. to 7 p. m., and cars are sent out of terminals at 9 and 11 p. m. The increase has been mainly in the passenger receipts.



EMERGENCY STRAIGHT-AIR BRAKE EQUIPMENT FOR MOTOR CAR AND TRAILER

LONDON LETTER

A most unfortunate accident took place last month on the electrified portion of the Metropolitan Railway at the West Hampstead Station. At the inquest it transpired that the fault was clearly that of the signalman at the West Hampstead Station. A train from Baker Street was at this station, but the fog was so thick that the signalman did not see that the train had not left the station. He evidently imagined that it had left the station and let an incoming train from Baker Street come on, with the result that there was a rear-end collision in which three persons were killed and thirteen injured. It was, indeed, fortunate that the accident occurred to a train on the outward journey from Baker Street, as very few passengers were in either train. It is interesting to note that since the electrification of a considerable number of different lines there have been comparatively few accidents on the electrified portions of the lines. With regard to the accidents which resulted fatally on account of the fact that the lines were electrically equipped, a recent Board of Trade return gives the number for the years 1904, 1905, 1906 and down to the end of August of this year, as sixteen killed and seventy-one injured by actual contact with the live third-rail. The fatalities included four railway servants and twelve trespassers; and the injured, forty servants, one passenger, five persons on business, and twenty-five trespassers. The largest number of casualties occurred on the North-Eastern system—namely, eight killed and twenty-eight injured—the next in order being the Lancashire & Yorkshire, with five killed and nineteen injured. The return for the whole period for the London underground lines is as follows: District, two killed, nine injured; Metropolitan & Great Central Joint, one killed, one injured; Metropolitan, six injured, Metropolitan & Great Western Joint, two injured; City & South London, Great Northern & City, and Metropolitan District Joint, one injured each.

The affairs of the Underground Electric Railways of London, Ltd., formed by Mr. Yerkes, and which has electrified the Metropolitan District Railway and built a number of tubes in London, would appear not to have prospered to the extent that was anticipated. The profit-sharing notes are now to be had on the market at anywhere from 30 to 40 per cent of the par value, and it would appear that more capital would have to be raised to enable the company to pay for certain work still to be accomplished and to meet certain charges. It seems a sad state of affairs, but the condition of the company is no worse than that of many of the other transportation companies in London. What the solution of the matter will eventually be it is extremely difficult to foresee. An interesting case was recently decided in favor of the Underground Electric Railways Company in one of the London police courts, that enterprising company having been summoned for permitting black smoke to issue from the chimneys of its generating station at Chelsea. The usual sort of evidence was put in for the prosecutor, whereas the Underground Company put in a vast amount of evidence of a scientific character showing that its station was constructed on the most modern and up-to-date lines. The magistrate dismissed the summons with 300 guineas costs against the Chelsea Borough Council, which was responsible for the case, and stated that, in his opinion, the works of the generating station at Chelsea were as perfect as science could possibly make them, and that it was quite evident to him that the prosecution ought never to have been brought on such slender and unsatisfactory evidence as the Borough Council had produced.

Some disappointment has been felt in the south of London by the decision of the London County Council to abandon for this year the construction of electric tramways from West Norwood to the Crystal Palace. A system of tramways to the Crystal Palace has been a crying need for years, and it seemed this year that the work would be put in hand. The governors of the Dulwich College Estates, however, have successfully opposed the scheme, so that for the present the Crystal Palace will have to go without its tramway system. Perhaps the reason of the abandonment of this most important scheme was on account of the route selected, and next year undoubtedly Parliamentary sanction will be sought for a route to the top of the Palace Hill by Central Hill and Westow Hill, which would appear to be a more natural route and one which will not be so vigorously opposed. The Council has, however, recently decided to proceed at once with the construction of a tramway from Hammersmith Broadway to the county boundary at Harrow Road, Harlesden, which decision has come to a certain extent as a surprise, as there were other routes which would appear to have been more pressing. This new route, however, is made necessary by the fact that next year there will be held at Shepherds Bush the Franco-British Exhibition, and by the construction of this tramway it will assist in opening up that vicinity to the large suburbs of the west of London. The overhead system is to be adopted on this portion, the London County Council fortunately not having met with any urgent obstruction in this particular case.

After a good deal of tribulation, permission has now been granted by the Board of Trade for the Council to proceed with its work of construction in connection with the Mile End and Bow Road tramways in the east of London, which section, as recently stated in this column, is to be equipped with the G. B. surface contact system from Aldgate to Bow. So much opposition, however, was made to the system that the Board of Trade was requested to act in the matter, and it is only within the last week or so that its permission has been secured. The work, however, has now been commenced, and it will not be long before Londoners are able to see this extremely interesting system in active operation.

The tunneling under the Strand and Wellington Street, which is to connect the Victoria Embankment with the Aldwych subway, is now nearing completion. For some months past the entrance to the tunnel has been visible from the Embankment at the west side of Waterloo Bridge, and by the first of the year it is expected that the work will be completely finished. The single-deck cars which will be used for this purpose have commenced a service temporarily from the Embankment to Woolwich, so that when the connection is made they will be all ready to be put into immediate service. The newly electrified system between Highgate and Highbury has also now been completed, and the first car, containing officials of the London County Council and representatives of the contractors, Dick, Kerr & Company, was watched with considerable interest in this busy section of the northern suburbs of London. As has already been stated, this system connects with the Middlesex County lines, which run out as far as High Barnet, so that it is now possible to travel to that picturesque town all the way from the city by electric railway.

Taken altogether, however, some disappointment is felt at the lack of enterprise shown by the Moderates, who are now in power in the Council, and at the discussion of the recent tramways account and in interviews to the press, some of the leading representatives of the Progressives, who are now in the minority, have been airing their views on the subject. Instead of spending about half a million next year, some of the more progressive of the members are loudly complaining that two millions ought to be spent, as there are still, according to them, 50 miles of tramways which ought to be electrified as soon as it is possible to accomplish the work. The writer heartily agrees with the Progressives in this statement, as there are miles and miles of antiquated horse tramways still left, especially in the north of London, and many new routes which ought to be equipped with electricity. When the whole of London is equipped with electric tramways, there is no doubt they will pay and pay handsomely, and it ought to be an easy matter to regulate the fare so that there is plenty of money for renewals, depreciation and reserve, while leaving a comfortable balance.

With regard to the two recent accidents which occurred to tramways a month or two ago, the report of the Board of Trade inspector who investigated the Bradford accident states that the inspector is of the opinion that the leading axle broke at the curve and that the hand brake became useless and, to a large extent, the electric brakes as well. The inspector goes on to state that what is required for cars on a steep gradient is a mechanical slipper brake that could be applied instantaneously, as once a car gets out of control on a steep grade it is impossible to stop it with the brakes at present in ordinary use. As to the Halifax accident, a sensational piece of evidence was given by one of the passengers at the inquest, in which he stated that he had frequently known the car to run backward on this particularly steep grade where the accident occurred, and the coroner came to the conclusion that the brakes had been improperly applied. Mr. Spencer, the company manager, explained also that the car in question was fitted with a running-back device, an invention of the rolling stock superintendent, and a device that is in use in many towns, but the driver, in his opinion, evidently did not know that such a

device had been applied to the controller and operated the controller in the ordinary way. The Halifax Tramways Committee, after the result of the inquest, decided to recommend the Town Council to ask the Board of Trade to nominate a mechanical engineer and an electrical engineer to report on the cars, brakes and working of the Halifax Tramways system and to suggest any improvements for the safety of the traveling public, but a reply has just been received from the Board of Trade intimating that it desires to reserve its impartiality and suggesting that the corporation should approach the Society of Electrical Engineers and Mechanical Engineers or the Tramways Association with a view to the nomination of such experts.

The press has lately contained many stories about the contract which Bruce, Peebles & Company, of Edinburgh and London, have recently secured for the electrification of the tramways of Moscow at a cost of about £2,000,000. We understand from Bruce, Peebles & Company that the statement is substantially correct, but that, unfortunately, it is somewhat premature as yet, as many details have yet to be settled and certain financial conditions are attached to the contract. It is evident to all, of course, that the financing of such a contract is a serious problem and that the conditions at present are adverse to the raising of such an amount of money. We are advised, however, that doubtless everything will be fulfilled later on, but that at present no details of any kind are available.

Morecambe Town Council has unanimously decided to promote a bill in Parliament authorizing it to purchase, construct and work tramways. At present the system of tramways along the sea front is by horse traction, and is run by a private company, whose lease has expired. The corporation is now seeking to acquire the undertaking in the Morecambe district, with a view to electrification. While the Council is unanimous in the acquisition of the tramways, opinion is divided as to electrifying them.

At a recent meeting of the tramways committee of the York Corporation, held at the Guildhall, the electrification of the tramway system was under consideration, and it was unanimously decided to proceed with the work by means of a Light Railway Order.

Leith Town Council has agreed to take steps for a provisional order for the proposed tramway extension, and also to resume negotiations with Edinburgh with a view to coming to some arrangement regarding the mutual roads. The feeling was that should no satisfactory arrangement be come to with the city, the proposal to extend the tramways to the Edinburgh territory will be dropped, and that the Leith Town Council will go on with the extension from Newhaven to Granton.

The Board of Trade recently made an official and satisfactory inspection of the new tramway route of the Torquay corporation tramways from the Mallock Memorial to St. Marychurch Town Hall by way of Babbacombe Road, Wellswood and Babbacombe. The piece of track inspected is a little over 2 miles in length, and has some rather steep gradients, the most elevated point being about 380 ft. above sea level. Its completion will extend the length of the tramway routes in Torquay to slightly over 4 miles, and the new line opens up a good portion of the residential part of the borough. The route is certainly a very beautiful one, opening up many peeps of the bay and the beautiful scenery at Bishopstown and Ilsham which cannot be seen by the pedestrian. With the opening of this piece of track the company will have completed the routes sanctioned by the corporation, and it may be expected that within a short time application will be made to the local authority for its consent to the commencement of work upon the Torbay Road. Like the sections which are already in operation, this new section is also operated on the Dolter surface-contact system.

After the Metropolitan District Railway had been electrified, it soon became apparent that the rails were wearing out very fast, very much faster than under the old system of steam traction, due it was supposed to a variety of causes, such as the rapid acceleration of the trains and the use of more powerful brakes in stopping the trains. The wheels also are smaller and the trucks on which the cars run and the length of the wheel base have much to do with the wear of the rails, a considerable side wear also having been noticed. A new rail has, therefore, been adopted with a great deal of success, so far as can be gathered at present. This rail is on what is known as the Sandberg system, and is the invention of C. P. Sandberg, who has devoted a lifetime to the study of steel for this particular purpose. It would appear that the ordinary rail in use is, as a rule, too soft, the rails for steam traction containing frequently about 0.5 per cent of carbon, while rails on the Sandberg system contain as much as 0.72 per cent of carbon, which has the effect of hardening the rail, while a considerable portion of silicon is also added to produce toughness. Very hard manganese check rails are also now being used with great success, the effect of the wear and tear on these rails when made of ordinary steel being altogether too great.

Another half mile is added, Nov. 30, to London's system of electric transit. This is a spur from the Strand to Holborn, where connection is made for Finsbury Park on the north and Hammersmith or Brompton on the west. It is the third cross-town line in operation between the Strand and the northern suburbs and is likely to command a large traffic as a branch of the Great Northern, Piccadilly & Brompton system of tubes.

A. C. S.

PETITION FILED FOR POSSESSION OF THE CHICAGO UNION TRACTION COMPANY

The Chicago Railways Company has filed a petition in the United States Circuit Court for an order of possession of the Union Traction and underlying companies. The hearing, which has been set for Dec. 9 by Judge Grosscup, will be a formal one, as objections by stockholders and holders of indebtedness, have been overcome. The petition for possession asks for a lease by the receivers to the new company of all the street car tracks, cars running on them, and other property. The lease is to be operative pending a sale by foreclosure proceedings. The plan is to have the Chicago Railways Company bid them in and thus acquire actual and permanent ownership.

CROSSING STOPS IN INDIANA

Hereafter all locomotive engineers and interurban motormen will be required to stop their trains or cars at all track crossings outside the limits of cities and towns in the State, where the crossing is not guarded by a switchman or watchman, or by a mechanical device recognized by the laws of the State as making the crossing safe. This decision was announced Nov. 25 by the Indiana Railroad Commission. At a conference of railroad managers and attorneys and the members of the commission, held a few weeks ago, it was unanimously determined by those present that stops should be made at all unprotected crossings that lay outside cities and towns. The question of whether criminal action should be instituted against motormen or engineers who did not obey this ruling of the commission was decided in the affirmative by the commission. Within cities and towns the commission holds that the City Council or town board is responsible, and that the commission may not order the use of safety devices at crossings in cities and towns without the consent and approval of the local authorities.

FROM NEW CASTLE, PA., TO CLEVELAND

With the completion of the Akron & Youngstown Air Line Company's road it will be possible to travel from Newcastle, Pa., to Cleveland, Ohio, in about four hours. With the completion of two 14-mile stretches—one between Mahoningtown and Morado Park, and the other between Garretsville and Leavittsburg—there will be thoroughly connected over 325 miles of interurban lines which will reach all the important towns in the vicinity of Pittsburg and Cleveland, besides connecting them with the intermediate towns of the tri-state belt. Roads already under construction, and which will be completed within the next few months, will connect a string of towns from Cleveland to Moundsville, W. Va. The Cleveland, Akron & Canton road operates limited cars between Cleveland and Canton, via Akron. The Stark Electric Company operates a line from Canton through Alliance and Sebring to Salem. The Youngstown & Southern line now connects Salem and Youngstown and will be built through to East Liverpool within a few months; the interurban line from East Liverpool to Steubenville is already established; a change of cars to the Wellsburg line continues the route from Steubenville to Wheeling, where a 12-mile line runs on to Moundsville. A part of the network of Ohio River lines reaches from Conway, Pa., by way of the new line about nearing completion and which is being constructed by the East Liverpool Traction & Lighting Company and Steubenville Railway & Light Company to East Liverpool from the Beaver Valley terminal at Vanport. The Pittsburg Railways Company operates across the Ohio River at Monaca, where a direct line to Pittsburg is secured by way of McKees Rocks and Coraopolis.

THE SITUATION IN CLEVELAND

At a conference, Wednesday afternoon, Mayor Johnson and President Andrews agreed to one point in the proposition to rearrange the tracks on Superior Avenue in order to relieve congestion, and the local papers have had much to say about the matter. In fact, the mayor made his first real concession—that the devil strip should be thirteen feet wide instead of ten, as an ordinance introduced in Council at the last meeting provides. In return for that he requested that the Cleveland Electric consent to the city's building and owning the tracks on Superior Avenue between the Public Square and East Ninth Street, where it now owns its own tracks. The mayor was frank enough to say he wanted this concession so the company would have no ground for injunction suits and that the city did not want to grant the company any franchise rights whatever on that strip. Mr. Andrews told him that he would bring the matter before the board of directors and they could decide as they think best.

It is probable that the change in the track on this street will not be made before spring, as not much can be done during the cold weather, which will doubtless come soon. An attempt will be made to build one or two of the loops that have been planned, and the others will have to wait for more favorable weather than the winter will bring. General Manager J. J. Stanley announced at this meeting that everything should be decided upon at as early a date as possible so that the special work can be ordered.

Although the statutes contain no provision for municipal ownership of street railway tracks, except on bridges and other places of the kind where the city already owns the property, an ordinance enacted on Monday evening of last week provides that in the rearrangement of the tracks on Superior Avenue the city shall own them and that the existing street railway companies shall be allowed to use them during the existance of their present franchises on the payment of 6 per cent on the amount of money the city has invested in them, this interest to be prorated among the companies according to the use they make of them.

In his letter to the city council, in answer to the resolution of Councilman Koch, President Andrews suggested that all negotiations be carried on between the Cleveland Electric Railway Company and the Municipal Traction Company, if the latter is to be the lessee, and that all differences be submitted to arbitration, the companies to abide by the result and the final agreement ratified or rejected by the City Council. This, the letter says, is the only manner in which an agreement can be made when it comes down to the legal view of the matter. In addition, the letter reiterated the substance of other letters recently sent to the City Council, embodying the views of the board of directors. The company will accept a franchise based upon the valuation of its properties by a fair and impartial board of arbitration, the rate of fare to be such as to yield a reasonable return on the investment, and the additional money that will be required to place the system in first-class condition and build such additions and extensions from time to time as will insure a good and proper service. It is believed, the letter states, that the people of Cleveland want a single fare with universal transfers, good to any part of the city or any point on the system. This point, however, the company is also willing to submit to arbitration.

Mayor Johnson declared the proposition made in this letter is foolish and that the Council should give it no attention. He repeated his former statement that he and the City Council had been appointed arbitrators by the people and that any other board of arbitration is out of the question. His wrath was aroused by the fact that the company named no figures upon which it would be willing to lease its properties to the holding company, which is the Municipal Traction Company, with less than $1,000 paid-up stock, according to the report of the accountants, made some time ago.

Under a suspension of the rules ordinances, approved by the committees in the afternoon, were passed, fixing the compensation for the joint use of the Cleveland Electric tracks on the West Side at $68,706. This sum was fixed on varying estimates made by the city engineering department. Thus the city is not only trying to force the Cleveland Electric to turn over its property to a holding company, but is endeavoring to force it to rent its tracks to other companies at rentals which it fixes. The mayor declared in an open meeting of the City Council that the holding plan is the only method of settling the question and that it will be settled that way with himself and the Council as the arbitrators.

A campaign was started Friday by the low-fare companies to secure consents of property owners on Quincy Street and Central Avenue. The officers of the low-fare companies state that they are willing to build the lines if the people want them. All of these ideas have been worked out without regard to the claims of the Cleveland Electric that it already has the consents of owners of a majority of the front footage on these streets and that power of attorney for six years accompany all consents. On the other hand, the Cleveland Electric seems to be resting secure in the possession of the consents and apparently does not consider the work the low-fare officials are doing of very much account.

Saturday evening President Andrews of the Cleveland Electric sent a communication to Mayor Johnson in which he says that the contracts made between the companies which formerly owned the local lines and the property owners along the streets seem to forbid the relocation of the tracks on Superior Avenue as has been provided by the city administration. A copy of the contracts, signed by the East Cleveland Railroad Company, A. Everett, president; the Woodland Avenue & West Side Street Railroad Company, J. B. Hanna, secretary; the Broadway & Newburg Street Railroad Company, Tom L. Johnson, president, and the Superior Street Railroad Company, Frank DeH. Robinson, president, accompanied the letter. If this change is prohibited in the contracts made by the original companies, as now seems true, the plan will have to be given up by the city. The clause in that contract relating to Superior Street is as follows:

"In consideration of the consent of the property owners to the laying of the fourth track in Superior Street, the street railroad companies named in said contract hereby agree to bind themselves to accept no ordinance or right from the board of improvement under said consent to lay said track that does not contain the following conditions:

"Said four tracks to occupy a space not to exceed thirty-three feet in width in the center of the street, and said thirty-three feet is to be paved by and at the expense of said railroad companies at the time of laying the tracks, with the best quality of dressed block paving, to the satisfaction and approval of the board of improvements; all tracks to be laid with new rail, with less than one inch rise."

Another portion of the contract relates to the operation of cars over the tracks on Superior Street. President Andrews, after mentioning this contract, stated that his company was ready to aid in relieving conditions in the down-town district by building loops or doing other things, so long as such action does not prejudice its rights. If any special work is to be removed or replaced, the directors feel that they should have the same rights and ownership in this property as in the original track.

It was reported on Dec. 4 in New York that the Cleveland Electric Railway Company had that day agreed to the holding plan proposed by Mayor Johnson, the agreement being made in a public meeting of Councilmen, Councilmen-elect, Mayor, city officers, officers of the traction company; and that Fred H. Goff was named by the Cleveland Electric to conduct negotiations. Mr. Goff, it is said, is empowered to accept the terms from Mayor Johnson with no report to the Cleveland Electric, and in his address at the meeting is said to have agreed to the merger of the three-cent and five-cent roads under a holding company, and declared all that remained was the fixing of the figure at which the Cleveland Electric stock shall be taken over. As appraisers, President Andrews of the corporation and President Dupont of the three-cent line, were named, with lawyers and real estate experts to assist, to fix a valuation on the old company's property. These appraisers are to report to another meeting next Tuesday.

Motions for the consolidation of the various foreclosure suits against the Union Traction Company and for the placing of the Chicago Passenger Road (the Adams Street line) in the hands of a receiver, have been made by Colin C. H. Fyffe, representing the eastern trust companies, in the United States Circuit Court. The Equitable Trust Company of Chicago objected to the motion as to the Passenger Railway Company, and the Guarantee Trust Company of New York to the consolidation one. Judge Grosscup said that as the objections did not seem to be insuperable he would postpone the hearings to give the attorneys a chance to get together.

OFFICIAL STATEMENT REGARDING P. S. C. CHANGES

President Thomas N. McCarter, of the Public Service Corporation, has issued a general statement, in which he sets forth in detail the several changes in the managerial force of the corporation, to become operative Jan. 1, 1908, and various economies contemplated which, it is estimated, will result in a net saving during the next fiscal year of about $500,000, of which mention was made in the STREET RAILWAY JOURNAL for Nov. 30. As previously stated, the principal officers retired are Secretary Frederick Evans, who will be succeeded by Colonel Edwin W. Hine, and Vice-presidents A. B. Carlton and Charles A. Sterling, who were in charge of the electrical and transportation divisions of the company, respectively. The former will be succeeded by George J. Roberts, present chief engineer of the United Gas Improvement Company, of Philadelphia, and the latter by John J. Burleigh, at present a vice-president of the Public Service. Mr. Roberts will be in charge of the operation of practically the entire system, and Mr. Burleigh will have charge of the commercial department. President McCarter also said:

"There has been no change of any moment in the stockholding interest of the Public Service Corporation, nor is any contemplated. The same interests that have controlled the company expect to continue to do so in the same proportions. Nor is any segregation of the different departments of the company's business under the least consideration. The company is following the lead of other large corporations in embarking upon a comprehensive scheme of retrenchment, made necessary by the prevailing financial conditions. Such a course seems dictated by common prudence.

"George J. Roberts, at present engineer in chief of the United Gas Improvement Company, of Philadelphia, will be elected to the office of first vice-president, and John J. Burleigh, at present a vice-president, will become second vice-president.

"Mr. Roberts is an exceptional man for this property. He has a wide knowledge of the property gained after years of familiarity with it, he is unique in possessing a technical knowledge of all three branches of the company's business. I have been trying to get him to come to the property and to obtain the consent of his present employers to his coming for nearly a year, and have only at last succeeded. He will be vice-president in charge of operation. The second vice-president will also be located at the home office. His duties will be connected with the commercial and executive branches of the company's business."

TRANSIT AFFAIRS IN NEW YORK

Justice Seabury, in the Supreme Court, appointed Paul Fuller, J. Hampden Dougherty and Melvin G. Palliser receivers for the New York City Railway Company in an action by Attorney-General Jackson, Nov. 29. Since Adrian H. Joline and Douglas Robinson, appointed receivers by Judge Lacombe in the United States Circuit Court, already hold possession of the books and properties of both companies, Justice Seabury by his action has precipitated a struggle between state and federal courts for jurisdiction over these companies which will probably go finally to the United States Supreme Court. Justice Seabury in his decision expressly directed his receivers to present the question of jurisdiction in an orderly fashion to the United States Court, and in the mean time not to molest or interfere with the federal receivers in any way other than by due process of law.

Twenty-five special policemen have been placed on duty in the subway at the stations where the crowds are largest in rush hours to stop people who try to board trains already overcrowded and arrest the insistent ones who hold doors open and delay trains. The men were selected by the Interborough Rapid Transit Company, and approved by Police Commissioner Bingham. The same number will soon be put on the elevated lines. The new policemen wear gray uniforms and regular special policemen's badges. To a certain extent they take the place of the platform men, who, though willing enough in most cases, did not have sufficient authority, in the opinion of the company's officials, to handle the subway crowds properly.

A plan has been advanced which contemplates the acquisition of the Belmont tunnel between Manhattan and Long Island City by the city, and what would amount to a partnership in its operation between the city and the interests now owning the tunnel. Briefly stated, the plan is that the city shall buy the tunnel, as it stands, for what it cost to construct it, with interest, to date; shall pay for it with city bonds instead of cash, and shall enter into a contract with the Belmont interests whereby those interests shall operate the line in connection with the Queens County surface lines, the net earnings to be equally divided between the city and the Belmont people, and the city to apply its share of the proceeds to the payment of the interest on the bonds.

At the continuation of the hearing on the affairs of the Brooklyn Rapid Transit Company by the Public Service Commission on Wednesday, Dec. 4, President Winter, of the company explained that the Transit Development Company, a subsidiary, is purely an instrument of economy, and described its purposes.

REPORT SOON ON MELBOURNE ELECTRIFICATION

In 1903 the conversion of the steam railway between Flinders Street and St. Kilda's, Melbourne, was recommended, and Mr. Tait, the Chief Railway Commissioner of Victoria, urged a thorough investigation as to the feasibility and advisability of using electric traction instead of steam locomotives on all the principal suburban lines within a distance of twelve miles of the central station at Melbourne. He advised that the St. Kilda line should be electrically equipped, having in view the extension of electric traction to the other suburban lines as the condition of each case might warrant, and funds became available for the purpose. As a result, it was decided that the Chief Commissioner should visit England and America and engage a consulting engineer, first to report on and then to superintend this work. This engineer is now in Melbourne engaged in preparing a full report in detail in reference to the subject of electric traction on the suburban lines there. This report is to include his views and recommendations as to the best system and methods to be adopted in connection with electric traction, and his estimates in detail of the financial results which will be obtained therefrom, including the expenditure involved, cost of working and maintenance, and the gross revenue and net revenue after electrification. In the course of an interesting report issued by Mr. Tait, giving an account of his inquiries in Europe and America on this question, he rightly states that great responsibility rests upon the engineer, who is undertaking this work under his agreement with the Commissioners, because the method and designs which are adopted in connection with the first lines to be converted will largely determine the methods and designs to be followed in connection with subsequent conversions.

Without wishing to anticipate the recommendations which the Railway Commissioners may make after the consideration of the report, the Chief Commissioner sets forth some of the special reasons favorable to the electrification of the St. Kilda and Port Melbourne lines, and the need for an early start with the work. Without electrification additional locomotives and rolling stock would have to be built for the Melbourne suburban traffic at an early date. Indeed, owing to shortage of the suburban type of locomotive, engines suitable for country trains have to be employed for the suburban traffic. These engines are unsuited and too costly in construction for the economical working of this service. Carriages built for country traffic are also being used on the suburban lines, but the principal need of additional carriages for the suburban traffic is to replace the obsolete stock still used in that traffic. By converting certain of the suburban lines for electric traction and building new electric rolling stock the steam rolling stock shortage will be relieved. In view of the possibility of the electrification of the busiest suburban lines, it would appear to be unwise to build more suburban locomotives and rolling stock in the meantime. Another reason favorable to the selection of the St. Kilda and Port Melbourne lines for the first step in electrification is that these lines are practically isolated from the rest of the railway system. These tracks are separate from those of the other lines at the principal station in Melbourne, Flinders street, lying, as they do, on the extreme river side of that station, and not being used for through traffic. It is also pointed out that, if the St. Kilda line be electrified, current from the power house supplying it can be used for working the electric tramway which is operated by the Victorian Government Railways, and the obsolete power house at which the current for that tramway is now generated can be abandoned. The financial and other results of the electrification of these lines will be of great assistance in determining the advisability of converting the other suburban lines in Melbourne, and in making detailed comparisons between steam and electric operation.

THE WESTINGHOUSE BALANCE SHEET

The receivers of the Westinghouse Manufacturing Company have issued a general balance sheet showing the affairs of the corporation on Oct. 23, 1907. The statement shows a profit and loss surplus of $11,610.756. The affairs of the company are apparently in excellent shape, except for its lack of cash. The details of its quick assets show $2,721,839, consisting of $427,262 cash available to receivers, $250,043 available to ancillary receivers, $275,477 in banks which refuse to honor receivers' checks; a special deposit of $1,536,385, which is in dispute, and $232,670 with cashiers and agents. The accounts receivable, $7,849,538, are available. Of this amount $324,661 is due from European Westinghouse companies; $143,430 from the Westinghouse Lamp Company, and $648,450 from the Westinghouse Machine Company. There is in litigation $183,087. The company has on hand raw material and supplies valued at $4,298,143, and work in progress valued at $6,221,129. The company has investments amounting to $29,490,614. A large amount of this consists of bonds of the Lackawanna & Wyoming Valley Rapid Transit Company, and foreign Westinghouse stocks, a large amount of United States Electric Lighting Company stock, representing originally real estate and buildings.

Following is the balance sheet in full:

ASSETS.

Property and plant	$12,342,223
Quick assets	2,721,839
Accounts receivable	9,210,671
Notes receivable	3,534,698
Interest accrued, not due	195,307
Working assets	17,799,465
Investments	29,490,614
Other assets	7,523,106
Total assets	$82,817,923

LIABILITIES.

Preferred stock	$27,998,700
Assenting stock	26,237,195
Non-assenting stock	600
Funded debt	20,469,000
Collateral notes	8,702,702
Current liabilities	13,462,009
Interest accrued, not due	410,528
Current accounts, special	13,875
Reserves	211,956
Profit and loss—surplus	11,610,756
Total liabilities	$82,817,923

The property and plant of the company, consisting largely of real estate, buildings and machinery, is alone worth $12,342,223. The current liabilities are only $13,462,609, almost covered by the real estate held by the corporation alone.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 41 Park Row, New York.]

UNITED STATES PATENTS, ISSUED NOVEMBER 19, 1907.

871,166. Railway Signal and Safety Appliance; George W. Gerlach, Cumberland, Iowa. App. filed March 27, 1907. Consists of a novel semaphore and trip. loated at a point or station, to give warning at a dangerous place.

871,200. Anti-Friction Lateral-Motion Center-Bearing; John C. Barber, Chicago, Ill. App. filed July 26, 1906. A lateral-motion roller-bearing interposed between the truck bolster and the lower plate of the center bearing proper. The bearings have a slightly elongated slot, laterally extending, for the king bolt.

871,220. Controller; Thomas Gilmore, Norwood, Ohio. App. filed Oct. 31, 1906. Designed to reduce the length of the drum and consequently the height of a series parallel controller adapted to heavy current.

871,232. Railway Track Construction; Edwin K. Morse, Pittsburg, Pa. App. filed March 14, 1907. Adapted for subway and elevated roads. A concrete roadbed has channels for the reception of fibrous belting or other sound-deadening material, and rail-supporting plates mounted upon the fibrous belting.

871,277. Pressure Reducing Valve; Andrew T. Johnson, Tonopah, Nev. App. filed March 6, 1907. An automatic pressure-reducing valve to be used in cross-over pipe of air-brake apparatus.

871,294. Vehicle for Recreation or Amusement; Thomas W. Potts, Fulham, London, England. App. filed June 17, 1907. Relates to the construction of vehicles for use on switchback and line pleasure railways.

871,378. Railway Signal; Louis H. Thullen, Edgewood, Pa. App. filed March 18, 1905. Mechanical construction for operating a semaphore arm from an ironclad solenoid magnet disposed within the standard of the semaphore signal.

871,394. Brake Shoe; Joseph D. Gallagher, Glenridge, N. J. App. filed April 3, 1907. Comprises a wearing body having at or adjacent to the back thereof a wire mesh and metal strap.

871,419. Convertible Street Car; George J. Knoll, Cleveland, Ohio. App. filed Oct. 23, 1905. The seats are pivoted so as to be arranged transversely for open or summer use and longitudinally for winter use.

871,424. Surface Electric Railway; Timothy Mahoney, San Francisco, Cal. App. filed July 6, 1906. Provides a system of distribution for alternating current with a third or signal, sectional, surface conductor-rail, which will avoid electrolysis of water and gas pipe mains. Has specially arranged reactance windings or choke coils.

871,442. Trolley-Pole Attachment; Robert P. Rever, Newark, N. J. App. filed Nov. 26, 1906. The trolley harp has a yielding spring connection with the pole, so as to yield in a lateral or in a forward and back direction.

871,455. Automatic Switch-Throwing Device; George R. Stuart, Owensboro, Ky. App. filed March 5, 1907. Automatic means for throwing a switch from a moving train.

871,457. Electrically Propelled Vehicle; Russel Thayer, Philadelphia, Pa. App. filed April 4, 1907. Has adjustable conductor shoes which may be dropped into engagement with the track rails so as to maintain connection therewith notwithstanding deviations of the vehicle therefrom.

871,496. Protection of Railway Trains; Abel R. A. Gerard, Pontgivart, France. App. filed May 1, 1906. A semi-automatic block signal system for railways in which the train itself effects the operation of setting the signals after passing a section and in which the completion of the signals are effected by a local operator.

871,501. Bond for Rails; Charles Y. Haile and George M. Hugus, Uniontown, Pa. App. filed May 17, 1907. The bond passes through the web of the rail and through the fish plates in a zigzag path, so as to prevent such fish plates from being surreptitiously removed.

871,512. Sweeping Machine; Joseph Ledwinka, Philadelphia, Pa. App. filed June 28, 1906. A sweeping machine for trolley roads. Relates to means for raising and lowering the brush and adjustment of the same angularly or laterally with respect to the car.

871,521. Car Fender; George R. Owings, Pittsburg, Pa. App. filed March 7, 1907. Details of construction.

871,538. Apparatus for Insuring Safety of Traffic on Single Lines of Railway; Edward Tyer, Dalston, London, England. App. filed Nov. 15, 1905. A stall system in which a tablet issued from an apparatus which may be electrically controlled, must be received by the engine driver, who can take his train to the next section.

871,616. Trolley-Pole Controller; Clarence Norland, Los Angeles, Cal. App. filed Nov. 19, 1906. The trolley pole is controlled by pneumatic cylinder having a piston therein. When air is introduced on one side of the piston the pole is held in contact with the feed wire, and when air is introduced on the other side of the piston the pole is retrieved. Means for automatically controlling the air.

871,643. Pleasure Railway; Lorenzo D. Shaw, Glen Echo, Md. App. filed Sept. 19, 1907. The car passes down an inclined plane over a body of water, the rails being at the water level. A pipe extends downward through the roof and floor of the car, the lower end of the pipe being adapted to take up water by momentum and spray it over the roof of the car.

871,722. Amusement Device: William J. Millican, New York, N. Y. App. filed April 16, 1907. Embodies features of both a toboggan slide and an ordinary amusement wheel. The wheel has directly opposed loops converging toward a common center, a car carried by the loops and means whereby the car will travel from side by gravity when the wheel is revolved.

871,740. Brake Shoe; Frank R. Spear, Chicago, Ill. App. filed July 3, 1907. A reinforcing and strengthening back for brake shoes, consisting of a malleable iron frame having a plurality of rods or bars connected together and all made in one casting, said rods or bars having beveled sides and ends.

871,744. Amusement Apparatus; Theophilus Van Kannel, New York, N. Y. App. filed March 9, 1907. Means for imparting a wave motion to a pliable floor over which passenger conveyances pass.

12,722. Trolley Retriever; Alfred W. Knutson, Brookfield, Ill. App. filed Aug. 19, 1907. Details of construction of a spring, drum and ratchet for controlling the trolley.

PERSONAL MENTION

MR. HUGH J. McGOWAN, of Indianapolis, presented an address on the subject of interurban railways at a meeting of the National League, held in Chicago, Nov. 23.

MR. L. W. LESTER has resigned as treasurer of the Worcester Consolidated Street Railway Company, and will be succeeded by Mr. Leverett Candee, who is now associated with New York, New Haven & Hartford Railroad interests, and was formerly treasurer of the Fair Haven & Westville Railroad.

MR. ROBERT T. GUNN has resigned as general manager of the Lexington Railway & Light Company, of Lexington, Ky., to become superintendent of transportation of the Ft. Wayne & Wabash Valley Traction Company. Mr. Gunn formerly was superintendent of the Norfolk Railway & Light Company.

MR. R. P. SHERMAN has not resigned as superintendent of the Los Angeles-Pacific Railway, as was recently reported in this column. It seems that through a grievous misunderstanding the impression gained circulation that Mr. Sherman intended to resign, and on the strength of rumor the announcement of his resignation was made generally in Los Angeles and was published by the STREET RAILWAY JOURNAL.

MR. JOHN I. BEGGS says the election of Mr. W. V. N. Powelson to the presidency of the Union Electric Light & Power Company, of St. Louis, as his successor, does not signify that he will retire from the presidency of the United Railways or the Laclede Gas Light Company. Mr. Beggs states that he resigned the presidency of the Union Electric in order to devote more time to the United Railways and the Laclede Gas companies.

MR. ROBERT MALLEN BABBITT has just been appointed Western business representative of the STREET RAILWAY JOURNAL, with headquarters in Chicago. Mr. Babbitt takes the place of Mr. H. B. Abbott, who has been compelled to resign on account of ill health. Mr. Babbitt is not a newcomer in the electric railway field, as for three years he was connected with the engineering force of Ford, Bacon & Davis, on construction work, and for the last two years has been associated with the operating department of the Chicago & Milwaukee Electric Railway Company.

MR. THEODORE P. SHONTS, president of the Interborough Rapid Transit Company, of New York, was, on Dec. 4, formally elected president of the Chicago & Alton Railroad, control of which recently passed from the Rock Island to the Toledo, St. Louis & Western, of which Mr. Shonts is also president. Mr. George R. Ross, vice-president of the Clover Leaf Railroad, was also elected vice-president of the Alton Company. Mr. Shonts' duties will be of a purely executive nature and in no way will his election to the company affect his connection with the Interborough Company.

MR. FRANK E. ELLIS, who for the past two years has been assistant to Secretary B. V. Swenson, of the American Street & Interurban Railway Association, will retire Jan. 1, 1908, owing to a proposed rearrangement of the work in the office of the association, which will go into effect the first part of the year. Prior to his connection with the association Mr. Ellis was engaged in newspaper work on the New York "Tribune" and other papers. He is planning to return to the Middle West, where he was a resident for a number of years, to act as freight or passenger agent, or both, for some interurban electric railway company.

MR. JOHN B. CRAWFORD, superintendent of transportation of the Fort Wayne & Wabash Valley Traction Company, of Fort Wayne, Ind., has been appointed general manager of the Lexington Railway & Lighting Company, of Lexington, Ky., to succeed Mr. R. T. Gunn, who has become superintendent of transportation of the Fort Wayne & Wabash Valley Company. Mr. Crawford is a very young man, only 31 years of age, but has had an extended experience in construction and operation, both in the East and the West. Twelve years ago he entered the railway field in connection with the work of electrifying the Hartford, Conn., Street Railway. Then, to extend the scope of his work, he took the electrical course in the testing department of the General Electric Company. Having completed this he entered the power field, filling the position of assistant superintendent of the Conductor Power Company, engaged in the construction of transmission lines for power and lighting service on the Pacific Coast. Returning East he accepted the position of general superintendent of the Groton & Stonington Street Railway Company. It was his record with this company that secured for him about a year ago the appointment to the Fort Wayne & Wabash Valley Traction Company, just as his subsequent record with the latter company secured for him the appointment to the Lexington Company. Mr. Crawford is a nephew of Mr. Norman McD. Crawford, vice-president of the Indiana, Columbus & Eastern Traction Company.

MR. WILLIAM WHARTON, JR.—A short notice was published last week of the death in Germantown, on Nov. 26, of Mr. William Wharton, Jr. Mr. Wharton was born in Philadelphia in 1830, and was a son of William Wharton and Deborah Wharton, both of whom belonged to that well-known old Quaker family. He was educated at the Philadelphia Friends' School, being first boy on the list. Of a mechanical turn of mind, Mr. Wharton early in life gave his attention to the construction of track for railroad, and to street railways, which were just then being introduced. His entire life, from the very beginning of street railways in America, was, therefore, given over to this industry. In 1859 he embarked for himself in the manufacture of street railway track material, thus laying the foundation for the business of the company which still bears his name, the Wm. Wharton, Jr., & Company, of Philadelphia. This company he formed in 1881, in conjunction with Edward Samuel and others, for the extension of his former individual business. He became the head of this company and held the office of president until his death. For many years he was also connected with the Wharton Railroad Switch Company, whose business was finally taken over by the Wm. Wharton, Jr., & Company, Incorporated. Among Mr. Wharton's early inventions was the "Wharton switch," which became very extensively used. The use of cold-bent rolled steel grooved guard rails for street railway curves was also originated by him, and he was one of the first to introduce girder rails in street railway track. In 1884 he helped to organize the North Branch Steel Company, of Danville, Pa., which for many years was well known as a manufacturer of girder rails for street railways. The first 9-in. girder rail was rolled at that mill.

In connection with the street railway industry he was a manufacturer, contractor, inventor, experimenter, owner and operator. He built the first street railway tracks in Philadelphia and in New York, and during the Civil War he built considerable railroad track in Virginia, right in the face of the hostile forces. During the Centennial Exposition in Philadelphia he did some remarkable track laying, besides building and operating some roads on his own account specially for the occasion. He built the first tracks on Broadway in New York in 1884, under circumstances recollected by many, and in a manner as to despatch unequaled and unthought of in those times. Wherever there was a difficult piece of track work to be done, requiring knowledge, unusual energy, tact and courage, Wm. Wharton, Jr., was sought. His experiences in this connection, of which he only told once in a while in a circle of intimate friends, would make interesting reading if they could be collected. In the early stages of electric traction he experimented extensively, especially with storage batteries. He built, owned and operated the Lehigh Avenue Railway, in Philadelphia, which for several years was run largely for the purpose of developing electric traction. His versatility and his ability to master and personally to go into the most minute details was most remarkable.

One of his many gifts was the ability to surround himself with men of integrity to carry out his principles. This faculty enabled him in his old age to direct and keep in close touch with all his many interests and to stamp upon them his character, which always stood for straightforwardness and absolutely strict business honesty. His old-time energy and ability as to details asserted themselves with youthful spirit even in late years, when aroused by any special interest in an undertaking. Everybody of the street railway fraternity remembers his able, untiring direction and the consequent success of the exhibition in connection with the convention in Philadelphia in 1905, the first at which this portion of the convention came under the management of the Manufacturers' Association of the American Street & Interurban Railway Association.

For the greater part of the past year Mr. Wharton was in ill health, and was incapacitated from attending to business, but as this was known to but few of his more intimate friends, his death came as a shock to most of them. His widow, for more than 55 years his faithful companion, one son, Mr. W. Redwood Wharton, and one daughter, Mrs. Mendelson, of New York, survive him. His memory will be cherished as a man and as a friend, and he will long be remembered as one of the Nestors of the street railway industry.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement, "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit. ‡ Including Rapid Railway system, Sandwich, Windsor & Amherstburg Railway, and Detroit, Monroe & Toledo Short Line Railway.

Company.	Period.	Total Gross Earnings.	Operating Expenses.	Net Earnings.	Deductions From Income.	Net Income, Amount Available for Dividends.
AKRON, O. Northern Ohio Tr. & Light Co.	1m., Oct. '07	155,291	92,701	62,590	43,369	19,221
	1 " " '06	134,890	80,054	54,836	39,548	15,288
	10 " " '07	1,615,075	925,289	689,787	426,529	263,258
	10 " " '06	1,428,244	845,227	583,017	401,147	181,870
CHAMPAIGN, ILL., Illinois Traction Co.	1m., Oct. '07	368,838	*198,852	169,986	.....	.....
	1 " " '06	280,339	*141,918	138,421	.....	.....
	10 " " '07	3,091,321	*1,732,926	1,358,395	.....	.....
	10 " " '06	2,443,647	*1,335,194	1,108,453	.....	.....
CHARLESTON, S. C. Charleston Con. Ry., Gas & Elec. Co.	1m., Sept. '07	56,731	38,516	18,215	13,517	4,699
	1 " " '06	51,732	34,275	17,458	13,017	4,441
	7 " " '07	424,110	264,583	159,527	94,617	64,910
	7 " " '06	380,237	233,130	147,107	90,967	56,140
CHICAGO, ILL. Aurora Elgin & Chicago Ry. Co.	1m., Oct. '07	122,930	67,554	55,376	27,074	28,301
	1 " " '06	109,738	59,153	50,585	26,158	24,426
	4 " " '07	564,973	288,261	276,713	106,224	170,489
	4 " " '06	502,821	250,070	252,750	100,809	151,941
Chicago & Milwaukee Elec. R.R. Co.	1m., Oct. '07	99,329	42,234	57,095	.....	.....
	1 " " '06	88,906	40,621	48,284	.....	.....
	10 " " '07	884,730	367,671	517,059	.....	.....
	10 " " '06	722,448	293,380	429,068	.....	.....
CLEVELAND, O. Cleveland, Painesville & Eastern R.R. Co.	1m., Sept. '07	29,370	*17,295	12,075	6,796	5,279
	1 " " '06	29,411	*14,729	14,682	7,108	7,574
	9 " " '07	222,082	*118,249	103,834	63,664	40,169
	9 " " '06	207,637	*110,355	97,282	62,530	34,751
Cleveland, S. W. & Columbus Ry. Co.	1m., Oct. '07	65,793	38,296	27,497	. .	.....
	1 " " '06	56,499	31,642	24,857	.....	.....
	10 " " '07	634,684	365,075	269,609	.....	.....
	10 " " '06	539,133	304,430	234,703	.....	.....
Lake Shore Elec. Ry. Co.	1m., Sept. '07	96,187	*46,279	49,908	25,189	24,719
	1 " " '06	89,023	*42,599	46,424	21,172	25,252
	9 " " '07	721,389	*386,021	335,368	218,242	117,126
	9 " " '06	664,806	*361,729	303,077	185,778	117,299
COLUMBUS, GA. Columbus Elec. Co.	1m., Sept. '07	28,980	*15,518	13,462	10,438	3,024
	1 " " '06	26,036	*14,042	11,994	8,773	3,220
	12 " " '07	326,006	*177,580	148,426	117,308	31,119
DETROIT, MICH. Detroit, Jackson & Chicago Ry.	1m., Oct. '07	38,724	*34,276	4,448	16,575	†12,127
	9 " " '07	323,467	*258,956	64,511	139,800	†75,289
‡Detroit United Ry. Co.	1m., Oct. '07	574,525	*379,419	195,106	116,857	78,249
	1 " " '06	511,240	*346,823	164,417	105,857	58,560
	10 " " '07	5,686,401	*3,496,221	2,190,180	1,145,796	1,044,384
	10 " " '06	5,106,926	*3,061,632	2,045,294	1,030,434	1,014,860
DULUTH, MINN. Duluth St. Ry. Co.	1m., Oct. '07	74,508	41,461	33,047	17,919	15,128
	1 " " '06	66,422	38,003	28,420	17,849	10,571
	10 " " '07	700,180	351,084	349,095	177,727	171,369
	10 " " '06	636,892	335,929	300,963	176,494	124,469
E. ST. LOUIS, ILL. East St. Louis & Suburban Co.	1m., Sept. '07	199,211	93,704	105,507	.....	.....
	1 " " '06	177,762	84,402	93,360	.....	.....
	9 " " '07	1,575,973	831,236	744,737	.....	.....
	9 " " '06	1,414,945	704,610	710,335	.....	.....
ELMIRA, N. Y. Elmira, Water, Lt.& R.R. Co. (R.R. Dept.)	3m., Sept. '07	78,132	53,213	24,919	14,945	9,974
	3 " " '06	67,731	44,352	23,379	12,118	11,261
	9 " " '07	185,430	133,763	51,667	40,572	11,095
	9 " " '06	164,743	115,680	49,063	36,632	12,431
EL PASO, TEX. El Paso Cos.	1m., Sept. '07	45,556	*31,906	13,650	5,222	8,428
	1 " " '06	35,905	*25,144	10,761	4,356	6,405
	12 " " '07	474,875	*364,530	110,345	56,434	53,911
	12 " " '06	360,128	*246,752	113,376	46,472	66,904
FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co.	1m., Sept. '07	125,732	69,984	55,748	.....	.....
	1 " " '06	106,276	61,258	45,018	.....	.....
	9 " " '07	937,622	557,012	380,610	.....	.....
	9 " " '06	804,926	492,754	312,172	.....	.....
FT. WORTH, TEX. Northern Texas Tr. Co.	1m., Sept. '07	93,468	*52,653	40,815	11,276	29,539
	1 " " '06	76,338	*50,982	25,357	9,942	15,415
	12 " " '07	1,018,274	*618,061	400,213	125,803	274,411
	12 " " '06	795,807	*502,226	293,580	119,288	174,293
GALVESTON, TEX. Galveston-Houston Elec. Co.	1m., Sept. '07	97,651	*56,652	40,999	13,176	27,823
	1 " " '06	84,356	*51,562	32,795	11,958	20,836
	12 " " '07	1,023,838	*637,947	385,891	149,339	230,552
	12 " " '06	880,219	*553,689	326,530	146,756	179,774
HOUGHTON, MICH. Houghton County St. Ry. Co.	1m., Sept. '07	23,878	*12,873	11,006	3,948	7,057
	1 " " '06	22,689	*11,781	10,908	3,896	7,012
	12 " " '07	247,581	*153,265	94,316	47,347	46,969
	12 " " '06	219,981	*144,506	75,475	46,486	28,989
JACKSONVILLE, FLA., Jacksonville Elec. Co.	1m., Sept. '07	32,651	*21,830	10,821	4,852	5,970
	1 " " '06	26,968	*17,480	9,488	3,333	6,155
	12 " " '07	386,478	*246,508	139,970	45,452	94,518
	12 " " '06	306,112	*191,656	114,456	40,445	74,011
KANSAS CITY, MO. Kansas City Ry. & Lt. Co.	1m., Sept. '07	534,923	262,980	271,943	156,157	115,786
	1 " " '06	476,756	224,968	251,788	144,600	107,188
	4 " " '07	2,087,825	1,072,997	1,014,828	619,891	394,937
	4 " " '06	1,875,098	934,209	940,889	573,950	366,939
LEXINGTON, KY. Lexington & Interurban Rys. Co.	1m., Sept. '07	59,195	31,120	28,076	.....	.....
	1 " " '06	61,634	34,370	27,264	.....	.....
	9 " " '07	420,783	266,307	154,476	.....	.....
	9 " " '06	394,768	259,736	135,032	.....	.....
MILWAUKEE, WIS. Milwaukee Elec. Ry. & Lt. Co.	1m., Oct. '07	338,049	179,645	158,404	101,063	57,340
	1 " " '06	312,631	152,170	160,461	92,451	68,010
	10 " " '07	3,228,886	1,628,980	1,599,907	982,010	617,897
	10 " " '06	2,935,470	1,432,580	1,502,890	884,369	618,521
Milwaukee Lt., Ht. & Tr. Co.	1m., Oct. '07	67,499	31,910	35,589	36,133	†544
	1 " " '06	56,607	23,747	32,861	28,257	4,604
	10 " " '07	703,259	299,357	403,902	342,921	60,981
	10 " " '06	592,271	229,029	363,242	267,501	95,741
MINNEAPOLIS, MINN. Twin City R. T. Co.	1m., Sept. '07	561,446	251,276	310,170	115,142	195,029
	1 " " '06	534,151	236,926	297,225	114,758	182,467
	9 " " '07	4,540,273	2,180,437	2,359,836	1,036,742	1,323,095
	9 " " '06	4,217,438	1,951,050	2,266,388	1,004,153	1,262,235
MONTREAL, CAN. Montreal St. Ry.	1m., Oct. '07	311,898	164,575	147,323	43,289	104,034
	1 " " '06	281,822	157,689	124,133	40,610	83,523
	12m., Sept. '07	3,558,744	2,104,653	1,454,091	585,250	868,841
	12 " " '06	3,100,487	1,850,720	1,294,767	546,064	703,703
NORFOLK, VA. Norfolk & Portsmouth Tr. Co.	1m., Sept. '07	295,611	161,921	133,690	.....	.....
	1 " " '06	155,558	94,908	60,650	.....	.....
	9 " " '07	1,977,297	1,200,668	776,629	.....	.....
	9 " " '06	1,275,754	833,831	441,923	.....	.....
PEEKSKILL, N. Y. Peekskill Lt. & R.R. Co	1m., Oct. '07	16,477	*8,284	8,193	.....	.....
	1 " " '06	12,151	*7,012	5,139	.....	.....
	10 " " '07	140,221	*76,495	63,726	.....	.....
	10 " " '06	120,963	*63,712	57,251	.....	.....
PENSACOLA, FLA., Pensacola Elec. Co.	1m., Sept. '07	20,005	*12,152	7,853	3,579	4,274
	1 " " '06	14,270	*8,835	5,435	3,164	2,271
	12 " " '07	212,759	*139,224	73,536	39,575	33,961
PHILADELPHIA, American Rys. Co.	1m., Oct. '07	242,281	.....	.....	.....	.....
	1 " " '06	230,190	.....	.....	.....	.....
	4 " " '07	1,108,524	.....	.....	.....	.....
	4 " " '06	1,038,728	.....	.....	.....	.....
PITTSBURG, PA. West Penn. Ry. Co	12m., Oct. '07	1,576,492	848,408	728,084	403,650	324,434
	12 " " '06	1,409,493	773,976	635,517	378,322	257,195
PLYMOUTH, MASS Brockton & Plymouth St. Ry. Co.	1m., Sept. '07	11,620	*8,927	2,693	1,745	948
	1 " " '06	12,236	*5,520	6,716	1,814	4,903
	12 " " '07	117,721	*82,540	35,182	21,447	13,735
	12 " " '06	109,777	*69,754	40,022	21,793	18,230
ST. LOUIS, MO. United Railways Co. of St. Louis.	1m., Oct. '07	971,322	*607,450	363,872	231,483	132,389
	1 " " '06	933,613	*558,915	374,698	231,984	142,714
	10 " " '07	9,087,659	5,906,466	3,181,193	2,315,214	865,979
	10 " " '06	8,566,571	5,344,588	3,221,983	2,318,131	903,852
SAVANNAH, GA. Savannah Electric Co.	1m., Sept. '07	52,894	*35,000	17,894	12,261	5,633
	1 " " '06	49,805	*31,812	17,993	11,529	6,464
	12 " " '07	583,939	*395,469	188,471	140,982	47,488
	12 " " '06	628,149	*379,396	248,754	133,262	115,492
SYRACUSE, N. Y. Syracuse R. T. Co.	1m., Oct. '07	108,880	65,377	43,503	27,242	16,261
	1 " " '06	95,923	55,060	40,863	24,137	16,726
	10 " " '07	1,042,790	589,763	453,027	257,851	195,176
	10 " " '06	901,698	513,111	388,587	231,314	157,273
UTICA, N. Y. Utica & Mohawk Valley Ry. Co.	3m., Sept. '07	328,918	218,722	110,196	81,443	28,753
	3 " " '06	295,882	168,834	127,048	48,614	78,434
	9 " " '07	835,607	557,605	278,002	236,586	41,416
	9 " " '06	740,833	441,853	298,980	141,664	157,316

Street Railway Journal

VOL. XXX. NEW YORK, SATURDAY, DECEMBER 14, 1907. No. 24

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Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1907 *to date,* 411,250 *copies, an average of* 8225 *copies per week.*

The Cleveland Situation

Under this caption the STREET RAILWAY JOURNAL has chronicled in almost every issue of the paper for more than a year the events each week in the contest waged between the Cleveland Electric Railway Company and Mayor Johnson, of Cleveland. We doubt whether any private corporation has ever engaged for so long in so unequal a struggle. Various compromises were possible earlier in the history of the conflict, but they involved what the company considered was an infringement of its rights, and so long as there was reasonable expectation that the people in Cleveland would support the efforts of the company to provide a good service, free from politics and at a low fare, the company considered its duty lay in continuing on the defensive. The last election—carried, it is true, by a small majority—was in favor of the tactics pursued by Mayor Johnson, and the indications are now that the company no longer considers it necessary to prolong the fight for good government without the complete support of the citizens of Cleveland. The first steps to be taken in the appointment of a board of arbitration for the appraisement of the railway lines in Cleveland were outlined in a speech made last week to the mayor and aldermen by Mr. Goff, a stockholder in the company, and reported elsewhere in this issue. The details are yet to be worked out, but the final compromise, if accepted, will involve no loss of honor. Mr. Andrews and his associates can retire from the direction of the Cleveland transportation system with the thanks of the street railway fraternity and of the conservative element in Cleveland for the resources which they have exhibited under tremendous odds in the defence of their property.

We imagine, however, that success will be not without its disadvantages for the victors. It is easy to criticize, but much less easy to give universal satisfaction. Heretofore the mayor has been an obstructionist, and his political capital has consisted largely of what might be called political promissory notes to the disaffected. We wonder whether he welcomes the suggestion of compromise as cordially as his political followers look forward to the operation of a municipal railway in Cleveland. Promise and performance in political matters have been found in the past to differ considerably from each other, and it remains to be seen to what extent this condition will apply in this case. Another serious question is the effect upon investors of public utility properties in general, and of those in Ohio in particular, of the events which have recently transpired in Cleveland. The growth of many of our cities depends upon the maintenance and extension of their local transportation systems, but capitalists will find little encouragement for investment if their enterprises are to be liable to such attacks as those to which they have recently been subjected in Cleveland. The result, so far as the investment of capital in the city itself is concerned, is still more doubtful.

In one respect encouragement can be found in the Cleveland episode. Up to the present street railway companies in this country have had to be on the defensive, as there have been no municipal roads in this country. At one time it seemed as if the experiment was to be tried in Chicago, but wiser counsels prevailed. Cleveland will now, under Mayor Johnson, attempt to prove that a municipal road can be made a success. We sincerely trust that such will be the case, but the odds are certainly very much against any satisfactory results from a transportation system operated for any length of time from the City Hall of any American city.

What Constitutes High-Tension Lines?

A prominent railway company has asked us "What voltage do steam railroad companies designate as high-tension lines," and further, "What requirements do they insist on for protecting crossings?"

The first question brings out some interesting facts. We use the phrase "high tension" daily, yet cannot define it. It is employed in drawing up franchises, contracts and other agreements by parties who, no doubt, have only a vague idea of what voltage constitutes "high tension."

All will agree that the ordinary railway voltage is not, and we have never heard the 1200-volt railway circuits referred to as high tension. The 2300-volt a. c. lines employed in commercial lighting carry practically the next commercial voltage, but we do not believe that they are generally classed under this head. A 6600-volt line is, no doubt, generally accepted as a high-tension line. The average person would probably place the dividing line between 6600 and 2300 volts. But this leaves the 4000-volt distributing circuits in several of the larger cities and the 3300-volt power circuits in the doubtful region.

It is possible that some of the States may have passed acts designating in definite terms what shall constitute high-tension lines. If so, it would be interesting to make a comparison and note any variations in the opinions of legislators. Any differences in State laws would certainly be embarrasing to a corporation doing business in several States. To remove all ambiguity, one of the prominent societies, the N. E. L. A. or the A. I. E. E., might take the matter up and specify what voltage shall constitute "high tension."

The second question relates to how these circuits should be protected at the points at which they cross railroad lines, but there seems to be no necessity for taking any more precautions at these points than at crossings with telephone and telegraph lines or at highway crossings. The probability of wires breaking and doing damage to the railroad trains appears to be no greater than the possibility of their causing injury at the other points mentioned. That this contingency is very remote may be judged from the fact that practically no reports of accidents are published due to any of the many 15,000 to 33,000-volt lines of interurban railways in the Middle West, although these circuits frequently follow the interurban tracks through villages and towns.

The Internal Combustion Engine

The December meeting of the American Society of Mechanical Engineers, held in New York last week, was of especial interest to power users on account of the attention given to the internal-combustion engine. Three papers were presented on this subject, the authors being Mr. Reeve, Prof. Lucke and Mr. Bibbins. Of these, the paper by Mr. Reeve was the longest and proposes a solution of some of the present difficulties which is somewhat of a startling compromise. His general view is that the explosion engine involves some inherent difficulties so great as to make a radical departure from present practice necessary. Especially in the matter of regulation is the gas engine at fault, since either with "hit-or-miss" governing or with operation at variable charge and hence variable compression the opportunity for regulation comes too far ahead of the power stroke. This failing is familiar, yet big gas engines are steadily coming into greater use. We do not think that engineers familiar with gas-engine practice will agree with Mr. Reeve that "With all fuels except blast furnace and producer gas a gas engine costs more for fuel than a steam engine." The statement is certainly incorrect with respect to the ordinary run of small steam engines if gas or gasoline can be had at prices now commonly current, and surely is open to question as a general proposition. We hold no brief for the gas engine, or any other type of engine, but must also strongly dissent from the proposition that "A gas engine may, and undoubtedly does, 'lie down on its job' at any moment." A long list could be made of gas engines that have shown reliability in service quite comparable with anything that could reasonably be required of a steam engine.

To our mind the most serious handicap of the gas engine has been the too frequent claim that it is "fool-proof" and the consequent carelessness with which it is very generally treated. Even the present commercial engines without any claim to perfection will give wonderfully reliable service if treated with reasonable intelligence. All this, however, is quite aside from the very interesting possibilities of improvement disclosed by Mr. Reeve. The first proposition touches operation at variable clearance, giving for all variations of charge nearly uniform compression and hence securing high efficiency at all loads. There are several possible methods of arranging for variable clearance, all rather troublesome yet not impracticable. Far more promising seems the plan of using outside compression. This requires a compressor cylinder delivering a predetermined charge of compressed air and gas. The compression is thus virtually uniform for all loads and the governor can act even into the beginning of the power stroke which supplies a great gain in regulation. Such an engine gives an impulse for each stroke, thus giving the advantage of a two-cylinder form to compensate for the addition of a compressing cylinder. By such construction the working value of compression and hence the efficiency could be considerably increased without danger of back firing, since the charge would not start compression at a rather high temperature as it does in the ordiary cylinder. Obviously such an engine can be readily arranged for reversal, which is still another advantage. Perhaps the objection advanced by Mr. Reeve, the limited rotative speed due to the time necessary for admission and ignition, may be the chief reason why external compression, already proposed in various forms, has not yet come into the use that seems its due. This objection, however, is certainly not serious for many of the uses to which such engines would be applied, and the type is one that deserves development.

By far the most interesting possibility considered by Mr. Reeve is the evolution of a totally different type of internal combustion engine with which he has already experimented with some degree of success. Briefly this substitutes for explosion, combustion under constant high pressure and in presence of water, the mixed superheated steam and products of combustion being then used expansively as in an ordinary steam engine. One may think of it almost as the last refinement of a flash boiler fired from the inside.

The plan involves substantially a compressor system feeding the mixed air and gas into a gas furnace supplied with water. The resulting mixture of superheated steam, nitrogen and CO_2 is led into the cylinder and used at high expansion, preferably with compounding. The working initial pressure would be perhaps 300 to 400 lbs. per sq. in., and the engines would have in themselves the ordinary properties of steam engines. A machine of this type requires rather formidable compression equipment with resulting mechanical losses, and obviously cannot start under load when cold without a good deal of trouble. It is obviously somewhat complex and heavy as a complete installation and would run, one would think, risk of heavy depreciation in the combined boiler and furnace. Mr. Reeve gives no definite figures for its efficiency. In the thermodynamic sense it is undoubtedly very high, yet there may be some question as to whether in fuel per brake-hp it would compare favorably with a first-class steam plant with high superheating. It would have no ordinary boiler to be sure, but would have other accessories about as considerable. It is, however, a mighty ingenious and interesting type of prime mover which we trust Mr. Reeve will work out into commercial development. It has not the simplicity of the explosion type of engine, yet it has some very evident compensating advantages which might put it into serious competition with ordinary steam plants, especially since it fits rather well with the growing practice of using turbines for the lower stages of expansion. At all events it is a departure that deserves to be encouraged.

The Gas Engine as It Is

In distinction from Mr. Reeve's paper dealing with the internal combustion engine as it may be, we have the two valuable papers by Professor Lucke and by Mr. Bibbins discussing things as they are. The former is an analysis of some of the peculiarities of internal combustion which cause practical difficulties as well as theoretical complications. Looking at the matter broadly it is a marvel that the present internal combustion engine performs as well as it does. It is required to work with a wide variety of mixtures, often with very imperfect elimination of the products of combustion and with ignition applied at various points of the stroke. In automobile engines particularly it has to perform at all sorts of speeds, often too high for good mechanical performance, frequently with rather imperfect ignition. Even under less strenuous circumstances the irregularities of supply due to governing are great enough to cause considerable and often inexplicable variations in the consecutive indicator cards. Two things in particular, the conditions leading to explosive waves which may result in serious strains, and to pre-ignition, which is only too familiar, are brought out by Professor Lucke with especial force. A smooth interior for the ignition chamber with a free entrance for a uniform gaseous mixture regularly supplied seems to give the best chance of averting both these troubles. Projecting parts in the cylinder that can readily become over heated and eddies in the gas supply seem to be the chief but not the only promoting causes. It is important to note that to produce pre-ignition in a pure and uniform mixture by compression alone requires compressions very much higher than are actually used in engines.

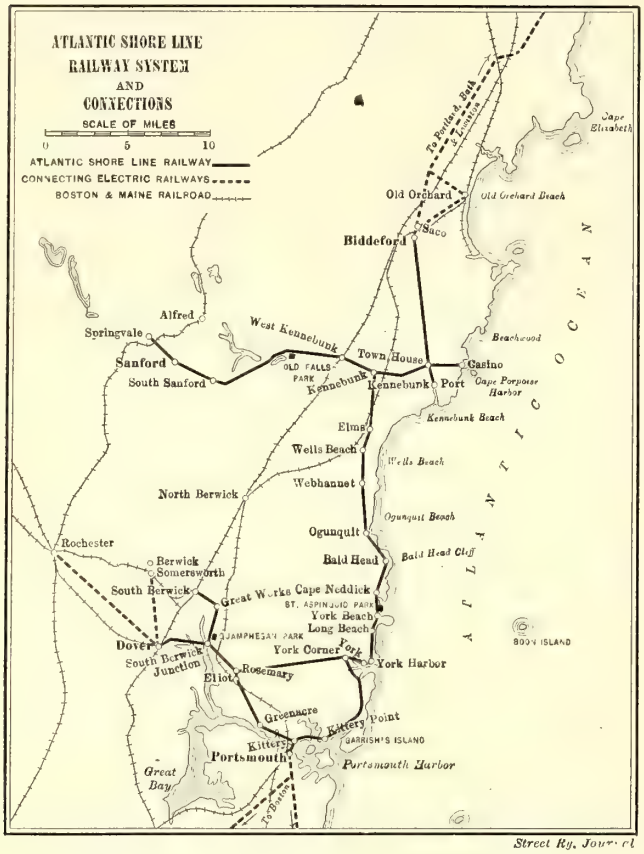
The facts thus presented lend additional force to the comments Mr. Reeve has made on the advantages of exterior compression. If properly carried out this should furnish a regularly distributed supply of uniform mixture in any required amount and should lead to considerably improved regulation, especially necessary in the large and relatively slow-running engines to which the process best applies.

Mr. Bibbins' paper is an exhaustive report of a service test of just such a large engine as now built worked after the ordinary methods on producer gas. The machine was a 500-rated-hp double-acting horizontal Westinghouse engine running 150 r. p. m. and directly connected to a 300-kw generator, and the particular interest which attaches to the test is that it was made with the equipment in charge of its regular operating force working under the ordinary conditions of service. The producer gas averaged nearly 115 effective B. t. u., so that the engine was in no wise under selected favorable conditions. The results were most satisfactory. The average consumption of coal at the producer during the 51 hours covered by the run was 1.4 lbs. per kw-hour, which was equivalent to 0.97 lbs. per hp-hour. The coal employed was Clearfield bituminous run of mine, averaging 14,321 B. t. u. per lb. This economy in fuel is certainly much better than could be reached by any standard steam-driven set of similar output in regular operation and would be extremely good for a plant of any size with the most refined equipment and operated under strictly test conditions. Most steam plants of comparable output would show more than double this coal consumption.

The cylinder oil consumption usually violently charged against the gas engine when all other arguments fail proved to be 0.6 gallon per operating day, or 1.44 gallons for a 24-hour day, an amount which surely does not imply a serious expense per hp-hour. The regulation proved to be from no load to full load 2.5 per cent above and below the mean. The operation of the engine at various loads showed a gas consumption varying from 190 cu. ft. per hp-hour at one-quarter load to 95 cu. ft. at full load, the thermal efficiency being 12.58 per cent in the first place, and 25.21 per cent in the second. These efficiencies are not at all extraordinarily high, although good, and the weakest point in the efficiency of the system seems to have been at the producer, of which the efficiency under the test load was 73.8 per cent. This would be considered high for boiler practice, however. There is probably much to learn regarding the most economical thermal value of gas and the best use of the fuel to produce it, for producer plants are not yet common enough in this country to furnish abundant data for the study of economies. Taken just as it is a plant such as the one here considered is a challenge that the steam engineer cannot safely overlook. The gas engine is far from perfect yet, but it is certainly even now capable of furnishing power at a wonderfully low cost. Its fuel consumption can be duplicated only by steam plants of great size and of the most elaborate and costly construction worked under almost ideal conditions with refinements as yet little known in this country. From Mr. Reeve's data one would be disposed to say that the present gas engine is now in about the relative state of the steam engine before Corliss and compounding. If the steam turbine and high superheating push the present gas engine into active improvement there will be something doing in economy records.

THE ATLANTIC SHORE LINE

The hope of a continuous trolley route along the Atlantic Coast from New York to Lewiston, Maine, has been recently fulfilled by the construction between York Beach and Kennebunk of the last coastwise link in the system of the Atlantic Shore Line Railway. The latter now extends from Portsmouth, N. H., connecting with the South and West via Boston, to Biddeford, Maine, where it meets lines running to Bath and Lewiston via Portland.



Street Ry. Journal

MAP OF DISTRICT SERVED BY THE ATLANTIC SHORE LINE

The stretch of Maine coast thus opened up for popular travel is widely noted for its long, splendid beaches, which alternate with rock-bound shores, peninsulas and islands, long famed for their majestic wildness. To the visitor, the district offers other attractions, too, for its quiet, old-fashioned villages still retain the stamp of the pioneer New Englander. In fact, from the start in Kittery, at the launching place of Paul Jones' "Ranger," to the end of the route in the flourishing mill town of Biddeford, the tourist will find many things of scenic and historic interest. It is hardly remarkable, therefore, to find that this is rapidly becoming a favorite trip for the New England trolley traveler.

Despite the fact that so much travel comes from non-residents, the Atlantic Shore Line Railway, properly called the "Sea View Route," originally consisted of several independent unconnected systems built by local capital purely for home needs. The first section (3 miles) of the system was built between Springvale and Sandford in 1892 under the name of the Mousam River Railroad, primarily to carry incoming and outgoing mill freight to the Boston & Maine Railroad. In 1899, this line, which is shown in the accompanying map, was extended to Kennebunk, Kennebunkport and Cape Porpoise, thus making it possible to secure deep-water freight connections at the cape. The line to Biddeford connecting to famous Old Orchard Beach was completed in August, 1904. Two years ago, the present owners consolidated these lines with the Portsmouth, Kittery & York Railway. The system now covers, including the York Beach line, 100 miles of track, of which 50 miles are on right of way. The York Beach-Kennebunkport line has a right of way 66 ft. 8 ins. wide beginning between York Beach and Cape Neddick, returning to the public road for the 6-mile run between Ogunquit and Kennebunk. All of the franchises are perpetual.

For operating convenience, the system is divided into a Central, Western and Eastern division. The Western division, formerly the Portsmouth, Kittery & York Railway, connects Portsmouth, Dover and Salmon Falls, N. H., Eliot, South Berwick, Kittery, York and York Beach, Maine; the Central division, constituting the latest addition, connects York Beach, Ogunquit, Moody, Webhannet, Wells, The Elms and Kennebunk; the Western division includes the Sandford-Springvale-Cape Porpoise route, and is the one doing the heaviest freight business. The Central division, which is the principal scenic line, has brought several attractive communities into close touch with the world. The village of Ogunquit, for instance, is 6 miles from the nearest railroad station. A characteristic scene in Ogunquit, typical of other villages in this section, is shown in one of the accompanying illustrations.

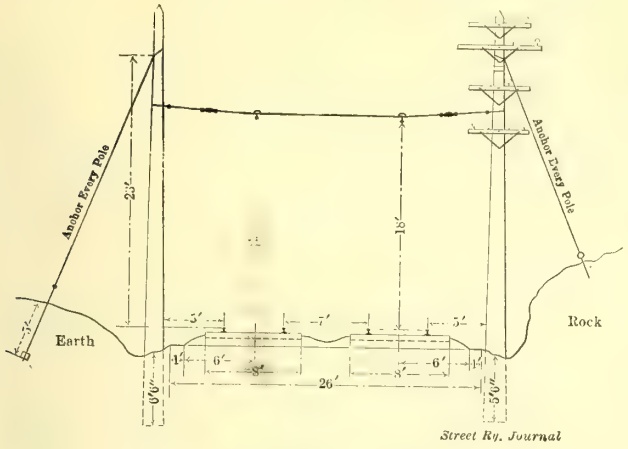
ROAD AND TRACK CONSTRUCTION

On the Atlantic Shore Line there are eighteen intersections with steam railroads, only one of which is at grade. This is on a branch line at South Berwick and will soon be converted into an under-grade crossing. A typical example of the company's latest practice in this direction is shown in the accompanying view of an under-grade highway crossing at Wells, on the York Beach-Kennebunkport section. The steam railroad crosses on a girder bridge car-



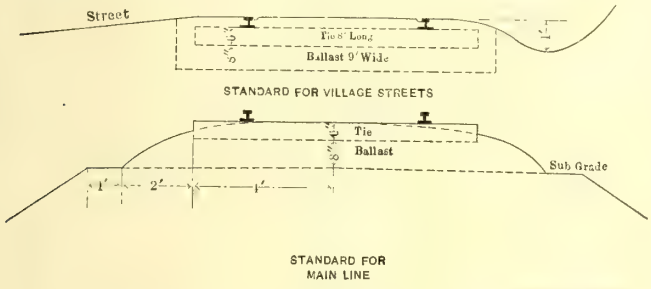
A LIVELY SCENE AT YORK BEACH DURING THE HEIGHT OF THE TOURIST SEASON

ried on granite abutments, while the trolley line is carried in a reverse curve along a depression in the highway. The part of the road reserved for other traffic is held by a retaining wall and is also fenced. Most of the later under-grade highway crossings are built with concrete abutments.



STANDARD TURNOUT CONSTRUCTION

There are about 3 miles of bridges and trestles on the entire system. The longest trestle, 600 ft., is over the channel of the Cape Neddick River on the new line. There are also several extensive rock fills on the new line. The



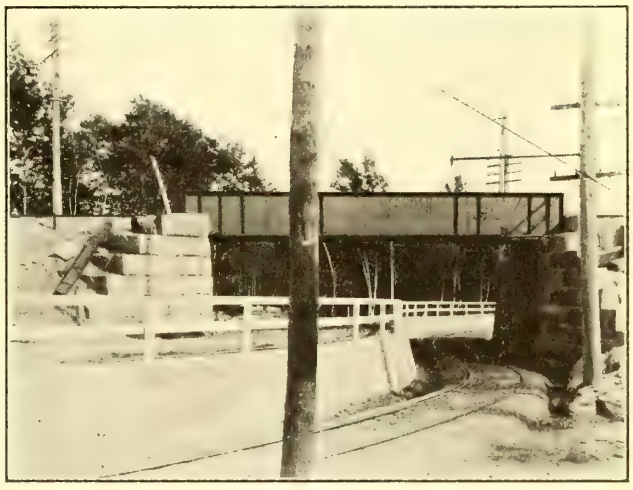
LATEST TRACK CONSTRUCTION STANDARDS OF THE ATLANTIC SHORE LINE RAILWAY COMPANY

longest of these, between York Beach and Ogunquit, is shown in one of the accompanying illustrations. The grades throughout do not exceed 4 per cent and, except in the towns, there are no curves of more than 50 ft. radius.



A TYPICAL SCENE IN OGUNQUIT ON THE ATLANTIC SHORE LINE RAILWAY

Two of the accompanying drawings show the character of the village and right-of-way roadbed construction adopted on the York Beach line, which represents the company's latest and best practice. The greater part of the line is ballasted with gravel from the company's pit at Wells, but rock has also been used where available. The rails are of 80-lb. T-section, laid in 33-ft. lengths on 6-in. x 6-in. ties 8 ft. long, spaced 2-ft. centers. The ties on tangents usually are of chestnut, but of oak on some of the



REVERSE CURVE UNDER THE BOSTON & MAINE RAILROAD, SHOWING RETAINING WALL FOR ROADWAY AND CHARACTER OF UNDER-CROSSING CONSTRUCTION

curves. The rails are jointed with simple angle plates and bonded with the American Steel & Wire Company's riveted copper bonds concealed under the fish-plates. No. 0000 flexible bonds are used for cross-bonding. The right of way is protected by wire fence and iron gates furnished by the American Steel & Wire Company. Stone for cattle guards has also been used in places where it could be conveniently obtained.

The roadbed construction on the other sections of the lines is somewhat lighter than that of the latest work, the rails varying in weight from 60 lbs. to 80 lbs. Lord soldered bonds are used on the Eastern division and different types of plain copper bonds on the other old sections.

OVERHEAD CONSTRUCTION AND TRANSMISSION LINES

The poles on the York Beach line are mostly of cedar with the rest chestnut, spaced 100 ft. on tangents. Those

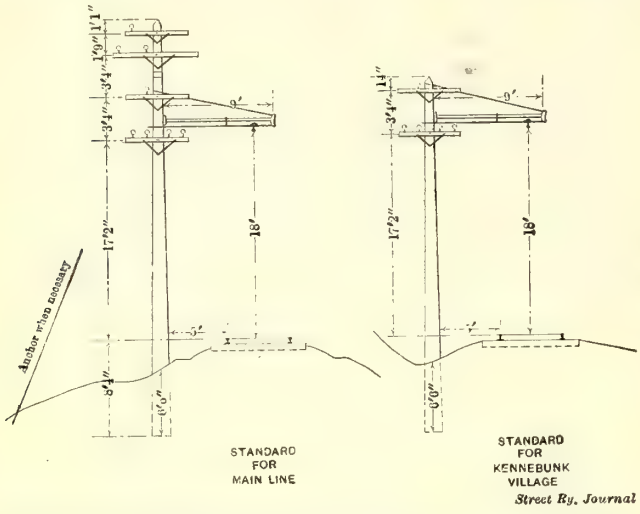


A HEAVY ROCK FILL NEAR CAPE NEDDICK, BETWEEN YORK BEACH AND OGUNQUIT

now carrying or intended to carry high-tension lines are 35 ft. long, but otherwise 3 ft. to 5 ft. shorter. Owing to the frequent heavy winds, it was considered advisable to anchor all the poles. Stombaugh anchors are used where

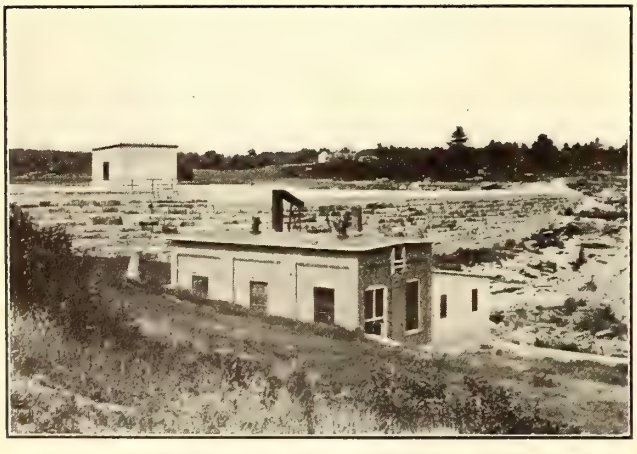
the soil is soft and anchor bolts in rock. The guy wires have wooden insulators to minimize current leakage.

Two cross-arms are provided for two three-phase, 10,000-volt transmission circuits. Only one of these is now installed, however, and is carried on brown Lima insulators placed on one side, which is 7 ft. 2¼ ins. long. The upper cross-arm for the future high-tension circuit is 1 ft. 6 ins. higher and 5 ft. 3¾ ins. long. The feeder arm



POLE CONSTRUCTION WITH AND WITHOUT HIGH-TENSION TRANSMISSION LINES

is also 5 ft. 3¾ ins. long, and is placed 3 ft. 4 ins. under the lower high-tension arm. A double telephone circuit of No. 10 iron wires is carried on the lowest arm 3 ft. 4 ins. below the feeder. These telephone circuits are transposed every six poles to minimize interference from the a. c. lines. The feeders are No. 0000 copper tapped by No. 0 wire every 1500 ft. The No. 0000 trolley wire on this division is suspended from Ridlon trolley brackets to give a clearance of 18 ft. above the head of the rails. Specimens of the overhead construction on tangents and at



ESTES DAM AND POWER PLANT

turnouts are shown in the accompanying illustrations. Wood-insulated span wires carry the trolley wire at curves and turnouts.

The overhead construction on the older divisions differs in several particulars from the foregoing, such as the use of Brookfield glass insulators on the Western division and Locke white porcelain insulators on the Eastern division for the 10,000-volt current. The feeders throughout are of No. 0000 section, in multiple where necessary. The trolley wire on the Western section is No. 00 and No. 0 on the Portsmouth, Kittery & York line, and No. 00 between Biddeford and Kennebunkport, in accordance with the different power requirements. All lines on the system of this company are protected at half-mile intervals by General Electric or Garton-Daniels arresters.

POWER EQUIPMENT

The power sources of the Atlantic Shore Line Railway are widely scattered and include two water-power plants, three steam plants, sub-stations and storage batteries. Within the last year the feeder lines for all divisions have been tied together at appropriate junctions with section insulators and switches. This work includes extending the 10,000-volt transmission system on the Western division now between Dover and York Corner to Ogunquit to meet the other a. c. transmission line from Old Falls. These changes will assist not only in better balancing of loads, but also cut down the losses resulting from long, low-tension, direct-current lines.

The principal steam plant is at Kittery Point, which served for years as the power supply for the Portsmouth, Kittery & York Railway, now constituting the Western division. This is a direct-current station and contains the following: Two Ball & Wood compound engines, belted to 225-kw and 110-kw G. E. generators respectively and one Erie City engine running a second 225-kw generator. The other steam plant operated directly by the company is of 300-kw capacity and located at Kennebunkport. It is used only as an auxiliary.

From a 1500-kw Curtis turbine steam plant at Dover, controlled by the railway interests alternating current at 3400 volts is transmitted to the South Berwick sub-station and at 10,000 volts to York Corner.

The company also operates two hydro-electric plants, using water from the Mousam and Alfred rivers. The lower of these plants was purchased some time ago from the Alfred Light & Power Company and is operated on a 60-ft. head. This station contains Smith turbines connected to



THE AUXILIARY STEAM PLANT AT KENNEBUNK, MAINE

three 500-kw Westinghouse a. c. generators, one of which is an a. c. d. c. generator.

The supply of power from this source has been recently increased by the construction of a new dam at Estes Pond, 850 ft. long and 40 ft. high. The new station is a brick building with a frame addition for the penstocks. The equipment consists of two 500-hp Victor turbines direct connected to two 300-kw, three-phase, 60-cycle, 2200-volt generators. Three water-cooled transformers are installed to step-up the generator potential to 10,000 volts for trans-

mission. The circuits from this station and from the other water-power plant are carried as a triple system to West Kennebunk. At this point one of the lines is carried to the sub-station at Town House, while the remaining two are carried across country to a portable sub-station kept near Elms and to the sub-station at Ogunquit. It will be noticed from the map that this arrangement saves considerable pole and wire material, besides avoiding the necessity of passing through Kennebunk with a high-tension line.

SUB-STATIONS AND STORAGE BATTERIES

The Western division has a sub-station at South Berwick which contains a 200-kw G. E. motor generator set and a 278-cell chloride accumulator battery. There is also a battery of 220 cells at York Beach, and a 300-kw Westinghouse rotary and transformer equipment is located at York Corner.

The Eastern division has a sub-station at Town House containing a 300-kw Westinghouse rotary. There is also a 240-cell line battery at Old Falls. This battery is kept in a separate wooden building directly alongside the turnout at this point at a short distance from the Old Falls power station. No regular attendant is found necessary at this section, but in accordance with the best practice in floating batteries installed at isolated points, a guide lamp is placed in front of the building to inform passing conductors whether the battery circuit breaker is open or closed. The station at Sanford contains step-down transformers and a 250-kw, 500-volt rotary converter to supply Old Falls power to local manufacturers.

It will be noted from the foregoing that sub-stations and batteries are located at both the northern and southern ends of the Central division. In addition, a sub-station equipped with a 300-kw, G. E. converter and transformers has been installed at Ogunquit, and a portable sub-station containing a 200-kw outfit of the same type was kept during the summer between Wells and Kennebunk to help out cars on the new division. This car outfit, when in service at any particular point, is jacked up to relieve the pressure on the car springs due to the movement of the rotary.



PARALLELING THE HIGHWAY ON AN EMBANKMENT IN WELLS, MAINE



THE STEAM PLANT AT KITTERY POINT, MAINE

SIGNAL AND DESPATCHING SYSTEMS

The company is now using the United States Electric Signal Company's signals to cover the block beginning at the Kittery ferry opposite Portsmouth, a second block at York, and spacing sets for the protection of two curves along the Portsmouth, Kittery & York division.

The Eastern division has one set of signals at Kennebankport installed by the Eureka Automatic Signal Company, of Tamaqua, Pa. The same type is also installed at Kennebunk on the new line, equipped with lights for night use, beside the usual semaphore signals. In case of a circuit disturbance, the signals drop by gravity to "danger."

All despatching is done by telephone to the car houses, sub-stations and booths placed at the turnouts. The instruments are of both Stromberg-Carlson and Holtzer-Cabot type, but the installation was designed by the Holtzer-Cabot Electric Company. The usual type of booth is shown in one of the accompanying cuts.

Both the Central and Western divisions are governed by the despatcher at Kittery Point, while the Eastern division cars are despatched from Kennebunk. Both despatchers may keep in communication through a separate telephone system. Pegged boards are used by the despatchers to fol-

low the progress of cars in their charge. All stations and turnouts not previously named are definitely named for convenience in dispatching. The scheme is also of value to passengers, inasmuch as every turnout is furnished with a locality sign.

The despatcher's orders are usually received by the car house or sub-station attendants, who write them out on Egry autographic registers, delivering one copy to the motorman and another to the conductor, while the third copy remains in the locked box. In cases when a car has been delayed for over five minutes, the motorman must call up



OGUNQUIT SUB-STATION WITH WOODEN CAR SHED AND TELEPHONE BOOTH ADJACENT

the despatcher at the first turn-out, receive his order and repeat to the conductor. The latter then must repeat the message to the despatcher before proceeding. It is also customary in busy times for the station men at York Beach and other important points to keep the despatcher informed of the progress of the cars.

During periods of heavy traffic, the company runs cars two or more in a block, on the car-following system. The



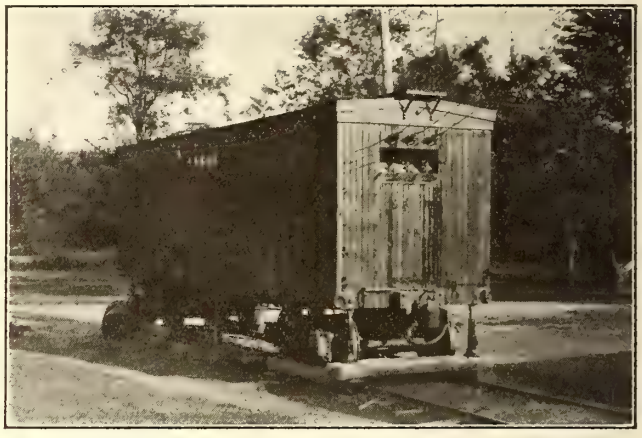
CAR AT SIDING IN WELLS, WITH CREW AT TELEPHONE BOOTH

first car carries a sign worded "Car Following," instead of having the customary green sign. This serves as an indication to intending passengers that there is a car behind. Upon reaching a turn-out the crew of this car notify the opposing car to wait for No. 2. Should No. 2 bear a "Car Following" sign, it is necessary to wait for No. 3, and so on. Following cars are not subject to despatcher's orders, being instructed simply to obey the orders given to the preceding car.

ROLLING STOCK AND BOATS

The latest cars purchased by the company are of the Brill semi-convertible type. Four are of the straight passenger and two have baggage compartments. These are intended to meet the exacting requirements of the new York Beach-Kennebunk line, both with regard to the high speeds and comfort of passengers. Each car is equipped with four Westinghouse motors carried on Standard trucks. Two fifteen-bench open cars have been obtained from the same car builder. In all the company has fifty-six cars for its passenger service, five locomotives and eight snow plows.

Among the apparatus used with this rolling stock are the following: Christensen air brakes, General Electric air



PORTABLE SUB-STATION AT KENNEBUNK, MAINE

brakes, arc headlights and some type M control equipments; Wilson trolley catchers, Consolidated heaters, Ohmer registers and Sterling-Meaker printing registers.

This company also owns and operates two ferryboats between Portsmouth and Kittery.

CAR HOUSES

The consolidation of the lines now making up the Atlantic Shore Line Railway placed in the company's hands sev-



A NEAT SUB-STATION AND WAITING ROOM AT YORK CORNER, MAINE

eral small frame structures, which have been retained because of their convenience in eliminating unnecessary mileage. The regular repair work for the Eastern division is cared for at Town House. At that place the company has built the brick car house shown in one of the accompanying illustrations. This structure houses twenty cars.

At Sanford, which is also on the Eastern division, there is a frame structure for six cars. Repairs for the Western division are made at the Kittery Point frame car house, which holds twelve cars. There is also a twenty-car capacity brick structure at South Berwick junction. On the Central division there is storage for six cars at York

Beach to save cars from returning to Kittery Point, and also a new three-track building at Ogunquit for six cars. The Ogunquit installation has a concrete pit to allow light repair work.

PASSENGER TRAFFIC SOURCES

While the tourist traffic is unusually important on the Atlantic Shore Line Railway, the territory itself affords a good steady travel throughout the year, owing to the manufacturing and other industries of this district. Although



CAR QUARTERS AT TOWN HOUSE, KENNEBUNK, MAINE

the Boston & Maine Railroad operates lines to many points reached by the electric railway, the latter has secured more business. The York Beach travel from Portsmouth may be given as an example. In 1896, the Boston & Maine Railroad, without any competition and charging a fare of 65 cents on a 35-minute trip, received $35,000, including the carriage of mails; the first year competition began, the electric line earned $75,000 on a 25-cent fare and an hour-and-a-half trip, took away the mail and beat the steam railroad on local express handling. Despite this, the earnings of the steam line were not seriously affected, demonstrating again how the electric railway creates traffic.

Local pleasure riding is induced by giving free concerts at certain parks along the line, while the handsome Casino at Cape Porpoise attracts both the tourist and native. The Casino has a fine dancing pavilion as well as public and private restaurants. On Sundays sermons are delivered there, followed by a sacred concert. During the summer the lessee of the Casino publishes a 16-page weekly pamphlet called the "Atlantic Shore Line Railway Messenger." This paper contains illustrated descriptions of interesting points on the line news of the latest attractions, such as water carnivals and concerts, the latest time-tables, local advertisements, etc. It is distributed gratis at all the hotels, cottages, stores and other points in the territory of the company.

FARES AND SCHEDULES

In general, the fares are based on about 2 cents a mile, except on the new line, where they are somewhat higher, the 16-mile trip between York Beach and Kennebunkport costing 40 cents. Commutation books for workmen are sold at the rate of $3.50 for 100 tickets, transportation good for fifteen days, and two books, good for one month, are sold to one individual. The rates on other sections work out as follows: Portsmouth to York Beach, 15½ miles, 25 cents; Dover to York Beach, 18 miles, 30 cents; Dover to South Berwick, 8 miles, 10 cents; Sanford to Cape Porpoise, 32 miles, 35 cents; Town House to Biddeford, 8½ miles, 10 cents. From this it is evident that the older portions of the system usually have the lowest fares. The fare zones are allowed to overlap to include churches, post offices or other points to encourage traffic.

School tickets, good only on school days, are sold at reduced rates, and reduced rate tickets are also sold under certain restrictions to workmen. Waiting rooms are provided, either in special buildings as at Ogunquit, or in village stores, where tickets may be purchased.

During the summer months the coastwise lines are operated on a half-hour schedule and, if the traffic is heavy, two or three cars are run in a block on the "Car Following" system, already mentioned. Otherwise the cars are run every hour. In winter, of course, the schedules call for less cars, as there is then less outside travel.

MAIL AND EXPRESS

The company carries mail in a combination mail and express car, receiving ¾ cent for each mile per lineal foot of car. Thus, a 12-ft. car returns 8 cents per mile traveled. Closed pouch mail is carried at 3 cents a mile. On the Eastern division mail is weighed for distances over 20 miles, as on steam railroads. On this the company is allowed about $42 per mile a year. All packages which consigners desire shipped on the next car are carried as express at the local rates of the American Express Company.



STRINGING A LIVE TROLLEY WIRE WITH THE AID OF ONE OF THE DOUBLE-CAB LOCOMOTIVES AND A STANDARD FREIGHT CAR

FREIGHT HANDLING

The Atlantic Shore Line Railway may justly claim the honor of being the pioneer heavy electric freight line of New England. As mentioned in the opening paragraphs of this article, the present Eastern division was built in 1892 by the Goodall Bros., manufacturers of Sanford and Springvale, to haul freight for their mills to and from the Boston & Maine Railroad. The success of this project led to the Cape Porpoise extension to secure the economies of a deep-water connection. During the summer the coal used by the mills comes by way of Cape Porpoise, where the company has a barge-unloading equipment and coal pocket. In the winter coal cars are also hauled from the Boston & Maine Railroad. About 125 tons a day is the average amount shipped on this division. Lumber and products of the local woolen and other mills constitute most of the remaining freight business. The company is so well satisfied with the financial aspect of this business that it is arranging for an independent steamboat line from Boston, called the Eastern Maine Steamship Company, which could carry by way of Portsmouth and Cape Porpoise much of the freight now going via the Boston & Maine Railroad.

The company has found that its customers do not care to pay on a ton-mile basis for hauling freight cars. All car charges are therefore made up of a lump sum basis. The following is the present schedule of prices and the corresponding distances on the Eastern division:



ELECTRIC LOCOMOTIVE HAULING A TRAIN OF STANDARD FREIGHT CARS OVER A MILL SIDING

SCHEDULE OF PRICES FOR HAULING BOSTON & MAINE CARS OVER THE EASTERN DIVISION OF THE ATLANTIC SHORE LINE RAILWAY

		Car	Miles
B. & M. Sta.,	Springvale to Springvale	$2.00	.5
"	Sanford	5.00	2.5
"	Siding No. 1	6.00	3.
"	Moulton's	7.00	4.
"	Siding No. 3	7.00	7.
"	Siding No. 4	8.00	9.
"	Estes	8.00	9.5
"	Whicher's	8.00	10.
"	Old Falls	10.00	11.5
"	Siding No. 10	10.00	12.5
"	W. Kennebunk	11.00	14.5
"	Kennebunk Sta	12.00	17.5
"	Brick Yard	13.00	19.
"	Town House	14.00	20.
"	Cape Porpoise	15.00	23.
"	Kennebunkport	15.00	21.5

Owing to the completion of the York Beach line, or missing link, the freight business will be greatly extended and some of the foregoing figures will be revised. The income from this business on the Eastern division in 1906 was $32,000 and $35,152, ending June 30, 1907.

The three electric locomotives principally used in this work were built by the Laconia Car Company after the railway company's specifications. They are of the sloping cab type and are each equipped with four 50-hp G. E. motors, K 28 B controllers with contactors, G. E. air-brakes, Consolidated electric heaters and Lintern sanders. They weigh 45,000 lbs. The company has also three electric locomotives of the box-car type and has freight cars of standard size in addition to flat cars, etc.

GENERAL

The gross earnings and operating expenses of the Atlantic Shore Line Railway for the twelve months ending June 30, 1907, were as follows:

Gross earnings from operation	$295,152.09	
Operating expenses	160,972.52	
Net earnings from operation		$134,179.57
Accrued from sinking fund		3,125.00
Gross income		$137,304.57
Deductions from income:		
Taxes	$3,600.00	
Interest on funded debt	89,990.00	
Interest on notes	59.93	93,649.93
Net income		$43,654.64
Deductions from net income:		
Burglary at Town House		575.45
Surplus for year		$43,079.19
Surplus from previous year		5,983.30
Total surplus June 30, 1907		$49,062.49

The financing of the Atlantic Shore Line Railway Company is conducted by A. H. Bickmore & Company, New York bankers, who are planning further improvements and extensions to the system. All the officers of the railway except the vice-president, who represents the Bickmore interests, are local men. They are as follows: President, E. M. Goodall, of Sanford; vice-president, I. L. Meloon, of New York; treasurer, L. B. Goodall, of Sanford; secretary and general attorney, Fred J. Allen, of Sanford. The management of the system is in the hands of W. G. Meloon, who was for many years general manager of what is now the Western division. The operating headquarters are at Portsmouth, which, as previously noted, is directly opposite Kittery, the starting point of the system.

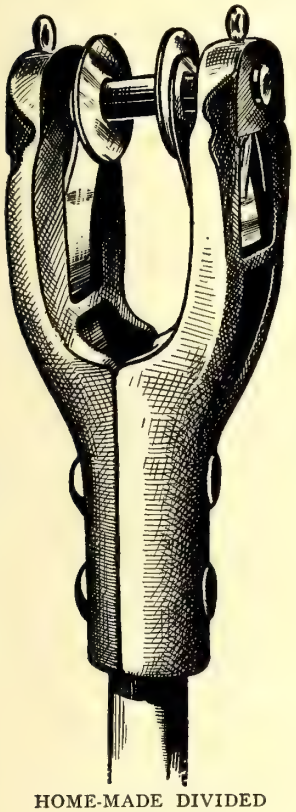
A by-law authorizing the Montreal Street Railway to carry freight over its line has been adopted. The company, which has signified its willingness to accept the conditions, will be allowed to carry freight at all times save between five and seven o'clock in the evening, and six and eight o'clock in the morning; freight is never to be carried to the detriment of the passenger traffic. The company is to pay a percentage to the city on the gross earnings received on freight cars entering or leaving the city as follows: Four per cent on earnings up to $200,000, 6 per cent on earnings between $200,000 and $500,000, 8 per cent between $500,000 and $800,000, 10 per cent between $800,000 and $1,000,000, 12 per cent between $1,000,000 and $1,500,000, and 15 per cent thereafter. The franchise is for fifteen years.

MONTREAL SHOP NOTES

During the last year or two the Montreal Street Railway Company has introduced several additional labor-saving methods in its shops and also made some other changes to keep down the cost of maintaining equipment.

JIG FOR BORING BEARINGS

One of the latest kinks is a jig for boring motor bearings and turning the collars of the same. The face of the lathe is recessed to receive the hub, *A*, shown in the drawing, and the bolt, *B*, is slacked to receive the bearing. The jig is bolted to the face plate at *D*. The boring bar used to bore the bearing is put through the hollow spindle of the lathe, which acts as a steady rest and the shoulder of the bearing is then turned off without any further truing-up. At least eight bearings an hour can be bored and turned, as against one or two by the former method of truing every bearing separately in the chuck.



HOME-MADE DIVIDED TROLLEY FORK

TROLLEY BASE

The company is now using a parallel-bearing trolley base made of cast steel and costing $8.50 each for material and labor. It is only 4 ins. high over all and is adjusted for 14 lbs. tension with a 5¾-in. diameter trolley wheel. The base has a dust-proof cap on the top and is oiled simply by removing a small screw.

AIR BULLDOZER

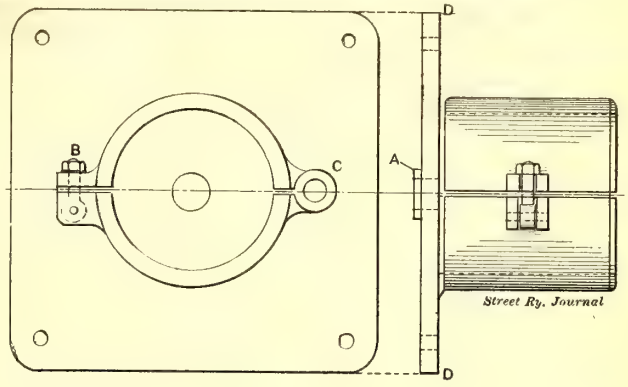
A broken air cylinder has been used to form part of a pneumatic bulldozer for small work, the arrangement being as shown in the cut, where it will be seen that the shock of the bulldozer is taken up by a wood bumper. The compressor furnishing air at 120 lbs. is taken at random from a number waiting their return to the cars, and is seldom kept around for more than a day or two. The air bulldozer, therefore, simply makes use of apparatus that would otherwise be idle, and does not require any separate investment for a compressor.

DIVIDED TROLLEY FORK

To reduce the expense of trolley-harp breakages, the company is now using a split fork of the type shown, so in most cases of breakage only half the form requires replacement. The harp is made of steel and costs 30 cents with spindle, washers and other details complete.

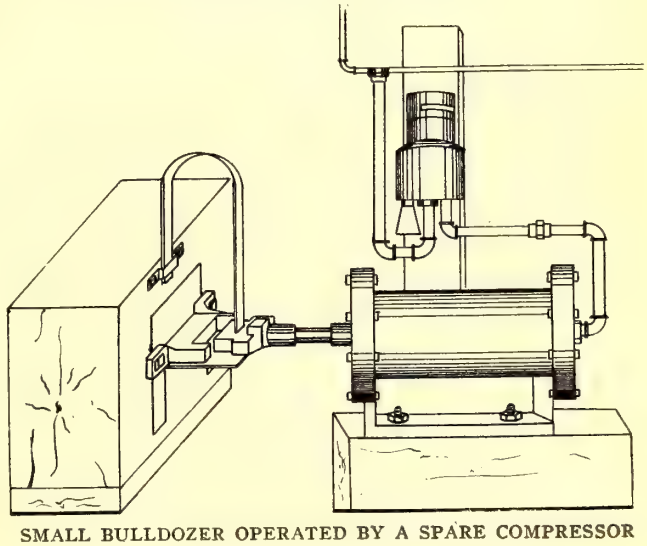
WELDING TROLLEY TUBING

Instead of consigning broken or bent tubing to the scrap heap, the poles are saved and rewelded on slack days in the blacksmith shop. The cost per weld is usually from 15 to 20 cents. During the year the company has purchased very little tubing in consequence of this policy.

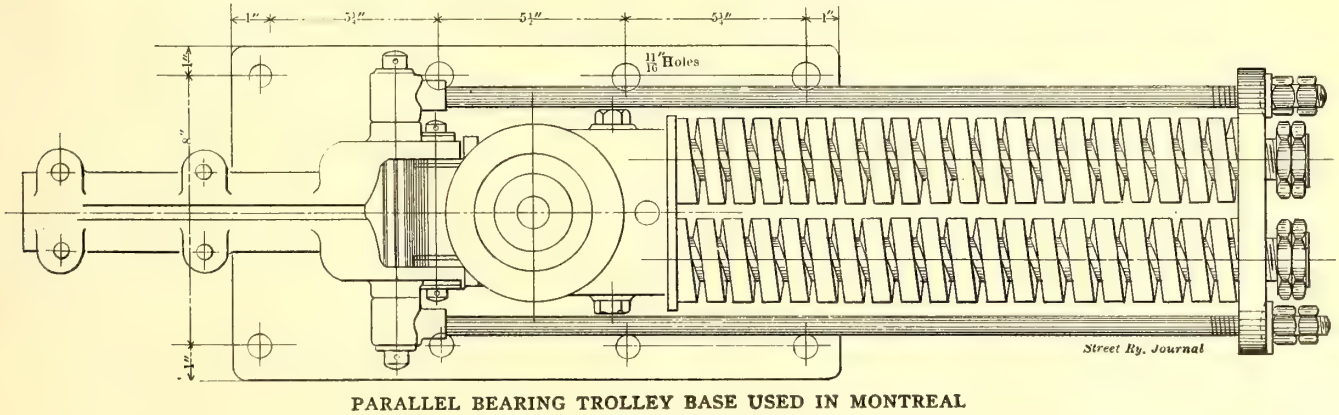


A- Hub for recess on face plate
B- Bolt
C- Hinge
D- Bolting to face plate

JIG FOR BORING BEARINGS



SMALL BULLDOZER OPERATED BY A SPARE COMPRESSOR

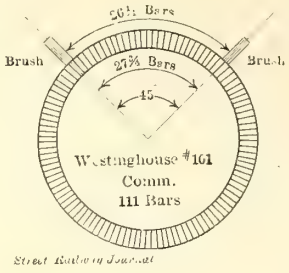


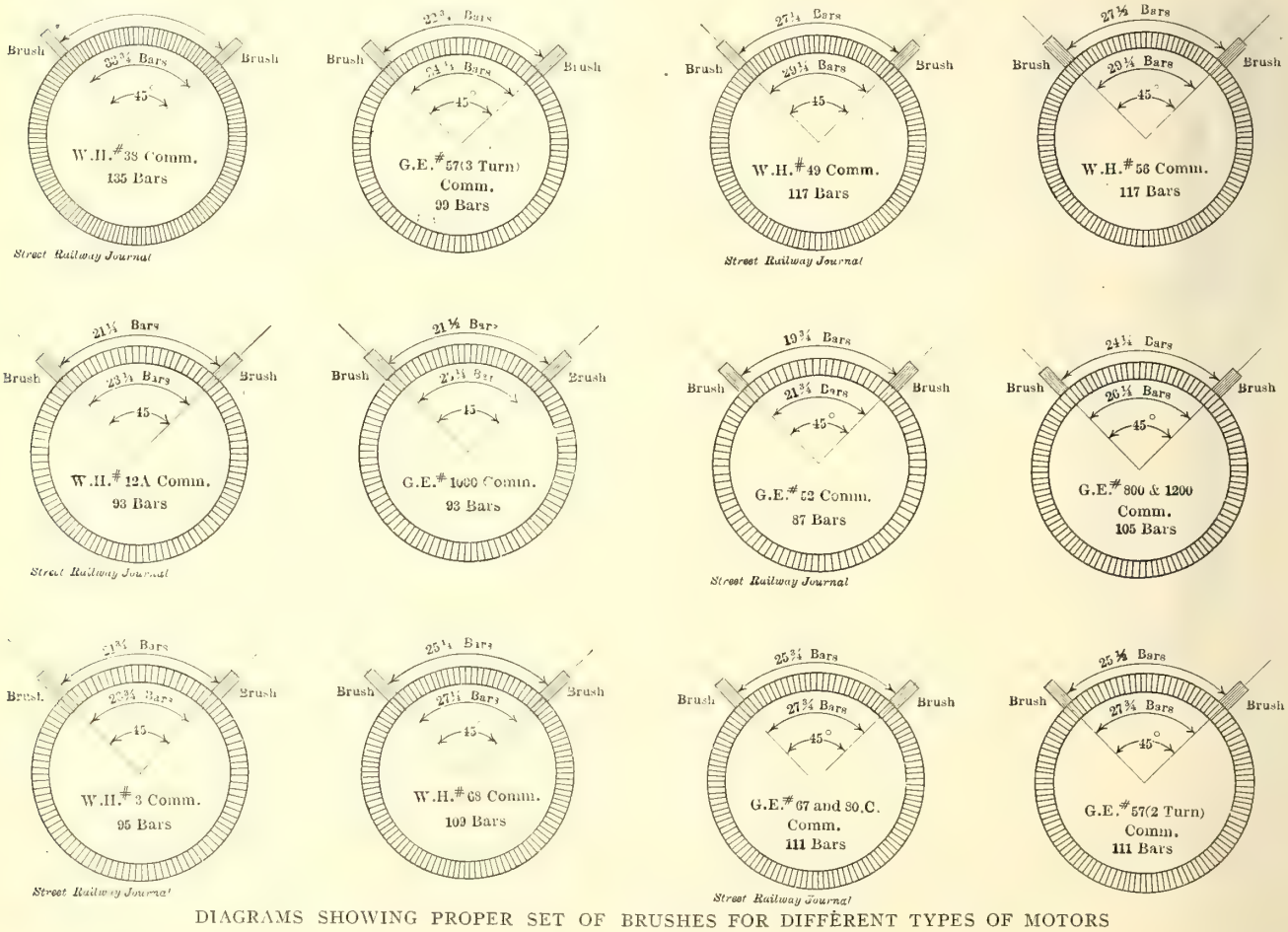
PARALLEL BEARING TROLLEY BASE USED IN MONTREAL

Mail service has been established on the Evansville & Eastern Electric Railway between Evansville, Newburg and Rockport. This is the first electric mail service in the district.

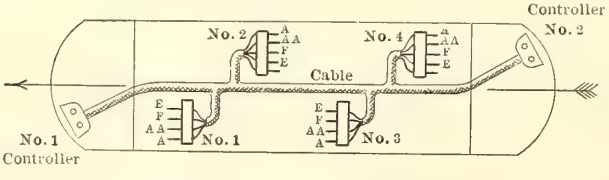
SHOP PRINTS OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY

For the use of the company's shop employees, Charles Remelius, master mechanic of the Public Service Corporation and the inventor of a number of shop labor-saving tools now in general use, has prepared a series of sixty instruction sheets, 6 ins. wide by about 3½ ins. high, of which he has had blue print copies made for distribution among the men. The Public Service Corporation, made up as it is of a number of constituent companies operating over all Northern and part of Southern New Jersey, naturally includes among its equipment a great variety of apparatus, and for this reason the instruction sheets covering much standard apparatus will be of considerable interest to street railway managers in general. The value to the employees of a set of prints of this kind, covering the apparatus which they handle constantly, has proved very great. Not only do they prevent costly mistakes from being made, but they save a great deal of time. In addition, they are not without educational value, as the man who has a set of them for himself is almost sure in his leisure, when away from the shop, to study them out and see how well his memory serves him when tested by some actual case in the shop. Especial attention, it seems, should be directed to the charts of the set of motor brushes, which, by their clearness, make impossible improper adjustment of the brushes with its direful consequences, among them at times the flash-over. All the evils following inaccurate brush adjustment do not evidence themselves on the surface, however, and for this reason are still more to be dreaded. A record, made not long ago by a man of wide experience in motor work, showed that out of a count of thirty only four were correct. Of the twenty-six improperly set, the error ranged from one to three bars, while in one case the error was five bars.





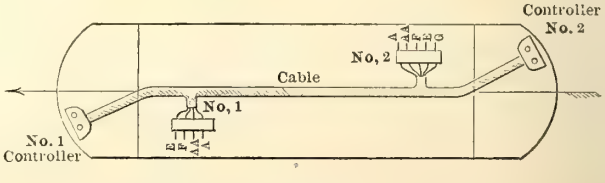
DIAGRAMS SHOWING PROPER SET OF BRUSHES FOR DIFFERENT TYPES OF MOTORS



Facing Junction Box Single A Wire must be to the right—observing the order—A—AA—F—E—G.

Street Railway Journal

JUNCTION BOX CONNECTIONS OF A FOUR-MOTOR CAR

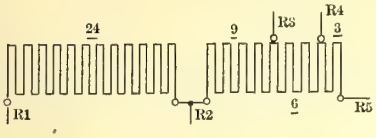


Facing Junction Box Single A Wire must be to the right—observing the order—A—AA—F—E—G.

Street Railway Journal

JUNCTION BOX CONNECTIONS ON A TWO-MOTOR CAR

Gen. Elec. Car Resistance Connections for Four 800 or 52 Motors and K11 or K12 Controller



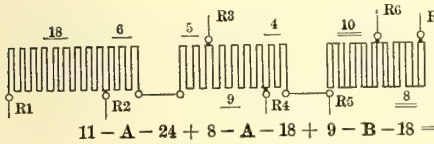
All Grids in Series

12 − A − 24 + (10 − A − 9 + 9 − A − 9) = 42 Grids Total

R1 to R2,	24 Grids of	26512	= 2.71	Ohms
R2 " R3,	9 "	" 26510	= .83	"
R3 " R4,	6 "	" 26519	= .44	"
R4 " R5,	3 "	" "	= .22	"

Street Railway Journal

Gen. Elec. Car Resistance Connections for Four 67 or 80. C. Motors and K6 Controller

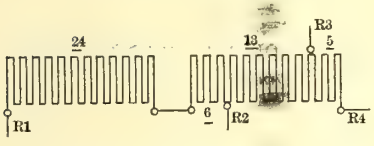


11 − A − 24 + 8 − A − 18 + 9 − B − 18 = 60 Grids

R1 to R2,	18 Grids of	26511	= 1.66	Ohms.
R2 " R3,	6 "	of 11+5 of 08	= 84	"
R3 " R4,	9 "	" "	= 53	"
R4 " R5,	4 "	" "	= .24	"
R5 " R6,	10 "	" 09	= .18	"
R6 " R7,	8 "	" "	= .15	"

Street Railway Journal

Gen. Elec. Car Resistance Connection for Two 800 or 52 Motors and K2 Controllers



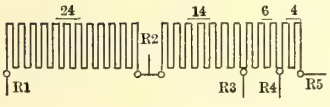
All Grids in Series

14 − A − 24 + (14 − A6 + 12 − A − 13 + 11 − A − 5) = 48 Grids Total

R1 to R2,	30 Grids of	26514	= 5.32	Ohms
R2 " R3,	13 "	" 26512	= 1.47	"
R3 " R4,	5 "	" 26511	= .45	"

Street Railway Journal

Gen. Elec. Car Resistance Connection for Two 58 or 1000 Motors and K11 Controllers



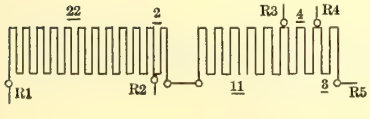
All Grids in Series

13 − A − 24 + 11 − A − 24 = 48 Grids Total

R1 to R2,	24 Grids of	26513	= 3.40	Ohms.
R2 " R3,	14 "	" 26511	= 1.29	"
R3 " R4,	6 "	" "	= .55	"
R4 " R5,	4 "	" "	= .37	"

Street Railway Journal

Gen. Elec. Car Resistance Connections for Two 57 (50 H.P.) Motors and K11 Controllers



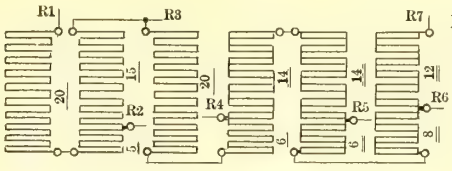
All Grids in Series

11 − A − 24 + 9 − A − 18 = 42 Grids Total

R1 to R2,	22 Grids of	26511	= 2.00	Ohms
R2 " R3,	2 "	" 11+11 of	09 = .98	"
R3 " R4,	4 "	"	26509 = .30	"
R4 " R5,	3 "	"	09 = .22	"

Street Railway Journal

Westinghouse Car Resistance Connections for Four No. 68 or other 40 Horse power Motors and K6 Controller or other Controller suited for 6 Section Coil



Total Grids—120

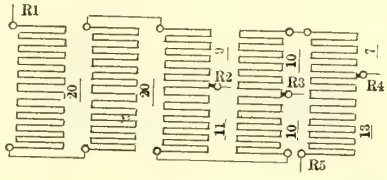
—— Series

═══ Parallel

R1 to R2,	25 Grids of	7468	= 1.50	Ohm
R2 " R3,	15 "	" 2444	= .60	"
R3 " R4,	26 "	" 9119	= .39	"
R4 " R5,	28 "	" 2444	= .28	"
R5 " R6,	14 "	" "	= .14	"
R6 " R7,	12 "	" 2445	= .09	"

Street Railway Journal

Westinghouse Car Resistance Connections for Two No. 68 or other 40 Horse-power Motors and K11 Controller or other Controller designed for a 6 Section Coil

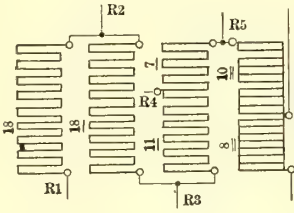


Total Grids 100—all in Series ——

R1 to R2,	49 Grids of	7468	= 2.94	Ohms.
R2 " R3,	21 "	" 2444	= .84	"
R3 " R4,	17 "	" 2445	= .51	"
R4 " R5,	13 "	" 9120	= .26	

Street Railway Journal

Gen. Elec. Car Resistance Connections for Four 57 (50 H.P.) Motors and K14 Controllers



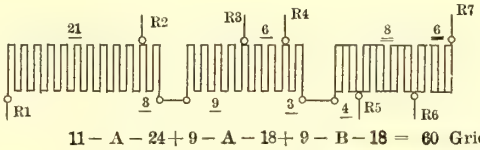
—— Series; ═══ Parallel

R1 to R2,	18 of	26510	= 1.66	Ohm.
R2 " R3,	" "	26507	= .85	"
R3 " R4,	11 "	26506	= .42	"
R4 " R5,	7 "	"	= .28	"
R5 " R6,	10 "	26508	= .15	"
R6 " R7,	8 "	"	= .12	"

10−A−18, 7−A−18, 6−A−18, 8−B−18 = Total 72 Grids

Street Railway Journal

Gen. Elec. Car Resistance Connections for Four 58 or 1000 Motors and K6 Controllers

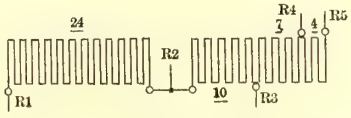


11 − A − 24 + 9 − A − 18 + 9 − B − 18 = 60 Grids Total

R1 to R2,	21 Grids of	26511	= 1.93	Ohms.
R2 " R3,	3 "	of 11 + 9 of 09	= .94	"
R3 " R4,	6 "	" 26509	= .44	"
R4 " R5,	3 "	" 09 + 4 of 09	= .29	"
R5 " R6,	8 "	" 26509	= .15	"
R6 " R7,	6 "	" "	= .11	"

Street Railway Journal

Gen. Elec. Car Resistance Connections for Two 67 or 80. C. Motors and K11 Controller



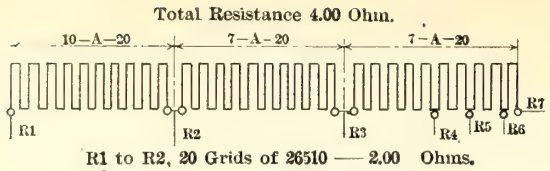
All Grids in Series

13 − A − 24 + 12 − A − 10 + 10 − A − 11 = 45 Grids

R1 to R2,	24 Grids of	26513	= 3.40	Ohms
R2 " R3,	10 "	" 26512	= 1.13	"
R3 " R4,	7 "	" 26510	= .65	"
R4 " R5,	4 "	" "	= .37	"

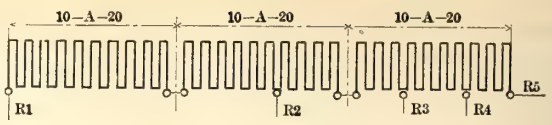
Street Railway Journal

GROUP OF SHOP DRAWINGS USED TO ILLUSTRATE PROPER RESISTANCE CONNECTIONS



R1 to R2, 20 Grids of 26510 — 2.00 Ohms.
R2 " R3, " " " 26507 — 1.00 "
R3 " R4, 10 " " " — .50 "
R4 " R5, 4 " " " — .20 "
R5 " R6, " " " " — .20 "
R6 " R7, 2 " " " .10 "

STANDARD RESISTANCE CONNECTIONS FOR FOUR (NOS. 800, 1000—52, 58, 67, 68 AND 80 C.) MOTORS

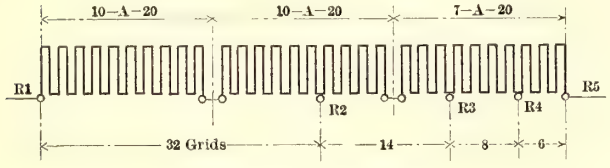


Total Resistance—6 Ohms.

R1 to R2, 32 Grids of 26510 — 3.20 Ohms.
R2 " R3, 14 " " " — 1.40 "
R3 " R4, 8 " " " — .80 "
R4 " R5, 6 " " " — .60 "

Street Railway Journal

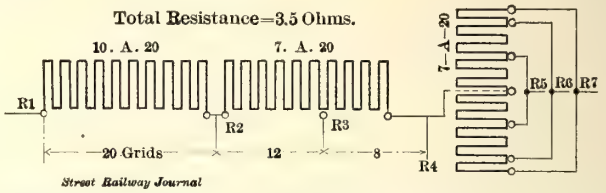
STANDARD RESISTANCE CONNECTIONS FOR TWO (NOS. 800, 1000—52, 58, 67, 68 AND 80 C.) MOTORS



Total Resistance=5 Ohms.

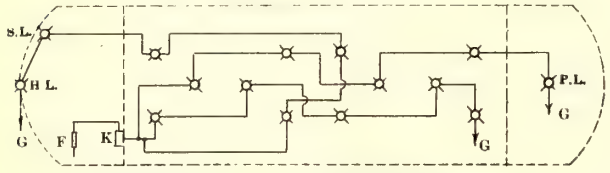
Street Railway Journal

STANDARD RESISTANCE CONNECTIONS FOR TWO G. E. 57, OR WESTINGHOUSE NO. 56 MOTORS



Street Railway Journal

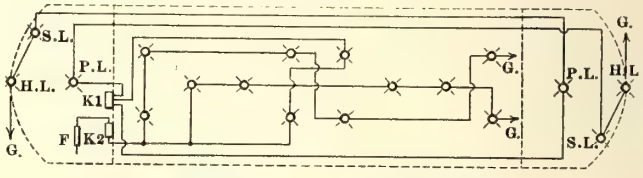
STANDARD RESISTANCE CONNECTIONS FOR FOUR G. E. 57, OR WESTINGHOUSE NO. 56 MOTORS



H.L.=Head Light
S.L.=Sign Light
P.L.=Platform Light
K=Light Switch
F=Fuse unless in Switch

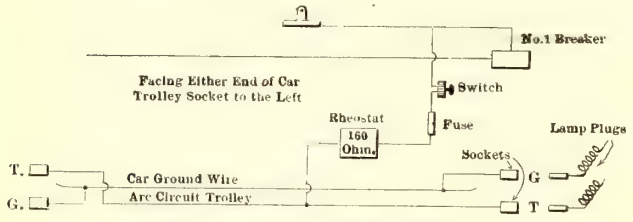
Street Railway Journal

LIGHT CONNECTIONS FOR SINGLE END CAR



H.L.=Head Light
P.L.=Platform Light
S.L.=Sign Light
K1=3 Way Switch
K2=Main Switch
F=Fuse unless in Switch

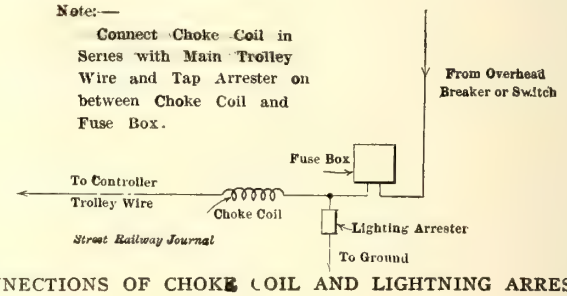
INCANDESCENT LAMP CIRCUITS OF A DOUBLE END CAR



Trolley and Ground Crossed on 2 End

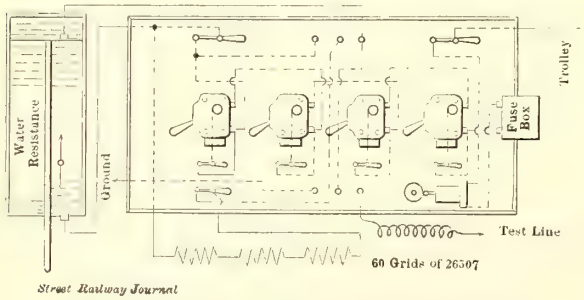
Street Railway Journal

ARC LIGHT CONNECTIONS FOR DOUBLE END CAR



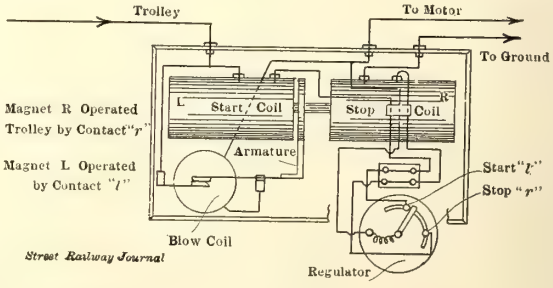
Street Railway Journal

CONNECTIONS OF CHOKE COIL AND LIGHTNING ARRESTER



Street Railway Journal

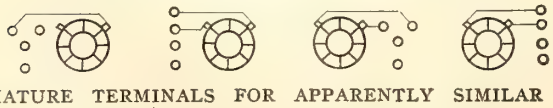
CONNECTIONS FOR CIRCUIT BREAKER TEST



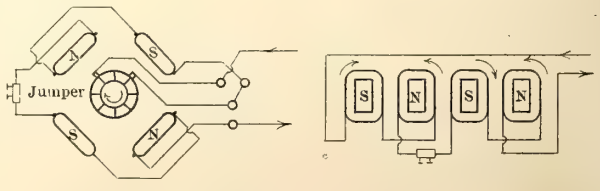
Street Railway Journal

CONNECTIONS OF CHRISTENSEN AIR GOVERNOR

Notes: For apparently the same Connections. Westinghouse and G. E. *Armatures run in opposite directions.—
In all Cases the Terminal of the near Brush-holder issues from the Motor through the Bushing nearest to it. * Except 57 and 1000.

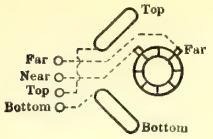


ARMATURE TERMINALS FOR APPARENTLY SIMILAR CONNECTIONS, BUT OPPOSITE ROTATION



WESTINGHOUSE NO. 68 FIELD CONNECTIONS OUTSIDE JUMPER

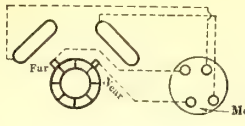
Note:—
Face Commutator End when looking at Armature Connections. Face Bushings when considering them.



Far Armature out of Top Hole
Near " " " 2nd "
Top Field " " 3rd "
Bottom " " "Bottom

Street Railway Journal

ORDER OF BRINGING OUT MOTOR TERMINALS OF G. E. 57, 67, 52, 58, 80 C., 1000 AND 800 MOTORS ON THE LEFT-HAND SIDE WHEN ARMATURE TERMINAL BUSHINGS ARE VERTICAL



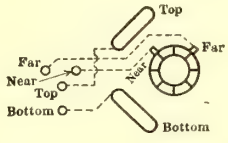
Facing Commutator, Motor Terminals come out on Right Hand Side of Motor

Far or Left Hand Armature out of Left Top Hole
Near " Right " " " " " Bottom "
Far " Left " Field " " Right Top "
Near " Right " " " " " Bottom "

Street Railway Journal

ORDER OF BRINGING OUT MOTOR TERMINALS ON WESTINGHOUSE NO. 68 MOTOR, NEWARK TYPE

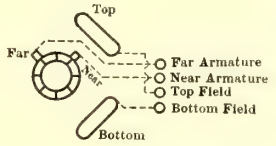
Note:—
Face Commutator End when looking at Armature Connections. Face Bushings when considering them.



Far Armature out of Left Hand Hole
Near " " " Right " "
Top Field " " 3rd "
Bottom " " " Bottom "

Street Railway Journal

ORDER OF BRINGING OUT MOTOR TERMINALS OF G. E. 57, 67, 80 C., 58, 52, 800 AND 1000 ON THE LEFT-HAND SIDE WHEN ARMATURE TERMINAL BUSHINGS ARE HORIZONTAL

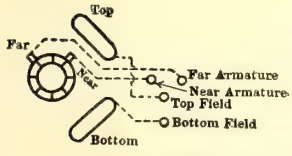


Note:—
Face Commutator End when looking at Armature Connections. Face Bushings when considering them.

Far Armature out of the Top Hole
Near " " " " 2nd "
Top Field " " " 3rd "
Bottom " " " " Bottom "

Street Railway Journal

ORDER OF BRINGING OUT MOTOR TERMINALS OF G. E. 57, 67, 80 C., 52, 58, 1000 AND 800 MOTORS ON THE RIGHT-HAND SIDE WHEN ARMATURE TERMINAL BUSHINGS ARE VERTICAL

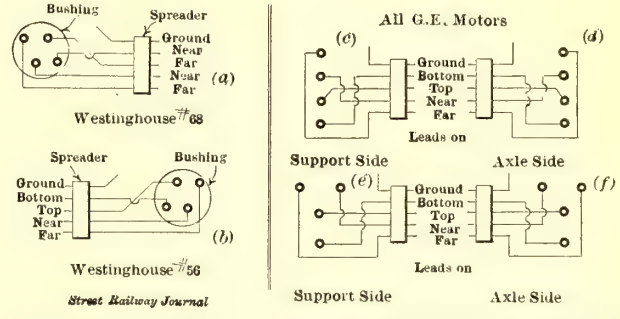


Note:—
Face Commutator End when looking at Armature Connections. Face Bushings when considering them.

Far Armature out of Top Right Hand Hole
Near " " " " Left " "
Top Field " " 3rd ——————"
Bottom " " " Bottom ——————"

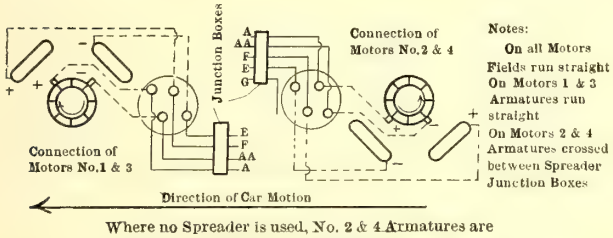
Street Railway Journal

ORDER OF BRINGING OUT MOTOR TERMINALS OF G. E. 57, 67, 80 C., 52, 58, 1000 AND 800 MOTORS ON THE RIGHT-HAND SIDE WHEN ARMATURE TERMINAL BUSHINGS ARE HORIZONTAL



Street Railway Journal

ORDER OF BRINGING OUT MOTOR LEADS THROUGH SPREADER

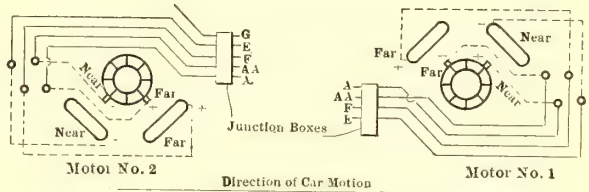


Notes:
On all Motors Fields run straight
On Motors 1 & 3 Armatures run straight
On Motors 2 & 4 Armatures crossed between Spreader Junction Boxes

Where no Spreader is used, No. 2 & 4 Armatures are crossed between Motor and Junction Box. Ground Wires on Motors No. 2 & 4 only.

Street Railway Journal

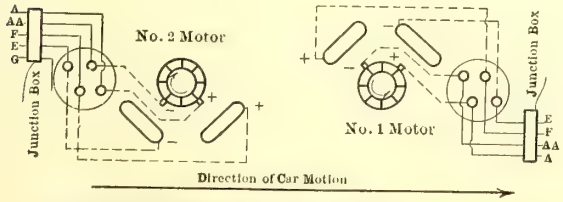
CONNECTIONS FOR FOUR WESTINGHOUSE NO. 68 MOTORS, HUNG OUTSIDE OF AXLES ON DOUBLE TRUCK CARS



No. 1 Armatures Crossed between Motor or Spreader and Junction Box. All other Motor Wires Run Straight

Street Railway Journal

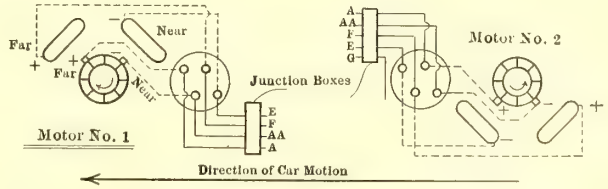
CONNECTIONS OF WESTINGHOUSE NO. 68 MOTOR MOUNTED ON DOUBLE TRUCKS; JUNCTION BOX ON AXLE SIDE



No.1 Connects same as No.2 on a 4 Motor Car
No.2 " " " No.1 " " " "
No.2 Armatures and Fields straight — No.1 Armatures Crossed

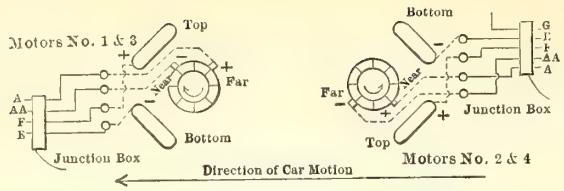
Street Railway Journal

CONNECTIONS FOR TWO WESTINGHOUSE NO. 68 MOTORS ON A SINGLE TRUCK



No. 2 Armatures Crossed between Motor or Spreader and Junction Box. All other Motor Wires Run Straight

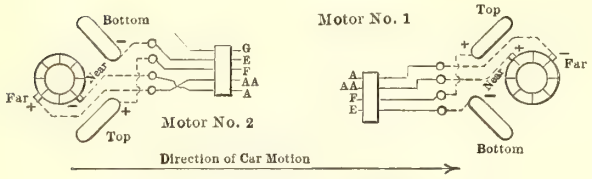
CONNECTIONS OF TWO WESTINGHOUSE NO. 68 MOTORS HUNG ON TWO DOUBLE TRUCKS; MOTOR TERMINALS OUT ON AXLE SIDE



Terminals out on Suspension Side
Armature Wires Motors #2 and 4 Crossed
All other Motor Wires Run Straight

Street Railway Journal

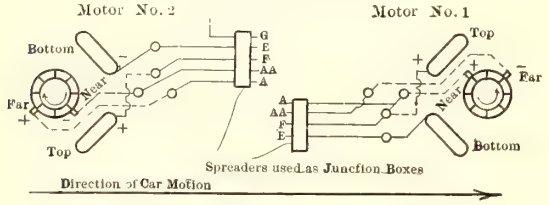
FOUR G. E. 57 OR 1000 MOTORS



No. 1 Armatures Crossed between Motor or Spreader and Junction Box. All other Motor Wires Run Straight.

Street Railway Journal

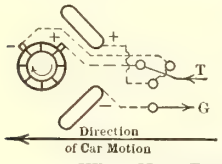
TWO G. E. MOTORS (EXCEPT NOS. 57 AND 1000), MOUNTED ON DOUBLE TRUCKS; MOTOR TERMINALS OUT ON SUSPENSION SIDE



Facing Commutator End, Motor Terminals come out on Left or Suspension Side of Motors.
Facing Spreader, Single A to the right.

Street Railway Journal

TWO G. E. MOTORS (EXCEPT NOS. 57 AND 1000), ON SINGLE TRUCK



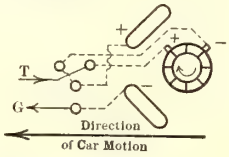
Notes:—
If Wiring is right, the Single As and Fs from Controller are +.
In considering Connections, Face the Commutator End.

When Near Brushholder and Top Field are Plus, Armature Rotates Clockwisely, and the Car moves to the left.

Street Railway Journal

DIRECTION OF ROTATION OF G. E. 800, 52, 58, 67 AND 80 C. MOTORS WITH GIVEN POLARITIES

Notes:—
If Wiring is right, the Single As and Fs from Controller are +.
In considering Connections, Face the Commutator End.

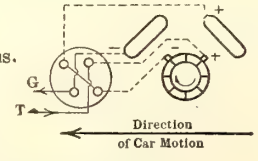


When Near Brushholder and Top Field are Plus, Armature Rotates Clockwisely, and the Car moves to the left.

Street Railway Journal

DIRECTION OF ROTATION OF G. E. 52, 58, 800, 67 AND 80 C. MOTORS, WITH GIVEN POLARITIES, WHEN TERMINALS COME OUT ON THE LEFT AND CORRESPONDING DIRECTION OF CAR MOTION

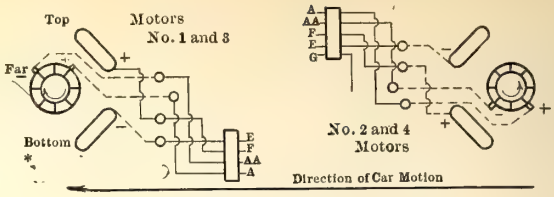
Notes:—
If Wiring is right, the Single As and Fs from Controller No. 1 are Plus.
In considering Connections, Face Commutator End.



When Far Brushholder and Far Field are Plus, Armature Rotates Clockwisely, as indicated, and the Car moves to the left.

Street Railway Journal

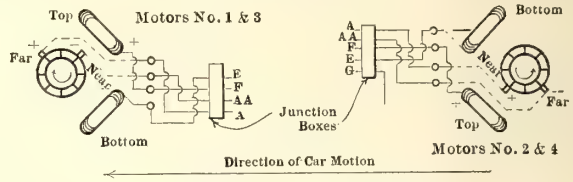
DIRECTION OF ROTATION OF WESTINGHOUSE NO. 56 MOTORS WITH GIVEN POLARITIES



Notes: Armature Wires on Motors No. 1 and 3 crossed between Junction Box and Spreader
All other Motor Wires Straight

Street Railway Journal

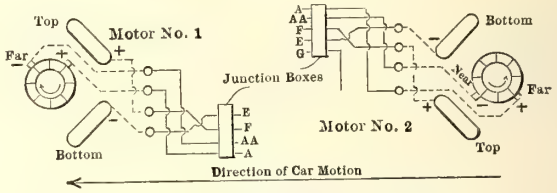
FOUR G. E. MOTORS (EXCEPT NOS. 57 AND 1000), HUNG OUTSIDE OF AXLES ON TWO DOUBLE TRUCKS; TERMINALS ON AXLE SIDE



Terminals out on Axle Side
Armature Wires Motors #2 and #4 Crossed
All other Motor Wires Straight

Street Railway Journal

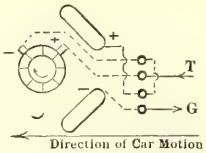
FOUR G. E. 1000 OR 57 MOTORS



No. 1 Armatures Crossed between Motor or Spreader and Junction Box. All other Motor Wires Run Straight.

Street Railway Journal

TWO G. E. MOTORS (EXCEPT NOS. 57 AND 1000), ON DOUBLE TRUCK; MOTOR TERMINALS OUT ON AXLE SIDE



Notes:—
If Wiring is right, Single As and Fs from the Controller are +.

In considering Connections, Face the Commutator End.

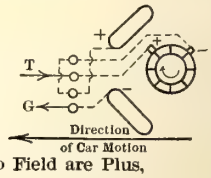
When Near Brushholder and Top Field are Plus, the Armature Rotates Clockwisely, as indicated, and the Car moves to the left.

Street Railway Journal

DIRECTION OF ROTATION OF G. E. 800, 52, 58, 67 AND 80 C. MOTORS, WITH GIVEN POLARITIES

Notes:—
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In considering Connections, Face Commutator End.

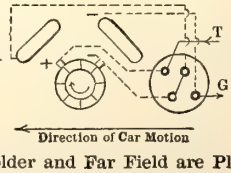


When Near Brushholder and Top Field are Plus, Armature Rotates Clockwisely, as indicated, and the Car moves to the left.

Street Railway Journal

DIRECTION OF ROTATION OF G. E. MOTORS (EXCEPT NOS. 57 AND 1000), WITH GIVEN POLARITIES, WHEN TERMINALS COME OUT ON THE LEFT AND CORRESPONDING DIRECTION OF CAR MOTION

Note:—
In considering Connections, Face the Commutator End.



Note:—
The Single As and Fs are Plus Wires from Controller, if Wiring is correct.

When Far Brushholder and Far Field are Plus, the Armature Rotates Clockwisely, as indicated, and the Car moves to the left.

Street Railway Journal

DIRECTION OF ROTATION OF WESTINGHOUSE NO. 68 MOTOR WITH GIVEN POLARITIES

In addition to the instruction prints, Mr. Remelius has also had printed a set of wiring diagrams for the K 6 controller, K 11 controller, K 11 (B 23) controller, K 2 controller. A feature of these prints is a key giving the lengths of wire needed. In this way a man can, by telling

LENGTH OF WIRES FOR K2 CONTROLLER

Trolley	44″	of	No. 2	flexible wire
R1	43″	of	No. 4	solid wire
R2	39″	"	"	"
R3	36″	"	"	"
A1	23″	"	"	"
AA1	27″	"	"	"
A2	28″	"	"	"
AA2	31″	"	"	"
F1	29″	"	"	"
F2	35″	"	"	"
F2	35″	"	"	"
E1	14″	"	"	"
L1	22″	"	"	"
L2	14″	"	"	"

SWITCH CONTACTS

15	39″	of	No. 4	solid wire
19	36″	"	"	"

BLADES

R4 or 19	20″	of	No. 4	solid wire
15	22″	"	"	"

LENGTH OF WIRES FOR K11 (B23) CONTROLLER

Trolley	2 18″ pieces		No. 2	flexible wire
R1	28″	of	No. 4	solid wire
R2	30″	"	"	"
R3	28″	"	"	"
R4	30″	"	"	"
R5	16″ of No. 4 solid and 42″	of	No. 2	flexible wire
A1	40″	of	No. 4	solid wire
AA1	40″	"	"	"
A2	39″	"	"	"
AA2	39″	"	"	"
E1	15″	"	"	"
E2	10″	"	"	"
8	16″	"	"	"
11	30″	"	"	"
12	36″	"	"	"
17	40″	"	"	"
20	35″	"	"	"
25	10″	"	"	"
Ground	2 20″ pieces	of	No. 2	flexible wire

LENGTH OF WIRES FOR K6 CONTROLLER

Trolley	42″	of	No. 2	flexible wire
R1	34″	of	No. 4	solid wire
R2	33″	"	"	"
R3	31″	"	"	"
R4	30″	"	"	"
R5	28″	"	"	"
R6	28″	"	"	"
A1	18″	"	"	"
AA1	21″	"	"	"
A2	27″	"	"	"
AA2	29″	"	"	"
A3	22″	"	"	"
AA3	23″	"	"	"
A4	30″	"	"	"
AA4	31″	"	"	"
F1	28″	"	"	"
F2	33″	"	"	"
F3	34″	"	"	"
F4	34″	"	"	"

SWITCH CONTACTS

19	9″	of	No. 2	flexible wire
15	21″	"	"	"

BLADES

R7 or 19	17″	of	No. 2	flexible wire
15	15″	"	"	"
E1	18″	"	"	"
Ground	14″	"	"	"

LENGTH OF WIRES FOR K11 CONTROLLER

Trolley	40″	of	No. 2	flexible wire
R1	41″	of	No. 4	solid wire
R2	37″	"	"	"
R3	34″	"	"	"
R4	31″	"	"	"
A1	21″	"	"	"
AA1	25″	"	"	"
A2	26″	"	"	"
AA2	29″	"	"	"
F1	27″	"	"	"
F2	33″	"	"	"
E1	12″	"	"	"

SWITCH CONTACTS

19	34″	of	No. 4	solid wire
15	37″	"	"	"

BLADES

R5 or 19	18″	of	No. 4	solid wire
15	20″	"	"	"

the job he is on, get just the material he needs, and by checking his time card against the material accurate tab can be kept on the material. The prints are all numbered and a key is published, making reference to them easy. The subjects covered include among others resistance connections for Westinghouse and G. E. motors; junction-box connections for four-motor cars and two-motor cars; order of bringing out terminals on Westinghouse and G. E. motors; direction of rotation of Westinghouse and G. E. motors; order of bringing motor leads through spreader; connections for two and four-motor equipments, both Westinghouse and G. E.; construction and connection of standard resistances for four motors; connection of choke coil and lightning arester; the set of brushes on both G. E. and Westinghouse motors; incandescent lamp circuits for both double and single-end cars; arc lamp connections for single-end car, and connections for the Christensen air governor.

T-RAILS FOR PAVED STREETS

In a recent communication to this periodical, H. L. Weber, Engineer Maintenance of Way of the Fort Wayne & Wabash Valley Traction Company, discusses the question of T-rails for paved streets. From his experience as a city engineer he can see no objection to the use of T-rails provided the proper paving is used in connection with them.

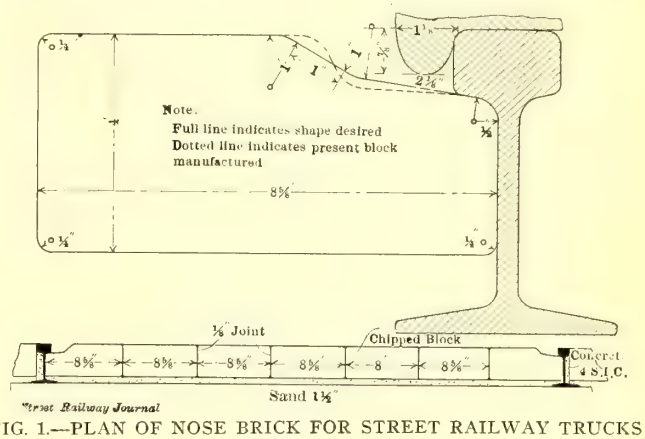


FIG. 1.—PLAN OF NOSE BRICK FOR STREET RAILWAY TRUCKS

While city engineer of Richmond, Ind., he designed, in 1894, the nose brick shown as Fig. 4, on page 884 of the STREET RAILWAY JOURNAL of Oct. 26, 1907, reproduced herewith by the solid-line drawing in Fig. 1. This shape was manufactured by the Canton Brick Company for the city of Richmond to repair some tracks on Main Street that

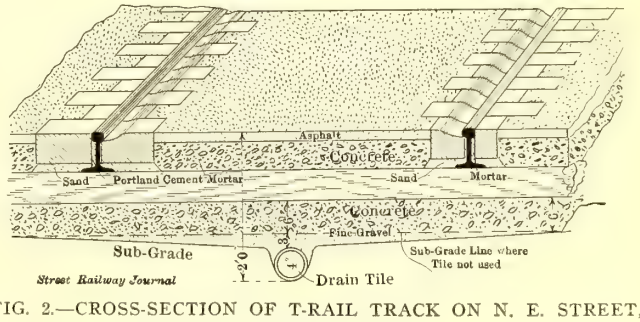


FIG. 2.—CROSS-SECTION OF T-RAIL TRACK ON N. E. STREET, RICHMOND, IND.

had been of poor construction, and to pave along the rails on N. E. Street, between Eighth and Tenth Streets, that had been contracted for. The track work on the N. E Street improvement was constructed as shown in Fig. 2, and is practically as good to-day as in 1894. The solid-line drawing in Fig. 1 represents the form as originally designed, the dotted line the form as manufactured to-day. Mr. Weber is convinced that the original form—the solid-line drawing—is the best to use, as it affords an easy egress

for the wheels of vehicles in turning out of the way of cars, for as the angle increases the brick eases the wheel out of the rut, there being almost a gradual incline from the bottom of the ball of the rail to its highest point. There is no abrupt hump to catch the inside of vehicle tires as in the dotted-line drawing. The rail used was a 6-in., 60-lb. T-rail, 6 in. x 8 in. x 7 ft. ties placed 30-in. centers, as fully shown in the accompanying drawing. The track drain used is shown in Fig. 3.

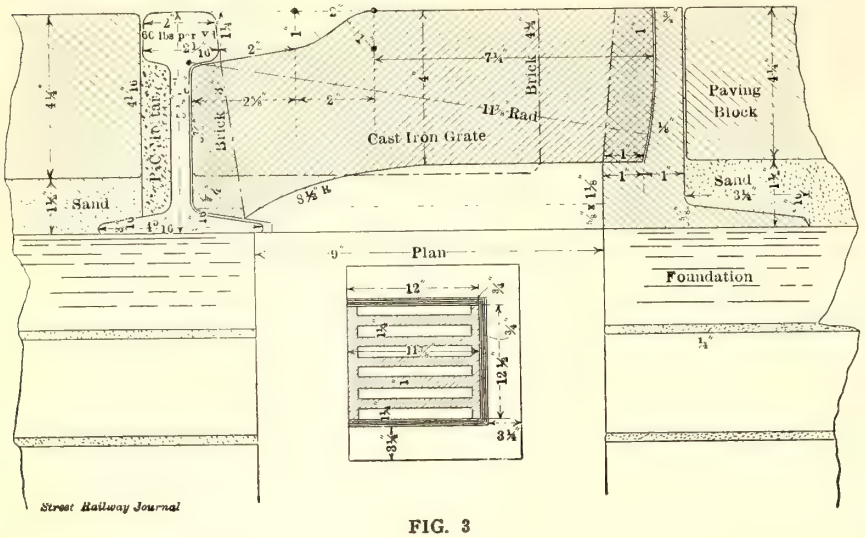


FIG. 3

The standard sections that Mr. Weber has recommended to his company include a 6-in., 72-lb. T-rail section as the standard for paved streets, as the bending moment of this size is about equal to the 85-lb. A. S. C. E. rail section and the rail has a depth sufficient for most kinds of paving.

What the street railway engineer must do in the near future is to use his old rail for cross ties, or steel cross ties and sheet concrete for the foundation. This form will give him the minimum depth of foundation he can use, with the maximum bearing surface. He believes it is better policy to adopt a rail with a good but not unnecessarily heavy foundation, than an unreasonably heavy rail with a poor foundation.

Should it be necessary to go to a 90-lb. per yard section he would favor the "Hunt" section. Where concrete beams are adopted they should have a base of at least 28 ins., for after the experience of his company he would not think of building any beam with less than 30-in. base and then on tracks over which only light city cars are operated. The first essential to any track is proper drainage and next bearing surface on a good foundation. The rails take the wear direct and transmit the weight to the foundation through the ties. All that is essential in a rail is to have one of sufficient strength that it will not bend under its load, and that will remain perfectly rigid, with ties placed from 36-in. to 49-in. centers. In sand, gravel or crushed stone he would use ties from 24-in. to 27-in. centers. In concrete we will soon have to go to steel at from 4 ft. to 5 ft. with a good concrete base. The accompanying drawings, Figs. 4, 5 and 6, which are the Fort Wayne & Wabash Valley Traction Company's standard form of construction, embody his ideas for this class of work.

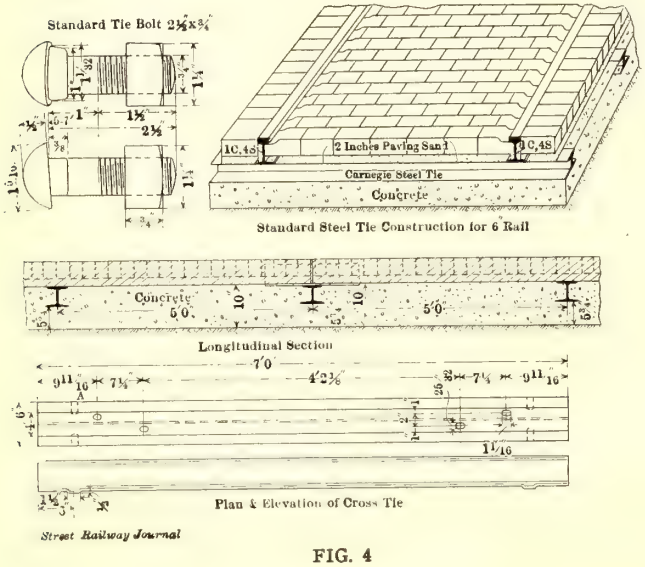


FIG. 4

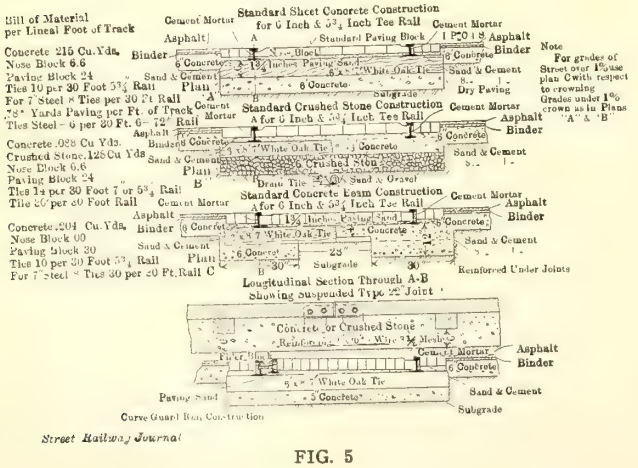


FIG. 5

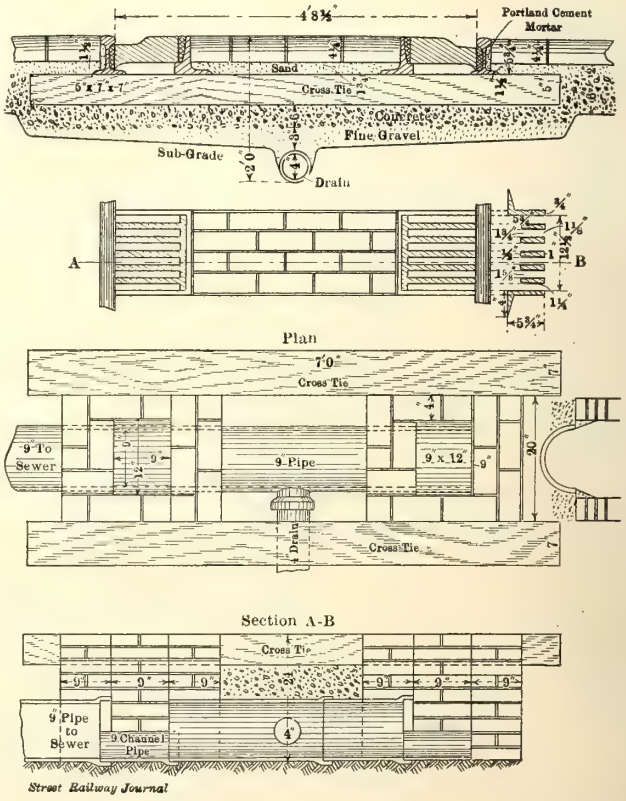
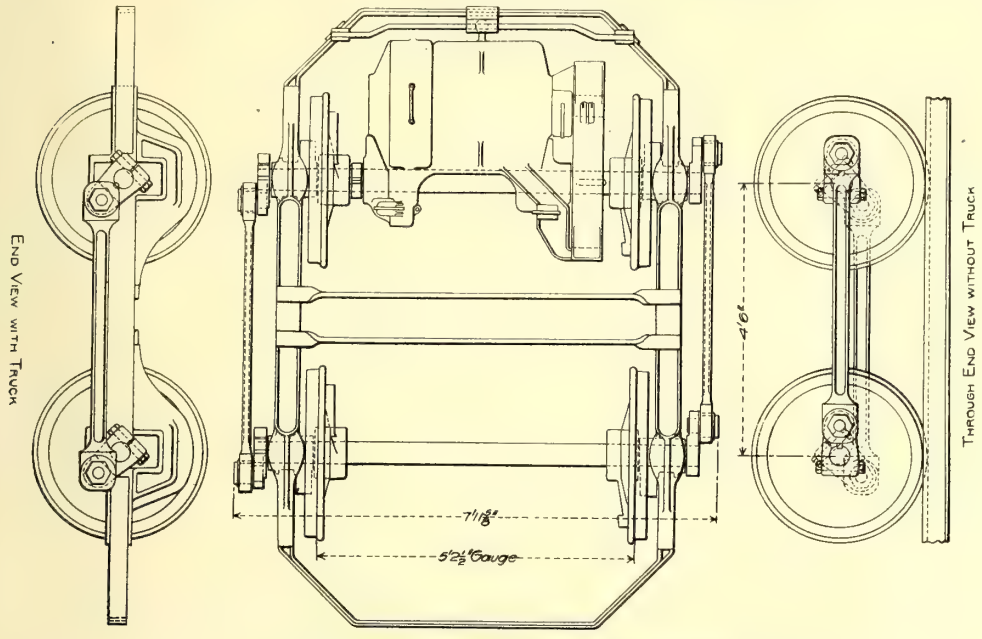


FIG. 6.—CROSS-SECTION OF TRACK AND DRAIN

CAR WITH SIDE RODS IN PITTSBURG

Some interesting tests have recently been conducted in Pittsburg by John Murphy, general superintendent of the Pittsburg Railways Company, on the lines of that road, to determine the relative economy of a four-motor car, a two-motor car of the usual type and a two-motor car in which side rods are used to connect the pairs of wheels under each truck. Some results which are quite striking in their character have been secured.



PLAN AND SIDE ELEVATION OF TRUCK WITH CONNECTING ROD

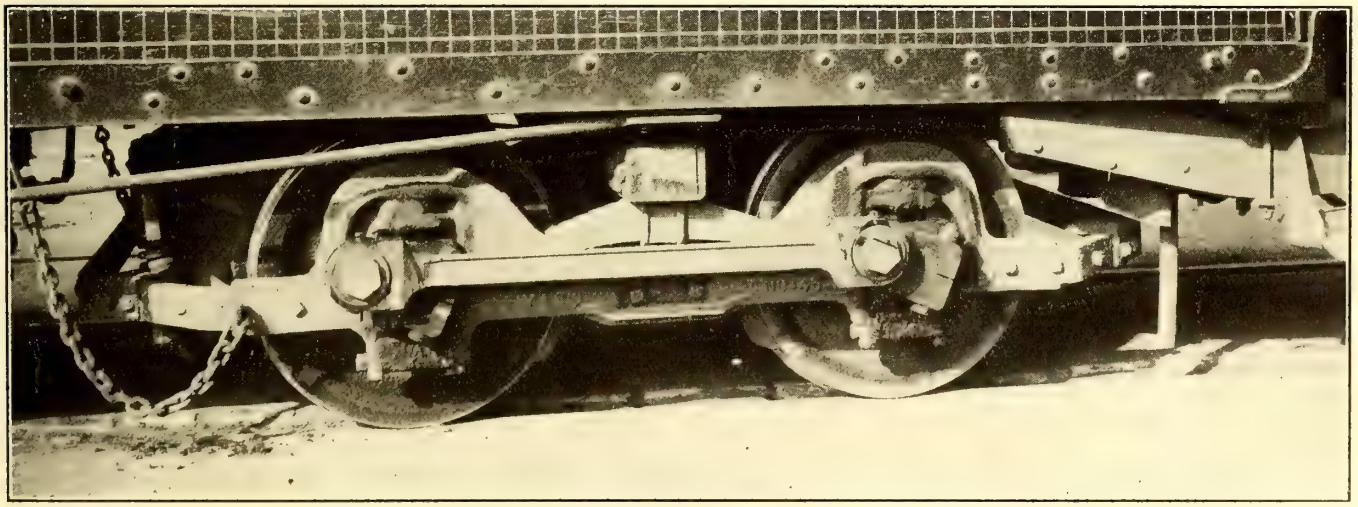
A standard double-truck car of the Pittsburg Railways Company measuring 40 ft. over all, and equipped with four 93-A Westinghouse motors, was selected for the trials. One motor was removed from each of the trucks of this car and the axles of each truck were connected with driving rods, as shown in the engravings. These driving rods were attached by extending the axle through the box and attaching thereon a crank made of a steel forging and measuring 6 ins. between the center of the axle and the center of the crank pin. The latter was 3 ins. in diameter. The connecting rod between these two cranks was also of forged steel, 4 ft. 6 ins. center to center of pins, 3 ins. high and 1½ ins. thick. The wheels were balanced in the usual way by weights attached between the spokes. Connecting rods were used on both sides of each truck. This car was put in operation on June 20, 1907, and run for twenty-seven days in comparison with another car of exactly the same type and on the same route, equipped with four Westinghouse 93-A motors, but having no connecting rods. Owing to the substitution of the rods for the motors there was a slight difference in weight, the four-motor car weighing 48,700 lbs. and the car with connecting rods 42,700 lbs. The result of this test, which showed a saving of 29.9 per cent in kw-hours for the car without connecting rods, is shown in Table I.

At the end of this test it was decided to make a comparison between the new car and a two-motor car of the ordinary type. Two motors were then removed from the four-motor car and the result of six days' operation is shown in Table II.

After these tests the car with connecting rods was put in regular service on what is known as "the express route." This route is quite hilly and for about 6000 feet there is a 5 per cent grade. The distance covered by the cars on this route averages 180 miles per day and the passengers carried per car from July 19 to July 28 averaged 1745 daily. The trucks and wattmeters of the two cars were exchanged on July 17 and 18, and during the next ten days readings were taken to determine the relative efficiency of the two cars, as shown in Table III.

TABLE I

Period		Total K.W.H. used	Total miles run	Total Pass'g'rs carried	Per Car Mile		Per cent saving
					K.W.H. used	Pass'g'rs carried	
27 days June 20 to July 16	Connecting Rod, 2 93-A motors.	7,291	2,129	29,231	3.42	13.7	29.9
	Ordinary Car, 4 93-A motors..	10,287	2,186	32,560	4.88	14.8	...



SIDE VIEW OF TRUCK WITH CONNECTING RODS

The car with connecting rods is still running on the express service and up to Dec. 4 had required no repairs

except truing of the wheels. The other cars operating on this route have quadruple equipments of 93-A motors.

A temperature test at the end of the 18-hour daily run has at no time been above 60 degs., which shows that the

TABLE II

Period		Total K.W.H. used	Total miles run	Total Pass'g'rs carried	Per Car Mile		Per cent saving
					K.W.H. used	Pass'g'rs carried	
6 days July 11 to July 16	Connecting Rod, 2 93-A motors.	1,695	528	7,183	3.21	13.60	15.5
	Ordinary Car, 2 93-A motors..	2,140	563	8,010	3.80	14.2	....

TABLE III

Period		Total K.W.H. used	Total miles run	Total Pass'g'rs carried	Per Car Mile		Per cent saving
					K.W.H. used	Pass'g'rs carried	
10 days July 19 to July 28	Connecting Rod, 2 93-A motors.	2,804	954	13,773	2.94	14.43	18.3
	Ordinary Car, 2 93-A motors..	3,092	862	11,823	3.59	13.71	....

motors were not overloaded even with this extreme service. Since this car was put in service on June 20 and up to Nov. 1, it had traveled 21,842 miles and carried 213,200 passengers, plus four days which the car was in the shop for truing of wheels and changing car bodies.

NO DOUBLE TROLLEY IN RICHMOND.

The City Council of Richmond Va., has defeated, by a vote of 21 to 7, an ordinance to require the Virginia Passenger & Power Company to install the double overhead trolley system as a means of preventing electrolysis. This action by the Council was taken as a result of the recommendations embodied in a majority report of a joint committee of the water and electricity boards, which has been considering the evidence submitted. The majority report recommends the appointment of a joint committee from the two branches of the Council to confer with the company as to the installation of appliances at certain points to indicate the condition of the return circuits so that they may be seen by the city; to agree upon methods for the prevention of the trouble in the future and to adjust the claim for past damage.

This action of the Council settles a question that from time to time since the summer of 1899 has involved the company. In that year A. M. Schoen, acting for the city, made a study of the electrolysis problem as it presented itself in Richmond, and, as a result of his report, a suit was begun by the city for damages. This suit, however, was not pushed.

When Mr. Gould took over the Richmond property, in 1903, the city began to force the matter of installing the double trolley. The company, to protect itself, engaged Lewis B. Stillwell, of New York, to investigate the return circuit and put the system in good shape in respect to the return. The investigation by Mr. Stillwell covered almost a year, and, as a result, about $100,000 was spent in bonding special work to the full carrying capacity of the rails and bonding the rails to 3-ft. per joint in the congested district and 6-ft. per joint in outlying districts. In addition, ground potential wires were installed by which records of the drop in potential might be kept up to a fixed standard. Since then a series of monthly tests has been instituted in addition to the drop tests. Further, A. B. Herrick was engaged to test the system with his car, and reported the return circuit of Richmond to be better than any he had studied.

The total claims of the city, made from time to time, as trouble with pipes was reported, amounted to less than $100 per year for six years, but, notwithstanding this fact, about eighteen months ago, D. A. Maury, of Peoria, Ill., made a sensational report to the city, in which he said that $160,000 damages had been done to the water mains. According to him some of the pipes were reported as almost completely eaten away. This startled the City Council, and immediately an ordinance was introduced to compel the installation of the double trolley. General Manager Huff, of the Virginia Passenger & Power Company; F. N. Waterman, of New York; Prof. Sever, of Columbia, and Mr. Herrick, all offered expert testimony for the company last fall. The city presented its side this spring. Mr. Schoen who had looked into the matter for the city, gave testimony unfavorable to the double trolley, and expressed the view that the present return system did not constitute a hazard to the city's pipes. Mr. Trafford, an electrical engineer of Richmond, testifying on behalf of the city, also declined to recommend the double trolley. Mr. Maury, of Peoria, and Mr. Foss, of Boston, both waterworks engineers, however, favored its installation. It is the testimony of these experts that the joint committee of water and electricity has been considering, and it is on the presentation of the case against the double trolley and the evidence as to the present excellent condition of the system, that the majority report in opposition to the double trolley was made and adopted by the City Council.

REPORT OF COMMITTEE ON CLASSIFICATION OF ACCOUNTS

The special committee on classification of electric railway accounts, appointed in conformity to the resolution passed at the conference held in Washington on Nov. 22, has rendered its report to Prof. Henry C. Adams, of the Interstate Commerce Commission. This committee consisted of the following members:

Geo. H. Harries, chairman, representing the American Street & Interurban Railway Association.

Wm. F. Ham, representing the American Street & Interurban Railway Accountants' Association.

C. Loomis Allen, representing the Street Railway Association of the State of New York.

Wm. J. Meyers, representing the New York Public Service Commission of the Second District.

Wm. O. Seymour, representing the National Association of Railway Commissioners.

C. F. Balch, representing the Interstate Commerce Commission.

Sessions of this committee were held in Washington from Nov. 29 to Dec. 3, and it went very fully into the subject. Prof. Adams has called a conference to consider the report of this special committee, the conference to be held at the rooms of the Interstate Commerce Commission in Washington on Dec. 17. It is expected that the subject will be very fully considered at that time, but that any action taken at that conference will be tentative in character and that before the Interstate Commerce Commission is asked to approve or disapprove the scheme submitted the accounting officers of the electric railway companies in the country, and others interested, will have an opportunity of making criticisms and suggestions.

The Traffic Commission of the municipality of Berlin has decided to build an underground railroad running northwest and southeast through the heart of the city, from Charlottenburg to Rixdorf. The cost of the new line is estimated at $15,000,000. It is an addition to the subway to run north and south, plans for which are now under preparation. Berlin is also to have five new surface lines.

THE CLEVELAND SITUATION

As stated in the STREET RAILWAY JOURNAL for Dec. 7, President Andrews of the Cleveland Electric, on Tuesday of last week, forwarded to Mayor Johnson a communication in which he informed that official that the company had chosen Attorney F. H. Goff, of the firm of Kline, Tolles & Goff, with full power to act in the negotiations with the city, the board of directors having passed a resolution to that effect. This was an unexpected move on the part of the company, as at a meeting with the Mayor on Monday, President Andrews had asked under what terms the city would be willing to allow the company to rebuild and operate the lines on Central Avenue and Quincy Street, and the Mayor had given the usual answer to the effect that a proposition should be made.

Wednesday morning Mr. Goff formally addressed the City Council and councilmen-elect. He said he entered upon his duties under some degree of embarrassment because he was only slightly acquainted with the members of Council and the Mayor. Further he said that the settlement would be somewhat in the nature of a trial with the Mayor as judge, and the councilmen as jurors, and that in making his preliminary statement, he came unprepared to a large degree, as he had not had sufficient time to go over the matter.

Mr. Goff first stated that he owned 200 shares and his wife 130 shares of Cleveland Electric stock, but he said he would submit this fact to the Mayor, and if he felt that it would bias him in his negotiations, he would dispose of the stock before he took up the work. Mr. Goff also stated that he is a volunteer in this work, so to speak, as he was undertaking it without pay and with full authority to act. In speaking to the councilmen, he said that the disputes that had taken place in the past might have caused some feeling and that for this reason the case might be considered as almost half tried at this time; but he asked them, for the good of the public and all concerned, to consider the negotiations as if they were a new subject altogether. Of the 1000 stockholders of the Cleveland Electric Railway, Mr. Goff said many were people who had put their savings into it with the expectation that they would in this way possess a competency in later years. In some cases aged couples, with no other assets, own stock in the company. Mr. Goff said he owes a duty to these minority stockholders, and until this is discharged, he will not feel that his work is done. The Mayor and the councilmen also owe a duty to them and he asked that they consider this responsibility.

In explaining his views upon the question in general, Mr. Goff said that he would insist upon the company opening all its books and records to the public and to any investigators or experts that may be chosen to go through them. As the Mayor and Council seem to have considered the holding company plan of settlement the only feasible one, Mr. Goff said he was willing to take up the negotiations along that line. Owing to a tendency toward municipal ownership of public service corporations, in some quarters, he expressed himself as willing to go into the matter and find out whether an amicable adjustment can be brought about in that way.

In regard to the values to be placed upon the properties of the Cleveland Electric, Mr. Goff said he believed that it would be to the interests of all to have President Horace Andrews of the Cleveland Electric Railway and President A. B. DuPont of the Municipal Traction Company take up that work. He said he could not aid in this valuation and that personally he wanted Mr. Andrews to take part in fixing it. A leasing arrangement contemplates not only a valuation of the physical properties, but of the underlying stock and the unexpired franchises. As there is a dispute as to when the franchises of the West Side lines expire, Mr. Goff suggested that City Solicitor Baker and some other attorney take this matter up and determine, if possible, the date of the expirations. After paying Mr. Baker a compliment for the work he has done, Mr. Goff suggested that his own law partner, S. H. Tolles, be selected to act with Mr. Baker and if they can not agree to call in a third lawyer.

As the basis for the valuation of the various kinds of properties can not be fixed otherwise, he suggested that engineers be selected to make an investigation and report their findings for the consideration of the representatives of the city and himself. As the proposed holding company has only a small capital stock, Mr. Goff proposed that the security franchise for the Cleveland Electric Railway Company should be very carefully drawn in order to protect the property of the company from depreciation. He felt that a fund should be set aside for maintenance and some arrangement made for the extension of the lines and other improvements.

Mr. Goff said there should be a unification of the lines and that he would endeavor to facilitate progress in every way in the discussion of the lease, the security franchise and other subjects that must be settled. He said he had no opinion yet as to the terms or the price upon which a leasing arrangement should be made.

Speaking of President Andrews, Mr. Goff said he yielded to none in appreciation of what he has done all through the negotiations between the city and the company. At the outset of these considerations, Mr. Goff said he wanted it understood that he will fight for the stockholders of the company just as hard as for the interests of the city and that he will hold out for the last dollar in the valuation. While endeavoring to be fair to the extreme so far as the city is concerned, he said he will never give up in his contention for what he thinks is right for the company. As to the directors of the holding company, he said they must be broad-minded business men, such as would make a success of any undertaking if the possibility of success lay within the proposition. In closing, he suggested that an armistice might be declared until some form of settlement is reached.

Mayor Johnson said he was very much pleased with Mr. Goff's presentation of the case and of his willingness to cooperate with the city in reaching an agreement. The city will approach the negotiations with the same degree of fairness that has been manifested by Mr. Goff, he said. He said, however, that he did not want to be considered a judge in this matter and that both he and the members of the council are open to conviction on all matters pertaining to it.

As to ascertaining the physical valuation of the property, the Mayor thought that men should be selected for each class of property, such as real estate, track, power houses, etc., and that they should report their findings for consideration. Then an attempt to agree could be made upon any point where differences arise. The Mayor finally agreed to the suggestion that Messrs. Andrews and DuPont be named to report on the valuations, with the understanding that they select men to go over the different kinds of property and report to them, after which they will report to the Council their findings. In effect, the detail is taken

from the Council by this arrangement and left to the two presidents.

Messrs. Baker and Tolles were agreed upon as a committee to investigate the franchise question and report upon the dates of expiration. The company claims that some of the franchises in question do not expire for two years after the dates claimed by the city. The city is relying on the decision of Judge Tayler, of the United States District Court, on the Central Avenue and Quincy Street matter for the expirations on the other streets in question. These gentlemen are to submit their findings to the council committee of the whole and Mr. Goff, and if agreements are not reached on all points before they are submitted, the committee will try to reach an agreement on them. That failing, a third lawyer will be called in for an opinion. However, none of the decisions will be binding on either side.

At the meeting of the Council committee of the whole to discuss the street railway question Tuesday, Nov. 10, Mayor Johnson suggested the appointment of two new committees of two members each to determine the ratio of increase or decrease in the gross receipts of the Cleveland Electric, and to fix a set of rules of procedure in the valuation of unexpired franchises. Both, of course, relate largely to the value of the franchises. Mr. Goff agreed to this, but the personnel of the committees was left open for the time.

Mr. Goff explained that he had endeavored to secure information that would enable him to state a figure somewhere near what he would demand as a basis price for leasing the properties of the company, but that he had been unable to do so as yet. He felt, however, that it will be easy to arrive at the physical value of the properties. The determination of the value of the franchises will be more difficult. He suggested that experts be employed and paid by the city and the company in conjunction, to aid in arriving at a proper valuation of the properties. He said that he wanted to get at the matter in a way that will bring results, and he believed this would be a good plan. The company is willing to pay its portion of any such expenses.

Mr. Goff reviewed the negotiations between the city and the company, saying that two years ago a price of 85 had been proposed, and that last summer the price was placed at 60, with a reduction of $2 for each month that the company delayed in accepting the proposal. This, he said, was a kind of penalty inflicted upon the company for not accepting the offer. He stands for the values as they are found by the investigation, and the board of directors of the company will accept what is shown to be fair and right. Mr. Goff called attention to the fact that during the past fourteen years the company had expended $12,000,000 for extensions and betterments, and that the property therefore contains that much more value.

Mr. Goff's suggestion of unification of the lines was repeated. He said he believed in only one company, and that if an arrangement was arrived at, then some way could be found to merge the owning companies. Stock of the Cleveland Electric might be issued to cover the assets of the Forest City Railway Company, or some other plan taken to unite the companies. A blanket franchise, with six tickets for a quarter, could then be issued to protect the old company.

Mayor Johnson agreed with Mr. Goff in his idea of unification. He said a new company might be organized by the stockholders of the Cleveland Electric to which the security franchise could be given, and that this would cover all the lines after the companies had been united under the new company. The city, he said, is not particular whether there are one or more companies; but the old company would be safer to have the merger made and the franchise cover all the lines thus taken in, as all the extensions and improvements would then go to it. A certain sum should be set aside each year to retire the bonds of the old company. All this may be worked out so there will be no conflict of interests.

The great difficulty, he said, would be in fixing the price as a basis for leasing. In this connection he referred to Mr. Goff's remarks about the expenditure of money in betterments, and said that much had also gone into legal controversies, purchasing consents and in taking up tracks. He stated that the offer of 85 was made two years ago because the city desired to purchase a settlement, and explained that the figure did not represent what he considered the real worth of the properties. The offer of 60, however, was what the property was thought to be worth at the time. The drop of $2 a month, he said, represented the further depreciation in the value of the properties.

The committee on buildings made a report on the value of structures aside from power houses and battery houses. On a portion of them they agreed to a value of $83,356. On the others, Mr. Vanderwerf reported $820,720 and Mr. Lougee $705,235.

CORRESPONDENCE

TURBINE ECONOMIES

Pittsburg, Pa., Dec. 2, 1907.

Editors Street Railway Journal.

Permit me to verify the statements made in your issue of Oct. 5 in connection with an economy test on a large turbine of the Parsons type at the New York Edison Company. The accuracy of the results has been called into question by a contributor to one of your contemporaries. I therefore desire, first, to uphold the accuracy of your published report, and second, to correct a popular misconception regarding comparison of turbine economies under different operating conditions. The point at issue is whether the water rate of 14.9 lbs. per kw-hour, developed by the New York Edison turbine, represents higher economy than 12.5 lbs. per kw-hour which is said to have been developed by a large Curtis turbine at the Chicago Edison Company. Presumably the latter figures have been incorrectly quoted from a test recently reported on a 9000-kw turbine at the Chicago Edison Company which showed a maximum economy of 12.9 lbs. per kw-hour at 10,000 kw load.

Now, as far as I am able to ascertain, the basic facts are these: Taking both machines at their point of maximum economy, the Westinghouse-Parsons turbine developed a water rate of approximately 15.1 lbs. per kw-hour output at the switchboard for two consecutive hours with an average steam pressure of 175 lbs. gauge, 97 degs. superheat and 27.3 ins. vacuum. Correcting to contract conditions, 175 lbs. pressure, 100 degs. superheat and 28 ins vacuum, this is equivalent to 14.73 lbs. per kw-hour. The Curtis turbine, on the other hand, developed 12.9 lbs. per kw-hour with 176 lbs. pressure, 147 degs. superheat and 29.5 ins. vacuum. Correcting to the above contract conditions by percentages advocated by the builders of these machines, it develops that the equivalent water rate at the

same load, is 15.08 lbs. per kw-hour. These results might be reduced still further—to a basis of dry-saturated steam —and still be within the limits of your published statement regarding the economic record established by the New York Edison tests, but I believe the above figures will be sufficient for the point in view.

The inference drawn from the above, is that economy tests are not comparable from either a technical or a commercial standpoint, unless respective operating conditions are known, so that it is manifestly improper to question the accuracy of your published report upon such a superficial basis. And, in making comparisons such as these (which heretofore have seemed neither necessary nor opportune), I do so purely in the interest of a clear understanding of the situation, not for the purpose of drawing illusive conclusions, even though the latter may be quite tenable on careful analysis. In examining the performance of prime movers, we must not simply accept the rate of consumption of heat energy in the form of steam, gas, oil, etc., but make comparisons on a true, scientific basis, else the results will quickly lead to erroneous conclusions. The sooner these principles are clearly understood and appreciated at their true value, the sooner will the apparently great disparity between turbine tests, such as those above outlined, be dispelled.

And herein, by the way, lies the greatest fallacy in the ceaseless struggle for high economies. Every engineer is, of course, interested from a personal standpoint, in the attainment of the highest cyclical efficiency for all forms of prime movers; but high efficiency, *per se*, means little from a commercial standpoint unless the cost of attaining it is reckoned. This is particularly true of the extreme operating conditions assiduously cultivated in turbine operation Unquestionably, the results are spectacular, but when we take into consideration the extra cost, maintenance, a complexity of the additional auxiliary equipment, and the losses incident thereto, our enthusiasm wanes, and we intuitively seek a lower plane where efficiency and cost form a more reasonable balance.

J. R. BIBBINS.

THE GENERATORS FOR THE LINCOLN WHARF STATION, BOSTON

The Allis-Chalmers Company is supplying the enlarged Lincoln Wharf station of the Boston Elevated Railway Company two 2700-kw direct-current railway-type generators driven by engines with cylinders 42 ins. x 90 ins. x 10 ins. stroke at a speed of 72 r. p. m.

With the additions at the Lincoln Wharf, Harvard and Charlestown power stations of the Boston Elevated Railway Company, now nearing completion, the total generating capacity for the system will reach approximately 50,000 kilowatts. The work of laying out and constructing these station improvements was placed in the hands of the Stone & Webster Engineering Corporation, of Boston, in accordance with the recommendations made by this firm for a system of generation and distribution of power which would provide for present and future demands. It was decided to add 5400 kilowatts capacity to the Lincoln Wharf station, 2700 kilowatts to the Charlestown and 2700 to the Harvard power station, as has been previously mentioned in the STREET RAILWAY JOURNAL. Direct-current, steam-engine driven generators were selected as the type of the new units in order to conform in general design to those already installed in the various stations.

PAY-AS-YOU-ENTER CARS FOR THE PUBLIC SERVICE CORPORATION

As the result of careful study of the pay-as-you-enter car, the Public Service Railway Company of New Jersey has placed an order with the Cincinnati Car Company, of Cincinnati, Ohio, for 150 cars of the pay-as-you-enter type for delivery commencing next January. Mr. Danforth, the general manager of the company, made this announcement after his return on Monday of this week from Chicago, where he went especially to study the operation of the car on the Chicago City Railway. Mr. Danforth confirms the statements previously made about the ability quickly to load and unload the new type of cars, and in speaking about them laid especial stress on the fact that much time is saved because the conductor is able to give a prompt signal for starting when all intending passengers are safely aboard, something that cannot be done at present in every case when the conductor is so frequently called to the center of the car to collect fares.

The new cars will not be as great an innovation in New Jersey as they were in Chicago, as the Public Service Corporation has for some time operated both single-end and double-end cars with the Detroit platform. It is the standard single-end car of this type that the company has modified for operation on the pay-as-you-enter plan. Certain minor details, however, remain still to be decided, and for this reason a plan of the car was not available for publication. The length of the present standard car body is 30 ft. 8 ins. with a front platform of 5 ft. and a rear platform of 8 ft. 6 ins., making the length of the car over all 44 ft. 2 ins. The width is 8 ft. 6 ins. These dimensions will not be changed in the new cars. Neither will the seating arrangement be altered, which provides for cross seats in the middle of the car and longitudinal seats at either end. Two railings will divide the rear platform instead of one as at present, and the passageways will be distinctly labeled "Entrance" and "Exit." The second of these railings will be 5½ ft. from the rear, giving a passageway of 3 ft. The other will be 3 ft. from the first or 2 ft. 6 ins. from the rear, thus giving room for a few smokers, while leaving ample room for passengers to board and leave the car.

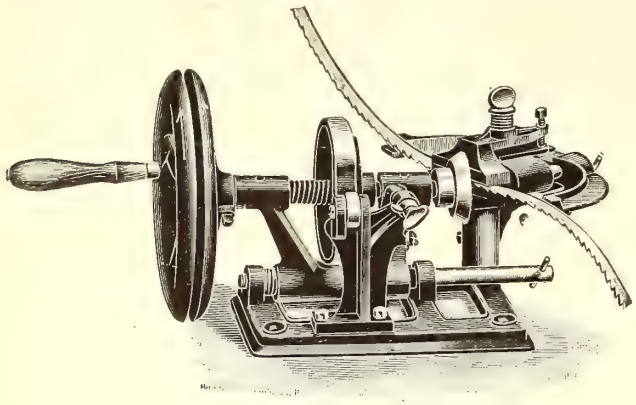
It is in the front platform that a decided change will be made. As now built, the single-end cars have a separate enclosure for the motorman. This will be done away with in the new cars, and a mutually operated door mechanism installed, controlled by the motorman. It is thus proposed to have passengers leave the car at the front. The front platform doors are to be of double folding type, so arranged that the grab handle will be in evidence only when the doors are open. Both front and back platforms will, of course, be enclosed. One of the considerations that governed in the decision as to form of front platform as made was the fact that the 44-ft. cars will just pass on curves with this form as previously adopted for all cars on the system.

As the cars are not to be put in service before March it has not been stated where they will be placed in service first. Before they do go into service, however, it is proposed to conduct a campaign to acquaint the public with their working, in which the daily newspapers will be largely used.

The Inglewood Park Cemetery Association has placed an order in the East for a funeral car, to cost $12,000. This is to be used between Los Angeles and the cemetery on the electric line of the Los Angeles & Redondo Railway.

A SIMPLE BAND SAW SHARPENER

Practically every large modern wood working shop is equipped with a more or less expensive automatic band saw sharpener, but the smaller users of band saws, with one or two saws a week to sharpen, which would not warrant a large machine, are still using the hand file. It is for the



BAND SAW SHARPENER.

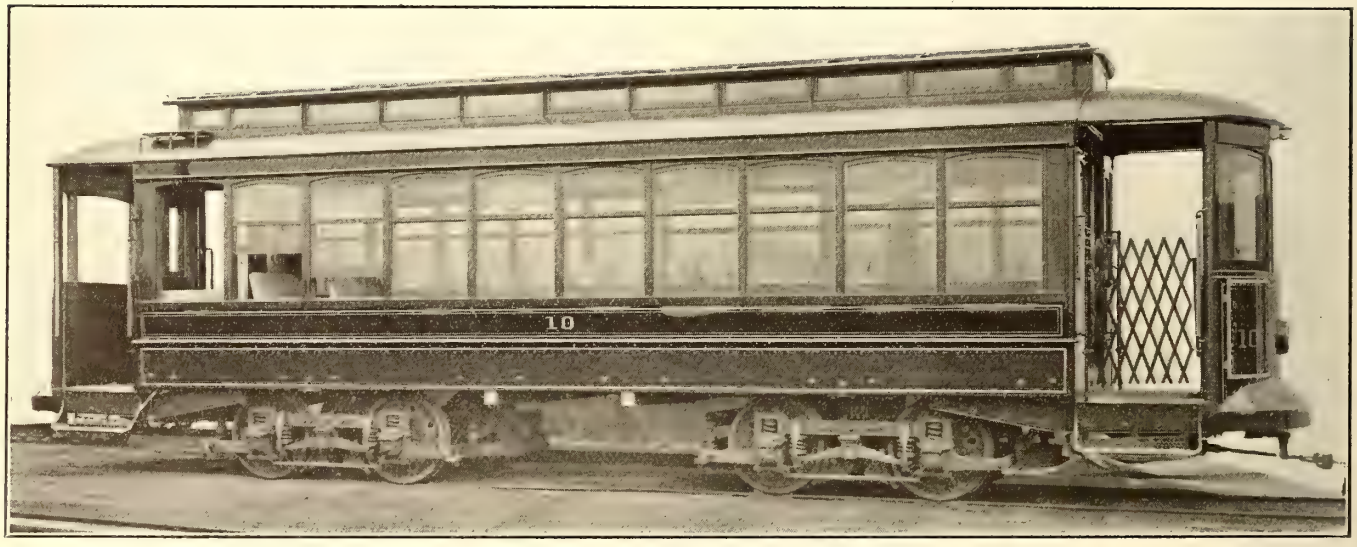
benefit of the latter that the Rotary File & Machine Company of Brooklyn, N. Y., is now making what it calls its Ideal sharpener for operation either by hand or power. This machine is adapted for filing small band saws, ranging in size up to and including saws with teeth ½ in. from tooth point to tooth point and 1½ ins. width of blade. The vise which carries the saw is clamped together by spring pressure sufficient to hold the saw firmly, yet allowing it to be slipped through as each tooth is filed. At each revolution of the file shaft, the file is automatically withdrawn from engagement with a tooth, dropped back, and just as the smooth portion of its circumference reaches the saw, it shoves the saw along for the next tooth. The amount of this movement is regulated according to the size of the saw tooth by a thumb screw. The file is controlled by cams to only cut a certain depth each time, and this feature always insures accurate and even teeth. The construction of the vise makes it possible for a thick weld, and, in fact, almost anything but a break to pass through the vise without stopping the machine or injuring a tooth. This machine, it is said, will save more than half the time of hand filing. If the saw through negligence is left in until it has passed the starting point, no harm is done. The wearing parts are made of high-grade steel.

RECEIVER FOR OHIO ROAD

Owen N. Wilcox was, on Dec. 10, appointed receiver of the Cleveland & Sharon Electric Railroad Company by Judge Strimple in the Common Pleas Court, on a petition filed by the company, through its president, Francis B. Morgan. An injunction suit was filed Dec. 9 by the Cleveland & Sharon Company to prevent the Eldenbel Construction Company, of New York, and C. F. Clendenin, trustee, from holding a stockholders' meeting, alleging the Eldenbel Company had arranged to get possession of the road. The traction company was organized under the laws of Ohio, with a capital stock of $2,500,000, and has issued $2,500,000 in bonds. Under an agreement, it is said that the Eldenbel Construction Company was to float the bonds for the road in London.

MORE SEMI-CONVERTIBLE CARS FOR LAKE CHARLES STREET RAILWAY

The accompanying illustration shows one of a number of semi-convertible cars recently delivered to the Lake Charles Street Railway Company by the American Car Company. The Lake Charles Company has had ample opportunity for testing this type of car and has been particularly impressed by its great carrying capacity. As many as 143 passengers have been accommodated on one of the single-truck convertible cars delivered by the American Car Company some fifteen months ago—a load that would be quite impossible with the drop-sash car with its restricted aisle space. The company has been introducing a number of improvements at Shell Beach to attract patrons of the line during the winter months, and it is expected that the new double-truck cars will prove of great service in handling the increased traffic. The Lake Charles Street Railway Company also operates convertible cars—two on the Gooseport line, one on the Hodges Street line and two on the Shell Beach line. The semi-convertible cars just delivered at Lake Charles are 8 ft. longer in the bodies than their predecessors, namely, 28 ft., and are 37 ft. 5 ins. over the crown pieces. The trucks are the No. 27-GEl with 4 ft 6 in. wheel base. Other dimensions are as follows: Width over sills, including sheathing, 7 ft. 11½ ins.; over posts at belt, 8 ft. 2 ins.; size of side sills, 4½ ins. x 7¾ ins.; end sills, 5¼ ins. x 6⅞ ins. The cars are finished in cherry.



SEMI-CONVERTIBLE CAR FOR LAKE CHARLES.

FINANCIAL INTELLIGENCE

WALL STREET, DEC. 11, 1907.

The Money Market

Developments in the monetary situation have been rather unfavorable during the past week, and as a result rates for money in the local market have ruled considerably higher. Money on call early in the week was obtained in quantity at rates ranging from 5 to 10 per cent, but toward the close there was an advance to 25 per cent, the highest price recorded for demand funds for a month past. Time money was practically unobtainable, while merchants experienced considerable difficulty in securing requirements. The advance in the call loan rates was attributed solely to the heavy transfers of funds from this center to the interior. It was generally believed that the urgent requirements at the West and South had been practically satisfied, but during the week a renewed demand developed from those sources, which made it necessary for the local institutions to call in their loans and ship the money to their country correspondents. According to the statements made to the controller of the currency, as of Dec. 3, the demands from the out-of-town banks are not justified, as in most instances the statements showed cash holdings largely in excess of reserve requirements, while in some individual cases the percentage of cash amounted to more than 50 per cent of deposits. The demand for currency continues, and although the volume of business in this branch of the market has fallen off considerably, it is sufficient to keep the premium around 1 @ 1¼ per cent. The foreign exchange market has worked firmer, and consequently gold imports from Europe have been reduced to comparatively small amounts. At the close of the week the belief prevailed that no material improvement in the local situation was likely until after the turn of the year. Many time loans are now maturing and it is understood that these loans are not being renewed. Preparations must also be made in the near future for the Jan. 1 interest and dividend disbursements, which are usually heavy.

The bank statement published last Saturday was more favorable than expected. Loans decreased $11,682,900 as a result of the liquidation in the stock market. Cash increased $4,671,100, and as the reserve required was $2,107,975 less than in the preceding week, the deficit was reduced by $6,779,075. The total deficit now stands at $46,210,350, as compared with a deficit of $6,702,175 in the corresponding week a year ago, and a deficit of $1,246,525 two years ago.

The Stock Market

The upward movement in the stock market which set in after the recent panic abated, and which has continued with very little interruption during the past few weeks, has come to a halt. The investment demand which has assumed such enormous proportions because of the unusually handsome yields that innumerable stocks afforded at the ruling prices has to a considerable extent subsided, and in consequence the tendency of values is downward. Efforts to inaugurate a bullish speculative campaign have failed, for the reason that the elements necessary to a successful movement of this character are lacking and that the recognized leaders of the market are averse to starting such a campaign at present, preferring to await the January interest and dividend disbursements before engaging in anything of the kind. As a matter of fact, conditions, while vastly better than they have been, are by no means propitious in the sense that an active bull movement is justified; on the contrary, all the underlying factors in the situation would seem to prompt the exercise of extreme caution. In the first place, there is still a very large deficit in the reserves of the New York Clearing House banks, while both time and call money are held at practically prohibitive rates. Furthermore, currency continues to command a premium, and matters in the mercantile world are anything but satisfactory. The principal argument against a sustained upward movement in security values at the present time, however, seems to be in the action of numerous corporations throughout the country in curtailing and deferring dividends. This policy is having a decided influence, as the average investor looks to the dividends which he is likely to receive, even before considering the security of his investment.

The only really bright spot in the situation is contained in the steadily increasing demand for railroad bonds, which for practically two years has been virtually nil. With dividends threatened, it is perfectly natural that investors should turn their attention to mortgages on which there is no danger of a default in interest, and the Wall Street community is now looking forward to a constant growth in the buying of first-class bonds as the chief means which will result in bringing money from its hiding places. London is in rather a pessimistic frame of mind regarding American securities and is disposed to sell on any favorable opportunity, while through the recent substantial advance a considerable portion of the short interest that had existed here was eliminated. It thus appears that there is little or no buying power behind the present market, hence the speculative temper has undergone quite a change from the optimism that has lately been in evidence. Then again the copper metal industry is in pretty bad shape, as indicated by the further reduction in output, as well as by the cutting and passing of dividends by many of the companies engaged in this branch of the business, to say nothing of the general belief that the reputed leader in this particular industry is about to follow a similar course. It may be that those having the destinies of our leading commercial enterprises in their hands may be endeavoring to paint the picture in its darkest colors, but whether this be true or not, there is no gainsaying the fact that the industrial situation at the moment is far from roseate, which explains the relative weakness of that class of securities, although railway shares have likewise suffered materially in the reactionary movement.

The local traction shares have stood up as well as any in the general decline, and there has been quiet absorption of most of them on the recessions. Brooklyn Rapid Transit has exhibited comparative strength, which is accepted as indicating that, as was stated in these columns some time since, the public investigation into its affairs would only result in giving to the company a clean bill of health.

Philadelphia

Trading in the local traction stocks has been considerably more active during the past week, and prices for all of the active issues have scored substantial gains in sympathy with the strength prevailing in the general securities market. The prominent feature was Philadelphia Rapid Transit, which advanced more than 2 points to 18½, on rather heavy purchases, but later there was a reaction of about a point on profit-taking sales. Union Traction also was conspicuously strong, the price making an extreme gain of 3 points to 50. American Railways advanced nearly a point to 44⅞ and Philadelphia Traction scored a similar gain to 84. Philadelphia Company common rose from 34½ to 37, and the preferred moved up a point to 37. Frankford & Southwark Passenger was traded in for the first time in several weeks, a small amount of the stock selling at 385. The United Companies of New Jersey made an extreme gain of 5 points to 30, and closed at the highest. Consolidated Traction of New Jersey sold at 60.

Baltimore

There was a broader market for the traction issues at Baltimore during the past week, and prices in nearly every instance scored gains over those prevailing at the close a week ago. Invesment buying of United Railway 4's advanced the price to 82¼, while the incomes rose from 45½ to 47. The new funding 5's, after changing hands at 70¼, advanced to 72¼, while the stock moved up a fraction to 10¾. Metropolitan Railway of Washington 5's sold at 105½, Washington City & Suburban 5's at 97½, Baltimore Traction 5's at 105, Norfolk Railway & Light 5's at 90, and Macon Railway & Light 5's at 91.

Other Traction Securities

The feature of the Boston market was the sharp fluctuations in Boston Elevated stock. Opening at 123, it advanced to 124 and then, on comparatively light transactions, the price

broke to 120. This was followed by a recovery of 2 points. Otherwise the trading in this market was extremely dull and devoid of any interesting feature. Boston & Worcester preferred sold at 55, Massachusetts Electric common at 9½, the preferred at 39, West End common at 81 @ 82 and the preferred at 98. Trading in the Chicago market was practically at a standstill. About the only noteworthy feature was Metropolitan Elevated preferred, which declined from 48 to 46. South Side Elevated sold at 64. The stocks of the various surface lines were neglected.

Cleveland Electric sold from 32 to 42 on the Cleveland Stock Exchange the past week, a number of sales being made around the latter figure. The negotiations, with Mr. Goff at the head, seem to have put some life into the business. Tuesday a few shares of Forest City stock changed hands at 100, but after that the asked price was raised to 101¼. Northern Ohio Traction & Light was quoted at 18¼ bid and 25 asked. Western Ohio preferred stock was listed on the exchange a few days ago.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Dec. 4.	Dec. 11.
American Railways	44	45
Boston Elevated	118½	124
Brooklyn Rapid Transit	38⅜	38⅜
Chicago City	a150	a150
Cleveland Electric	—	36
Consolidated Traction of New Jersey	—	59
Detroit United	32⅝	35
Interborough-Metropolitan	7⅛	7
Interborough-Metropolitan (preferred)	18¼	19
International Traction (common)	—	40
International Traction (preferred) 4s	—	61½
Manhattan Railway	116	115
Massachusetts Elec. Cos. (common)	9¼	9¼
Massachusetts Elec. Cos. (preferred)	38	38
Metropolitan Elevated, Chicago (common)	a20	21
Metropolitan Elevated, Chicago (preferred)	46	46
Metropolitan Street	23	—
North American	47¾	43
North Jersey Street Railway	25	25
Philadelphia Company (common)	34	36½
Philadelphia Rapid Transit	17½	16½
Philadelphia Traction	83	82
Public Service Corporation certificates	54	54
Public Service Corporation 5 per cent notes	89	85
South Side Elevated (Chicago)	—	62
Third Avenue	18	25
Twin City, Minneapolis (common)	79	81
Union Traction (Philadelphia)	49	47

a Asked.

Metals

According to the "Iron Age" there were 226 furnaces in operation on Dec. 1, producing at the rate of 347,372 tons per week, a drop in two months of 164,000 tons. Since the first of the month seven furnaces have gone out, and the announcement in a number of cases that other plants will shut down. Transactions are on a limited scale. The Erie Railroad has placed an order for 25,000 tons of steel rails, and it is known that some other business for 1908 is pending. The old material markets are thoroughly demoralized and very low prices are being made.

The copper metal market continues dull. Lake is quoted at 13⅞ @ 10½, Electrolytic at 12⅞ @ 10⅛ and Castings at 12⅝ @ 12⅞.

ASKS RECEIVER FOR DELAWARE COMPANY

George H. Bates and Richard R. Kenney, counsel for Samuel F. Nirdlinger, of Philadelphia, have filed a bill in equity before Chancellor Nicholson, at Dover, Del., asking for a restraining order against the Delaware General Electric Railway Company, the Delaware Electric Traction Company, the Milford Construction Company, John B. Wharton, Thomas N. Rawlins, treasurer of the State of Delaware; Lewis Heisler Ball and Martin B. Burris, each of whom were former State treasurers of Delaware; James Frank Allee, Caleb R. Layton, George W. Marshall, Luther S. Conwell, Sylvester John Abbott and Thomas C. Moore. The bill asks that respondents be enjoined from disposing of any of the effects, materials, etc., of the corporations named, and that a receiver be appointed for the companies. The chancellor granted the rule to show cause why a receiver should not be appointed for the Delaware General Electric Company, also a rule restraining Allee, Layton, et al., from disposing of any of the property of the company. A rule to show cause, returnable next Monday, Dec. 16, was also granted directing State Treasurer Rawlins to show cause why he should not be enjoined from using the fund otherwise than as simple custodian of it.

FIRE IN MILWAUKEE

The Farwell Avenue barns of the Milwaukee Electric Railway & Light Company were partially destroyed by fire Dec. 7, and the adjoining sub-station of the company also was damaged by the flames. The car barns are separated from the sub-station by a fire wall, which prevented the fire from spreading. There were some 200 cars in the barn at the time of the fire, about 45 being in the part which was attacked by the fire. Most of the cars were run into the street, but it was impossible to get out those at the rear before the flames had reached them. Among the cars destroyed were three salt cars, three snow sweepers, the private car of President Beggs and a number of passenger cars. Mr. Beggs is quoted as saying that nine cars in all were totally destroyed and that the loss aggregates about $70,000.

ELEVATED TRAFFIC IN CHICAGO FOR NOVEMBER

Traffic of the elevated railroads of Chicago for the month of November showed a good increase over the corresponding month last year, with the exception of the figures of the Metropolitan elevated. These latter showed a decrease in the daily average of number of passengers carried of 953, or 0.63 per cent. The loss is attributed to the laying off of men in the large plants in the territory served by the company. Northwestern and South Side elevated each had large gains. The figures follow:

SOUTH SIDE ELEVATED.

	1907.	1906.	Increase.	P. Ct.
January	92,411	92,406	5	0.00
February	96,094	95,077	1,017	0.00
March	100,226	95,466	4,760	4.98
April	103,152	95,756	7,396	2.72
May	109,880	91,759	12,721	13.03
June	115,686	101,770	19,986	13.67
July	111,933	92,796	19,187	20.39
August	113,847	88,539	25,308	28.58
September	118,256	89,749	28,507	31.74
October	126,670	93,577	33,093	35.36
November	120,594	94,281	26,313	27.99

METROPOLITAN ELEVATED.

January	150,165	129,720	20,445	15.76
February	154,444	135,570	18,874	13.91
March	154,790	138,169	16,621	12.02
April	156,275	137,477	18,798	13.67
May	151,423	136,735	14,688	10.72
June	148,518	133,974	14,544	10.85
July	135,779	123,370	12,409	10.37
August	136,517	123,512	13,005	10.52
September	140,979	126,975	14,004	11.02
October	157,080	142,671	14,409	10.09
November	151,518	150,565	*953	*0.63

NORTHWESTERN ELEVATED.

January	88,632	81,204	7,428	9.15
February	88,435	83,572	4,863	5.81
March	89,344	85,154	4,190	4.92
April	99,134	84,244	5,800	6.99
May	94,204	81,748	12,456	15.24
June	99,051	80,165	18,886	23.56
July	91,542	73,308	18,234	24.87
August	93,174	73,170	19,998	27.32
September	97,447	77,508	19,939	25.72
October	108,806	88,344	20,462	23.16
November	106,847	93,238	13,609	14.59

*Decrease.

ANNUAL REPORT OF THE MASSACHUSETTS ELECTRIC COMPANIES

The Massachusetts Electric Companies has issued its eighth annual report, covering the year ended Sept. 30, 1907. The detail figures of operation show as follows:

	1907.	1906.
Gross earnings	$7,758,511	$7,518,240
Operating expenses	5,000,652	4,883,552
Net earnings	$2,757,858	$2,634,688
Fixed charges	1,702,622	1,594,502
Balance	$1,055,235	$1,040,185
Dividends	880,773	710,406
Surplus	$174,462	$329,779

The profit and loss statement of the parent company compares with previous years as follows:

	1907.	1906.
Dividends on stock owned	$880,837	$710,498
Miscellaneous interest on notes	82,003	66,651
Total income	$962,840	$777,149
Total expenses	16,629	18,395
Net income	$946,211	$758,754
Interest on notes	157,500	157,500
Surplus	$788,711	$601,254
Total surplus	1,566,884	778,173

*After $157,500 has been charged out for discount on coupon notes.

The general balance sheet of Sept. 30, 1907, compares with the two previous years as follows:

ASSETS.

	1907.	1906.
Sundry stocks in treasury	$33,360,839	$32,860,420
Stock deposited to secure notes	4,375,000	4,375,000
Cash	60,847	183,180
Notes and accounts recorded	1,280,000	1,063,819
Due from operating companies	880,705	687,366
Cash to pay dividends	1,021	2,209
Total	$39,958,413	$39,171,994

LIABILITIES.

Preferred stock	$20,557,400	$20,557,400
Common stock	14,293,100	14,293,100
Coupon notes	3,500,000	3,500,000
Accounts payable	632	1,737
Accrued interest on notes	39,375	39,375
Dividends uncalled for	1,021	2,209
Discount reserve	.....	.....
Surplus	1,566,884	778,173
Total	$39,958,413	$39,171,994

President Abbott, of the company, says in part: "The net results have been nearly identical with those of last year. There has been a certain amount of variation in the items—gross earnings increased $240,270, winter expenses were larger, cost of accidents was smaller—but the final result of all these variations is that net divisible income increased $15,050; or, in other words, remained substantially the same as last year. The freight and express business has shown a gratifying increase on these parts of the Old Colony, where it has been put in operation, but it has not been possible even yet to secure all the necessary rights to carry freight over the whole of that system.

"With respect to the physical condition of the property, it has improved over that of last year. Liberal charges to operating expenses for maintenance have been supplemented by the expenditure of $1,574,680 for construction, reconstruction, and the purchase of additional rolling stock and other property. Whether or not it will be judicious to spend, during the coming year, the balance required to complete the reconstruction of the property, will depend upon the general business situation, and the trustees do not intend to approve of any considerable new expenditures until that situation shall be clearer than it is at present.

"The above-mentioned expenditure of $1,574,680 during the year just closed, has been divided as follows: Track construction $158,080, track reconstruction $393,048, cars and electrical equipment $555,645, wire and bonding $42,568, power stations $294,111, land and buildings $111,150, sundries $20,073; total, $1,574,680.

"It was of the utmost importance that the work outlined two years ago should be done as quickly as possible. Without it the system could not have been operated economically and successfully. And in view of the developments of the general financial situation during the past year, the trustees are of opinion that the wisdom of omitting the payment of dividends has been sufficiently demonstrated. The failure to pay dividends during the past year was not due to lack of earning power, or to disastrous losses from accidents. The earning power has proven excellent. The trustees expect that when the operating companies shall have completed the reconstruction of their property, they will be in such physical condition as to require only ordinary annual expenditures for maintenance and reconstruction, and that they will then be able to finance their needs without drawing from the treasury of the Massachusetts Electric Companies the dividends they pay in."

TRANSIT MATTERS IN NEW YORK

The Public Service Commission has approved an order directed to the Interborough Rapid Transit Company regarding its Ninth Avenue elevated line. The order is to show cause why the service should not be increased by the addition of 58 cars to the 222 trains now run, southbound, from Thirty-Fourth Street between 6.30 and 9 a. m., and why 62 cars should not be added to the 252 trains at present running north between 4.30 and 7 p. m. The hearing was set for Dec. 17. Two orders, identical in form, calling for certain reports from corporations, were approved. One was directed to railroad companies and the other to gas and electric companies. The first was as follows:

That every railroad corporation, street railroad corporation, common carrier, and every stock corporation holding any shares of the capital stock of any railroad corporation, street railroad corporation, or common carrier, be and they are hereby severally required to file with the secretary of the Public Service Commission for the First District at its office, No. 154 Nassau Street, Borough of Manhattan, New York City, on or before the ———— day of ————, 1907, specific answers, verified by an oath of an officer of such corporation, to the following question, which is now addressed to each of them, to wit:

Give the name of every railroad corporation, street railroad corporation, or common carrier, organized or existing under the laws of the State of New York, of which, on July 1, 1907, you held any shares of the capital stock, the number of shares of such capital stock as held by you, and the par value of each such share.

That every railroad corporation, street railroad corporation, and common carrier, organized or existing under or by virtue of the laws of the State of New York, be, and they are hereby severally required to, file with the said secretary, at said office, on or before said date, specific answers, verified by an oath of an officer of each such corporation, to the following question, which is hereby now addressed to each of them, to wit: "Give the name of every stock corporation, railroad corporation, street railroad corporation, or common carrier, which, on July 1, 1907, held any shares of your capital stock, the number of such shares held by it, and the par value of each such share."

In 1908 the Public Service Commission of the first district will cost the taxpayers of New York City more than $1,095,000. It will spend in addition $150,000 of the State's money. A letter has been sent to the Board of Estimate by the commission, which contains a table of the commission's probable expenditures. This is the list:

Office and telephone rentals and lighting	$50,000
Salaries	850,000
Furniture	2,500
Printing, stationery and supplies	25,000
Disbursements (of employees and counsel)	15,000
Maps, plans, prints and photographic supplies	5,000
Engineering instruments and supplies	10,000
Compensation and expenses of special commissioners	10,000
Advertising	25,000
Real estate, search and appraisals	2,500
Contingencies and rapid transit studies	50,000
Special service and investigations	50,000
Total	$1,095,000

Adding to this the $150,000 which the commission receives from the state, the total is brought up to $1,245,000.

The Fidelity Trust Company, of Philadelphia, has filed a petition in the United States Circuit Court in New York, asking to be allowed to intervene in the receivership of the Metropolitan Street Railway. The Fidelity Trust also asks to be allowed to intervene in the action which the Morton Trust Company has begun to foreclose the Metropolitan Street Railway's refunding mortgage, under which it is trustee. Ownership of 7,800 shares of Metropolitan Street Railway stock is made the basis of the application in both instances. The petition of the Fidelity Trust sets forth that the allegation of the insolvency made against the Metropolitan Railway is unfounded, and that the income of the corporation is sufficient to meet all its outstanding obligations, including fixed charges. Therefore, the petition urges there can be no legal default either under the mortgage, of which the Morton Trust is trustee, or under the lease to the New York City Railway. The attention of the court is also called to the proposition that the interests of the Metropolitan Street Railway cannot properly be committed to those who are in charge of the New York City Railway, because of a diversity of interest, the New York City Railway being desirous to rid itself of the obligations attaching to the Metropolitan lease, and the latter corporation being equally anxious to have the payment of the rental continue.

Arguments were made before the United States Supreme Court, Dec. 9, on motions asking for a writ of mandamus against the appointment of receivers for the New York City Street Railway Company. The case was then taken under advisement, but a decision is expected at an early date. Roger Foster addressed the court in favor of the prohibition against the naming of receivers. The street railroad interests were represented by J. Parker Kirlin and James Byrne. Frederic R. Coudert also filed a brief in intervention. This action was for the sole purpose of affording an opportunity of bringing the case before the Supreme Court later in another form if it becomes necessary. The motions for writs of mandamus were filed on Nov. 11. One was on behalf of Joseph Konrad, who claimed $200 paid in fares where he thought transfers should have been issued. As administrator of the estate of Paul Planovsky, who was killed by the cars of the defendant company, Konrad claimed damages aggregating $8,538. Another motion was filed in connection with suits brought against the company by Daniel Gallagher and Francis Peisenberg, both of whom claimed damages. The receivers were appointed on applications by the Pennsylvania Steel Company and the Degnon Constructing Company. Judge Lacombe having declined to permit intervention in New York, Attorney Foster sought the writ of mandamus from the Supreme Court.

The Public Service Commission of the first district will hold a hearing Dec. 21, at which the New York City Railway Company will be given an opportunity to show why the order of the board directing that all its cars be overhauled should not be complied with. The order is based on a report made to the Commission by A. W. McLimont, who was engaged to make a study of the service and equipment of the lines of the company. The details of the report have not been made public. The suggestion is made that the cars should be overhauled ten at a time, and that every detail of their construction shall be subjected to scrutiny by expert engineers. It is provided that the cars be inspected by employees of the commission after the repair work is done and before the car is put into service.

ANOTHER MOVE IN INTERURBAN MATTERS IN MASSACHUSETTS

Another step in the interurban railway development now beginning in Massachusetts under the "electric railroad law," so-called, was taken last week, when the Railroad Commission granted to the Boston & Worcester Street Railway the long-desired right to build a branch connecting the town of Natick with its main line. The decision is virtually a statement of the State policy with regard to the construction of fast-service routes in districts already supplied with ordinary street railway service. The situation presented in Natick was one of a chain of local roads recently formed into a system by the Boston Suburban Railways Company, with the possibility of a straighter and quicker run into Boston for the Boston & Worcester Company by the construction of 2 miles of track northward to a junction with the Boston & Worcester. Previous petitions for a location have been negatived by the Railroad Commission because they contemplated entrance into the center of Natick through streets regarded as too narrow; but the present location will keep to the wider thoroughfares, crossing the Boston & Albany Railroad on the Washington Street bridge. In its decision the board says: "The action of the Legislature in enacting the Electric Railroad Law and the subsequent action of this board in granting under it a certificate of exigency to the Boston & Providence Interurban Electric Railroad Company has established beyond question a State policy which approves the fast electric interurban railway. With it must necessarily come branch lines connecting through other local railways with cities and towns along the route. The fact that the Boston & Providence Interurban would bring the benefit of such connection with different communities along its route was one of the features which made that enterprise preferable to the undertaking of the New York & Boston Electric Railroad Company. The Boston & Worcester Street Railway was the forerunner of this class of railways. The people of Natick have desired a branch connection with it in order to secure quicker transit to and from Boston. The construction of that branch may to some extent affect the patronage of the existing line which now serves Natick and other communities, but it cannot be said that the result of building and operating the new line will be such a loss to existing lines as to make the net outcome harmful to the public interest. In view of that fact, the board must certify that the location granted to the Boston & Worcester Street Railway Company under the order of the Selectmen of Natick, dated July 5, 1905, is consistent with the public interests." The decision is signed by two of the Commissioners, Chairman James F. Jackson and George W. Bishop.

The other interurban matter before the Massachusetts Commissioners was that of the proposed line westward from Waltham, which would enter Boston over the lines of the Newton system (Boston Suburban) of street railways. This project, known as the Boston, Waltham & Western Electric Railroad, was up for a hearing on its merits on Friday forenoon. The Commissioners took a view of the proposed route in automobiles a month ago, and the question is now whether to issue the certificate of public exigency which gives the promoters sanction in going ahead to secure definite locations from local authorities.

INAUGURAL DINNER AT THE ENGINEERS' CLUB

The inaugural banquet to commemorate the opening of the new club house of the Engineers' Club in New York, was held on the evening of Dec. 9, in the banquet hall at the club house, at 32 West Fortieth Street. Andrew Carnegie was the guest of honor and about 220 members were present, a number which taxed the seating capacity of the banquet hall. The speakers were Mr. Carnegie, John Fritz, Samuel L. Clemmons, John Foord, Wm. H. Fletcher and Thos. C. Martin, president of the club. The menu was bound in a cover of Scotch plaid and the participants were presented with souvenirs of the occasion of a particularly artistic and handsome design.

TWIN CITY RAPID TRANSIT MAKES IMPORTANT LEASE

The Twin City Rapid Transit Company has leased from the Minneapolis & St. Louis Railroad 1½ miles of its track from Manitou Junction to Tonka Bay, Lake Minnetonka, and has graded 1½ miles of right of way from the end of the present Excelsior line to Manitou Junction, and will lay the track early in the spring. The Twin City Company will electrify the Minneapolis & St. Louis line from Manitou Junction to Tonka Bay, and will then be able to take passengers direct to Tonka Bay Hotel, which is the finest hotel at Lake Minnetonka. This means that the Minneapolis & St. Louis Railroad practically gives up the tourist business to Lake Minnetonka and leaves the Twin City Company in possession of the heavy south shore trade.

SOUTHERN PACIFIC COMPANY

In connection with the electrical work already planned and being investigated by the Southern Pacific Company in California, the following news item from San Francisco is of interest: "It is reported that the Southern Pacific Company contemplates changing its motive power for the movement of its trains between San Francisco and Sacramento. The general manager of the General Electric Company, of New York, visited the Pacific Coast recently, at the instance of President E. H. Harriman, to investigate the feasibility of the change and to report on the difference in cost of operation. The expert reported that the road could be operated with electric power at a saving of 38 per cent over the expense of operation by steam. He also said that the main purpose of Harriman's recent visit to the Pacific Coast was to investigate the electric power proposition, and that as a result of the investigation the president of the railroad company was favorably impressed with the advantages to be gained by the contemplated change in motive power. In case this change is made, it is the intention to obtain electric power from the Western Power Company, which is planning to construct a power line to have its source in some of the available water sheds in Lake County. Although the present financial stringency will have some bearing on the proposed project, it may be assumed, with a reasonable degree of certainty, that eventually the trains on this division of the Southern Pacific Company will be operated by electricity instead of steam."

NEW PUBLICATIONS

Locomotives: Simple, Compound and Electric. By H. C. Reagan. John Wiley & Sons, New York and London, 1907. Fifth Edition. Price, $3.50.

The increasing use of electricity on steam railroads brings in its train many new problems to be solved by the operating departments of the converted systems. Among these few are more important than the instruction of steam locomotive engineers and firemen in the principles upon which electric motive power depends in its application to heavy railroad service. There has thus come about a real need for the preparation of an exhaustive descriptive treatise including within its covers the best current practice in both the steam and electric locomotive fields. Mr. Reagan has endeavored to bring the whole matter up to date in the fifth edition of his work on locomotives, and so far as descriptive matter, clearly expressed and exhaustive in detail, is concerned, he has produced a volume of positive worth to the engine runner primarily, and to the motive power officer and shop worker secondarily.

The first twenty-one chapters of the book, covering 583 pages, are devoted exclusively to steam locomotives and their equipment, including both domestic and foreign designs. The boiler, cylinders, frames, rods, valve motion and setting, compounding, indicator cards, superheating, brakes, auxiliary apparatus, typical locomotives, troubles, remedies and fuels, are considered at length, with numerous illustrations and data. Special attention has been given to the compound locomotive and to the steam superheater in view of the recent progress in these directions. A chapter has been devoted to foreign built engines, some types no longer modern being described because they show the efforts put forth at their respective periods to improve the compound locomotive and form part of the evolution of the compound engine.

The rapid development of the electric locomotive and its use on trunk lines require the treatment of the construction and operation of the electric locomotive in great detail, together with the apparatus essential to the generating and transmitting of the current which operates the locomotive. The principles of the generating and translating apparatus and the method of application are fully explained, and the following electric systems described: The single-phase system, using single-phase motors; the polyphase system, using induction motors; the three-phase system of generation and transmission, using rotary generators, with direct-current motors on the locomotive; the three-wire direct-current system, and the simple direct-current system. Methods of control and brake systems are also described, and a brief chapter is devoted to gasoline-electric cars. Eight chapters are devoted to the electric locomotive, making a total for the book of 932 pages, including an index.

The explanatory matter in the electric locomotive chapters includes a very clear exposition of the principles of current generation, free from needless technicalities in phraseology, including the relations of the magnetic field and the windings, both in generators and motors. Counter electromotive force, reversing motors, electrical instruments, lightning arresters, rheostats, controllers, direct and alternating currents, are all treated in a manner that should offer little difficulty to the intelligent layman's understanding. The more important electrical generating apparatus of the power plant is handled with simple directness and an excellent description given of the relations of the transformer, rotary converter and distribution circuits in the alternating-current and direct-current system so frequently installed. Alternating-current systems and catenary trolleys also receive due attention, and the detailed descriptions of earlier and recent electric locomotives leave little to be desired. Considering the amount of attention given to apparatus outside the locomotive itself it is singular that the functions of the third rail and the suburban motor cars should apparently be overlooked, both in the context and index. The latter might well be amplified with profit to the reader, especially in reference to the individual electric locomotives described. As a manual for the student of locomotives and a reference book of recent designs, in both steam and electric fields, the volume is certain to be highly useful.

C. E. Robertson, read a paper before the Toledo Section of the American Institute of Electrical Engineers at the regular meeting, Friday evening, Nov. 6, on the rotary converter. He illustrated his remarks with blackboard sketches and drawings. Aside from explaining the various uses of the rotary, Mr. Robertson told of the latest methods of starting them.

DIVISION CHANGES ON THE P. S. C.

Announcement has been made by the Public Service Railway Company of changes in the street railway operating department. John McCarthy has been appointed supervisor in charge of the turnpike, Fourth, Mt. Prospect, Mulberry and Kearny lines and the Harrison and the Miller Street car houses in place of George Christensen and C. H. Coe, who are transferred. Mr. McCarthy has been at the Springfield Avenue station for the last year. Mr. Coe has been supervisor at the Miller Street station, and he has been made general instructor of the school for motormen and conductors. Mr. Christensen has been appointed supervisor in charge of the Bloomfield Valley Road, Crosstown and Eagle Rock lines and the Montclair and Orange and Passaic Valley car houses, vice A. M. Stewart, who resigned to engage in business. Mr. Joseph Welch has been appointed acting supervisor in charge of the South Orange, Plank Road and Chapel lines and the South Orange and the Sixteenth Avenue car houses, vice C. H. Thorne, transferred. Mr. Welch was station master at the Sixteenth Avenue barns and has been in the employ of the company for about ten years. C. H. Thorne has been appointed supervisor in charge of the Roseville, Orange and South Orange and Maplewood lines and the South Orange and Maplewood car houses, vice A. W. Pratt. Mr. Thorne has been at the South Orange station for three years. A. W. Pratt has been made supervisor in charge of the Springfield and Kinney lines and the Springfield car house, vice McCarthy. Mr. Pratt has been at the Roseville station.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED NOV. 26, 1907

871,777. Amusement Device; William J. Browne, Pittsburg, Pa. App. filed March 27, 1907. A pleasure railway in which the car is elevated by mechanism on the principle of the Archimedean screw and allowed to descend a spiral trackway by gravity.

871,826. Electric Train Lighting System; Walter Scribner, Columbus, Ohio. App. filed Jan. 12, 1907. System of lighting from a dynamo carried by the wheel axles and including storage batteries with automatic means for shifting the connections to accord with the speed and direction of the dynamo.

871,909. Combined Tie-Plate and Guard-Rail Clamp; William F. Bossert, Utica, N. Y. App. filed March 18, 1907. Means for holding a guard and main or stock rail spaced apart and rigidly held to the cross-piece of a railway without the utilization of springs or wedges for adjusting the parts to the proper distance between the rails.

871,913. Trolley Wheel Bearing; William M. Caswell, Warren, Pa. App. filed June 6, 1907. An oil cup in the bearing of the trolley wheel so disposed that the oil will not run out of the bearing when the trolley wheel leaves the wire and the pole flies upwardly to a vertical position.

871,960. Signaling System; Wilmer W. Salmon, Buffalo, N. Y. App. filed Aug. 29, 1905. Details of a signal system having sectionally energized track rails and polarized relays operated by the short-circuiting of local batteries by the wheel axles.

871,970. System of Motor Control; Emmett W. Stull, Norwood, Ohio. App. filed March 31, 1906. Means whereby injured or disabled motors may be cut out from the circuit without affecting the action of the controller upon the remaining motors. Has a unitary cut-out switch for cutting out either pair of motors.

872,002. Railroad Signaling Device; Burns S. Miller, Everett, Wash. App. filed May 4, 1907. Mechanical means whereby a semaphore is operated when a track-protecting bulkhead is broken by a landslide.

872,014. Bolster Swing-Damper; William G. Price, New Castle, Pa. App. filed Aug. 18, 1906. Means for damping or checking the endwise movement of swinging bolsters.

872,015. Bolster Swing-Damper; William G. Price, New Castle, Pa. App. filed Aug. 18, 1906. See above patent.

872,016. Truck Frame; William G. Price, New Castle, Pa. App. filed Aug. 18, 1906. The transoms are so constructed and located as to make the wheel base as short as possible and provide for the insertion of the bolster hangers between the transoms and the bolster.

872,017. Truck; William G. Price, New Castle, Pa. App. filed Jan. 17, 1907. Consists of the combination of side frames, a bolster, transoms secured to said side frames, a stiffener-plate on the outside of the side frame, and gusset plates connecting the transoms to the stiffener-plate.

872,094. Trolley Securing Device; John Szekeres, Pittsburg, Pa. App. filed Aug. 23, 1907. A rectangular frame surrounds the trolley wheel and has upwardly extending swiveled hooks which close over the wire.

872,104. Sand Box for Cars; Abbott L. Bacon, Franklin, Mass. App. filed March 22, 1907. Consists of improved means for electrically heating the supply of sand contained within the sand box and in an improved outlet valve.

872,116. Fluid Pressure Brake Apparatus; Charles H. Ferguson, Jersey City, N. J. App. filed Feb. 12, 1907. Consists of a triple valve, a retainer valve connected with the exhaust therefrom and operated by fluid pressure supplied through an auxiliary train pipe, and a valve in said train pipe at either side of the retainer valve adapted to act to retain pressure in the retainer valve upon a sudden reduction of pressure in the train pipe.

872,142. Rail Bond; Asa H. Mosher, Westfield, N. J. App. filed Jan. 17, 1907. The bond is received in a conical plug with an eccentric hole and slotted on one side so as to be driven into binding or wedging relation on the bond.

897,197. Electric Switching Device; James A. Posey, Midlothian, Tex. App. filed March 3, 1906. A track switch including a movable trolley section displaced by the wheel and closing or opening the circuit to a solenoid which has contacts for energizing either of a pair of electromagnets to operate the switch point.

872,253. Amusement Apparatus; Henry E. Riehl, New York, N. Y. App. filed July 17, 1907. A pleasure railway having a rotatable car and means for imparting rotation thereto as it travels over its tracks.

PERSONAL MENTION

MR. N. A. THOMPSON, who has been solicitor in the passenger and freight department of the Columbus, Delaware & Marion Railway, headquarters, Columbus, has tendered his resignation, which took effect Dec. 1. Mr. Thompson was formerly soliciting passenger and freight agent for the Indiana, Columbus & Eastern Traction Company, and later was the company's freight agent at the Columbus interurban station.

MR. CHAS. A. CLARK, engineer of way of the International Railway Company, of Buffalo, N. Y., has been appointed by the Cleveland Electric Railway Company, of Cleveland, Ohio, to act as appraiser of tracks and pavements, in co-operation with Mr. Robert Hoffman, city engineer, of Cleveland, Ohio, who will look after the interests of the Municipal Traction Company and the City of Cleveland, in the settlement of the street railway situation in Cleveland.

MR. M. D. KILBRIDE has been appointed superintendent of the Rochester & Eastern Rapid Railway Company, of Canandaigua, N. Y., to succeed Mr. Wm. W. Griffin, who, as noted elsewhere in this column, has been appointed superintendent of the Rochester Railway Company. Mr. Kilbride started electric railroading under the late Mr. F. J. Stout, on the Lake Shore Electric Railway at Beach Park, as cashier of the Cleveland division, on Aug. 16, 1902; on Jan. 1, 1903, he went into the despatcher's office and resigned on March 1, 1904. On March 10, of that year, Mr. Kilbride entered the employ of the Rochester & Eastern Rapid Railway Company, and was made chief train despatcher Nov. 1, 1904, remaining in that capacity until Dec. 1, 1907, when he was appointed superintendent of the company.

MR. MARCELLUS HOPKINS, president of the South Side Elevated Railroad, of Chicago, died Dec. 7, of pneumonia. Mr. Hopkins was born in Kennebec County, Me. His parents were in moderate circumstances, and Mr. Hopkins, when only 17 years old, secured a position on the Chicago & Northwestern Railroad as brakeman. While he was working he went to school, and at the end of six months became a clerk in the Chicago station. Mr. Hopkins was then sent to the Wisconsin Division of the same road, and was made foreman of freight houses and docks. He held this position eight years, later becoming assistant superintendent of the Galena Division. When the South Side Elevated Railroad became the successor to the South Side Rapid Transit Company, Mr. Hopkins was made general manager. That position he held until the death of the president of the company, when he was elected to fill the vacancy.

MR. J. R. HARRIGAN has resigned as assistant general manager of the Buffalo & Lake Erie Traction Company, Buffalo, N. Y., to take effect Jan. 1, 1908. Mr. Harrigan formerly was general manager of the Chippewa Valley Electric Railroad, of Eau Claire, Wis., and before that for a year, in 1901, was general superintendent of the Dayton, Springfield & Urbana road, under Mr. A. E. Appleyard. In 1902 he became general manager of the Columbus, Buckeye Lake & Newark Traction Company and the Columbus, Newark & Zanesville, remaining in that capacity four years, until the road was purchased by the so-called Widener-Elkins syndicate. In 1906 he assumed the management of the Canton-Akron road, another Tucker-Anthony property, and was general manager of the company until it was absorbed by the Northern Ohio interests. He has been in Buffalo since Jan. 1, 1907. Mr. Harrigan is going to take a needed rest, and will probably visit his old home in Wisconsin. He has not, however, definitely decided what he will do after his vacation.

PROF. CHARLES P. MATTHEWS, professor of electrical engineering at Purdue University, died at Phoenix, Ariz., on Saturday, Nov. 23, 1907. Professor Matthews was of Vermont stock, his family going from that State to New York in 1852 where, at Fort Covington, he was born Sept. 18, 1867. At the time of his death he was, therefore, a little more than 40 years of age. He attended the St. Johnsbury Academy at St. Johnsbury, Vermont, graduating there in 1887. He then entered Cornell University, graduating from Sibley College with the degree of Mechanical Engineer in 1892. In 1901 he received the degree of Ph. D. from his Alma Mater. Immediately after graduation he became instructor in physics and applied electricity at Cornell, serving in that capacity four years, until 1896. At that time he was called to Purdue and was appointed associate professor of electrical engineering. In 1905 he succeeded Prof. Goldsborough as head of the School of Electrical Engineering, and from this time until his death he was continuously a member of the Purdue faculty. Prof. Matthews made valuable contributions to the science of electrical engineering, particularly in connection with the subject of photometric standards for arc lamps. This work was done in connection with the National Electric Light Association.

MR. WILLIAM W. GRIFFIN has been appointed general superintendent of the Rochester Railway Company and its connecting lines, to succeed the late Mr. E. J. Wilcoxen. Mr. Griffin has been identified with the Rochester & Eastern Rapid Railway from the time work was begun on the line, five and one-half years ago. To take up the superintending of the construction of the line from Rochester to Geneva for the Comstock-Haigh-Walker Company, Mr. Griffin came from the West, where he had superintended the building of several railways, and he has had practical charge of the Rochester & Eastern operations since the road was opened about four years ago. Mr. Griffin entered mining and electrical engineering about twenty years ago. He is about forty years of age, and is president of the Rochester Engineers' Society, a member of the Rochester Club, the Red Jacket Club of Canandaigua and the Canandaigua Business Men's Club, and is also an associate member of the American Institute of Electrical Engineers. Mr. Griffin's appointment has resulted in some changes in the personnel of the Rochester & Eastern Company. Mr. M. D. Kilbride, chief dispatcher and for some time past Mr. Griffin's chief assistant, will become superintendent of the Rochester & Eastern. The management of the affairs of the Ontario Light & Traction Company will pass out of the supervision of the Rochester & Eastern officials, and Mr. S. P. Cobb, of Rochester, who has been the constructing engineer for the Canandaigua Gas Light Company, will be made superintendent of the lighting companies.



W. W. GRIFFIN.

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Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1907 *to date,* 419,250 *copies, an average of* 8220 *copies per week.*

Preserving Construction Records

It ought not to be necessary in these days to urge the importance of preserving construction records in proper shape for future reference, but the frequent absence of such data in projects where extensions or alterations of existing plants are planned justifies further reference to the matter. The trouble is not so much that figures of construction progress and cost are not kept at the time the work is under way, as that they tend to disappear after the contracts are paid, or fail to show the information peculiar to special conditions. In very large engineering undertakings, and especially in electric railway construction work, these special conditions are almost always present, and if the costs and data are properly brought together and then filed for convenient reference they are certain to be highly valuable when wanted in future estimates and comparisons.

In the stress and hurry of starting operations on a new line it is difficult to take the time to make these notes, but as some particular engineer on the work is always specially acquainted with the exceptional circumstances a little forethought will preserve the data in sufficiently complete form to enable deductions to be drawn from it in the future. The cost of excavating power house foundations may be double the usual expense, for example, because of the existence in a special case of sunken wharf timbers or parts of old piles; the cost of building a certain thousand feet of track may be as great as the expense of the balance of the mile on account of insecure ground; or the cost of building a sub-station in an out of the way spot may be much increased over the normal, on account of the remoteness from the skilled labor market. All such cases need the qualification of special circumstances when costs per kilowatt, per foot of area or length are considered, and unless the data are completed at the time construction is ended, there is usually small chance that the future will witness the bringing of the notes up to date.

Battery Houses and Battery Practice

Upon looking over many of the storage battery buildings in use to-day, one is led to wonder why the design of the structures housing this valued adjunct of electric railways should be so often neglected. A battery house, as a matter of course, should be well lighted and liberally ventilated. Although the attendant may be in the building only for a few minutes at a time every day, he should not be encouraged to neglect his duties by being obliged to work in darkness and in an atmosphere filled with the throat-tickling and eye-smarting vapor of the battery chemicals. What likelihood is there of a battery receiving proper care when it is installed in a cellar, as is actually the case in certain installations? Proper ventilation is one of the most important factors in keeping a battery in the best condition. When the natural airing secured by louvres proves ineffective on account of atmospheric and temperature conditions, good ventilation can be secured by operating fans to remove the fumes.

Concerning the care of the battery itself, one may mention the extensive use of both rubber and glass covers to protect the electrolyte from the deposition of foreign matter and to reduce the evaporation. A special condition, such as the presence of iron particles in the air, is enough to make such protection advisable, but it is also worth the

trouble in cases where the amount of evaporation or spraying is liable to be excessive. This is true in the case of large batteries, which are subject to heavy peak discharges each day followed by a corresponding continuous charge. It is during the latter period that the greatest amount of evaporation and spraying takes place, and the loss of electrolyte may be considerably reduced by covers. This reduction not only saves considerable expense in labor for refilling with water from time to time and supplying additional acid to make up for that which is carried off in the spray, but it also tends to prevent excessive corrosion of any iron work and preserves the insulation between the tanks and the ground. If the battery room is filled with acid spray, it is apt to settle on the insulators and impair the insulation, and it may also settle on and deteriorate the woodwork of the tanks.

Where a small battery is used merely for charge and discharge to regulate a rapidly fluctuating load, and is not doing any appreciable amount of peak work, the amount of charging is much less and the beneficial effect of the covers is not nearly so marked. In many such plants, covers are not advisable, as they add somewhat to the difficulty of inspection and of taking proper gravity readings in the different cells.

It should be remembered that no one has better opportunities to study battery house design and operation than the battery manufacturer. Power engineers would do well, therefore, to take advantage of this fact whenever the question of a battery installation presents itself. The makers of storage batteries naturally desire to see their product used under the most effective conditions and through their special experience they can be relied upon to be of material assistance in the solution of battery house problems.

The Cost of Electric Freight Service

One of the most difficult problems in steam railroading is to determine the relative cost of passenger and freight service. In some quarters it is considered useless to attempt to solve this question, for the complications are almost unlimited. The same question is coming up with reference to electric express service, but fortunately the limitations are fewer in these cases. Few roads have as yet settled the cost of their freight and express service in any standard way, but certain items are of fundamental importance on all systems which attempt to determine the actual profit of their merchandise business. A sound sense of proportion will count heavily in the accuracy of this important work.

Few managers of electric railway properties are so shortsighted as to believe that their freight and express service costs practically nothing. The considerations of power, wages of express-car crews and possibly of clerks, repairs of merchandise cars and motors, and special advertising, are clearly legitimate charges on the freight traffic. Compared with the total operating cost of the road, these totals are generally almost insignificant percentages in large systems on which scores and perhaps hundreds of passenger cars are run. The proportions of these expenses are important in so far as they show what items can be roughly estimated and what lumped together as an aggregate of small costs; but the real question is whether the charges and volume of traffic are sufficient to clear a good profit on the service rendered, regardless of whether the total cost of freight and express service is a large or small percentage of the total operating charges of the road. It is doubtless true that in the passenger end of the business, particularly in city systems, the lines of heavy traffic often pay a profit on routes which, in themselves, are poor revenue producers; but this is no reason why an electric road should maintain an unprofitable express service on the proceeds of its passenger business.

One of the great difficulties in estimating the cost of trolley freight service all told, is the selection of a perfectly satisfactory unit of comparison. Cost per ton-mile is well worth knowing, but in proportioning the fixed charges and operating expenses, common to both the passenger and freight service, one cannot secure much of a comparison on this basis. The different classes of freight in force complicate the problem still further, but if the car-mileage records and the weights of merchandise transported are kept carefully, and if the charges and bills are properly filed in the office, a good idea of the operating cost on the unit basis of weight can be secured; we must go farther afield, however, to prorate the items of line repairs, roadway and track maintenance, general expenses, power cost (unless wattmeters are used on the cars), taxes, interest, depreciation, sinking fund, telephone and other office expenses. Insurance, legal expenses, accidents, repairs of buildings, provender and stabling, tolls for trackage rights, removal of snow and ice, and rentals of buildings must all be considered. Some of these items are proportional to the freight equipment investment, but others can only be figured on the basis of the one unit common to both the passenger and express traffic—the car-mile. Every auditing officer recognizes that there is no unit which is in all particulars a satisfactory one for these comparisons, but the discrepancies arising from different sizes of cars are far less troublesome than the risks of figuring the profit on the freight service without reference to other than the barest costs of running the cars.

Graphic Studies of Competitive Schedules

The comparison of time tables maintained by different transportation companies in competitive territory is an essential feature of every analysis of traffic conditions in such a district. Usually this work is done by tabulating the running times of the rival steam and electric companies in as compact form as possible and interpreting the parallel figures as the case requires. Under some conditions, however, the use of graphic methods of comparing schedules is much to be commended, and particularly in cases where the various factors are to be shown to non-technical boards, or at public meetings and hearings.

The most familiar graphical method of plotting schedule times is doubtless to set off as abscissæ the hours and minutes, and as ordinates the points reached at different times. A line drawn through these points represents a train or car trip, and such diagrams are the usual method of locating turn-outs. To compare the running times of rival companies, however, a still more effective scheme is to plot the schedule of each road in the form of a skeleton map, but instead of making the distances between centers served pro-

portional to the miles between them, making the former proportional to the schedule times. Thus, if A, B and C are three cities connected by a highway trolley line and an interurban road with running times of 30 and 45 minutes between each pair by the former and 20 and 30 minutes by the interurban on private right of way, a diagram drawn on a scale of ½ in. per minute would show by a line 15 in. long the schedule from A to B by street railway, and by one 22½ in. long extended from B in the actual direction of C, the running time from B to the latter point. Similarly, a second diagram for the interurban road would illustrate by a 10-in. line the schedule from A to B by the high-speed route, and a 15-in. extension to C would complete the parallel. The difference in size of the two parallel diagrams shows at a glance the difference in schedule times.

In the estimation of these times, it is often necessary to determine the average walking time between points, such as from a certain street corner to a station. This can be plotted on the diagram or time-map with ease when it is ascertained. To secure average walking time, however, allowance must be made for the passing of persons on the sidewalks and streets. By allowing just as many persons to pass the counting observer as he himself passes in traversing the route, the average walking time becomes known, and can be plotted on the time-map to scale to enable the total elapsed time between origin and destination to be exhibited. As we have often pointed out, it is this total elapsed time which so often settles the choice of the passenger upon one route in favor of another, and for this reason it deserves careful study for a great variety of conditions. It will pay the time-table man now and then to make a few walking tests between certain districts and his lines in the study of competitive traffic. After the conclusion of a celebrated murder trial in Massachusetts, a year or so ago, the Governor of the State personally timed the walking distance between the various points bearing upon the case, in order to assure himself that the condemned man could have traversed the ground as indicated by the evidence. A similar test made in street railway territory might now and then be instructive to the manager who finds himself at a loss to explain the diversion of traffic to rival routes, perhaps making slower schedule speeds from point to point, but more quickly accessible from certain localities. There is clearly a broad field for the analysis of traffic causes and conditions along still more scientific lines than have been commonly followed in the past.

Trolley Service to Railroad Terminals

Recent experience with inadequate trolley service connecting with steam railroad terminals in several large cities inclines us to emphasize again the importance of developing this class of business in a better way. It is hard to understand the indifference betrayed in some quarters toward the facilities which can profitably be accorded the public in providing rapid transit between important railroad stations and the business districts, as well as interterminally. We believe that it would pay many companies to make a study of the travel on lines serving the railroad stations, with particular reference to the volume of traffic at different hours of the day, and in a general way its origin and destination. It is certain that in many communities the total movement of people to and from the railroad terminals far exceeds the traffic handled on the particular trolley routes serving the stations. A count of the number of persons entering and leaving the doors of a railroad station during one day compared with the number riding on the company's cars to and from that destination would furnish some instructive figures for the manager who thinks that he is carrying a large percentage of the possible traffic.

Local conditions must inevitably determine the frequency of the service which will pay. In a very large city well supplied with facilities, the condition of meeting every train will be more than exceeded, perhaps. It would be interesting to compare the total number of inbound and outbound trains per day with the number of cars to and from the station on all the routes focussed upon it, but we fancy that few managers have ever compiled such data. Theoretically, every train should be met by at least one car, but while this is possible for cabs and busses in the smaller towns, which are not as closely bound to schedule as are the trolley lines, it is exceedingly difficult to bring this to pass when the steam service is irregular, except in the largest cities. In cities of medium size only a study of the depot traffic will show how frequent the service should be, and it requires frequent watching after a decreased headway has been inaugurated. Careful analysis will show whether every train should be met or not, taking into account the stimulus of active advertising in the station and its vicinity upon the growth of trolley traffic to and from it.

The competition of the cab, the automobile and the hotel omnibus, ought to be more keenly appreciated in connection with terminal service. Most people gladly take a trolley car to their destination in a strange city if they know, in the first place, where the cars run and how often they leave given points. After a company has found out the percentage of persons who reach the stations by other means than its own lines in a given time, measures should be undertaken to attract more of this traffic, as was recently emphasized in these columns. The trouble is that few street railway managers realize the magnitude of traffic flowing into and out of the steam railroad stations in their cities, but in the larger communities of several hundred thousand population, it may easily amount to several millions per station per year. Although the location of the station, with respect to the business district, makes a great difference in the number of passengers that can be diverted to the trolley lines, there is prospective business not yet touched in not a few cases which should at once be investigated. It ought not to be necessary to wait even five minutes for a railroad station car on a double track line in a large city serving a terminal whose trains per day exceed two or three hundred. Even through the business center may be within ten minutes' walk of such a station, many more fares can be secured by proper advertising and regularity of short interval service. Again, the failure of a street railway company to stop its limited cars at the local railroad station simply deflects travel to the hackman and the bus. The baggage question is a complicated one at times, but it is not enough of an obstacle to discourage the kind of investigation needed in connection with railroad station service in many cities, and from the lack of which substantial earnings on certain routes have long suffered.

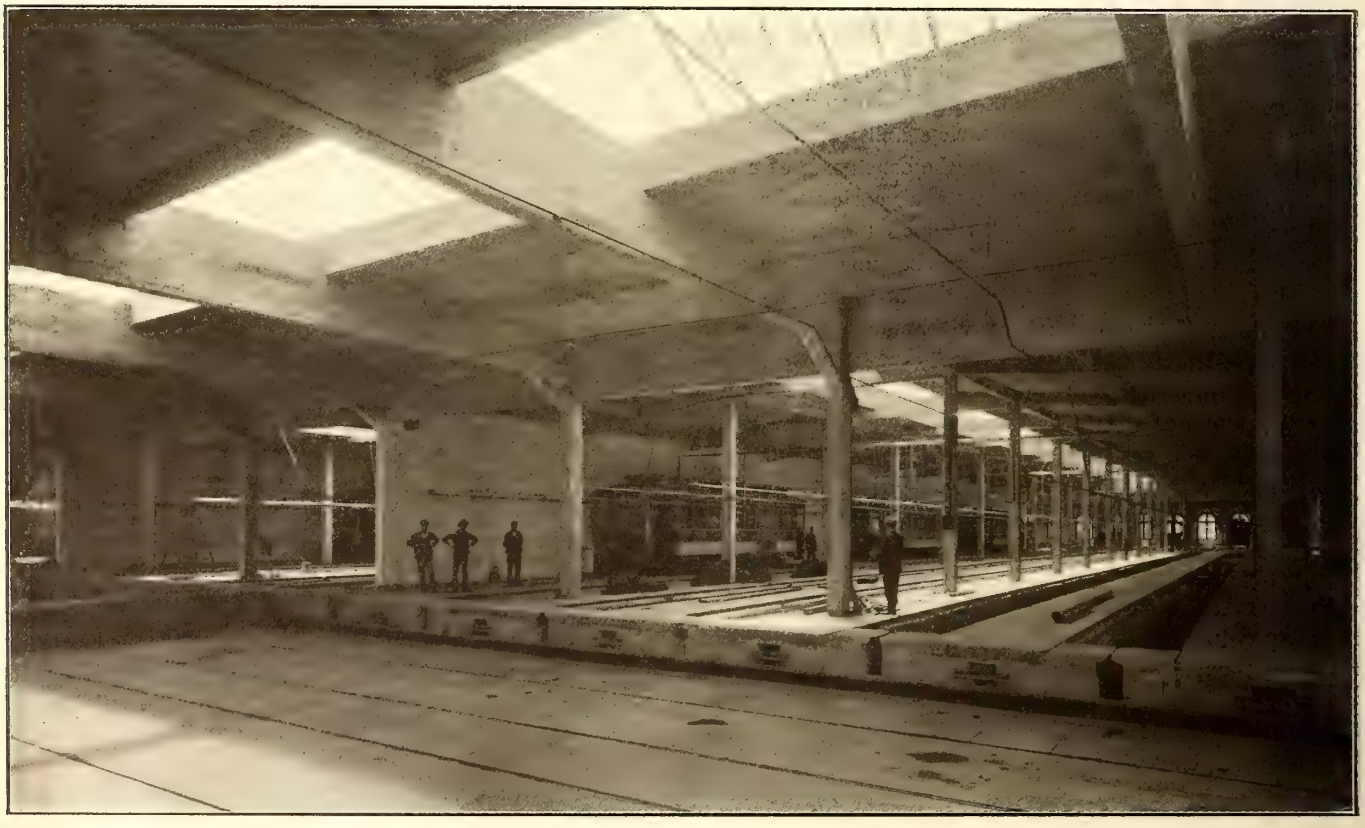
THE NEW FOURTEENTH STREET CONCRETE STORAGE CAR HOUSE OF THE CAPITAL TRACTION COMPANY, WASHINGTON

In deciding on the character of the construction for the car house built about one year ago at the northern terminus of the Fourteenth Street line, by the Capital Traction Company, protection of the cars from the weather was considered with more weight than is customary. The people of Washington are more insistent than residents of other cities that the cars make a good appearance. This fact alone put open storage out of the question and necessitated more than a mere shelter for the cars. Moreover, the location where it was desired to store the cars, in what is destined to become one of the best resident sections of the city, necessitated more than the usual amount of attention being given to the exterior appearance of the terminal erected.

The car house as built is of particular interest from the standpoints of size, type of construction, architecture and interior arrangement to facilitate car handling. It is in fact one of the largest and most extensively equipped terminal structures in the country.



GENERAL VIEW OF THE NEW FOURTEENTH STREET CAR HOUSE OF THE CAPITAL TRACTION COMPANY. THE OFFICE BUILDING IS IN THE FOREGROUND

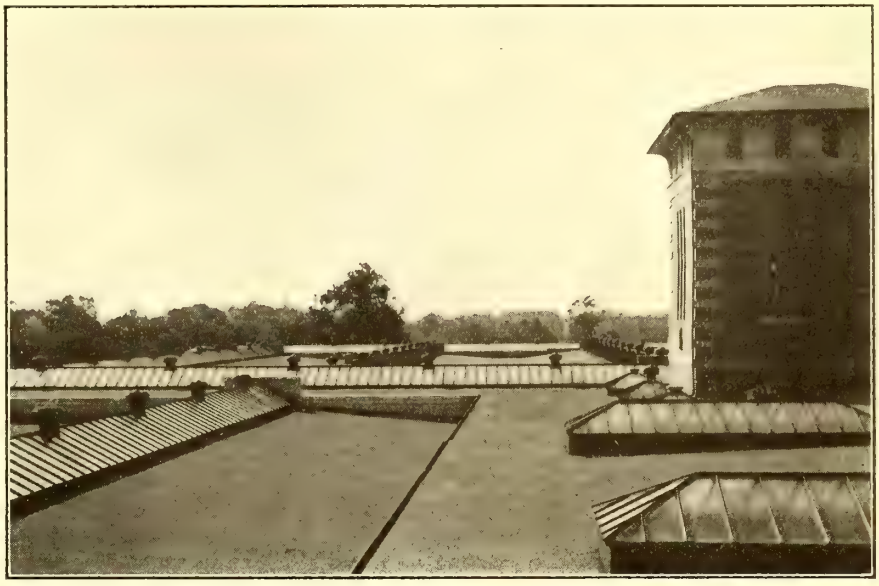


INTERIOR VIEW, ILLUSTRATING BOTH THE CONCRETE CONSTRUCTION AND THE FIRE PROTECTION SYSTEM

The building which covers an area of 109,000 sq. ft. is approximately square and measures 537 ft. 6 in. x 208 ft. It has about 7900 ft. of storage track on the first floor with a capacity for about 250 cars, and 3000 ft. of track will ultimately be laid in the basement. In addition, it contains a portion of the terminal loop of the Fourteenth Street line, the terminal offices, a small heated shop in

which minor repairs to cars are made and the transfer tables.

The walls of the building are of red brick trimmed with white brick and Indiana limestone. The tower in which the storage tank for the sprinkler system is located, the arched entrances of the tracks and the roof construction of the office section add much to the appearance, while the monotony of the long, low line of the car storage section which fronts the street is relieved by two gable ends at the transfer table runways.



VIEW OF THE ROOF, SHOWING THE GREAT AMOUNT OF SKYLIGHT SURFACE AND THE LOCATION OF THE SKYLIGHTS

CONSTRUCTION DETAILS

With the exception of the walls, the tower and the more prominent roofs, the building is of reinforced concrete construction. The roofs of the office and of the tower are of green slate, while the interior partition walls are of 8-in. hollow tile.

The site was a somewhat uneven piece of ground which sloped abruptly from a point over which the loop is now located. Instead of filling in it was considered more economical to build a basement under the southern portion. This basement is now enclosed by retaining walls which in places are 12 ft. thick. The concrete used in the building consists of Giant Portland cement mixed in the proportions of 1, 2 and 4 with a good quality of bank sand obtained near the work and with "Potomac blue gneiss stone" of ¾ in. and gravel size. A cubical rotary mixer located near the center of the building was employed. After the concrete was mixed it was distributed in wheelbarrows and for the roof work was elevated in automatic dumping buckets. The columns are reinforced with plain round bars, but Johnson corrugated bars are in all the other concrete construction.



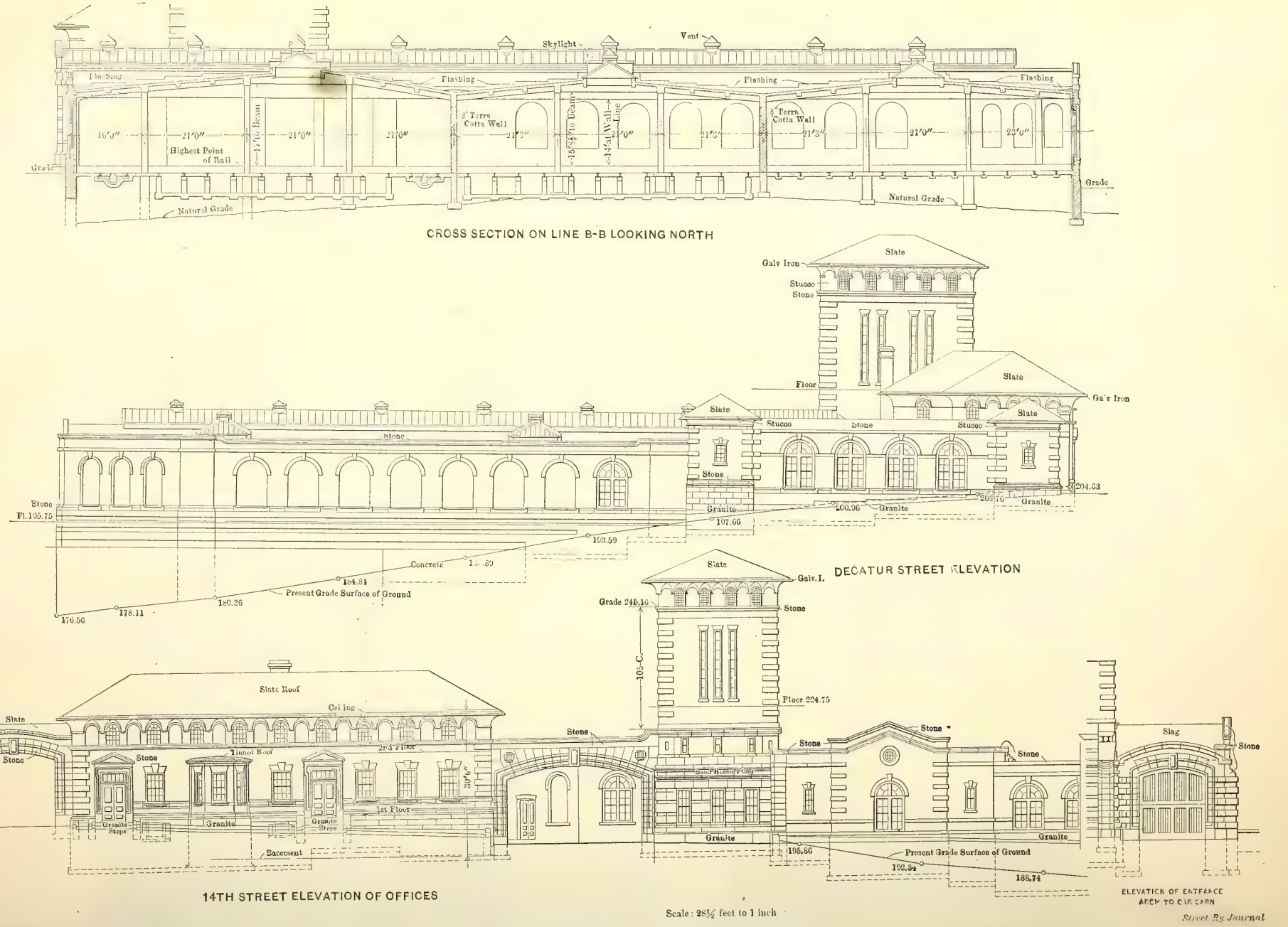
VIEW ALONG THE UPPER TRANSFER TABLE RUNWAY, ILLUSTRATING THE HEAVY ROOF BEAMS, HOLLOW TILE PARTITIONS AND THE ROOF DRAINS

The floors over the basement were designed to carry 20-ton cars and for this reason were rather heavily reinforced. They are supported on concrete columns 18 ins. square placed about 21 ft. 3 ins. between centers. The columns rest on bases 6 ft. square and 16 ins. thick, and are reinforced with ⅞-in. x 1-in. rods. Those under the pit tracks are capped with 18-in. x 36-in. concrete beams running at right angles to the tracks. The pit floors, which are 3½ ins. thick, rest directly on the 36-in. transverse beams, and are reinforced with ½-in. rods placed at right angles to the tracks on 10-in. centers. The pit walls, 9 ins. thick and 45½ ins. high, have reinforcement at the bottom and serve as longitudinal girders. In this capacity they remove the necessity of girders parallel to the tracks between the columns.

The construction under the east bay where the tracks are not provided with pits is radically different, due to the absence of the trussing effect of the pit walls. Under this bay 14-in. x 36-in. beams run parallel with the track and connect the columns. The floor is supported on these and on 12-in. x 32-in. transverse beams, placed 7 ft. 1 in. center to center.

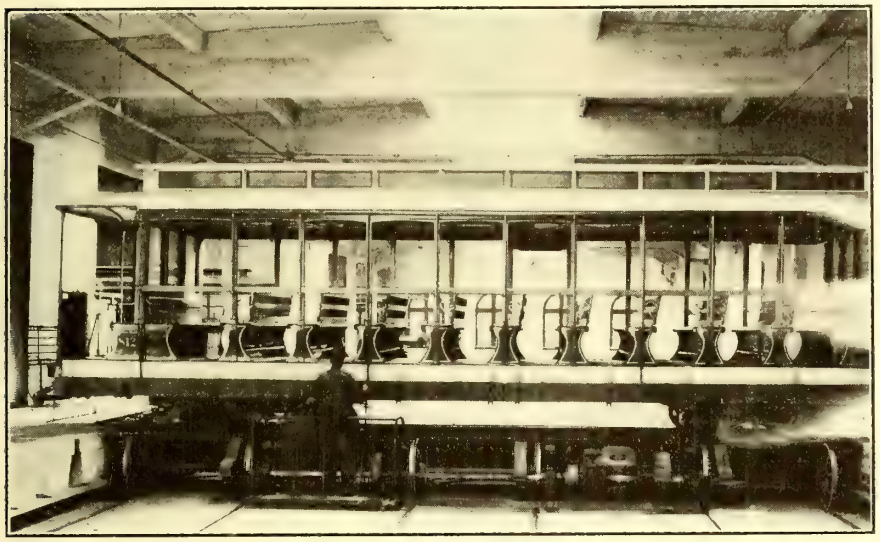
The roof over all of the space devoted to the storage of cars is supported on 12-in. x 12-in. columns placed about 21 ft. apart. The columns alongside the transfer table runways, however, are 12 ins. x 14 ins. All these columns are reinforced with longitudinal round bars and in addition by ties of ½-in. rods placed 12 ins. apart which enclose the longitudinal rods. The roof girders capping the columns and running at right angles to the tracks are generally 9 ins. wide and 18½ ins. high. The ribs running parallel to the track immediately over the columns, equidistant between them and on either side of the skylight openings, are usually 6 ins. x 15 ins.

Over the transfer table runways the roof span of 46 ft. 9 ins. is carried on a concrete beam 10 ins. thick and 48 ins. deep at the center. The depth decreases gradually to 29 ins. near the columns. The beams are 23 ft. apart and



CROSS-SECTION AND ELEVATIONS OF FOURTEENTH STREET CAR HOUSE OF THE CAPITAL TRACTION COMPANY

are reinforced with six 1¼-in. rods at the bottom and three ⅞-in. rods at the top. Although this span is a comparatively long one for concrete construction only a very slight deflection was observed when the centering was removed after having been left in place about six weeks. The roof proper is made of 3½-in. concrete slabs resting directly on the girders and ribs. The slabs are reinforced with ½-in. rods placed 12 ins. center to center. The top coating is of slag and pitch.



ONE OF THE TRANSFER TABLES IN OPERATION

Skylights 9 ft. wide, of wire glass held in metal frames, extend the full length of each bay. The frames are provided with ventilators placed about 21 ft. apart. There is a total of 8700 sq. ft. of skylights. An idea of the skylight arrangement may be obtained from one of the accompanying illustrations.

TRACK CONSTRUCTION

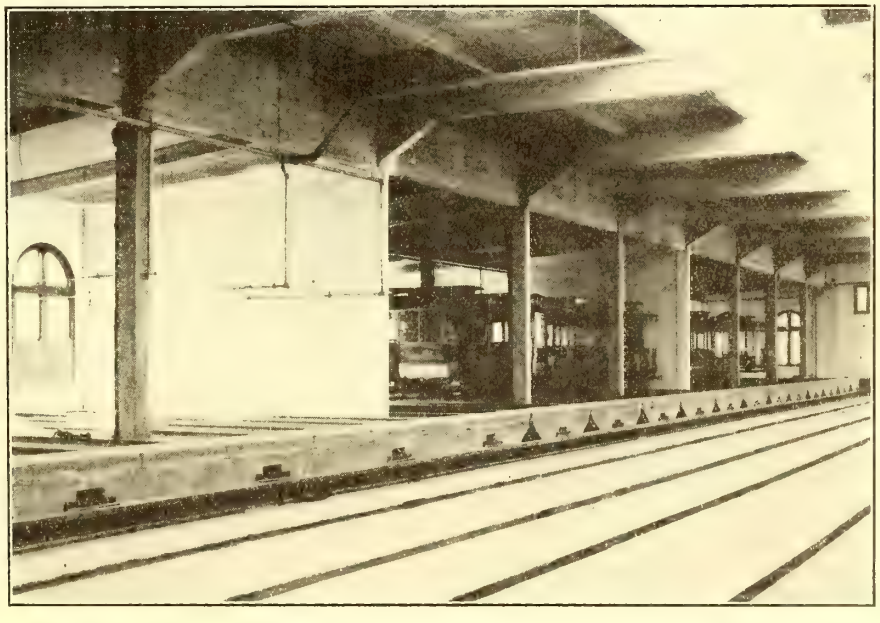
The car storage space is divided into three sections by the two transfer table runways. Moreover, the hollow tile walls separate the sections into bays containing six and seven tracks each. All tracks, with the exception of those in the central and southern sections of the east bay and the outside tracks in the west bay between the transfer tables, have pits under them their full length. Those in the central section and the east bay have pits 50 ft. long at the north end. This section is intended for the storage of out of season equipment from which the plows are removed, the short pit facilities being provided for removing and replacing the plows.

The storage of cars operated by underground trolley necessitated several departures from the usual track construction. The necessity for pits and in addition the expense prohibited conduit construction throughout. As a substitute for the trolley, terminals for 600-volt current were placed at 50-ft. intervals in all pits. Current is applied to the cars by plugging in these terminals long flexible leads having at the car end a yoke which fits over the collecting plow under the car. As each transfer table is provided with conduit and trolley connections, it was necessary to construct guides at the ends of the pits to conduct the plow into the slot on the table. The guide as designed also serves as a walkway over the pit.

The conduit tracks in the westernmost bay are of practically the same construction as the tracks in the streets. The standard yokes employed are supported on reinforced concrete. Manholes are 12 ft. 9 ins. apart to correspond with the columns of the building. The rails of pit tracks are held in position by metal ties embedded in the concrete floor between two adjacent tracks. Wherever the strength and the rigidity of the rail would be of benefit, as in the tracks over the basement, new 80-lb. 6-in. T-rails were employed. Other tracks were built with 40-lb. relaying T-rails. The light rails were used in the runway of the upper transfer table and the heavier ones were employed in that of the lower table, as this is immediately over the basement.

INTERIOR ARRANGEMENT

The present interior arrangement was adopted after considerable study as to the best method of handling cars. Partly with a view to assisting in the handling of cars, the tracks between the transfer tables were made on a 2 per cent grade sloping south, and shifting cars is very much facilitated by the use of the two tracks with standard conduit construction in the east bay. Connections with the city system are made by two tracks leading to the loop inside the building. The track openings into the building are provided with Cross folding doors. In storing cars at night or after the rush periods the upper transfer table is placed at the west end of its runway and cars from the loop are backed down on it. The table is then set opposite the desired track and the cars are run off. The grade of the track and the momentum obtained on the table are usually sufficient to run the cars wherever desired. In getting cars

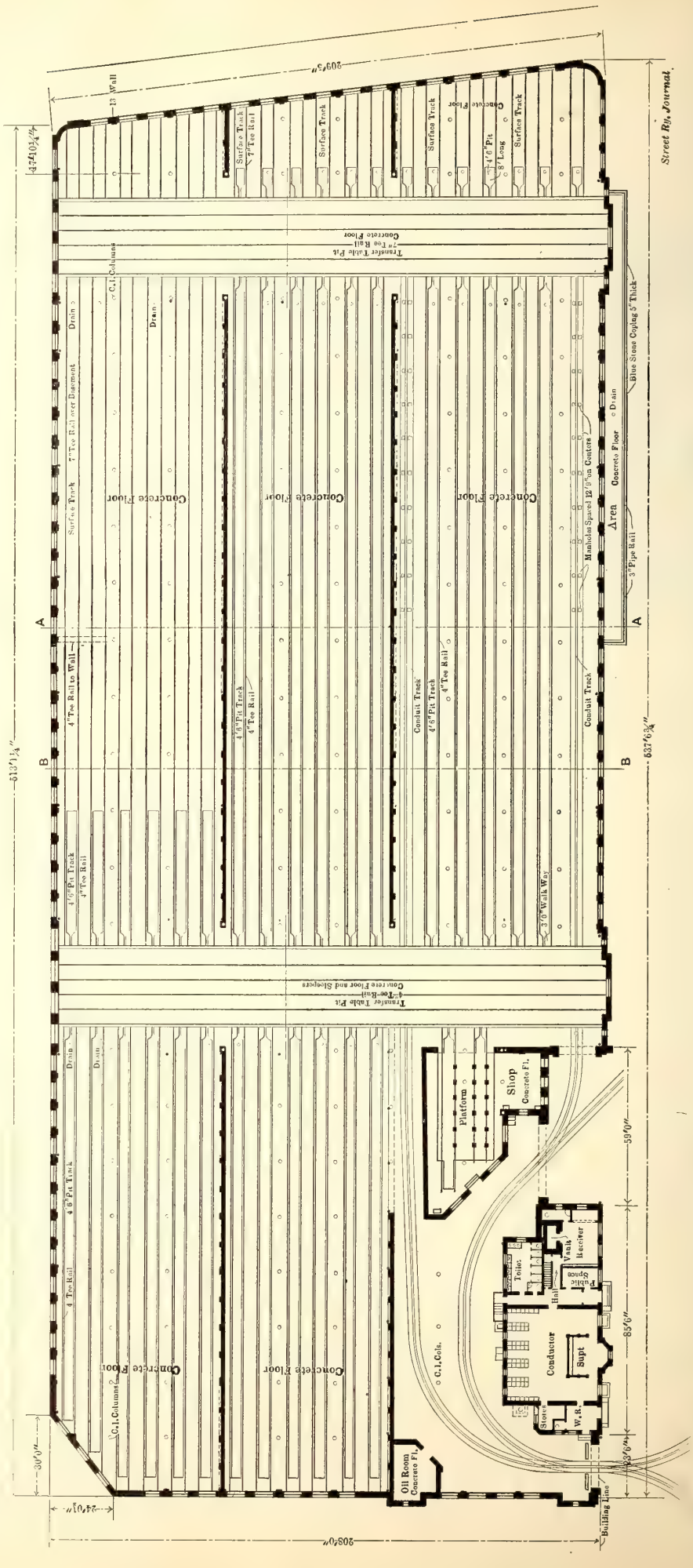


VIEW SHOWING THE SHORT BAYS AT THE SOUTH END OF THE CAR HOUSE

out of the middle section the upper transfer table is left connecting the east conduit track with the spur to the upper portion of the loop. The cars to be gotten out are then let down on the lower table by gravity and are transferred and run off on the east conduit track. They are then run across the upper transfer table and out of the building by their own motors. To get cars out of the section north of the upper transfer table it is necessary to run them to the table by connecting the plows through leads to the 600-volt outlets already referred to. The conduit track nearest the roadway is usually reserved for sprinklers, sand cars and cars which it is desired to get out quickly. It may appear at first thought that the movement of cars is dependent on both transfer tables being in good working order. However, those cars in the middle section could be gotten out with very little inconvenience in the event of either one of the tables being out of order. Should the lower table be disabled, the cars could be run up the grade and onto the upper table under their own power. With the upper table out of order, it could be left in a position to bridge the runway and the cars could be shifted to the proper tracks by the lower table.

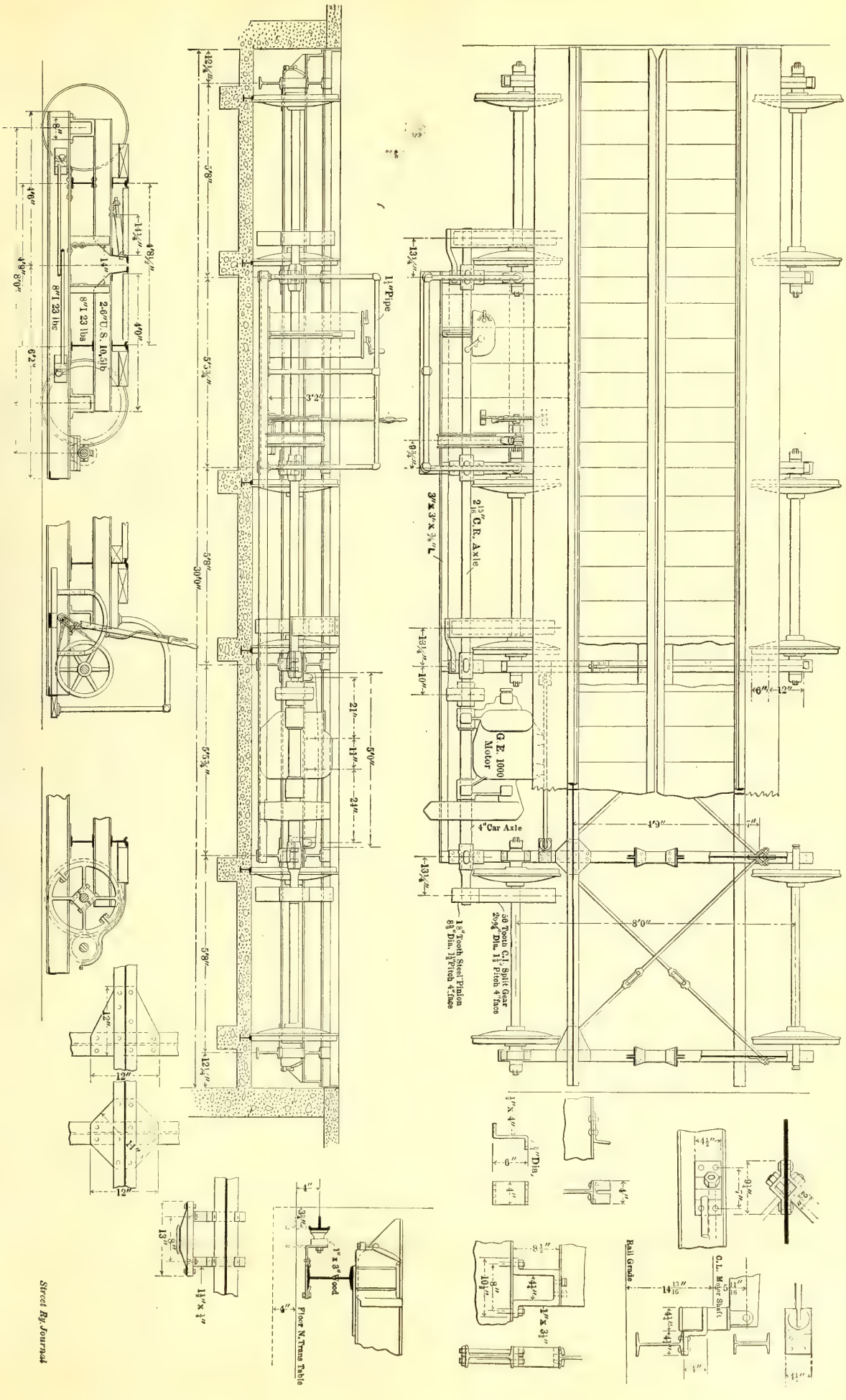
THE TRANSFER TABLES

Both transfer tables were designed by the company and were built in the repair shops. They differ radically from the usual table in that they are constructed for cars with underground trolleys, and for this reason it was necessary to carry all strains on a bottom member. Each table runs on six sets of car wheels mounted on car axles, provided with the ordinary type of journal boxes. The lower member of the turntable, an 8-in. 23-lb. I-beam, is suspended from the boxes by means of saddles. Upon this I-beam is built a structure for the support of the track and the conduit. The table is driven by a G. E. 1000 motor, geared to a shaft which corresponds to a car axle. This shaft is provided with pinions for driving



GENERAL FLOOR PLAN OF THE FOURTEENTH STREET CAR HOUSE OF THE CAPITAL TRACTION COMPANY

CONSTRUCTION DETAILS OF ELECTRICALLY OPERATED TURNTABLE USED BY THE CAPITAL TRACTION COMPANY



Street Ry. Journal

the three sets of wheels on the motor side of the table. Near the K-type controller is the brake apparatus, which consists of a band wheel on the driving shaft and a lever for tightening the friction band on this wheel. Current is obtained through sliding shoes from protected conductors, supported on standard insulators and placed against the side walls of the runway.

THE SHOP

The shop, which is intended for minor repairs only, has a capacity for three or four cars, depending on their size. The pits are of the open type, the track being supported on concrete piers as shown in an accompanying illustration. The shop is supplied with compressed air for blowing out motors from the compressor used in connection with the sprinkler system. It is heated by a steam heater in the basement. The two entering doors are of the Kinnear rolling steel hand-operated type.

THE OFFICE SECTION

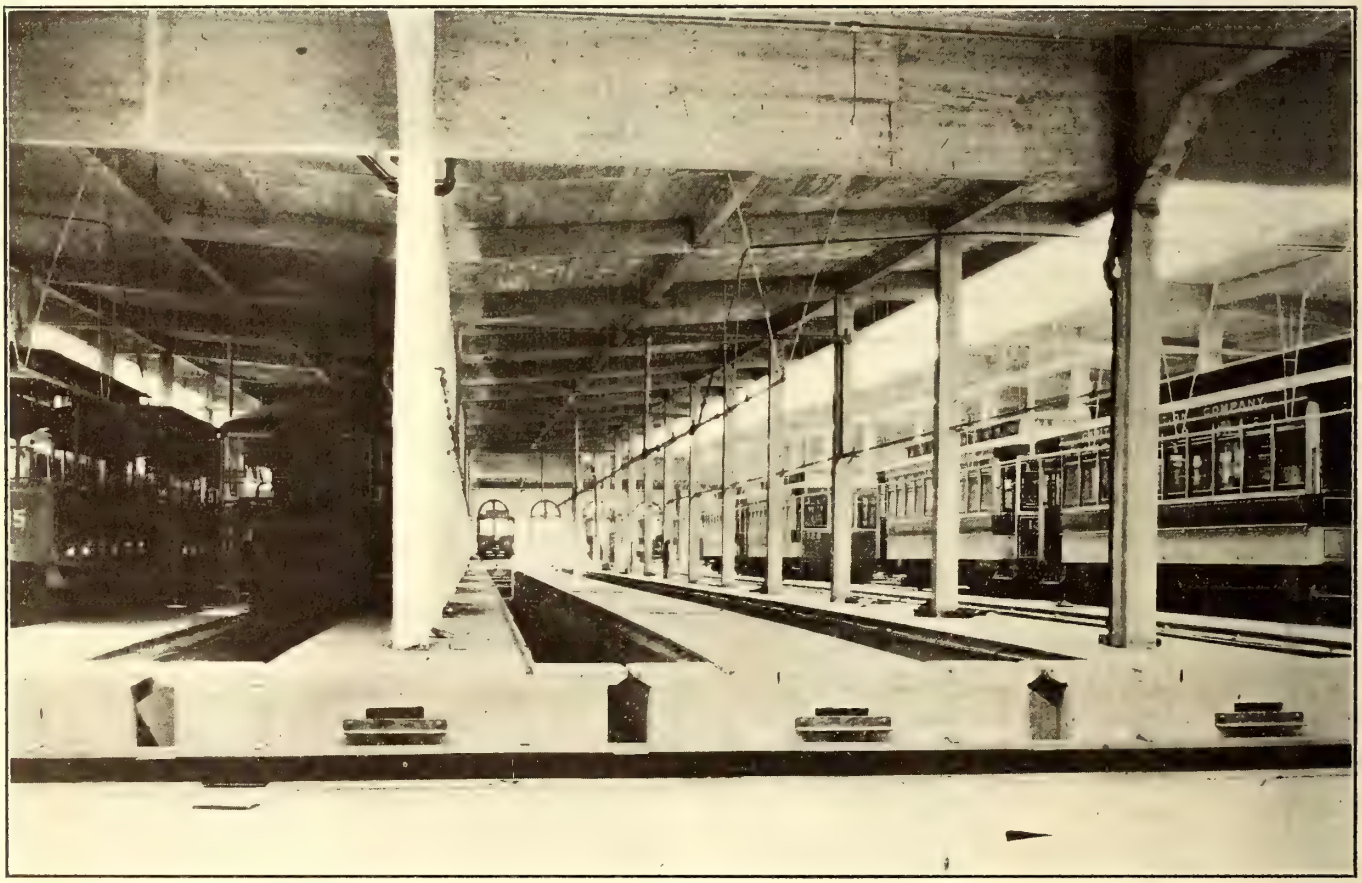
The office section is a two-story structure and, like the remainder of the car house, has concrete floors. A small room on the second floor is used for storage of material and a terminal storage battery may at a future time be installed in the one room which takes up the greater portion of the second floor. The lower floor contains a superintendent's office surrounded by a conductors' room, a small terminal waiting room, receiver's office and vault, an alcove in the rear of the receiver's office for lost articles and toilet rooms. All the rooms have plaster walls and are finished in yellow pine. The conductors' room is provided with tables for making out reports and with expanded metal clothes lockers. The basement contains a boiler for heating the offices and the small repair shop, space for coal storage, a switchboard for controlling the lighting circuits in the building and the lighting transformers.

THE LOOP AREAWAY

The loop areaway has a concrete floor and its roof structure is contiguous with, and is of the same construction as, that of the storage bays. The track openings are not provided with doors. Both openings were purposely made to the west, with the idea of avoiding draughts through the areaway. In one corner is a fireproof room for the storage of oils used in the barn.

THE TOWER

The tower was built primarily for enclosing the tank used as a reserve in connection with the sprinkler system. Nevertheless, it adds considerably to the appearance of the building. The tank of 50,000 gallons capacity is located in the top of the tower. Below it is a room for drying and storing sand.



GENERAL VIEW OF THE CENTRAL BAY BETWEEN THE TRANSFER TABLES, SHOWING ALSO THE PROTECTED TROLLEY FOR THE TRANSFER TABLE AND THE CONSTRUCTION AT THE ENDS OF THE PITS

SAND DRYING APPARATUS

Sand is elevated to a drier on the first floor of the tower by a motor-driven bucket conveyor. After being dried it falls into a hopper with chutes leading to the ground floor.

THE SPRINKLER SYSTEM

The structure is equipped throughout with an automatic sprinkler system installed by the International Sprinkler Company. A total of 1613 sprinkler heads is installed, 1165 being on the first floor and 488 in the basement. Most of the heads are placed on lines varying in size from 1 to 1½ ins., run between the tracks, and between walls and tracks about 6 ins. below the tops of the windows of the cars. These heads are located 7 ft. apart and are automatically controlled.

In addition to the automatic protection, the first floor is

divided into separate fire sections by curtain sprinklers which extend lengthwise on three sides of the two transfer tables. It was, of course, necessary to omit the fire walls across the transfer tables and these curtain sprinklers are installed as a substitute. The heads have a ⅜-in. orifice and are placed 8 ft. apart. They are installed on an independent line, controlled by a hand-operated valve, outside the building. The automatic sprinklers are supplied with water through ten independent 6-in. Evans air valves. Two of these are for the basement sprinklers. Each bay north of the upper transfer table and the central bay south of this table has its independent valve, while each of the two outside bays south of the table has two valves. These valves are installed under the floor in groups in concrete pits, which are reached by doors in the walls of the track pits. All sprinkler lines are supported and thoroughly braced by galvanized hangers extended from hanger spuds, which were placed in the forms before the concrete was poured. The overhead equipment is provided with galvanized fittings throughout, and all turns in the feed mains are made easy by the liberal use of long turn fittings.



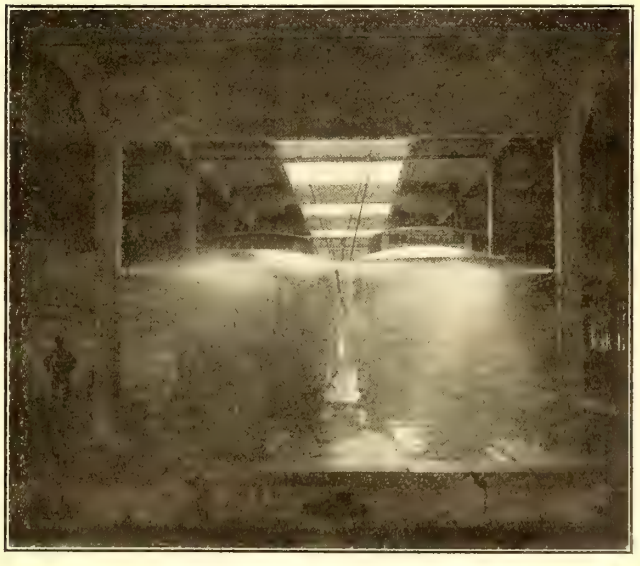
ROOF SPRINKLERS UNDER TEST



VIEW ALONG SPRINKLER LINES WITH REFERENCE TO THE CAR WINDOWS AND SHOWING THE METHOD OF HANGING THE LIGHT CONDUITS AND LAMPS UNDER THE SPRINKLER PIPES

WATER SUPPLY

The primary water supply is through an 8-in. connection to a 12-in. city main on Fourteenth Street. The secondary supply is obtained from the 50,000-gallon tank already mentioned as being installed in the tower. This tank is elevated 25 ft. above the highest point of the roof and is connected with the underground piping system supplying the dry valves by an 8-in. drop. As an auxiliary supply a Siamese steamer connection in the street has an 8-in. pipe connection with the sprinkler system. The system is supplied with air by the electrically driven compressor located in the repair shop. An independent line of ¾-in. galvanized pipe laid underground with control and check valves at the compressor is extended to each separately controlled system. This pipe affords a means for readily examining and manipulating the apparatus to replenish air pressure.

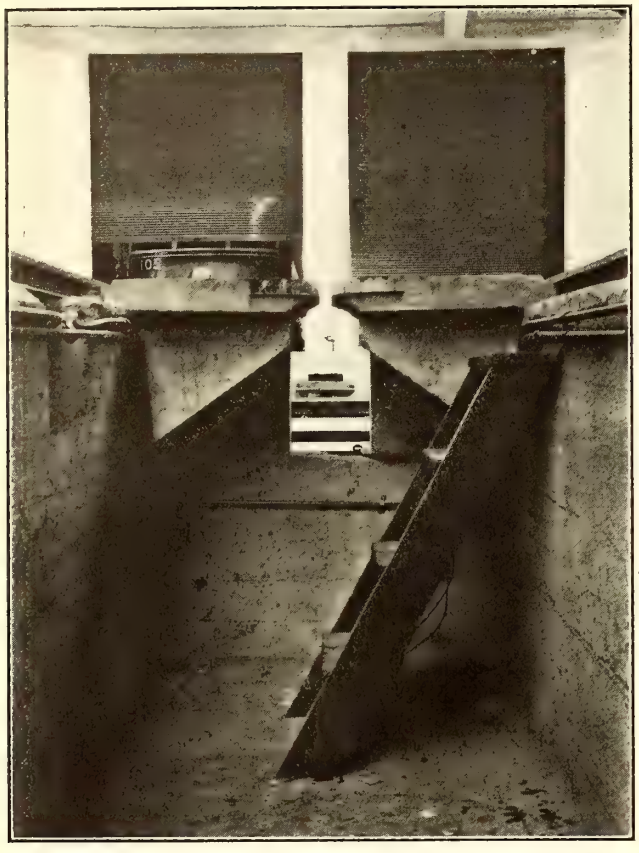


AISLE SPRINKLERS UNDER TEST

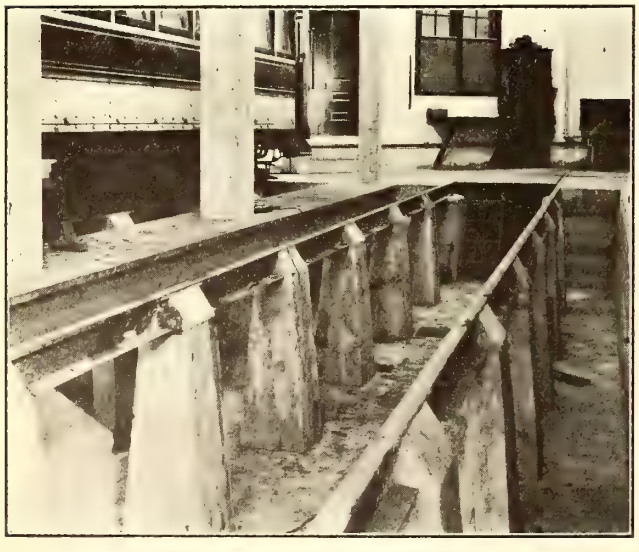
ALARM SYSTEM

Each air valve is provided with a circuit closer and is designated by a number. From the circuit closer, wires are extended to a ten-point annunciator located near the air compressor in the repair shop. A point on the annunciator is similarly marked with the number of the valve and

the opening of a sprinkler or the dripping of the air valve from any cause sounds a 10-in. alarm bell and indicates what system is in trouble. There is also an electrically-connected device in the gravity tank which indicates by means of an annunciator in the repair shop the height of the water in the gravity tank. In addition to the sprinkler system fire protection is afforded by risers provided with



WALKWAY AND GUIDE FOR PLOW AT THE ENDS OF THE PIT TRACKS. THE DOOR OPENINGS IN THE BACKGROUND ARE THE ENTRANCES TO THE REPAIR SHOP



VIEW IN THE REPAIR SHOP, SHOWING THE METHOD OF SUPPORTING THE TRACK ON CONCRETE PIERS

fire hose, and hand fire extinguishers are placed on the walls at frequent intervals.

LIGHTING AND WIRING

General illumination is effected by 16-cp incandescent lamps, there being 832 such lamps in the building. In addition, 5 arcs on a 600-volt circuit illuminate the loop areaway. There is not an exposed wire in the building; all are run in conduit, provided with "condulets" for outlets at the lamps. Lighting current is obtained from the city system through 2300-volt mains which are connected to transformers in the basement. Throughout the building the three-wire system with 110 volts between outside and neutral wires is employed. A rather ingenious method of installing the lamps for general illumination was employed. The conduits are tied to the under side of the sprinkler line, and the lamps are placed 25 ft. apart in condulets. Should it be necessary to repair the sprinkler line, the conduit may be dropped down by simply removing the wire hooks with which it is held in place.

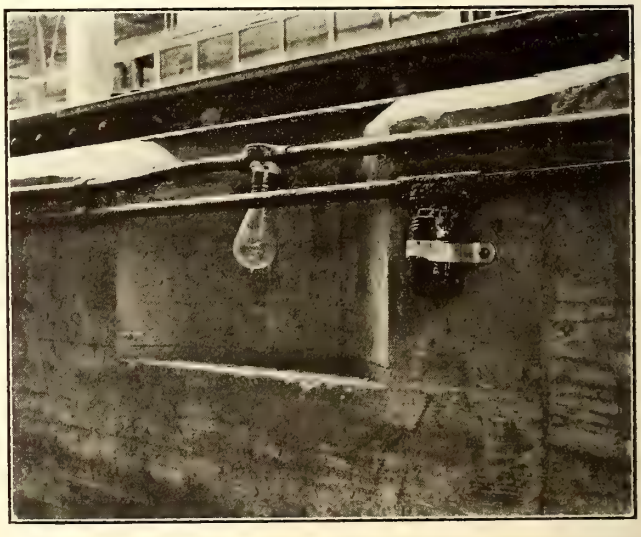
From the transformers three single O wires are carried overhead in conduit to a three-pole switch and cut-out located in a box on a column in each section of each bay, and from this box the distribution is overhead to the separate lines. Twelve lamps scattered throughout the building are on a separate circuit and at night are kept burning constantly.

PIT LIGHTS

For pit lighting three conductor No. 0000 lead cables are carried in conduits under the floor on each side of the upper transfer table and are distributed to separate cut-out boxes for each bay. No. 12 wires are carried to each pit and the lamps for each pit are controlled by a snap switch in the pit. In addition, key sockets are used. The lamps on each side of the pits are staggered and are 50 ft. apart. Where possible they are installed in recesses in the pit; but over the basement the reinforcement did not permit these recesses. The 600-volt wiring for the pit sockets is also carried in the conduits under the transfer table and the distribution to the pits is made in pipe conduits. One of the illustrations shows one of the maple terminals for the 600-volt wiring, which terminals are placed 50 ft. apart.

THE BASEMENT

Seventeen tracks to be laid in the basement will run at right angles to those on the first floor and entrance to them



SIDE OF PIT, SHOWING RECESS FOR PIT LIGHT AND MAPLE TERMINAL FOR THE 600-VOLT PIT CIRCUIT

will be made through doors in the rear side of the building, there being one door for each pair of tracks between columns. Cars will be brought to the rear of the building over a track along the south side, and will be distributed to the tracks in the building by a transfer table running in front of the doors in the east wall.

DRAINAGE

The roof is drained through an independent system of pipes and tile to an 18-in. pipe which runs under the building and takes the flow of a small stream which formerly ran across the site of the structure. The pits are also drained into this pipe. The toilets in the office building have outlets into the city sewer running along Fourteenth Street.

GENERAL

The general arrangement of the floor plan was laid out in the office of D. S. Carll, chief engineer of the company, through whose courtesy this article is published, and the details were cared for by J. H. Hanna, assistant chief engineer and superintendent of the system. Credit for the architectural features is due to the firm of Wood, Down & Dunning, architects of Washington. The building was originally planned as a steel structure. Later the steel design was abandoned for one employing reinforced concrete, made by Sydney B. Williamson, at the time agent for the Baltimore district of the Expanded Metal & Corrugated Bar Company. The adoption of concrete construction instead of steel resulted in a saving of about 10 per cent in the first cost. The contract for the construction of the building was let to Richardson & Burgess, of Washington, in May, 1906, with O. L. Meigs, building superintendent for the company. The building was ready for occupation July 1, 1907. The entire cost of the building was about $300,000.

In the construction of the building about one and one-half million brick were used. Of the 9000 cu. yds. of concrete poured, 6500 cu. yds. were reinforced with 720,000 lbs. of steel. The remaining 2500 cu. yds. were used in the construction of retaining walls and footings.

THE ADVANTAGE OF NEW BOILER DESIGNS

BY W. H. BOOTH

If the numerous tests that have been published on steam boiler performances are carefully examined and the doubtful and extravagant ones are eliminated there will still remain quite a number of tests, conscientiously and carefully carried out, which show that steam boilers have been and are made which return in the form of dry steam heat to the amount of not less than 80 per cent of the calorific capacity of the fuel burned in the furnace of such boiler. Now an efficiency of 80 per cent is very great. There are numerous deductions to be made from the given calorific power of the fuel. There is loss in the shape of heat radiated from the walls of the boiler seating and from the parts of the boiler not covered by the seating and walls. There is heat lost in the ashes and there is the loss of heat in the waste gases which leave the boiler at a temperature very much above that of the atmosphere. Then there is loss by imperfect combustion, for there is generally some carbonic oxide and some hydrocarbon gas in the waste gases. All these losses have to be taken out of the 20 per cent of efficiency of which the boiler falls short of theoretically perfect efficiency. But no boiler of ordinary rational dimensions can ever reduce its waste gases below its own temperature so that an efficiency, as ordinarily rated, of 80 per cent, really represents 86 to 90 per cent of efficiency based on what it is theoretically possible to perform. Such figures of what has been accomplished should therefore be very carefully considered by all who set forth to improve the design of boilers except in respect of furnace arrangement or details of construction and fitting. Any improvement of efficiency appears extremely unlikely to be secured by any fresh design, any rearrangement of parts. Existing boilers showing low efficiency may be improved by the addition of such things as retarders in the fire tubes. Certain baffles which compel a better spread of the hot gases over the heating surface have often done good, but nothing has been done to improve boilers already returning 80 per cent. Boiler improvers should therefore think twice before going to the trouble of making new designs in any serious expectation of surpassing records, and their efforts should be confined to other matters. Thus recently a great German shipyard was looking for a boiler which, while of good and safe design, would provide more grate surface per square meter of the plan of the ship so that more coal could be burned and more power and speed obtained, for ocean vessels of high speed are already full from end to end with engines and boilers and cannot hold more, yet there must be room for coal and there must be passages by which to convey it to the furnaces and space in which stokers can stand to shovel the coal into the furnaces. Thus there may be new designs of boiler that will effect certain practical and desirable improvements of the above order, but no great hopes must be entertained in respect of better efficiency of performance.

GAS ENGINE ECONOMY

In the paper on gas engines presented at the annual meeting of the American Society of Mechanical Engineers, by G. I. Alden and J. R. Bibbins, and discussed editorially last week, the authors presented the following interesting table of distribution of heat in percentages at average load:

	Engine only.		Entire plant.	
	Brake.	Electric.	Brake.	Electric.
Useful work	24.9	22.98	18.38	16.97
Electrical losses	———	1.92	———	1.41
Friction and pump work	4.58	4.58	3.37	3.37
Jacket absorption	34.22	34.22	25.22	25.22
Exhaust and radiation	36.30	36.30	26.81	26.81
Loss in producer	———	———	26.22	26.22
Total	100.	100.	100.	100.

The plant tested belonged to the Norton Company, of Worcester, Mass., and consisted of a 500-hp Westinghouse horizontal double-acting engine connected to a 300-kw d. c. generator, with a bituminous gas generating plant of the intermittent type supplied by the Power Mining & Machinery Company. The consumption of coal per kw-hour averaged 1.402 lbs.

MASSACHUSETTS BOARD STUDIES THE QUESTION OF FARES

An interesting inquiry of importance to street railways as well as steam roads was started by the Massachusetts Railroad Commission with a public hearing on Friday, Dec. 13, looking toward a scheme for equalization of fares on the steam roads. The board acts in this matter under the following, Chapter 82 of the Resolves of 1907, of the Massachusetts Legislature: "Resolved, That the Board of Railroad Commissioners is hereby directed to investigate the matter of fares charged for passenger transportation upon railroads within the Commonwealth, and to report what changes, if any, are required to remove inequalities therein, and to make the rates paid for travel upon such roads more uniform. Said board shall report to the next General Court on or before the fifteenth day of January." It is the intention of the board to include in this general inquiry several specific complaints as to suburban and other fares which have been filed at its offices within the past three or four months.

AN EXHAUST STEAM TURBINE PLANT *

BY HENRY H. WAIT.

At the Wisconsin Steel Company's mill at South Chicago, the turbine utilizes the exhaust steam from a reversible 42 in. x 60 in. double cylinder engine which drives the blooming rolls. The steam passes first to the receiver which takes out the shock of the puffs of steam, thence to the steam accumulator or "regenerator," and from there to the turbine and condenser. The average i.h.p. while the engine is actually running is 1010, and if the total work per hour were distributed evenly over the hour, the average i.h.p. for the hour would be 820. Figuring back from the total steam consumption, gives 64 lbs. of steam per average i.h.p. for the hour, or 54 lbs. during the running period. This large consumption is readily understood when we consider that the engine takes steam for practically the full stroke when starting the passes, and is running on very light load most of the rest of the time.

When the engine is exhausting directly to the atmosphere and is taking steam at nearly full stroke, the puffs of steam shoot a long distance up in the air and make a noise like a number of big locomotives puffing in unison. The receiver relieves the accumulator of the strains which would occur if the puffs went directly to it. It consists of a vertical tank with baffle-plates and drains for water and oil. At the top of the receiver, between it and the vertical exhaust-pipe, used when desired to exhaust directly to atmosphere, is a relief valve to permit the escape of steam to the air during the periods when there is more than the demands on the turbine and regenerator require.

The accumulator or regenerator is a very interesting piece of apparatus, and is virtually the same as the more recent Rateau regenerators built in Europe. The accumulator might be called a heat fly-wheel, absorbing or giving up energy in accordance with the requirements. It might also be likened to a storage-battery floating on the line. When the engine is running the exhaust steam comes from the engine through the receiver and is delivered to pipes immersed in the water in the regenerator. These pipes or ducts are perforated with a number of small holes, spraying the steam, so to speak, in through the water in the regenerator. A greater or less proportion of this steam is condensed in passing through the water, and gives up heat to the water in the regenerator.

It is usual to operate the regenerators at about atmospheric pressure. In other words, the steam coming to the regenerator will usually have a temperature of 212 deg. F., and will tend to heat the water to just that temperature. If the engine stops and the supply of exhaust steam discontinues, we will see that we have a large mass of water heated to 212 deg. F., and if there is a continuous load on the turbine the flow of steam through the turbine to the condenser will tend to make the pressure fall off slightly in the regenerator, and 212 deg. F. will then be slightly above the boiling temperature of water at this lower pressure, so the mass of water begins to give off steam and act like a boiler running at approximately atmospheric pressure. If, now, the engine starts again, steam will be delivered to the accumulator at a temperature slightly above that to which the water has fallen, due to the cooling effect of the evaporation of the steam for supplying the turbine, and the mass of water will again absorb heat from the exhaust steam.

In practice it is more convenient to run the regenerator at a pound or two pressure above the atmosphere, as in this case the piping is not under vacuum, so that so much care does not have to be exercised to avoid air leaks. However, in certain cases, it is desirable to run below atmospheric pressure. In this way the power of the primary engine may be augmented by letting it operate at a partial vacuum. Plants are running with a delivery pressure to the turbines as low as six pounds below atmosphere.

The accumulator at South Chicago being quite a large one, is divided by a diaphragm in the middle into two decks, each deck having a series of flues. The steam generated in the lower deck passes up through steam flues into the upper chamber and passes out with the upper steam through the steam dome. A small percentage of the steam delivered to the regenerator is condensed on account of radiation from the surface of the apparatus. This makes an accumulation of excess water in the regenerator which is automatically discharged by a float trap. Where the fullest possible amount of steam must be saved, the regenerators are lagged.

DATA FROM TESTS ON THE EXHAUST STEAM TURBINE OF THE WISCONSIN STEEL COMPANY.

Observed and Derived Values	Unit	Test No. 1	Test No. 2	Test No. 3	Test No. 4
Date of trial	1907	Mar. 11	Mar. 11	Mar. 12	Mar. 12
Duration of trial	hours	1.00	2.00	2.00	2.00
Condenser					
Average initial temperature of condensing water	deg.	38.40	39.30	38.90	39.55
Average final temperature of condensing water	deg.	80.00	68.30	61.50	66.55
Average condensing water per min	cu. ft.	151.9	192.8	247.2	295.4
Average barometer	ins.	29.6	29.6	29.2	29.2
Regenerator					
Average pressure at turbine, abs	lbs.	16.9	16.6	15.9	15.3
Average temperature of steam at turbine	deg.	215.5	217.0	216.3	213.2
Average temperature of air	deg.	48.0	48.0	64.0	64.0
Average steam delivered per hour	lbs.	19,500.0	20,220.0	22,050.0	29,280.0
Turbine					
Average pressure above controlling valve	ins.	32.9	32.4	30.93	29.75
Average pressure under controlling valve	ins.	18.6	19.0	21.47	24.85
Average vacuum at exhaust casing	ins.	25.31	26.6	26.95	26.40
Average brake hp at turbine shaft	hp	409.0	544.0	727.0	869.0
General					
Average power delivery in kw	kw.	265.1	366.7	489.2	591.6
Steam per minute to turbine	lbs.	326.0	337.0	367.5	488.0
Steam per kw-hour	lbs.	73.3	55.2	45.2	49.5
Steam per brake hp at turbine per hour	lbs.	47.7	37.1	30.7	33.7

If the primary engine shuts down for a considerable period, the heat stored in the regenerator will become exhausted and the pressure will fall below a workable amount for the turbines. To take care of this condition, there is an automatic reducing valve set so that it will open whenever the pressure falls below atmosphere and deliver live steam to the regenerator. At the Wisconsin Steel Company's plant the pressure usually ranges about 1 lb. or 2 lbs. above atmosphere; when the engine is exhausting heavily it runs up to about three lbs. The lower limit of pressure, when the reducing valve opens, is about atmosphere.

The turbine is of the well-known Rateau type, similar to those of the same character built in Europe, except that on account of American conditions it was necessary to

*Abstract of a paper presented before the American Institute of Electrical Engineers, Dec. 13, 1907.

make the construction heavier and stronger. As the turbine is of the impulse type, the pressure is the same on both sides of the wheel, and there is no tendency to leakage of steam through the clearance spaces around the periphery. These clearances can therefore be made as large as desired within reason, without having any material effect on the efficiency.

The governor regulates the speed by throttling, the valve being of the double-beat type. Of course, it will be realized that the steam admission pipe and the throttle valve have to be of abnormally large dimensions on account of the steam being delivered at such a low pressure.

When it was decided to put in this plant we found that direct-current generators of the speed and capacity required had not been built in this country, and were not obtainable, so it was necessary for us to design the generators ourselves. It might also be remarked that although larger direct-current turbine dynamos had been designed in Europe, there were none, as far as we could find out, adapted to the requirements of American steel-mill practice. To make the problem simpler and not run so much risk with abnormally long commutators, it was decided to divide the generating capacity into two direct-current interpole units of 250 kw. each, the pressure being 250 volts.

The condenser and air pump are of standard type. There has been no difficulty in maintaining a good vacuum in normal operation, and the plant is usually run at a vacuum of about 28 in.

The accompanying table gives the details of the more important observations. The steam consumption was determined by temporarily putting a Venturi meter in the pipe delivering the condensing water to the condenser and measuring the temperature of the entering and discharged water, in this way using the condenser as a calorimeter to determine the heat rejected from the turbine. To get suitable temperature ranges, and on account of other local conditions obtaining at the time of the test, the vacuums were not as high as the turbine was designed for, so although the steam consumption was better than the guarantees, the values given do not represent the actual capabilities of the turbine.

The general result of the installation of this low-pressure turbine equipment is that it enabled the mill to shut down the two 250-kw engine-driven generators which formerly operated the mill, and for a long time the turbine carried the entire electrical load of the steel mill, operating from the exhaust of the blooming engine, and not taking any live steam except during abnormal stoppages of the blooming engine.

At this plant the boilers are supplied principally by gas from the blast furnace, but the supply of gas is quite variable and usually not adequate to give all the steam required, so that more or less coal has to be used. The installation of the turbine, therefore, results in a saving of the coal corresponding to the steam required for operating the generator engines. This, as indicated above, is quite a variable quantity, but has been variously estimated at from $10,000 to $20,000 per year. In figuring on the installation of the turbine plant, it was estimated that the turbine would effect a considerable saving, even if the supply of gas were generally adequate, as the maintenance of the turbine plant would be considerably less than the corresponding engine and boiler plant, or even a gas-engine plant.

During three months when the steel plant was running at nearly full capacity, the turbine delivered an average of 188,300 kw-hr. per month, or 51 per cent of the total possible kw-hours if run at its rated load the entire time. The operating expenses are at the following rates, based on the above output:

Oil, waste, etc.	0.002 cents per kw-hour
Attendance	0.074 cents per kw-hour
Maintenance and miscellaneous	0.011 cents per kw-hour
Total operating	0.087 cents per kw-hour
Fixed charges	0.212 cents per kw-hour
Total cost	0.299 cents per kw-hour

The fixed charges are figured on the basis of a cost of $80 per kilowatt. This figure would, of course, vary considerably with the conditions, but it can be taken as an average for moderate-size plants. Interest, depreciation, etc., are allowed for at 12 per cent. Nothing is allowed for superintendence, as no additional force is required for this item.

The cost being made up so largely of fixed charges, varies very markedly with the load-factor. In fact, if the plant is run 24 hours a day, the lubrication, attendance, and maintenance are only affected to a slight extent by the amount of load, so that they have almost the same effect as a fixed charge. Of course, if the plant were run only during the day shift, the operating expenses would go down.

If the exhaust steam turbine plant were used for electric smelting or similar purposes, it is probable that the load-factor could be kept up over 80 per cent, which would give a cost of 0.19 of a cent per kw-hour.

CARBON DIOXIDE RECORDERS

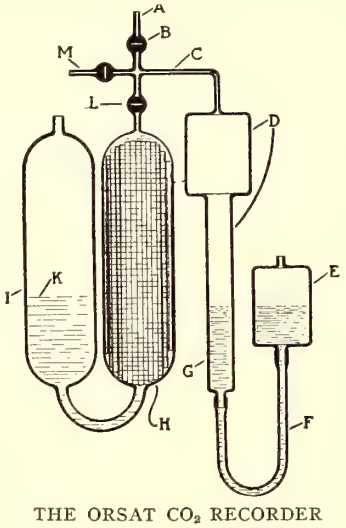
In a paper entitled "The Westover CO_2 Recorder," read in New York before the Dec. 13 meeting of the American Institute of Electrical Engineers, C. O. Mailloux discussed the value of CO_2 recorders in general, and also gave detailed descriptions of the original Orsat apparatus for this purpose and a later recorder designed by J. H. Westover.

It has been shown that there is an important and close relation between fuel economy and the percentage of CO_2 in the flue gases. In one case H. G. Stott had found that in one of the most efficient plants the loss to the stack was 22.7 per cent; in the majority of cases this loss exceeds 30 per cent. The application of a CO_2 recorder in the first case resulted in a saving of 19 per cent. High efficiency corresponds to high percentage of CO_2 in the flue gases. A falling off in percentage of CO_2 in the fuel efficiency is due primarily to excess of air. Thus it is obvious that the percentage of CO_2 in the flue gases, being influenced directly and solely by the conditions of combustion of the fuel, can serve as a criterion of the performance and efficiency of the boiler plant and as a means of detecting defects and suggesting improvements in operation.

To make clear the operation of these recorders, Mr. Mailloux presented the accompanying diagram and description of the Orsat apparatus, which is the oldest form used for making chemical analyses of flue gases.

The movable vessel *E*, of glass, containing water, is connected by a flexible (rubber) tube, *F*, with a stationary vessel, *GD*, of glass, of the general form shown, having graduations at the upper part of the tubular portion, *G*, and connecting by a small tube, *C*, with a three-way coupling in which are valves or stop-cocks, *B*, *L* and *M*. The cock *L* controls a connection leading to a receiving vessel *H*, filled with small glass tubes, and connected at the bottom by a bent tube with a supplemental receiver, *I*, open to the atmosphere at the top. The liquid put in the vessels

H and I depends on the particular gas to be analyzed. When the apparatus is to be used for determining the percentage (by volume) of CO_2 in flue gases, the liquid put in these vessels consists of a solution of caustic soda, or caustic potash. The process of making an analysis comprises various manipulations which must be made in proper order, with a certain care, each requiring a certain time. The cocks M and L being both closed, the cock B is opened, leaving a free passage from the receiver D to the atmosphere. The movable vessel E is then raised, causing the level of the liquid to rise in the vessel G and the liquid to fill the portion D as far as the small tube C. The cock B is then closed and the cock M, controlling the connection with the supply of gas, is opened, allowing the gas which is to be analyzed to enter. The vessel E is now lowered, and the gas enters and fills the vessel D and a part of the vessel G as far as desired. The exact quantity of gas allowed to enter is controlled by the position of the movable vessel E, which is adjusted to bring the level of the liquid in G to a certain mark, corresponding to a definite volume, say 100 cc of gas. The cock M is then closed and the cock L is opened. The vessel H is normally left filled with the absorbent liquid at the end of the preceding test. Therefore, on opening the cock L this liquid begins to fall in H and the gas begins to enter. The movable vessel E is now raised again until the gas has been entirely forced out of the vessel D by the rise of the liquid in G and D. The gas enters the vessel H, forcing down the absorbent solution, which is displaced into the vessel I. The glass tubes in the vessel H present a greatly increased surface, wet with the caustic soda or potash solution, whereby the chemical reaction on which the analysis depends is expedited. This reaction is the absorption of CO_2 gas contained in the sample of gas forced into the vessel H, and its combination with the soda or potash contained in the solution to form a "carbonate" of soda or potash, which remains in solution. The volume of the gas in the vessel H is diminished in proportion to the amount of CO_2 abstracted from it by this chemical reaction. After a certain time, sufficient for the reaction to be practically ended, the movable vessel E, which was held at its upward position during the time allowed for the reaction to take place, is lowered, causing the residue of gas to return into the vessel D. The vessel E is lowered until the liquid in H rises and fills the vessel to the top as far as the cock L. If the sample of gas contained no CO_2 it will not have been reduced in volume when it returns to the vessel D, and the level of the liquid in this vessel will be at the same mark as it was before the gas was sent into the vessel H. If the gas contained CO_2, the volume returned from H to D will be smaller than it was before; consequently, when the residue has all passed out of H, the liquid in G will stand at a higher mark than before. Suppose, for example, that the initial volume was 100 cc and that the residual volume is found to be 92.5 cc. Then the percentage (by volume) lost, in passing through the vessel H, was 100 — 92.5, or 7.5 per cent. Since the loss in volume was due to the absorption of CO_2 only, it follows that this sample of gas contained 7.5 per cent of CO_2. If the residue is not to be subjected to further analysis, the cock B is opened and the gas is forced out at A, by raising the movable vessel E and filling the vessel D, as before. If it be desired to analyze the residue for some other gas, say oxygen, for example, the pipe A is connected with another vessel similar to the vessel H and containing a chemical reagent which can absorb the gas whose percentage is to be determined. The reagent used for the oxygen analysis is pyrogallic acid dissolved in a solution of caustic potash. The operation is conducted in substantially the same manner as for the estimation of the percentage of CO_2. The residue of gas is returned to the vessel D, its volume is measured, and the loss of volume, if any, is noted, as before. Suppose the volume be now found to be 90 cc. Then the percentage of oxygen which was present in the gas was 92.5 — 90, or 2.5 per cent. A third analysis may serve to determine the percentage of CO (carbon monoxide), present in the sample. The reagent then used is cuprous chloride, dissolved in hydrochloric acid. The residue left after this determination will be substantially all nitrogen. From the data thus obtained it is possible to determine the percentage of CO_2, O, CO, N, and of air, contained in the flue gas.



THE ORSAT CO_2 RECORDER

That the results of flue-gas analysis may be of service, it is necessary that the analyses should be obtained under practical requirements, including the following: The apparatus should work automatically with little care and attention; it should give results quickly and regularly; it should give a visual indication and record of all the results. It is not necessary that analysis should be made of all the constituents of flue gases. This would require too much complicated apparatus, and would lengthen the time required for each operation. Practically, the determination of the percentage of CO_2 is all that is required.

In the Westover recorder, when used for, say, a four-boiler battery, there is a succession of steps or a cycle of operations very similar to those described in connection with the Orsat apparatus. All the manipulations are made automatically, the work incidental thereto being done by a small constant-speed electric motor.

The function of the movable vessel E is performed, in this case, by two movable vessels which are counterweighted and raised, lowered or held stationary at certain positions and at certain times, by cam-actuated devices driven by the electric motor. One of the movable vessels serves to displace the sample of gas when it is first received from the boiler flue. The other movable vessel serves to displace it during the operations of measuring, "treating," and remeasuring the gas. The rising of displaced liquids results in a float making contacts to close an electric circuit which actuates a recording mechanism. In practice, when the same recording apparatus is used for several boilers, the recording point and recording strips used are repeated.

The external features which distinguish this recorder from all previous forms, is the liberal use which has been made of metal to the exclusion of glass in its construction. Glass has been eliminated everywhere except where it is desirable to allow the operation to be seen at any point or at any stage.

The tests made by Mr. Stott and others have shown conclusively that the CO_2 record gives accurate information regarding the efficiency of a steam boiler. For a boiler

working constantly at the highest possible theoretical efficiency, the CO_2 record would be a straight line, corresponding to a little over 20 per cent of CO_2. In practice, such high CO_2 values are seldom attained, even momentarily. Occasionally, the records may "make a jump" to 16, 17 or even 18 per cent; but even those results are infrequent and of very short duration, and may be considered abnormal, since they correspond to conditions of combustion which cannot be maintained for any great length of time without affecting the output, or steam capacity, of the boiler.

The above-mentioned CO_2 record corresponds to the condition of perfect combustion, in which only the quantity of air theoretically necessary for perfect combustion is admitted into the furnace. We all know that this ideal or theoretical condition could not be satisfied in practice. There always is, and, indeed, there must always be, a certain excess of air, as there are always some parts of the fire which have a deficiency of air even when there is an excess of air in the rest of the fire. The consequence is that practically the highest efficiency attainable corresponds to a CO_2 record, which is seldom higher than 15 per cent, and is usually considerably lower, being as low as 9, or even 8 per cent, in some cases. This highest attainable line depends upon the design of the boiler plant and, especially, upon the kind and quality of coal and the way in which it is burned. For the very lowest grades of culm, the line of highest attainable practical efficiency probably could not be higher than 8 per cent.

One of the important lessons which the CO_2 recorder has taught the boiler-room expert is that the damper must be adjusted much more often, and usually much less at a time, than it has been hitherto, if we expect to get very near the maximum efficiency obtainable in any particular plant. In the case of boiler plants which are operated at more or less constant load, and with automatic stokers, the damper adjustment may not need to be so frequently changed; but, in the case of boilers which are hand-fired and which supply steam for variable loads, it sometimes seems, judging from the CO_2 records, as if the damper adjustment ought to be changed every few moments.

If we admit the necessity and desirability of frequent changes of damper adjustment, the question of finding ways and means of doing it properly and cheaply assumes some importance. In several cases the problem has been partly solved, and with satisfactory results, by making the fireman himself watch the CO_2 records, and adjust and readjust the dampers accordingly. In some cases, in large boiler plants, it might even be profitable to have a special attendant for the purpose of watching the CO_2 records and of adjusting and readjusting the dampers. The ideal solution is, obviously, automatic damper control.

At the shops of the Cleveland Electric Railway Company a passenger car is being converted into a postal car to be used on the local lines in collecting mail and in carrying incoming mail to the various sub-stations. The car will make a route as follows: From the main office to East 105th Street over the St. Clair Avenue line; from this point to Euclid Avenue over the 105th Street line; thence west to Fifty-Fifth Street; south on Fifty-Fifth Street to Woodland Avenue and on to a station on Broadway. From this point the car will go to a station on Detroit Avenue near West Twenty-Fifth Street, after which it will return to the main office. Four such trips a day will be made and mail will be picked up from certain boxes, which will be painted a different color from the others. The car will be ready for service in about two months.

THE RATIO OF HEATING SURFACE TO GRATE SURFACE AS A FACTOR IN POWER PLANT DESIGN

At the Dec. 13 meeting, in New York, of the American Institute of Electrical Engineers, Walter S. Finlay, Jr., presented a paper on the proper relations between heating surface and grate surface. A rule of boiler and grate practice, he said, was that all other conditions remaining constant, capacity developed is, with slight modifications, in direct ratio to the area of the active grate surface. An increase in capacity, while the heating surface remains constant, caused by an increase in grate area, is accompanied by a loss in economical evaporation, due to the increased temperature of the escaping gases. Under normal conditions, this loss varies from practically zero to as much as 15 per cent fuel economy for an increase of 100 per cent in boiler capacity.

Lately, however, the opinion has been advanced that considerable increase in capacity can, without great sacrifice in economy, be obtained by proportional increase in grate area. This idea is based on the possibility that combustion, heat distribution and transfer could be much improved under the new conditions, when in increasing the grate area careful attention is given to details of design most conducive to these features. With a belief in the correctness of this theory, a change was made in the design of eighteen of the boiler furnaces in the Fifty-Ninth Street plant of the Interborough Rapid Transit Company, New York. This change gave the possibility of operating within the range of the original single-stoker boiler, together with the higher range of the double stoker. The second stoker installed has an area of 80 per cent of the original stoker, local conditions preventing an installation of a larger size. The second, or lower stoker, is constructed practically within a so-called "Dutch oven."

From the tests made after the installation, it appears that in this particular case double-stoker operation covers the entire range of single-stoker operation and adds an increase in capacity proportionate to its larger grate surface with but slight loss in economy; and that an increase of 71 per cent in capacity was accomplished with no loss in economy.

Taking the foregoing results as a basis, Mr. Finlay considers the effect of this change on a plant, as a whole. He assumes a plant with a first cost of $125 per kw, equipment including turbo-generators and boiler stokers with, say, sixty to one ratio. Relative costs are given as follows:

		Per cent
Total cost per kw	$125.00	100
Building	43.75	35
Boilers	6.875	5.5
Grates	1.75	1.4
Piping	5.625	4.5
Coal-handling apparatus per kw	2.30	1.84
Balance of equipment	64.70	....

Interest on investment is assumed to be 5 per cent, depreciation 6 per cent, taxes and insurance 1 per cent, making the total fixed charges 12 per cent.

The effect of a change, as outlined on the different items making up the plant cost, is then considered as follows:

Piping: In the case involved the cost of steam piping between boilers and manifolds, plus boiler feed piping and boiler blow-off piping alone, has been considered. With any change in number of boilers, capacity remaining the same, the cost of piping will vary in the same ratio times a factor due to change in size of pipe.

Coal-Handling Apparatus: Fixed plant capacity would seem to demand fixed cost of this item, but the propor-

tionate value of the conveying apparatus is so large that when any change is made affecting the length of carry the total system cost will be raised or lowered, although not in direct ratio to such a change:

Change of Ratio: Suppose, in reconsidering the plant design, it is decided to cut in half the ratio of heating surface to grate surface by using double grates or stokers under boilers of the same rating while the plant output remains the same. A tabulation of the revised costs would be as follows:

	Per kw
Building (reduced 40 per cent)	$26.25
Boilers (reduced 50 per cent)	3.438
Stokers (remain same)	1.75
Piping (reduced 40 per cent)	3.735
Coal-handling apparatus (reduced 15 per cent)	1.955
Balance (remain same)	64.70
	$101.468

From the foregoing it is found that the plant first cost and fixed charges would each be reduced 19.6 per cent. Based on figures on this plant, furnished by H. G. Stott in his A. I. E. E. paper on "Power Plant Economics," Mr. Finlay estimates that the change to double grate operation would decrease maintenance and operating charges by 0.25 per cent.

The speaker presented also a set of figures on a plant cost of $150 per kw, for which he estimated a reduction in first cost and fixed charges of 20.8 per cent. The following summary of savings was then presented for the case of the $125 plant using double grates: First cost, 19.6 per cent saving; total plant charges varying from a saving of 5.64 per cent at 100 per cent load-factor, to 7.54 per cent at 50 per cent factor, to 9.65 per cent at 4.16 per cent factor (365 hours per year).

In the case of the $150 plant: First cost, 20.8 per cent saving; total plant charges vary from about 7.06 per cent saving at 100 per cent load-factor, to 9.26 per cent at 50 per cent factor, to 11.51 at 4.16 per cent factor.

STREET RAILWAYS DISCUSSED BY NATIONAL CIVIC FEDERATION

A meeting of the National Civic Federation was held at the Park Avenue Hotel, New York, on Dec. 16-17, and the annual banquet occurred at the Hotel Astor on the evening of Dec. 16. Tuesday afternoon was devoted largely to a discussion of trade agreements with labor organizations and was of interest particularly because of the account given by August Belmont of the experience of the Interborough Rapid Transit Company with labor unions. Mr. Belmont is president of the National Civic Federation, and said in part: "I am for the trade agreement in principle and in practice in connection with trade in general. But I have come to the conclusion that it is not the only and safe method in connection with public utilities. The convenience, comfort and safety of the public are too closely connected with the operation of these concerns to make any other course possible. A public utility company, in accepting a franchise, assumes certain duties and any man accepting employment from a transportation line should also be considered as entering into a contract with the public not to leave his post except on account of illness or after having given a reasonable notice of his intention to stop work—say two weeks or whatever time shall be agreed upon. The law cannot compel a man to engage in this work, but having done so, it should see that he performs his duties to the community as it does that the company is held to its contract. The Subway and elevated systems in this city were operated for some time under trade agreements with union organizations. Both were separate, but they passed under one management and there was a gradual merging of the unions of the two roads. The employees of one made an agreement with the other. The strike that followed was not because the employers wished to cut down wages or increase the hours of labor, and was in contravention of the agreements. Had the National organization been able to enforce the agreement there would have been no strike. But it could not—it has no way of doing so except to expel the local organization. The result in New York was that new men were hired in the strikers' places and the union was thrown out. The companies could take no risk and had to employ new men. It is impossible to operate a big transportation system in a city like this in any other way. A member of one of the labor committees asked me whether I would oppose a re-establishment of the union. I told him that it was impossible for a public utility corporation to operate its lines under a trade agreement as long as there was no way of forcing both parties to live up to their agreements. We could not take the risk of making another try. It is perfectly just for labor to demand consideration from the corporations, but the corporations have a right to demand the same consideration from the men. A man entering the employment of a public service corporation should consider that he is in the service of the public and give suitable notice of his intention of quitting work."

A. O. Crozier, of Wilmington, Del., then asked Mr. Belmont this question:

"If the humble employee in entering the service of a public service corporation at a modest wage thereby incurs an obligation as a servant of the public, should not the corporation which receives from the public a franchise free, a franchise which is not property but which is merchandise, also have an obligation to the public and be prevented from capitalizing that franchise for $100,000,000 and then charging the public high rates to earn dividends on it?"

The audience seemed inclined to laugh Mr. Crozier down, but Mr. Belmont replied: "That is a good question and I want to answer it. In the first place, you have stated your premise incorrectly in saying that the franchise is obtained free. The franchise tax is very heavy, and it is not operated free by any means. In the case of the subway the company leases the property from the city, so that the conditions there are somewhat unique, but with the surface lines the companies pay a very large amount of money for the use of the streets. I might say, therefore, that your premises being wrong, the question cannot be answered. Nevertheless, I will take up your question on capitalization. In the amalgamation of properties inducements have to be held out to the stockholders to get them together, and then the investor must be provided with the kind of security that he wants. If there is considerable risk there must be a corresponding possibility of considerable profit. The great difficulty with transportation in New York to-day is that the money cannot be obtained to give the service. A great deal of hostility has developed against the transportation systems, caused in large part by incorrect ideas, such as that the companies are using the streets free, as indicated by the first part of your question. Even if this hostility were just, as some of it may be, it makes it impossible for the corporation to obtain money for needed extensions and improvements. The only alternative is that the citizens must undertake what the corporations cannot or will not do. But because of this opposition by

certain parts of the press and public that has frightened the investor, the city will be hampered in its work. What is public money? There is no public money other than that which is obtained from taxation that is not furnished by the investor. In other words the municipality, to undertake any constructive work, has to go to the same source of money supply as the company, i. e., the investor. Because the corporation could not reach the investor, it has had to take out short-time notes, and after the lack of currency has passed, the lack of confidence will remain and will show up this fallacy as to the power of the public to do what the corporation cannot do."

Early on Tuesday afternoon Mr. Belmont announced that owing to his many business duties he would not be able to serve as president for another year. Ex-Mayor Seth Low was elected to succeed him.

CONFERENCE ON STANDARD CLASSIFICATION OF OPERATING ACCOUNTS

A conference on a standard classification of accounts of electric railway companies, between representatives of the American Street and Interurban Railway Association, the Interstate Commerce Commission and the National Association of Railway Commissioners, was held this week at the rooms of the Interstate Commerce Commission in Washington. Meetings were held on both Dec. 17 and 18, and among those present were:

Howard Abel, comptroller Brooklyn Rapid Transit Company, Brooklyn, N. Y.

C. Loomis Allen, vice-president and general manager Syracuse Rapid Transit Railway Company and Utica & Mohawk Valley Railway Company.

C. F. Balch, special examiner, Interstate Commerce Commission, Washington, D. C.

D. Dana Bartlett, general auditor, Massachusetts Electric Companies, Boston & Northern Street Railway Company and Old Colony Street Railway Company.

H. M. Beardsley, secretary, Elmira Water, Light & Railroad Company, Elmira, N. Y.

John I. Beggs, president, Milwaukee Electric Railway & Light Company and United Railways Company, of St. Louis.

E. S. Benson, consulting accountant, representing the Interborough-Metropolitan Company, of New York.

T. B. Bradley, of the Richmond Light & Railroad Company and Staten Island Midland Railway Company, of New York.

Arthur W. Brady, president, Indiana Union Traction Company, of Anderson, Ind.

W. B. Brockway, representing the United Railways Investment Company and American Cities Railways & Light Company, of New York.

J. F. Calderwood, vice-president and general manager, Brooklyn Rapid Transit Company, Brooklyn, N. Y.

J. F. Collins, secretary and auditor, Rochester Railway Company and Rochester & Eastern Rapid Railway Company, of Rochester, N. Y.

W. H. Davis, comptroller of the United Traction Company, of Albany, N. Y.

R. A. Dyer, Jr., of the Rochester, Syracuse & Eastern Railroad and Auburn & Syracuse Electric Railroad, of Syracuse, N. Y.

G. L. Estabrook, of Philadelphia, representing the Bangor Railway & Electric Company, Grand Rapids Railway Company, St. Joseph Railway, Light, Heat & Power Company, East St. Louis & Suburban Company, and other roads.

Frank R. Ford, of New York, representing United Railways Investment Company, American Cities Railway & Light Company, etc.

W. H. Forse, Jr., treasurer, Indiana Union Traction Company, Auderson, Ind.

W. F. Ham, comptroller, Washington Railway & Electric Company, Washington, D. C., representing American Street & Interurban Railway Accounting Association.

G. H. Harries, vice-president, Washington Railway & Electric Company.

J. Leslie Hess, president and general manager, Fonda, Johnstown & Gloversville Railroad.

Chas. O. Kruger, second vice-president and general manager, Philadelphia Rapid Transit Company.

Lewis Lillie, of Philadelphia, representing the Public Service Corporation of New Jersey.

Arthur L. Linn, Jr., general auditor, Mohawk Valley Company, N. Y., Utica & Mohawk Valley Company, and other roads.

Thos. N. McCarter, president, Public Service Corporation of New Jersey.

Geo. F. McCulloch, representing the Indiana Union Traction Company, of Anderson, Ind.

W. G. McDole, auditor, The Cleveland Electric Railway Company, of Cleveland, Ohio.

James Marwick, of New York, representing the Twin City Rapid Transit Company, Chicago City Railway Company and Duluth Street Railway Company.

W. J. Meyers, chief of division of statistics and accounts, Public Service Commission of the Second District, Albany, N. Y.

J. H. Pardee, operating manager, J. G. White & Co., of New York City, representing Eastern Pennsylvania Railways Company, Tri-City Railway Company, Davenport, Ia., and other roads.

C. A. Pearson, Jr., of Philadelphia, representing the Bangor Railway & Electric Company, Grand Rapids Railway Company, East St. Louis & Suburban Railway Company, and other roads.

E. F. Peck, general manager, Schenectady Railway Company, Schenectady, N. Y.

H. J. Pierce, president, International Railway Company, Buffalo, N. Y.

A. Stuart Pratt, of Boston, representing the properties managed by Stone & Webster.

C. Gordon Reel, vice-president and general manager, Kingston Consolidated Railroad Company, Kingston, N. Y.

Alex. Rennick, auditor, Philadelphia Rapid Transit Company, Philadelphia, Pa.

Charles S. Sergeant, vice-president, Boston Elevated Railway Company, Boston, Mass.

Wm. O. Seymour, Railroad Commission, Connecticut.

J. N. Shannahan, general manager, Washington, Baltimore & Annapolis Electric Railway.

F. E. Smith, auditor, Chicago Union Traction Company, Chicago, Ill.

Dana Stevens, vice-president and general manager, Cincinnati Traction Company, Ohio Traction Company, and other companies.

Bernard V. Swenson, secretary and treasurer, American Street & Interurban Railway Association, New York City.

C. L. S. Tingley, of Philadelphia, Pa., representing The American Railways Company and its many properties.

Robert I. Todd, representing the Indianapolis Traction & Terminal Company, the Terre Haute, Indianapolis & Eastern Traction Company, and allied roads.

A. F. Weber, chief statistician, New York Public Service Commission (First District), New York City.

Clinton White, Massachusetts Railroad Commission, Boston, Mass.

H. L. Wilson, comptroller, Boston Elevated Railway Company, Boston, Mass.

T. W. Wilson, general manager, International Railway Company, of Buffalo, N. Y.

Thos. Yapp, assistant secretary, Railroad & Warehouse Commission of Minnesota, St. Paul, Minn.

P. S. Young, comptroller, Public Service Railway Company, New Jersey.

The discussion centered about the report of the special committee which was appointed at the previous meeting, held Nov. 22, and which was unable to settle definitely upon any single tentative classification. In its report, this committee suggested one tentative classification of construction accounts, termed "Exhibit A," and two classifications of operating accounts termed "B" and "C" respectively. Classification "B" was preferred by the representatives of the national and state commissions on the committee and is published herewith. Classification "C" agreed substantially with the text of the tentative classification of

operating expenses drafted by the American Street and Interurban Railway Accountants' Association at its Atlantic City convention, and published in the Street Railway Journal for Nov. 16. The report of the committee also contained a comparison of the two classifications under the title "Exhibit D."

While different opinions were expressed on the relative merits of schedules "B" and "C," the discussion at the conference centered mainly upon the desirability of including in any classification of street railway accounts the subject of depreciation. Arguments were presented in favor of and against this course, the representatives of the Interstate Commerce Commission and State commissions, as a whole, favoring the inclusion of accounts bearing on this subject. Prof. Adams, statistician of the commission and the chairman of the conference, in this connection read a letter from Hon. Frank W. Stevens, chairman of the Public Service Commission of the Second District of New York State, stating that he hoped the subject of depreciation would be provided for in the classification, as it would strengthen the position of the New York Commission, which expected to include in its classification, accounts of this character. It was finally decided to adopt two classifications, one for the larger roads, the other for the smaller roads. The line of demarkation is yet to be determined, but the smaller roads will probably consist of those having gross receipts per annum less than some sum between $50,000 and $300,000, the larger roads being above the limit decided upon. These two classifications will be similar in principle but that for the smaller roads will have a very much smaller number of accounts.

It was decided tentatively to adopt for the amplified classification of accounts, or that for the large roads, the classification referred to in the report of the sub-committee as "Exhibit B," and published on pages 1177 to 1179, except that the subject of depreciation is to be referred to a committee representing the interests involved for further action. In other words, accounts Nos. 16, 25, 33, 46, 59, and 69 in the subjoined tentative classification, being those relating to depreciation, are to be omitted for the present. The classification is then to be printed and sent to all of the railway companies with the explanation that depreciation is not included owing to its being referred to the committee. All suggestions received from different companies will be compiled and submitted to a committee of fifteen, consisting of five members representing the American Street and Interurban Railway Association, five members representing the American Street and Interurban Railway Accountants' Association and five members representing the Interstate Commerce Commission and State commissions. There will be no formal adoption of any classification by the Interstate Commerce Commission until these suggestions have been compiled by the committee mentioned and submitted to the commission and passed upon by it. It was also proposed to include in the circular accompanying the printed reports of this tentative classification the latest steam railroad classification, so that the recipients can have an opportunity to compare the two, with the view of making the two harmonize as closely as possible.

The same plan will be followed in connection with the abbreviated schedule for the smaller roads, which will contain 21 accounts instead of the 116 accounts contained in tentative classification B. The following gentlemen were appointed to compose the committee of fifteen on the standard classification of accounts:

COMMITTEE ON THE STANDARD CLASSIFICATION OF ACCOUNTS.

Representing the American Street and Interurban Railway Association: Gen. G. H. Harries, of Washington, chairman; Arthur W. Brady, of Anderson, Ind.; C. Loomis Allen, of Utica, N. Y.; Frank R. Ford, of New York; W. B. McKinley, of Champaign, Ill.

Representing the American Street and Interurban Railway Accountants' Association: W. F. Ham, of Washington, chairman; F. E. Smith, of Chicago; W. G. McDole, of Cleveland, Ohio; H. L. Wilson, of Boston, Mass.; W. H. Forse, Jr., of Anderson, Ind.

Representing the Interstate Commerce Commission and National Association of Railway Commissioners: Prof. H. C. Adams, of the Interstate Commerce Commission, chairman; Clinton White, member of the Massachusetts Railroad Commission; Wm. O. Seymour, member of the Connecticut Railroad Commission; Thos. Yapp, member of the Minnesota Railroad Commission; Wm. J. Meyers, member of the Public Service Commission of the Second District, of New York.

COMMITTEE ON DEPRECIATION.

The following gentlemen were appointed members of the committee on depreciation of the American Street and Interurban Railway Association to take up the consideration of that subject as outlined above:

Gen. G. H. Harries, Washington, chairman; John I. Beggs, of Milwaukee; C. S. Sergeant, of Boston; Arthur W. Brady, of Anderson, Ind.; Frank R. Ford, of New York.

REPORT OF COMMITTEE ON CLASSIFICATION OF ACCOUNTS

This committee was appointed at the meeting in Washington on Nov. 22 to consider a standard classification of accounts and presented its report to Prof. Adams, Dec. 3. The report as stated in the previous article was accompanied by four exhibits, of which "A" and "B" are reprinted in this issue. "Exhibit C," as explained in the previous article, was practically the classification tentatively decided upon by the Accountants' Association at its Atlantic City convention, and "Exhibit D" was a comparison of classifications "B" and "C." The report of the committee follows:

Washington, D. C., Dec. 3, 1907.

Mr. Henry C. Adams,
In charge of Statistics and Accounts,
Interstate Commerce Commission,
Washington, D. C.

Dear Sir: The members of the committee of six appointed by yourself at the instance of a conference held at the office of the Interstate Commerce Commission on Nov. 22, for the purpose of considering a scheme of accounts to be prescribed by the Interstate Commerce commission for street and interurban railway companies within its jurisdiction, have to report that they met on Nov. 29 and have spent that and the following days to the present date in consideration of the matters intrusted to them. They find themselves unable to agree upon a complete scheme of accounts, nor have they been able to agree upon the importance of conformability to the system of accounts already promulgated by the Interstate Commerce Commission for steam railway carriers. They do, however, agree as follows:

That if it is necessary that the system of accounts to be prescribed for street and interurban railway companies shall conform closely to that prescribed for steam railway carriers, the classifications "Exhibit A" and "Exhibit B" are practicable and conform to the system of accounts prescribed for steam carriers as closely as the differing conditions of the two classes of carriers permit.

The members of the committee who are actively connected with the administration of street and interurban properties do not, however, believe that the Classification of Operating Expenses outlined in "Exhibit B" meets the needs of the managements of such properties to a sufficient degree, and therefore recommend in lieu thereof the classification herewith designated as "Exhibit C."

A comparison of these two classifications is submitted as "Exhibit D."

And the members of the committee connected with the Interstate Commerce Commission and State Commissions are of the opinion that, except for its lack of conformability to the scheme of accounts prescribed for the steam railway carriers, the scheme designated above as "Exhibit C" may be made by suitable subdivision and expansion to meet the requirements of the various Commissions.

The committee therefore recommend that the conference before which this report is to be laid on Dec. 17 shall consider both of these schemes of accounts, many of the individual accounts in both schemes being identical in name and character. It has not been thought necessary at this time to attempt a complete statement of the various classes of items to be comprehended in each particular account suggested, it being thought that when the system of accounts is settled upon by the Interstate Commerce Commission the details of the classes of items to be included in each separate account may be then readily worked out. This applies particularly to the Road and Equipment Expenditures Accounts ("Exhibit A"), the detailed items included in which the members of the committee that are connected with the operation of railways have not had time to examine carefully.

The committee recognize that various important elements of a complete system of accounts have not been completely provided for in "Exhibit C," the principal one among these being the matter of depreciation. The committee agree in recognizing the necessity of provision for depreciation in any complete scheme of operating expense accounts designed to show or to approximate the cost of operation. They are not, however, able to agree upon the practical method by which depreciation shall be accounted for, nor are the committee able to agree to what extent, if any, it is necessary to provide in the scheme of accounts for the matter of joint facilities, which is recognized in the system of accounts promulgated for steam railway carriers.

Of somewhat similar character to the matter of joint facilities is that of power produced in the power plant of a street or interurban carrier, but utilized outside the transportation operations of the carrier. The committee are not able to agree as to the proper method of accounting for the cost of production of such power and the revenue derived from the sale thereof.

Neither are the committee able to agree upon the best method of disposing of the matter of rents, nor upon the extent to which it is important and practicable to provide for the distinction between the elements of cost of production, interest, and profit in the amounts paid or received as compensation for the use of facilities owned by one corporation and furnished to another for a gross rent, or for products furnished for a gross sum.

Nor are the committee able to agree to what extent, if any, a scheme of amortization accounts should be provided through which to secure suitable disposition of extraordinary casualties, abandoned property, and expiring tangible assets, such as limited franchises, patent rights, and the like.

The foregoing is respectfully submitted.

(Signed) GEO. H. HARRIES, Chairman,
American Street and Interurban Railway Association.
WM. F. HAM,
American Street and Interurban Railway Accountants' Association.
C. LOOMIS ALLEN,
Street Railway Association of the State of New York.
WM J. MEYERS,
New York Public Service Commission (Second District).
WM O. SEYMOUR,
National Association of Railway Commissioners.
C. F. BALCH,
Interstate Commerce Commission.

EXHIBIT A.

TENTATIVE CLASSIFICATION OF EXPENDITURES FOR ROAD AND EQUIPMENT OF ELECTRIC RAILWAYS.
(Recommended by the special committee.)

GENERAL ACCOUNTS.

I. ROAD.
II. EQUIPMENT.
III. GENERAL EXPENDITURES.

PRIMARY ACCOUNTS.

I. ROAD.

Right of Way.
1. Engineering and Superintendence.
2. Right of Way.
3. Real Estate Other Than Right of Way.

Roadway.
4. Grading.
5. Ballast.
6. Ties.
7. Rails.
8. Track Fastenings and Other Material.
9. Frogs, Switches, and Special Work.
10. Paving.
11. Track Laying and Surfacing.
12. Roadway Tools.
13. Tunnels.
14. Bridges, Trestles, and Culverts.
15. Over and Under Grade Crossings.
16. Fencing Right of Way.
17. Grade Crossings, Cattle Guards, and Signs.
18. Interlocking and Other Signal Apparatus.
19. Telegraph and Telephone Lines.

Electric Line.
20. High-Tension Transmission Lines.
21. Overhead Feeders.
22. Track Bonding.
23. Underground Feeders.
24. Overhead Trolley Lines.
25. Third-Rail Conductors.
26. Conductor Rails.

Buildings and Structures.
27. Generating Plant Buildings.
28. Power Sub-station Buildings.
29. General Offices.
30. Stations, Waiting Rooms, and Other Buildings.
31. Docks and Wharves.

Permanent Equipment.
32. Generating Plant Equipment.
33. Sub-station Equipment.
34. Shop Machinery and Tools.
35. Cost of Road Purchased.

II. EQUIPMENT.

Revenue Equipment.
36. Passenger Cars.
37. Combination Cars.
38. Express Cars.
39. Mail Cars.
40. Freight Cars.
41. Locomotives.

Electric Equipment of Revenue Equipment.
42. Electric Equipment of Passenger Cars.
43. Electric Equipment of Combination Cars.
44. Electric Equipment of Express Cars.
45. Electric Equipment of Mail Cars.
46. Electric Equipment of Freight Cars.
47. Electric Equipment of Locomotives.

Service Equipment.
48. Work Cars.
49. Snow Equipment.
50. Electric Locomotives (Utility).
51. Miscellaneous Equipment.

Electric Equipment of Service Equipment.
52. Electric Equipment of Work Cars.
53. Electric Equipment of Snow Equipment.
54. Electric Equipment of Locomotives (Utility).

III. GENERAL EXPENDITURES.

55. Law Expenses.
56. Stationery and Printing.
57. Insurance.
58. Taxes.

59. Injuries to Persons.
60. Interest and Commissions.
61. Other Expenditures.

The text of this classification agrees substantially with the text of the Tentative Classification of Expenditures for Road and Equipment of Electric Railways.

EXHIBIT B.

Tentative Classification of Operating Expenses of Electric Railways.

(Prepared by the special committee and recommended for adoption, provided essential agreement with the steam railway accounts is necessary.)

I. Maintenance of Way and Structures.

Maintenance of Way.

1. Ballast.
2. Ties.
3. Rails.
4. Rail Fastenings.
5. Frogs, Switches, and Special Work.
6. Underground Construction.
7. Paving.
8. Roadway and Track (Labor and Expenses).
9. Tunnels.
10. Bridges and Culverts.
11. Over and Under Grade Crossings.
12. Grade Crossings, Fences, Cattle Guards, and Signs.
13. Signals and Interlocking Plants.
14. Telegraph and Telephone.
15. Other Maintenance of Way Expenses.
    - *a.* Superintendence.
    - *b.* Injuries to Persons.
    - *c.* Stationery and Printing.
    - *d.* Insurance.
    - *e.* Other Expenses.
16. Depreciation Estimate "Roadway."
    - *a.* Ties.
    - *b.* Rails.
    - *c.* Rail Fastenings and Other Material.
    - *d.* Frogs, Switches, and Special Work.
    - *e.* Underground Construction.
    - *f.* Paving.
    - *g.* Tunnels.
    - *h.* Bridges and Culverts.
    - *i.* Over and Under Grade Crossings.
    - *j.* Grade Crossings, Fences, Cattle Guards, and Signs.
    - *k.* Signals and Interlocking Plants.
    - *l.* Telegraph and Telephone.

Electric Line.

Transmission Lines—

17. High-Tension Transmission Lines.

Distribution System—

18. Overhead Feeders.
19. Underground Feeders.
20. Track Bonding.

Conductors—

21. Overhead Trolley Lines.
22. Third-Rail Conductors.
23. Conductor Rails.
24. Miscellaneous Electric Line Expenses.
    - *a.* Superintendence.
    - *b.* Injuries to Persons.
    - *c.* Stationery and Printing.
    - *d.* Insurance.
    - *e.* Other Expenses.
25. Depreciation Estimate "Electric Line."
    - *a.* High-Tension Power Transmission Lines.
    - *b.* Overhead Feeders.
    - *c.* Track Bonding.
    - *d.* Underground Feeders.
    - *e.* Overhead Trolley Lines.
    - *f.* Third-Rail Conductors.

Maintenance of Buildings and Structures.

26. Power Plants.
27. Power Sub-stations.
28. General Offices.
29. Carhouses and Shops.
30. Stations, Waiting Rooms, and Other Buildings.
31. Docks and Wharves.
32. Miscellaneous Buildings and Structures Expenses.
    - *a.* Superintendence.
    - *b.* Injuries to Persons.
    - *c.* Stationery and Printing.
    - *d.* Insurance.
    - *e.* Other Expenses.
33. Depreciation Estimate "Buildings and Structures."
    - *a.* Power Plants.
    - *b.* Power Sub-stations.
    - *c.* General Offices.
    - *d.* Car Houses and Shops.
    - *e.* Stations, Waiting Rooms, and Other Buildings.
    - *f.* Docks and Wharves.

Availability Maintenance Expenses.

34. Care of Track.
35. Removal of Snow and Ice.
36. Cleaning, Sprinkling, and Oiling Roadbed.
37. Injuries to Persons.
38. Other Miscellaneous Maintenance Expenses.
39. Other than Railway Operation—Cr.
40. Maintaining Joint Tracks, Yards, and Terminals—Dr.
41. Maintaining Joint Tracks, Yards, and Terminals—Cr.

Maintenance of Service Equipment.

42. Snow Equipment.
43. Work Cars.
44. Electric Locomotives (Utility).
45. Miscellaneous Service Equipment.
46. Depreciation Estimate "Service Equipment."
    - *a.* Snow Equipment.
    - *b.* Work Cars.
    - *c.* Electric Locomotives (Utility).
    - *d.* Miscellaneous Service Equipment.

II. Maintenance of Equipment.

Maintenance of Revenue Equipment.

47. Passenger Cars.
48. Combination Cars.
49. Express Cars.
50. Mail Cars.
51. Freight Cars.
52. Locomotives.

Maintenance of Electric Equipment of Revenue Equipment.

53. Electric Equipment of Passenger Cars.
54. Electric Equipment of Combination Cars.
55. Electric Equipment of Express Cars.
56. Electric Equipment of Mail Cars.
57. Electric Equipment of Freight Cars.
58. Electric Equipment of Locomotives.

II. Maintenance of Equipment—Continued.

Maintenance of Electric Equipment of Revenue Cars—Cont'd.

59. Depreciation Estimate "Revenue Equipment."
    - *a.* Passenger Cars.
    - *b.* Combination Cars.
    - *c.* Express Cars.
    - *d.* Mail Cars.
    - *e.* Freight Cars.
    - *f.* Locomotives.
    - *g.* Electric Equipment of Revenue Cars.

Miscellaneous Maintenance of Equipment Expenses.

60. Shop Machinery and Tools.
61. Power-Plant Equipment.
62. Sub-station Equipment.
63. Other Equipment Expenditures.
    - *a.* Superintendence.
    - *b.* Injuries to Persons.
    - *c.* Stationery and Printing.
    - *d.* Insurance.
    - *e.* Other Expenses.
64. Other than Railway Operations—Cr.
65. Maintaining Joint Equipment—Dr.
66. Maintaining Joint Equipment—Cr.

67. Equipment Borrowed—Dr.
68. Equipment Loaned—Cr.
69. Depreciation Estimate "Maintenance of Shop and Power Apparatus."
    a. Shop Machinery and Tools.
    b. Electric Power Plant Apparatus.
    c. Sub-station Apparatus.

III. TRAFFIC EXPENSES.

70. Soliciting and Administering.
71. Advertising and Attractions.
72. Traffic Supplies and Expenses.
    a. Stationery and Printing.
    b. Insurance.
    c. Miscellaneous Traffic Expenses.

IV. TRANSPORTATION EXPENSES.

Power.

73. Wages of Power Plant Employees.
74. Fuel for Power.
75. Water for Power.
76. Lubricants for Power.
77. Other Supplies and Expenses of Power Plants.
78. Operating Sub-stations.
79. Power Transferred—Cr.
80. Other than Railway Operations—Cr.
81. Purchased Power.

Operation of Cars.

82. Supervising.
83. Passenger Motormen.
84. Passenger Conductors.
85. Passenger Trainmen.
86. Freight, Express, and Other Motormen.
87. Freight, Express, and Other Conductors.
88. Freight, Express, and Other Trainmen.
89. Interlockers, Block, and Other Signals—Operation.
90. Telegraph and Telephone—Operation.
91. Stationery and Printing.
92. Clearing Wrecks.
93. Station Employees.
94. Station Supplies and Expenses.
95. Car Supplies and Expenses.
96. Carhouse Employees.
97. Carhouse Expenses.
98. Express Service.
99. Other Transportation Expenses.
    a. Switchmen, Crossing Flagmen, Watchmen, and Other Car Service Employees.
    b. Drawbridge Expenses.
    c. Other Expenses.
100. Insurance.
101. Loss and Damage.
    a. Passenger.
    b. Freight.
102. Damage to Property.
    a. Property.
    b. Stock on Right of Way.
103. Injuries to Persons.
104. Operating Joint Tracks, Yards, and Other Facilities—Dr.
105. Operating Joint Tracks, Yards, and Other Facilities—Cr.

V. GENERAL EXPENSES.

106. Salaries and Expenses of General Officers.
107. Salaries and Expenses of Clerks and Attendants.
108. General Office Supplies and Expenses.
109. Law Expenses.
110. Insurance.
111. Relief Department Expenses.
112. Pensions.
113. Stationery and Printing.
114. Other Expenses.
115. General Administration Joint Tracks, Yards, and Other Facilities—Dr.
116. General Administration Joint Tracks, Yards, and Other Facilities—Cr.

The text of this classification agrees substantially with the text of the Tentative Classification of Operating Expenses of Electric Railways, which harmonizes closely with the Classification of Operating Expenses of Steam Railways.

ADVERTISING A NEW TYPE OF CAR IN BOSTON

One of the latest ways in which the Boston Elevated Railway Company is making use of space in the newspapers at advertising rates is to make display announcements of changes or new features in its service. An example is the accompanying two-column announcement, making suggestions as to the novel features of the new semi-convertibles which it is introducing on suburban lines:

Boston Elevated Railway Company

Information Concerning the

NEW EASY ACCESS, SEMI-CONVERTIBLE CARS

Safety, Speed, Sanitation and Seats

The company is about to put in service 100 additional Easy Access, Semi-Convertible Surface Cars. As some of them will be operated over routes where this type of car has not been previously used, the following facts are stated for the guidance and information of passengers:

The new cars are 45 feet in length over all, have an unusually wide aisle, seat 52 passengers and weigh 28 tons. The cars generally used by the company are 35 feet in length over all, seat 34 passengers and weigh 12½ tons. The new cars are too heavy to be operated over certain bridges until these bridges are strengthened; and can be used only on routes where conditions are feasible.

The cars are equipped with four motors, with General Electric Automatic Control, Westinghouse Air Brakes and improved heating, lighting and ventilating apparatus. The seats and floors are especially designed for sanitation, and the floors are fireproof.

The cars have pneumatic sliding doors and folding lower steps that are closed and raised respectively when the car is in motion, so that passengers may not get on or off until the car has come to a stop, the door has been opened and the step dropped. A cab is provided for the motorman. The platform space is commodious, and the doors of such width that passengers may enter and leave the car by the same door at the same time.

Passengers, therefore, about to leave the car are requested to be near the door when the car approaches the desired stopping place, thus saving time for themselves and aiding the company to give rapid service and maintain its operating schedule for the benefit of all its patrons.

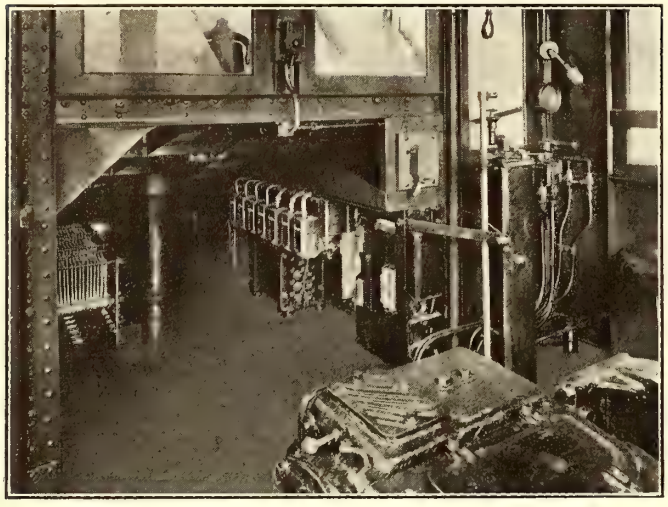
Boston Elevated Railway Company

These extra large cars have been used heretofore chiefly on the lines running under Boston Harbor in the East Boston Tunnel. Other lines are now to be equipped with them, however, and the fact that the first arrivals on this new order are this week being placed in service on the Brookline and Newton lines, where they are novelties, makes the advertisement worth while. Nothing similar to the folding step and double doorways of the new cars has heretofore been familiar to patrons on that side of the city.

In the second annual report of the Ohio Railroad Commission, which has been submitted to the Governor of the State, the Commission recommends that it be given jurisdiction over municipal railroad systems, where any portion of the system extends beyond the municipal corporation lines. The Commission expresses the belief that that is the intent of the present law, but the wording is so obscure it leaves a doubt. The wording is to the effect that the authority of the Commission shall not apply to street and electric railroads engaged solely in the transportation of passengers within the limits of cities, but does not mention the city systems, portions of whose lines extend beyond the city limits.

ELECTRIC LOCOMOTIVE FOR PORTLAND

Among recent electric locomotives the one illustrated and described below possesses some features of unusual interest. It is one of two 40-ton switching locomotives built for the Portland Railway, Light & Power Company, Portland, Ore., by the General Electric Company and American Locomotive Company at their Schenectady



INTERIOR OF CAB OF PORTLAND LOCOMOTIVE

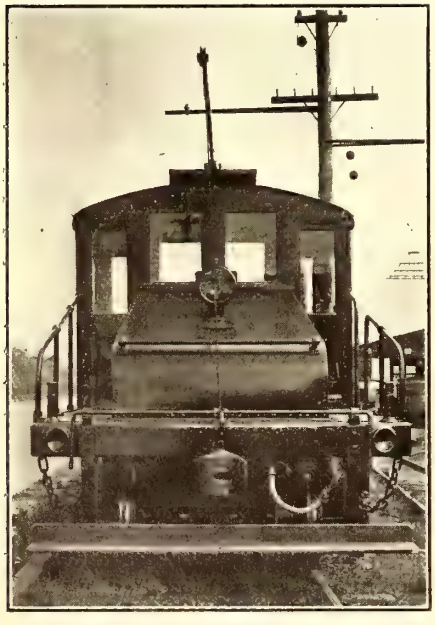
works. The classification of the locomotive, according to the standard rating of the manufacturers, is 404-E-80-4-GE-205-B.

The motor equipment consists of four GE-205-B motors. This motor is one of the latest types with commutating poles developed by the manufacturers. The commutating pole motors are particularly desirable for locomotive service, as the maximum torque demanded of a locomotive, when starting on grades, is often four or five times that demanded under ordinary full speed running conditions, and in addition, a locomotive in switching service is often operated with power on the motors a very small proportion of the total time. The amount of time lost in coasting, making switches without power, waiting for couplings and other delays, under the conditions of some recent tests, amounted to well over 75 per cent of the time that the locomotive was engaged in a service that could fairly be called continuous. The equipment of the locomotive illustrated, on a one hour rating, will exert a tractive effort of 9200 lbs. at a speed of 16½ m. p. h. Under starting conditions the same equipment is easily capable of exerting a tractive effort of 20,000 to 25,000 lbs. without danger from commutator troubles.

The electric equipment of the locomotive aside from the motors consists of type M multiple unit control, with contactors and rheostats in the auxiliary cabs, and controllers located in diagonally opposite corners of the main cab. The locomotive is equipped with two trolleys to avoid turning the trolley and to provide additional carrying capacity when engaged in service so heavy as to call for the full overload capacity of the locomotive. In the center of the main cab is a CP-23 air compressor, having a capacity of 50 cu. ft. displacement when delivering air at 90 lbs. pressure.

Referring to the mechanical construction of the locomotive, the sloping end cabs are a separate frame work of angles and sheet iron, bolted to the platform and main cab so that they may be removed without disturbing any of the apparatus contained therein. The locomotive platform is built of four 10-in longitudinal channel irons securely fastened to the end frames or bumpers, which are of cast iron cored out to obtain the necessary weight with push bolt sockets cast in. The main cab is built of structural steel angles and sheets, with a platform of ⅜-in. sheet steel covered with ¾-in. hard wood. The two ends of the locomotive are equipped with four M. C. B. vertical plane couplers, having shank springs and follower plates, carried in a draw head casting attached to the main sills of the locomotive.

The truck is of the bar frame rigid bolster equalizer type, but, as shown in the side view, the weight of the side frames and bolster is transmitted to the equalizers through a heavy semi-elliptic spring on each side instead of through a series of double elliptic and helical springs as is customary on the so-called M. C. B. equalized truck for high speed service. The axles are 6 ins. in diameter, of hammered open hearth steel, with 33-in. Taylor fused



END VIEW OF LOCOMOTIVE



SIDE VIEW OF PORTLAND LOCOMOTIVE

steel tired wheels having the M. C. B. tread and flange.

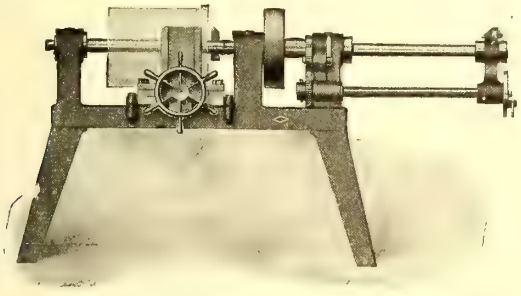
The locomotive is equipped with bell, whistle and headlights. The headlights are 32-cp incandescent, and 4-cp gage lamps are wired in each headlight circuit and controlled by the same switches.

The principal dimensions of the locomotives are as follows:

Length inside to inside of knuckles, 31 ft. 1 in.
Height over cab, 11 ft. 9 ins.
Length of rigid wheel base, 6 ft. 6 ins.
Width over all, 9 ft. 6 ins.
Track gage, 4 ft. 8½ ins.
Weight on drivers, 81,000 lbs.

BORING ARMATURE BEARINGS

It is a well-known fact that the armature shaft wears more rapidly in the bearing at the pinion end than the other end of the shaft, on account of the thrust of the gearing, and that after the motor has been in use for some time the decrease in diameter is considerable. For this reason it is



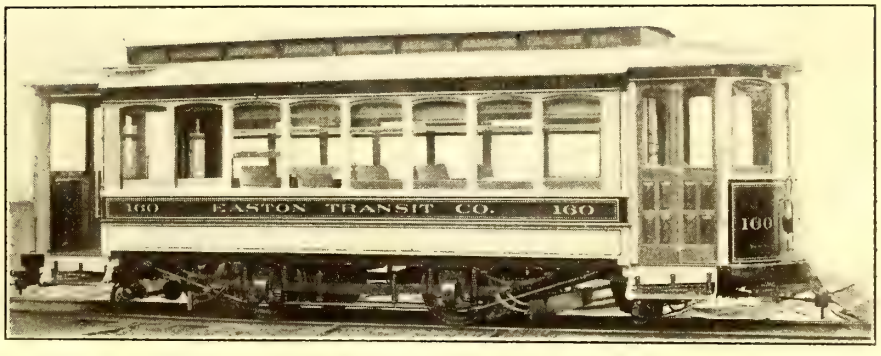
MACHINE FOR BORING ARMATURE BEARINGS

not practicable to keep bearings babbitted up to standard sizes, as even the bearings on the same shaft are different sizes and a bearing that is 1-32-in. loose is half worn out. It has also been shown by experience on various kinds of bearings moulded on mandrels that when the mandrel is of a lower temperature than the babbitt metal, as it usually is, the babbitt will have blow holes and shrinkage cracks after being moulded. That is, it will not have the wearing surface possessed by a bearing that has been bored out to fit the shaft revolving in it. Another objection to the mandrel method is that different sizes of mandrels must be kept on hand to fit the various journals. The shrinkage of the babbitt on the mandrel also is likely to make it difficult to drive the mandrel out, if the mandrel is made straight, as it should be. If the mandrel is made with a taper to release it easily from the bearing, the bearing, of course, has a taper, which with a straight shaft means a quickly worn bearing.

Mainly to overcome these objections the Black Diamond Engineering Company, of Monongahela, Pa., has designed the machine illustrated herewith, which is built to bore bearings up to 12-in. O.D. and 18-in. long. The chuck is two-jawed, self centering and is operated by means of the hand wheel. It will firmly hold round, square or hexagonal bearings, either split or solid, up to 12-in. diameter. The boring bar is of 2-in. cold drawn steel, and can be slid in the long sleeve, which revolves in the bearings. The driving pulley and feed gear are keyed to the sleeve, the boring bar being revolved by means of the key. The boring bar is fed through the work by means of a feed screw parallel with it and driven by the gearing from the sleeve. On the outer end of the boring bar is a split nut through which the boring bar revolves. The collars on the boring bar keep it in place. The split nut is opened from gripping the feed screw by means of a casting on the end. When the handle is raised this casting holds the split nut open and prevents it from coming in contact with the feed screw. Returning it is locked in either position. The intermediate gear, on an eccentric stud, by means of the handle, can be thrown out of gear with the driving pinion on the sleeve. By locking the feed nut on the feed screw the bearing can be faced off at either end, while the tool can be advanced by turning the large gear on the hand screw. The boring bar is fitted with a No. 4 Morse taper socket, but the bar can be taken apart and a drill or reamer placed in the socket and the work drilled or reamed, making practically a drill press. The machine also makes it possible to bore bearings with one end closed. It can be fitted with a crank handle so as to operate it by hand, and the manufacturers can supply a boring bar extension for journals smaller than 2-in. The machine may be driven direct by a motor or by a belt.

MORE SEMI-CONVERTIBLE CARS FOR EASTON, PA.

Early this year, seven 20-ft. closed cars, built by the John Stephenson Company, were purchased by the Easton Transit Company; then eight 10-bench open cars, built by The J. G. Brill Company, were purchased, and these were followed by a lot of six 30-ft. 8-in. semi-convertible cars, illustrated in the STREET RAILWAY JOURNAL of June 29, and now operating on the new Easton & South Bethlehem division. The equipment just delivered consists of six 20-ft 8-in. cars, also of the Brill semi-convertible type, one of which is illustrated. These cars contain all the features of the double-truck, semi-convertible type, and are equipped throughout with the same specialties manufactured by the builders, namely, seats, gongs, bells, angle-iron bumpers, ratchet brake handles, etc. The principal dimensions of the



EXTERIOR OF CAR FOR EASTON

new single-truck cars are as follows: Length over end panels, 20 ft. 8 in.; over crown pieces, 30 ft. 1 in.; width over sills, including panels, 7 ft. 10-½ in.; height from rail over trolley board, 11 ft. 1 in.; size of side sills, 5 in x 3⅜ in.; end sills, 3½ in. x 6⅝ in. The trucks are the builders' No. 21-E type with 7 ft. 6 in. wheel base.

The associates of the late Superintendent E. J. Wilcoxen, of the Rochester Railway Company, are preparing two memorial books. One contains all the messages of condolence received and the other is made up of expressions of appreciation from his associates. The books will be presented to Mrs. Wilcoxen.

FINANCIAL INTELLIGENCE

Wall Street, Dec. 18, 1907.

The Money Market

There was no material change in the local money situation during the past week. The demand for call money for stock market purposes was somewhat more active as a result of the calling of loans by the local institutions and rates for day to day money have ranged between 17 and 6 per cent, the bulk of the business being transacted at above 10 per cent. In the time money market business was practically at a standstill, the only money coming upon the market consisting of small amounts put out by out of town institutions. Loans of sixty-day funds were reported at 10 and 12 per cent and 10 per cent was bid for accommodation for that period. For the longer periods, four to six months, 8 per cent was quoted, although no transactions were reported at that figure. The demand for money from the West and South continues, although upon a somewhat smaller scale. The currency market has been considerably less active than heretofore, but the demand from certain sections of the West continued rather persistent, which has been sufficient to maintain the premium around 1 per cent. The foreign exchange market has ruled decidedly firmer, notwithstanding the increased offerings of bills against cotton and grain shipments, the strength in this department being attributed to the purchases in connection with the end of the year settlements abroad, and also to cover gold imports. Additional engagements of the yellow metal have been made during the week, bringing the total amount on this movement up to about $100,000,000. Of this amount about $85,000,000 has been laid down on this side. A feature of the week was the large increase in cash made by the New York City banks which resulted in a material reduction in the deficit of the Clearing House institutions. Further strengthening of bank reserves is expected from now on, as in some instances the banks have notified their borrowing customers that their loans must be reduced to the greatest extent possible between now and Jan. 1. At the close of the week there was nothing in the situation to warrant the expectation of a decidedly easier market in the near future. Preparations must soon be made for meeting the Jan. 1 interest and dividend disbursements, which this year amounted to upward of $180,000,000. The disbursements on Jan. 1 next are not likely to be as heavy owing to the fact that many corporations have passed their dividends, while many others have materially reduced their distribution or have deferred payments on their stocks. It is expected, however, that shortly after the first of the year the market will work easier. Usually at this time of the year the country banks begin to send their unemployed funds into New York for loaning purposes, but so far the offerings of the country banks have been extremely small, owing to the stringency existing all over the country. After the first of the year the supply from that source is likely to be much freer. It is also pointed out that much relief will be afforded by the reaction in practically all branches of business, which, of course, will greatly reduce requirements.

The bank statement published on last Saturday was extremely favorable. Loans decreased $11,367,700, while deposits decreased $7,985,500. Cash increased $4,112,800, and as the reserve required was $1,996,375 less than in the preceding week, the deficit was reduced by $6,109,175. The total deficit now stands at $40,101,175, as compared with a deficit of $1,699,050 in the corresponding week a year ago and with a surplus of $3,961,075 in the corresponding week two years ago. Another feature of the statement was an increase in circulation of $3,339,800.

The Stock Market

The stock market continues to display reactionary tendencies and prices have during the greater part of the past week declined still further from the substantial recovery made from the recent price level. Speculation, however, becomes more and more professional, as well as narrower and duller, which may in a measure be explained by the close approach of the holiday season, although a more potent reason is the absence of any pronounced selling pressure from any quarter other than the professional traders. In consideration of the main factors underlying the market, it is perfectly natural that prices should recede. To begin with, money, both on call and on time, continues stiff, with every prospect that it will become even more so between now and the beginning of the new year, because of the preparations necessary to meet the enormous dividend and interest payments then due. Then, again, the flow of money to the interior keeps up, despite the fact that many of the banks outside this city now have reserves largely in excess of anything in their history; currency here still commands a premium, whereas it had been the general expectation that this would have long since disappeared, and while the Clearing House banks are gradually restoring their surplus reserves, the process is a slow one and they still show a deficit beneath the legal requirements of some $40,000,000. With such a condition of affairs prevailing, to say nothing of the tendency on the part of railway and industrial managements to husband their resources through the medium of either reduced or deferred dividends, it is little wonder that prices for stocks show a drooping disposition.

There have of late been a few encouraging features in the situation, but these have for the time being been without avail in so far as arresting the decline in prices is concerned. The Bank of England in its last weekly statement made a very strong showing, further considerable amounts of gold were secured abroad for shipment to the United States, our Government gave out a very encouraging report on the cotton crop, estimating this year's yield at 11,678,000 bales and finally the bond market exhibited much greater strength and activity than that for stocks, which is one of the most encouraging signs of the times, especially as the demand for bonds has been virtually dead for over a year. This growing faith in railway mortgages, which in numerous instances yield at current prices unprecedented returns on the investment, is conclusive evidence that while for the moment capital is a bit chary about buying into stocks, even those of the gilt-edged class, the belief of the average investor in the ultimate prosperity of this country is unshaken and there is absolutely no fear of anything like defaults in meeting interest payments, otherwise there would be no such inquiry for railway mortgages as that now in evidence and which in all probability will continue to grow with the approach of the January interest and dividend payments. Sooner or later this demand will spread to the stock market, but for the present the tendency is in an opposite direction, with the industrials the particularly weak spots. The copper shares have been especially depressed by reason of unsatisfactory trade conditions and either actual or anticipated suspension or passing of dividends.

While moving more or less in unison with the balance of the market, the local traction shares have shown relatively greater firmness than the general run of stocks and a continuance of the quiet buying of them that has been going on for some little time, and which is based on the present and prospective large earnings of all these companies. An additional incentive in the case of Brooklyn Rapid Transit is found in the fact that the investigation into the company's affairs failed to disclose anything detrimental to its interests.

Philadelphia

There was a material falling off in the transactions in the local traction issues during the past week, and prices, while displaying considerable irregularity, tended downward. In the early dealings Philadelphia Rapid Transit dropped nearly a point on comparatively light trading, but later there was a sharp recovery to 17⅝. The advance, however, was only temporary, and at the close of the week there was another reaction to 17¼, or ¼ below last week's closing figure. Union Traction was also under pressure during the greater part of the week, the stock sustaining a sharp loss to 46¾. Philadelphia Traction also was weak, and closed at 82, which represents a loss of 2 points for the week. Philadelphia Company common ran off

1⅞ to 35⅞, and American Railways declined to 44. Consolidated Traction of New Jersey sold at 60, and United Companies of New Jersey at 226. Frankfort & Southwark Passenger sold again at 385, unchanged.

Chicago

Considerable progress has been made in clearing up the Chicago traction situation, and it is now believed that the whole matter will be amicably settled in the near future. The proposed plan it is thought will go through as it is understood there will be no opposition by certain interests which have held out against the plan for some time.

Trading in the local traction issues has been limited and prices generally show no material change. Metropolitan Elevated common sold at 17, and South Side Elevated at 63½ and 62. Chicago Railway 5's sold at 95, Northwestern Elevator 4's at 87.

Other Traction Securities

Trading in the Baltimore market was extremely light during the week and prices generally suffered fractional losses. United Railway incomes were exceptionally weak, the bonds declining more than two points on limited transactions. The 4 per cent bonds lost ½ from 82 to 81½, and the refunding 5's lost a point to 71. Baltimore Traction 5's sold at 106, and Macon Railway & Light 5's at 90. The Boston market was unusually quiet and devoid of special feature. Transactions included Massachusetts Electric preferred at 27, Boston Elevated at 125½, Boston & Worcester preferred at 55½, West End common at 81½ @ 81, and West End preferred at 98½.

Cleveland Electric securities were very quiet on the Cleveland Stock Exchange the past week. A few small lots of stock sold at 37, but for the most part the asking price was several points above this and the takers were few. Aurora, Elgin & Chicago was in fair demand both for the common and preferred. Several lots of common changed hands at 27, and the preferred 68, with a few 5 per cent bonds at 94½. The asked price of the preferred advanced to 70. Northern Ohio Traction & Light sold at 19½, with 20 asked at the close. Western Ohio preferred was quoted at 55, but there was little trading in it. Small lots of Forest City changed hands at 100, with 101¼ asked at the close.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Dec. 11.	Dec. 18.
American Railways	45	43⅞
Boston Elevated	124	123½
Brooklyn Rapid Transit	38⅜	37½
Chicago City	a150	a150
Cleveland Electric	36	37
Consolidated Traction of New Jersey	59	59½
Detroit United	35	34
Interborough-Metropolitan	7	6½
Interborough-Metropolitan (preferred)	19	17
International Traction (common)	30	35
International Traction (preferred) 4s	61½	59¼
Manhattan Railway	115	114
Massachusetts Elec. Cos. (common)	9¼	9
Massachusetts Elec. Cos. (preferred)	38	37
Metropolitan Elevated, Chicago (common)	21	a17
Metropolitan Elevated, Chicago (preferred)	46	44
Metropolitan Street	—	21
North American	43	41¾
North Jersey Street Railway	25	25
Philadelphia Company (common)	36½	35½
Philadelphia Rapid Transit	16½	17¾
Philadelphia Traction	82	83
Public Service Corporation certificates	54	54
Public Service Corporation 5 per cent notes	85	85
South Side Elevated (Chicago)	62	62
Third Avenue	25	22
Twin City, Minneapolis (common)	81	83
Union Traction (Philadelphia)	47	46⅝

a Asked.

Metals

According to the "Iron Age" new business is light, and in the finished trades does not probably amount to more than one-third of the total capacity. What developments there have been in the leading distributing markets for merchant pig iron are rather adverse since lower figures have been made. Coke continues weak.

The copper metal market continues quiet but steady at 13@13¼c. for Lake, 12¾@13c. for electrolytic, and 12½@12¾c. for castings. Export business continues large, and present indications point to record breaking exports of the metal for December.

THE PROPOSED IOWA CENTRAL RAILWAY—PLANS FOR BUILDING BEING MADE

The construction of the Central Railway Company's proposed interurban line to connect Clinton, Ia., with Dubuque, is practically assured, according to T. J. Wilcox, of Clinton, who was the promoter of the Iowa & Illinois Interurban Railway, now in operation between Clinton and Davenport. Mr. Wilcox states that the construction and equipment of the line will cost approximately $2,500,000. His plan is to operate by the third-rail system between the two cities, but to install the trolley in cities and towns through which the line will pass. The line from Clinton to Dubuque will be about 80 miles in length and will run through a rich agricultural region. It is not to be an air line. Instead of constructing the road due northwest from Clinton to Dubuque, it is the intention to build west and north to Maquoketa and thence north to Dubuque. It will be remembered that there has been under consideration the construction of two lines to Dubuque, one from Clinton in a northwesterly direction to Dubuque and the other from Maquoketa due north to Dubuque. It is the intention to make one line take the place of the two above mentioned, and to unite into one company all the parties interested in the above mentioned projects. The route has been surveyed as far as Maquoketa and several routes from Maquoketa to Dubuque have been mapped out for the surveyors to follow.

IMPORTANT DECISION ON STREET RAILWAYS IN NEW YORK

An important decision as to what sort of construction must be actually begun by the holders of a certificate of convenience and necessity for street surface roads to secure them from the possibility of a revocation of their certificate under section 99-a of the Railroad Law has been announced by the Public Service Commission of the Second District. Before entering into the merits of the application for the annulment of the certificate of the Rockland Railroad the commission announced at a hearing given on the subject that as the law provided that when the holders of a certificate of convenience and necessity fail to begin construction within two years the Public Service Commission may, at its discretion, annul the permission, the power of the commission in this matter depended upon whether or not the Rockland Company had begun construction as meant by the statute.

In the opinion of the commission, as written by Chairman Stevens, it has such power, and the decision lays down the general rule that the construction required by the law is actual physical construction, that attempts to obtain local franchises are not a beginning of construction, but merely attempts to obtain the right to begin construction and that surveys and engineering work before the granting of the certificate of convenience which are necessary in order to procure such a certificate are not a beginning of construction, which is prohibited by section 59, until after the certificate is granted.

This decision affects some 40 street surface railroad corporations which have not begun construction within the time limits. Some 20 or more steam railroad corporations in a similar position are not affected owing to the law passed in 1895, extending the time for all steam railroads for three years from date. Chairman Stevens rules in his decision that this law does not apply to street surface railroads.

REPORT OF THE RECEIVERS OF THE NEW YORK CITY RAILWAY COMPANY

The receivers for the Metropolitan Street Railway Company and New York City Railway Company have applied to Judge Lacombe, in the United States Circuit Court, for instructions regarding the operation of the Third Avenue Railway Company, which the court recently ordered them to abandon. The application was in the form of a petition, which included a report of the lines since taken charge of by Adrian H. Joline and Douglas Robinson.

The report states that the Third Avenue Railroad was leased April 13, 1900, to the Metropolitan Company for a term of 999 years. The latter corporation was thereby obliged to pay a quarterly dividend upon the road's capital stock of 6 per cent from 1906 to 1910. The quarterly dividend due October, 1907, amounting to $239,937, was, by order of Judge Lacombe, defaulted. The lease also stated that the Third Avenue had executed, or was about to execute to the Morton Trust Company, as trustee, a "first consolidated mortgage" to secure payment of bonds amounting to $35,000,000, and that the Metropolitan Company guaranteed the prompt payment of interest and principal.

The receivers say there is now outstanding $37,560,000 of the bonds referred to, with a semi-annual interest at the rate of 4 per cent and that on Jan. 1 the sum of $751,200 will be due. Having no money to pay such interest, the receivers ask the court for instructions. There is also outstanding a prior issue of bonds by the Third Avenue, amounting to $5,000,000, bearing 5 per cent interest, which constitutes a prior lien upon the property to the first consolidated mortgage, the petition says.

Continuing, it is alleged that there is now outstanding of the Third Avenue Company's capital stock $15,995,800, par value. Of this amount, it is stated that $5,970,000 was formerly owned by the New York City Railway Company, but on May 22, 1907, it was transferred to the Metropolitan Securities Company. The balance of the issue $10,025,800, is in the hands of the public.

Before making the lease the Third Avenue Railroad Company purchased the control of the stock of the following roads:

	Total.	Owned by Third Avenue R. R.
42d St., Manhattanville & St. Nicholas Ave	$2,500,000	$1,671,100
Dry Dock, East Broadway & Battery	1,200,000	1,128,700
Kingsbridge	8,600	8,600
Union Railway	2,000,000	2,000,000
		Owned by Union Ry.
Southern Boulevard	$250,000	$248,000
Westchester Electric Railroad	500,000	500,000
Yonkers Railroad	1,000,000	992,500
Tarrytown, White Plains & Mamaroneck	300,000	300,000

All of the stock given in the second column is now owned by the New York City Railway Company, as the lessee of the Metropolitan Company. All of this property is pledged under the first consolidated mortgage.

The question of the supply of power is a mixed one, the receivers say, citing the fact that the Third Avenue gets its power from its own plant at 216th Street, and the Ninety-Sixth Street power house of the Metropolitan. On the other hand, the power house at 216th Street supplies certain lines of the Metropolitan. The Third Avenue owns more cars than are operated on its lines, whereas none of the controlled lines, excepting the Union Railway System, owns as many cars as are operated on their respective lines.

At present the operation of the Third Avenue Railroad costs for operation about $1,300,000 more than its receipts from all sources, as shown by the following table. In this table the column headed "Direct" includes income and expenditures which arise directly from the operation of the Third Avenue Railroad Company, and which can be ascertained separately. The column "Apportioned" includes the proportionate share of the income and expenditures in respect to the Third Avenue Railroad Company's property, and other property owned by the New York City Railway Company, and which is properly applicable to the leasehold operations of the Third Avenue Railroad Company:

New York City Railway Company: Statement of approximate results of operations under lease of the Third Avenue Railroad Company for the year ending June 30, 1907:

	Direct.	Apportioned.	Total.
Gross earnings from operation of car lines:			
Cash fares	$1,983,573.74	.....	$1,983,573.74
Ticket fares	88,970.52	.....	88,970.52
Mail	2,587.57	.....	2,587.57
Express	.....	$7,573.96	7,573.96
Advertising	.....	16,000.00	16,000.00
Total	$2,075,131.83	$23,573.96	$2,098,705.79
Operating expenses:			
Maintenance of way	.....	$101,677.33	$101,677.33
Maintenance of power plant	.....	12,906.11	12,906.11
Maintenance of other bldgs	.....	8,076.33	8,076.33
Maintenance of equipment	.....	158,409.02	158,409.02
Operation of cars	$396,810.75	106,306.08	503,116.83
Operation of power plant	.....	116,587.14	116,587.14
Injuries and damages	221,813.58	77,554.62	299,368.20
General expenses	.....	79,484.58	79,484.58
Total	$618,624.33	$661,001.21	$1,279,625.54
Net earnings from operation of lines	.....	.....	$819,080.25
Gross profit on sales of power	.....	$229,401.45	229,401.45
Rental of land and bldgs	.....	31,000.00	31,000.00
Rental of tracks and terminals	$2,850.00	18,000.00	20,850.00
Rentals of equipment	.....	28,195.00	28,195.00
Interest realized on advances to other companies	217,195.44	.....	217,195.44
Total	$220,045.44	$306,596.45	$1,345,722.14
Taxes, excluding franchise tax.	$83,027.36	.....	$83,027.36
Int. on first mortgage bonds	250,000.00	.....	250,000.00
Total	$333,027.36	.....	$333,027.36
Balance of income available for special franchise tax or interest on refunding mortgage bonds	.....	.....	$1,012,694.78

The receivers think that there is no reason to expect an increase in the gross earnings of the Third Avenue system sufficient to offset the increase in operating expenses which may reasonably be anticipated, and operating expenses are likely to increase rather than diminish, owing to the tendency toward higher prices for material and labor and the increased cost of operating cars due to the greater congestion of traffic at various points. The gross earnings have decreased between 1896 and 1907, as shown by the following table:

1896	$2,628,628
1897	2,590,473
1898	2,519,360
1899	2,176,910
1900	2,139,834
1901	2,222,489
1902	2,275,176
1903	2,212,652
1904	2,217,417
1905	2,251,057
1906	2,259,036
1907	2,098,705

This reduction, the petition says, is due partly to the loss of traffic to the subway and elevated, but principally to the increase in the percentage of transfers. While it appears that the total number of passengers carried in 1906 on the Third Avenue almost equals the number of passengers carried in 1897, the percentage of transfers to paying passengers has increased from 19.144 in 1897 to 38.144 in 1907.

The New York railroad law requires a street surface railway which has contracted with any other such company for the use of its road or any portion thereof to give a transfer without extra charge entitling the passengers to a continuous trip over any portion of any such railroad embraced in any such contract. The report says that it is difficult to prevent the fraudulent use of such transfers, and the loss on this account is steadily increasing. It may very well be that with the operation of the Third Avenue Railroad as under a separate system, and the consequent elimination of the burden of these transfers, the earnings would show a substantial gain.

The receivers also point out that no provision has been made for depreciation of the properties, and that to keep them up large sums must be expended from time to time. Except for the year 1900, no special franchise tax has been paid by the Third Avenue, the taxes for subsequent years being in litigation, but the receivers estimate them at approximately $70,000 annually. They also say that car license fees and paving claims of the city of New York against the Third Avenue Railway are now under litigation and it is impossible to estimate the amount ultimately payable thereunder. Notes of the Third Avenue Railway Company have been given to the Metropolitan Street Railway Company for advances made by the latter for construction on the Third Avenue lines and those of the so-called controlled companies. Interest on these notes amounts to approximately $268,000 per annum.

The receivers say that, irrespective of any question as to whether or not it is possible for them to operate the Third Avenue Railroad Company to advantage as a part of the New York City Railway system, there is a practical obstacle in the way of their so doing in the fact that they are wholly without means to pay the rental and interest aforesaid. Their receipts from all sources from the date of their appointment to the 30th day of November, 1907, aggregate $4,253,460.35. Their operating

expenses, including payrolls, payments for taxes and necessary material supplies have aggregated $2,420,266.54, and the interest and rentals for subsidiary lines paid as directed by the court aggregate $1,157,011.89. For equipment and construction work that was absolutely indispensable and for miscellaneous requirements they have expended $418,994.02, leaving cash on hand Nov. 30, 1907, $257,187.90.

This amount and such additional sums as may be derived from current earnings will barely suffice to meet the indispensable requirements for the month of December, especially in view of the fact that with the advance of the winter season the daily earnings show material diminution.

THE CLEVELAND SITUATION

At a meeting of the Council committee of the whole, Monday forenoon, the committee appointed to value the buildings of the Cleveland Electric Railway Company reported an agreement on $842,987. This includes all the buildings, with the exception of the power houses and the four battery houses which will be valued by Messrs. Andrews and DuPont, in connection with the machinery and power house equipment.

The committee on land valuations also filed its report. The land in use was valued at $921,155.96, while that not in use was valued at $213,318, making a total valuation of $1,134,473.96. A year ago the land was valued at $1,084,204. Members of the committee said that they had reduced some values and increased others, as they thought right, but that the result was a larger total than before. A. S. Taylor acted for the company and C. D. Moore for the city. Mr. Taylor made the valuation a year ago. The valuations were made by the square foot.

It was reported that the committee on track valuation would probably disagree, as the members could not arrive at a basis for estimation. In that case, two reports will be submitted to the Council and Mr. Goff. The committee consists of City Engineer Hoffman and C. H. Clark.

N. T. Cook, acting as the city's representative on the committee on car valuations, states that he and J. J. Stanley, acting for the company, will probably bring in two reports also. Mr. Cook said he had reached a valuation of $2,672,663 on passenger cars, but had not yet gotten to the other rolling stock. Messrs. Andrews and DuPont, committee on overhead construction, said they were not ready to make a report. Charles Cook, of Buffalo, formerly chief engineer of the Cleveland Electric, will aid in this work, and he has not yet been able to reach the city. H. J. Davies, secretary of the company, is having an inventory of the stores made, and as soon as this is completed the committee will endeavor to place a value upon them.

In speaking to the Council Monday morning, F. H. Goff, representing the Cleveland Electric, said that in both addresses made by Mayor Johnson at the former meeting, he had stated that there would be considerable depreciation in the pavement assets, and that he had begun to doubt whether this property should have any value in arranging the leasing plan. The paving, he said, is a part of the roadway. The city, in granting franchises, requires certain top dressing for the streets and this is pavement. In this way it becomes a part of the roadbed cost. The question is, "How is it to be treated in these negotiations?" Mr. Goff said he did not believe that any company could charge this cost up to expenses; that the profits on operation would not stand such an expense. Some provision must be made for the valuation of this portion of the assets.

Mr. Goff said that he was pleased that the Mayor had coincided with him in recommending a consolidation of the companies, if the leasing plan is to be followed out. He said further that he believed the Mayor's idea of the plan of consolidation was more mature than his own suggestion. If this is to be done, however, the capital accounts of the companies must be entered upon the same basis. If the pavement is a part of the capital account of one company, it must be of the other. If the engineering expenses, the interest charges and other things of this kind are to be capitalized by one company, they must be with the other.

The earnings of the company were larger in 1906 than at any former time in the history of the road. Mr. Goff said that the properties were valued by Mr. Andrews and Mr. DuPont, but they differed materially. For the purpose of getting at the franchise value, however, he said he was willing to take Mr. DuPont's figures, $14,000,000. Allowing 6 per cent on this, a fair profit, he said that the earnings were sufficient to pay $60,000 a month on something else. This, then, must be on the franchise value, both inside and outside the city. But the depreciation of the values at the rate of $2 per share a month means $468,000 a month. This, the Mayor said, is because one-third of the franchises expire in February of next year. President Andrews stated, when asked, that the gross earnings this year have been greater than last, but that the operation of the lines at seven tickets for a quarter and some other expenses might make a difference in the dividends that are paid. Mr. Goff said that, reasoning along the line of counting everything down to the lowest ebb, it would probably be impossible to get together on an agreement. He will insist upon fairness.

Speaking of the franchises to be given the old company, Mr. Goff said he would not take a stand on six tickets for a quarter as an ultimatum, but that he would insist upon adequate security in the leasing plan. The Municipal Traction Company, he said, is irresponsible, and it is not the desire that the lease should be forfeited or that the operating company should fail in the accomplishment of its plans. There should be something to secure the return of the property to the company at the expiration of the franchise and this must be something more than faith. Mr. Goff said that, although he did not believe in it himself, he wanted to help on the Mayor's hobby. There has been such a trend toward municipal ownership of street railway companies that it should be well tried out some place.

The speaker said that it is his notion that, with a fair valuation of the assets and franchises, the holding company should be allowed to operate at any fare the grants may name. It is desirable that the city grant the old company a franchise, and the new one as well, that will allow making loans, as it may be that the city will be bonded up to the full limit when rapid transit lines, subways or something else entailing great expense is needed. It is better that the franchise be sufficiently liberal that the companies may take care of themselves in this respect.

The Cleveland Electric Railway Company has secured the aid of William Barclay Parsons, of New York, in fixing the franchise values, and Mr. Parsons was in the Council chamber during the meeting. Mr. Goff insisted upon an expert being employed to inform him on this subject. On nearly every line on which the franchises are claimed to expire in February a portion of it, lying outside the city limits, has several years to run. Although the Mayor has claimed a great reduction in the value of the franchises within the city, he has counted the outlying franchises as worth no more. In fact, Mr. Goff read from one of his addresses an extract where he said that the outlying franchises should be valued at half what those inside the city are worth and that, taking the average time inside and out, franchises on all the lines would expire in 1912.

Mayor Johnson said that the Doan Street franchise was granted on terms that would require the company to carry people at the regular fare and transfer them to any part of the city for seventeen years after the franchises on most other lines have expired. He said he did not know how the company was going to live up to its obligations, and make any money from a business of this kind, if it allows its franchises to expire and does not take up the leasing plan. He intimated that the company would have to live up to its agreement on this street and transfer to the lines of any company that may build them and pay the full fare that company might charge. It is possible, however, that these conditions contemplated that the company transfer to its own lines. That being true, there are some pretty big meshes in the net, although the Mayor talked as if the company had a big load on its shoulders in that time which it built to accommodate people who wanted a cross-town line. The company makes no money from the business it originates.

Mayor Johnson agrees that the security franchise should be broad, but seemingly he could see no necessity of guaranteeing the restoration of the property to the original owners at the expiration of the grant. He says the city can not obligate itself to do that, but that it can make conditions such that the property shall be sold to any company that may receive franchises at the end of that time and that the value shall be arrived at by arbitration. This provision has been made in the franchise of the new companies and the Mayor intimated that it would be insisted upon in the franchise to be granted the Cleveland Electric. He said he would be willing to make the franchise term twenty-five years, and that he would make it

fifty years if that term were legal. Any franchise should allow the company fifteen years to operate after any possible lapse of the lease.

The value of the pavement, he said, is in doubt. The grants require that when the tracks are taken up the company must leave the pavements in good condition. For this reason he doubted whether the company has any real ownership in them. Yet, he said, in the negotiations the cost of pavements have always been considered.

Another meeting Tuesday morning to hear a report or two.

From the standpoint of discussion the street railway meeting Tuesday was interesting. Mayor Johnson, among other things, agreed to accept William Barclay Parsons as an expert to represent Mr. Goff in the franchise question and in other matters that come up from time to time. He did not name a man to represent himself.

City Solicitor Baker said that the Cleveland Electric attorneys have filed with himself and Mr. Tolles, as a committee on franchise expirations, the claims of the company, and he is now engaged in reducing the city's claims to writing. The Mayor suggested that the hearing be open, with himself and Mr. Goff present.

Mayor Johnson and C. H. Clark, representing the Cleveland Electric on the track and pavement valuation committee, had several little tilts over the manner of doing the work. The Mayor accused Mr. Clark at guessing at valuations, especially when he said that the cost per mile of laying track is $2,112, while City Engineer Hoffman, the other member of the committee, said that the cost is $800. He asked Mr. Hoffman to produce his figures. On the other hand, he told Mr. Hoffman that he should increase his price of foundation under the tracks, when he said he had not allowed anything for excavating concrete. Mr. Hoffman had figured the cost at 60 cents a square yard, while Mr. Clark had placed it at a dollar. Mr. Clark also said he had counted the track on the viaduct, to which the Mayor objected, although he admitted that the company had placed the track there in the first place. Mr. Goff suggested that the members of the committee get together and educate each other. Neither of them had a complete report that they had submitted to each other. On the suggestion of Mr. Goff, the Mayor dictated rules which they shall follow in their work.

Mr. Goff again referred to the Mayor's method of valuing franchises in 1905, when he estimated that the outlying franchises were worth half as much as those inside, and that the average date of expiration would be January, 1912. He said he would be willing to negotiate with the Mayor on that basis now, if the directors of the company cannot show why the valuations should not be made in that way. The Mayor said he would not be willing to make a settlement on that basis at this time, because the people expect him to use his best judgment at the very least in this matter. He said that several things have occurred since then to change his views, and that he must now take them as they are. The Mayor said, however, that the outlying lines have a value to the inside lines, since they contribute business to them, which could not be gotten without the extensions outside the city. This is one of the few suggestions of this kind the Mayor has made, but he has spoken of a few that will have a bearish tendency in the settlement.

ITHACA BRANCH MEETING A. I. E. E.

The regular meeting of the Cornell University branch of the A. I. E. E. was held in Sibley College on Friday evening, Dec. 6. An enthusiastic audience of 273 greeted the speaker, W. N. Smith, electric traction engineer of Westinghouse, Church, Kerr & Company. Mr. Smith's paper was the first formal Institute paper presented before the Cornell University branch, and it was entitled "Practical Aspects of Steam Railway Electrification." The speaker dwelt particularly upon the necessity of a study of electrification from all points of view. In the discussion Prof. H. W. Hibbard, head of the railway mechanical engineering department of Cornell University, expressed his appreciation of this kind of treatment of the problem. Professor Hibbard felt that to a certain extent the steam railroad man has been ignored in the electrification problem. He emphasized that there is no antagonism to electrification on the part of steam railroad men, where the conditions seem to warrant its introduction. He did not feel, however, that electrification should be forced upon steam railroads, but rather that it should be adopted as necessary when conditions fully warrant such adoption. The steam railroad man is first and foremost a transportation engineer, regardless of the source of motive power.

Prof. V. Karapetoff discussed the problem from the standpoint of power supply, comparing the steam locomotive to a "power plant on wheels." He also drew attention to the gasoline-electric car as having a bearing upon the subject of the evening. The informal smoker after the meeting was an important feature of the occasion, and was largely attended. Simple refreshments were served by the entertainment committee, and music was supplied by local talent.

NORTH AMERICAN COMPANY EXTENDS ITS FOREIGN HOLDINGS

By the acquisition of the Laclede Power Company and the Edison Electric Illuminating Company, of St. Louis, the North American Company of New York is now in control of all the lighting and power companies and the street railways of St. Louis. The North American Company secured the properties through the Union Electric Light & Power Company, one of its subsidiary concerns. In order to acquire the property the latter company increased its capital stock from $10,000,000 to $18,000,000. At the same time $8,000,000 of new bonds were authorized, bringing the bonded indebtedness of the company from $10,000,000 up to $18,000,000. A director of the North American Company is quoted as stating that the large amount of stocks and bonds of the Union Electric Light & Power Company remaining after the purchases of the newly acquired properties had been provided to take care of future developments. The plants of the Laclede Company will be operated as a branch of the Union Company's business, with E. V. Matlack, president of the Laclede Company, as manager. The Laclede had a franchise, obtained in 1891, which has 30 years to run. It also owned an old franchise of the Edison Illuminating Company, of Carondelet. Under these it maintained a valuable conduit system in the business district, as well as overhead wires. It is said that the contracts of the Laclede with consumers will be carried out by the Union until expiration, when they will be supplanted by contracts on the new Union schedule.

FREIGHT RIGHTS TO THE OLD COLONY

By the action of the Massachusetts Railroad Commission, in granting freight rights to the Old Colony Street Railway in Fall River and the town of West Bridgewater, the company is set free from that check on its trolley freight expansion which these two communities have been able to continue for a period of about two years. In each it was admitted that the new service was desirable, but in each the local authorities chose to impose conditions as to limitations of franchise, restrictions on service and rates, requirements as to rolling stock, which were absurd as compared with those generally applied to this and other companies operating similar service elsewhere in the state. The company now gets its rights through the obstructing communities under the so-called "missing link" law, which allowed it to appeal direct to the railroad commission in case of failure of the local authorities to make a grant within sixty days of the filing of a new petition.

The opening of West Bridgewater will make it possible to start a direct freight service from Brockton to Bridgewater, Middleboro and New Bedford, whereas the company has recently been forced to put this business over a roundabout route via Taunton, involving something approaching a ten-mile detour. Brockton manufacturers and business men supported the company splendidly in presenting this case before the railroad commission, giving testimony indicating that a surprising amount of goods were being shipped out of Brockton through the agency of the new service, and showing that even in a district where railroads form a network, the trolleys can develop new opportunities for local trade.

The company is not yet ready to state what it will do in developing freight routes to and through Fall River, or in negotiating for possible steamboat connections to New York; but since it is already operating trolley freight cars in Brockton, Middleboro, New Bedford, Taunton, and the intervening towns, with connections to Plymouth and Providence, R. I., its entrance into Fall River, the largest manufacturing center in southeastern Massachusetts, and a seaport, is practically the final step in developing its territory outside of Boston. Its rights now cover practically all through routes between important centers, including access to the Boston Elevated trackage at the Boston-Milton boundary.

ACCIDENT RECORD IN NEW YORK

Figures compiled from the reports filed with the Public Service Commission by the street railway and railroad companies show that within the last three months the street cars, elevated, steam and subway trains in the City of New York have killed 155 persons and have seriously injured 500 more. The exact figures compiled from the reports would indicate that there have been between 600 and 700 persons killed every year, and that at least 2000 people have been maimed annually. The figures for November were given out at the offices of the Public Service Commission Wednesday, Dec. 18. The table of serious accidents for the month was as follows:

Killed	45
Fractured skulls	12
Amputated limbs	4
Broken limbs	47
Other serious accidents	135
Total	243

The total record for the month compares unfavorably with that for the two months preceding. The record by months is as follows:

KILLED.

September	63
October	47
November	45
Total	155

FRACTURED SKULLS.

September	11
October	15
November	12
Total	38

AMPUTATED LIMBS.

September	8
October	9
November	4
Total	21

BROKEN LIMBS.

September	39
October	40
November	47
Total	126

OTHER SERIOUS ACCIDENTS.

September	95
October	80
November	135
Total	310

The grand total for each month of all serious accidents is as follows:

September	216
October	191
November	243
Total	650

The total number of accidents reported for the last two months is as follows:

	October.	November.
Collisions	221	160
Struck by cars	791	977
Injured boarding	510	438
Injured alighting	593	465
Employees injured	603	150
Contact with electricity	...	27
Other accidents	1,794	1,820
Total	4,866	4,037

The decrease in the number of persons injured in boarding cars and alighting from them is credited to the change from open to closed cars on the surface lines.

THE SITUATION IN NEW YORK

Chairman Wilcox held a hearing Dec. 12 on the proposal to put the automatic safety devices used on the subway express tracks on the local tracks as well. General Manager Hedley, of the Interborough, was examined. He declared that the installation of the "tripper" on the local tracks would necessitate the cutting down of the service, as trains could not be run so close together as they are at present. He declared, too, that with the automatic devices, motormen would rely too much on outside interference, and would not pay strict enough attention to the rear lights of the train ahead.

The Public Service Commission in the First District has reported to the State Civil Service Commission the appointment of twenty-seven transit inspectors at an annual salary of $1,200.

Gov. Hughes had the members of the Public Service Commissions of both districts compare notes and confer with each other Wednesday afternoon, Dec. 18, and at a dinner at the Executive Mansion in the evening heard the result of the deliberations and made suggestions. While the members of the boards were in session in the afternoon, the Governor was closeted with Theodore P. Shonts, president of the Interborough-Metropolitan Railway Company, for a long conference. Mr. Shonts came, it is believed, at the request of the Governor to give him the corporation's side of the railway problem in New York, and to point out a way to remedy certain abuses which are impossible under the present law. The dinner was over shortly after 10 o'clock, but the Governor held the commissioners at the Executive Mansion until past midnight, talking over the proposed amendments to the law, the application of the statute, and the thrashing out of various complaints and rumors about the application of the law by the two boards.

DISCHARGE IN CASE OF CENTRAL'S ELECTRIC ACCIDENT

The trial of Alfred H. Smith, vice-president and general manager of the New York Central Railroad, for manslaughter in the third degree in connection with the wreck at Woodlawn, on the Harlem division of the railroad, in February last, came to an abrupt end on Dec. 18, when Justice Kellogg announced that there was not enough evidence against the vice-president to warrant sending the case to the jury and directed that body to return a verdict of "not guilty." Justice Kellogg said that the prosecution had failed to show personal negligence by the defendant. The latter had control of 50,000 men, 7000 miles of track and 1500 miles of curve. Of necessity the most that he could do was to provide a general scheme for traffic and the safety of passengers. Justice Kellogg spoke of the frequency with which railroad accidents occur, and advised Mr. Smith to go back to the Central and add to the railroad's present precautions all that he could devise for the protection of the people.

The train which met with the accident was one drawn by the new electric locomotives of the company. A feature of the hearing was the statement of the witnesses who were passengers which placed the speed of the train at anywhere from 60 to 90 miles per hour. Much expert testimony was offered by the company in rebuttal.

AMERICAN MUSEUM OF SAFETY DEVICES

A friend of the American Museum of Safety Devices and Industrial Hygiene has offered a prize of $100 for the best essay on the Economic Waste of Accidents. The committee of award consists of Richard Watson Gilder, George Gilmour and W. H. Tolman.

Prof. F. R. Hutton, past president of the American Society of Mechanical Engineers, is the chairman of the Committee on Admission of Exhibits for the museum, which occupies the entire fifth floor at 231 West Thirty-ninth Street, New York. The museum desires exhibits of devices and processes for safeguarding life and limb in connection with wood-working machinery, railway and marine transportation, mining, agriculture and manufacturing of all kinds. One exhibit already consists of specimens of fifty different kinds of dusts illustrating the occupational diseases; accompanying each is the photograph, a microscopic section of the lungs showing the effect on the worker of coal, iron, brass, steel, wood and other dusts. There are also wax models of lungs and hands illustrating those occupational diseases which attack the bones and skin.

All exhibits accepted by the committee on exhibits will be eligible for the gold medal offered by the "Scientific American" for the best device, exhibited at the museum, for safeguarding life and limb.

THE WESTINGHOUSE AFFAIRS

It is said that within a few days plans will be announced for the rehabilitation of the Westinghouse Electric & Manufacturing Company, which went into the hands of receivers in October. One of the features of the plans of rehabilitation is the proposal for putting the affairs of the company more directly in the hands of the board of directors. The present board of directors is made up as follows: A. N. Brady, G. W. Hebard, E. M. Herr, Brayton Ives, H. H. Westinghouse, George C. Smith, F. H. Taylor, George Westinghouse, T. W. Simeon, W.

D. Uptegraff and W. W. Bumstead. On the financial side the plan is understood to contemplate the issuance of new bonds to the extent of from $25,000,000 to $30,000,000 at an interest rate which will probably be 5 per cent. In addition to this the stockholders will be invited to subscribe to new stock to the extent of some $7,000,000. Of the new bonds a sufficient amount will be reserved to provide for the retirement of the outstanding 5 per cent. debenture certificates, now amounting to over $2,200,000 and due in 1913.

STREET RAILWAY PATENTS

UNITED STATES PATENTS, ISSUED DEC. 3, 1907.

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

872,329. Controller; Arthur T. Crocker, Schenectady, N. Y. App. filed March 3, 1906. Means for effectually locking a reversing controller in such a way that it is unnecessary for the motorman to remove the handle or any other bulky part.

872,369. Brake Cylinder; William K. Rankin, Philadelphia, Pa. App. filed Feb. 11, 1907. The cylinder has an intermediate ported connection member, cross-head guides formed at their outer and opposite ends, and cross-heads thereon having means for brake lever connections.

872,473. Railroad Frog; James B. Strong, Hillburn, N. Y. App. filed March 18, 1907. Relates to the construction of the frog block.

872,477. Rail Joint; William P. Thomson, Philadelphia, Pa. App. filed Feb. 6, 1907. The splice bar has a portion depending below the base of the rail and designed to fit on one side of two adjoining rails and having each half of its length unsymmetrical with reference to a vertical plane equi-distant from the ends of the bar and at right angles to the bar.

872,514. Automatic Train Pipe Coupling; Phillip Hien, Chicago, Ill. App. filed Feb. 26, 1906. Provides an automatic train pipe coupling which will protect from injury the terminal gaskets of the pipes in coupling and uncoupling.

872,515. Automatic Motor Control Apparatus; George H. Hill, Schenectady, N. Y. App. filed May 21, 1906. Means whereby the governing device for controlling the automatic operation of the controller is made flexible so as to automatically adjust itself to meet the requirements of different conditions of load.

872,532. Rail Joint; Andrew Morrison, Pittsburg, Pa. App. filed March 13, 1907. One fish-plate has a depending, hook-shaped portion to engage the free end of the base plate of the other fish-plate.

872,537. Fare Register; John F. Ohmer & Elmer H. Bridenbaugh, Dayton, Ohio. App. filed Aug. 27, 1906. The object of this invention is to dispense with the use of springs in the manufacture of such apparatus.

872,540. Slack-Adjuster for Car Brakes; William G. Price, New Castle, Pa. App. filed Aug. 18, 1906. The invention comprises an automatic turn-buckle located preferably in the bottom brake rod.

872,541. Brake Shoe Hanger; William G. Price, New Castle, Pa. App. filed Aug. 20, 1906. Consists in making the brake hanger bracket adjustable in a horizontal plane, so that it can be adjusted in position both in a direction lengthwise of the axle so as to bring the central line of the hanger in exact line with the center of the brake shoe, no matter what the width of the wheel and the shoe may be, and also adjustable in a direction transversely of the axle so as to compensate for wear on the wheel and preserve the angle of the hanger.

872,563. Control System; George H. Hill, Schenectady, N. Y. App. filed Nov. 27, 1905. Provides means whereby when one or more motors of a system is eliminated from a circuit, the control system shall be changed so as to give the most advantageous operation of the remaining motors.

872,570. Railway Switching and Signaling Apparatus; William Macomber, Buffalo, N. Y. App. filed March 15, 1904. Relates to mechanism of the type adapted to cause alternate actuation of a part by successive closures of a circuit.

872,613. Railway Signaling Apparatus; Frank L. Dodgson & Winthrop K. Howe, Buffalo, N. Y. App. filed Nov. 27, 1905. A train stop device for applying air brakes when an engineer passes a danger signal, or in case of any brake-down in the mechanism, or the cessation of line current.

872,631. Audible Warning-Signal for Railway Crossings; Charles D. Anderson & Ashby G. Stout, Louisville, Ky. App. filed May 27, 1907. Special track plates adjacent to the track rails and engaged by a depending brush carried by the motor trucks.

872,661. Brake Leverage System; George Macloskie, Schenectady, N. Y. App. filed April 25, 1907. Applicable to combined hand and air brakes. Has an equalizing leverage system and operative connections between the piston and shoes independent of the equalizing system.

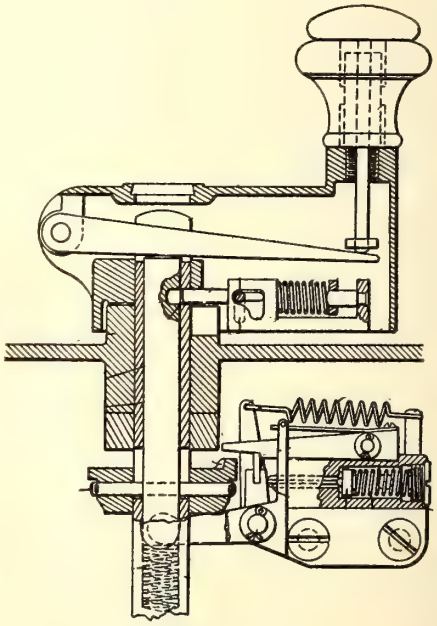
872,674. Safety Guide for Trolley Wheels; Frank J. Nolan, Buffalo, N. Y. App. filed Nov. 26, 1906. An inverted V-shaped hood is mounted over the trolley wire, so that in case the wheel leaves the wire, it may take current from the hood.

872,707. Automatic Connector for Train Pipes; Peter Beahm, Altoona, Pa. App. filed June 29, 1907. Details of an improved coupling device for air-brake, signal and steam pipes.

872,713. Signaling System; Clarence W. Coleman, Westfield, N. J. App. filed June 22, 1906. The signals are actuated by liquified gas. Means for preventing the leakage of the gas to thus increase the number of operations of the signal that can be obtained from a given stored supply of gas.

872,720. Controller Operating Mechanism; Carl Fleming, Norwood, Ohio. App. filed Jan. 31, 1907. A controller for electric motors comprising fixed and movable contacts, means which, when released, tend to move the movable contact to "off" position and two locking devices for said means.

872,798. Signaling System; Clarence W. Coleman, Westfield, N. J. App. filed May 1, 1906. See patent 872,713.



PATENT NO. 872,329

872,802. Trolley; Gustav Ehmann, Canton, Ohio. App filed June 19, 1906. The trolley harp is swiveled on a vertical axis on the pole by a ball-bearing connection.

872,898. Trolley Harp; James L. Chase, Ayer, Mass. App. filed July 18, 1907. The trolley wheel has two peripheral grooves for the reception of the wire. Automatic lubricating means.

872,938. System of Control; George H. Hill, Schenectady, N. Y. App. filed Oct. 31, 1904. A system of motor control adapted for systems embodying a plurality of motors arranged to be grouped in various relations. Means whereby the entire number of motors of the system may be grouped in series and in different ways so as to avoid supplementary resistanct.

872,939. System of Motor Control; George H. Hill, Schenectady, N. Y. App. filed April 7, 1906. Relates to modifications of the above.

872,990. Control Apparatus; Arthur T. Crocker, Schenectady, N. Y. App. filed March 21, 1907. Provides an improved mechanism for operating the emergency air-brake valve and the emergency circuit-breaker when the controller handle is released by the motorman.

872,991. Control Apparatus; Arthur T. Vrocker, Schenectady, N. Y. App. filed Sept. 18, 1907. Provides means for limiting and checking the movement of the controller drum in accordance with circuit requirements by means of electrically operated ratchets and depending devices acting thereon.

STREET RAILWAY PATENTS, ISSUED DEC. 10, 1907.

873,017. Trolley Wire Ear; William G. Carey, Schenectady, N. Y. App. filed Feb. 21, 1907. The trolley wire has a grooved upper edge which is engaged by a pair of depending jaws pinched thereon by a nut.

873,091. Automatic Uncoupling Handle for Vestibule Curtains; Henry M. Robertson, St. Paul, Minn. App. filed Sept. 13, 1907. Relates to guard curtains for use on the vestibules of coaches and provides an automatic uncoupling handle therefor.

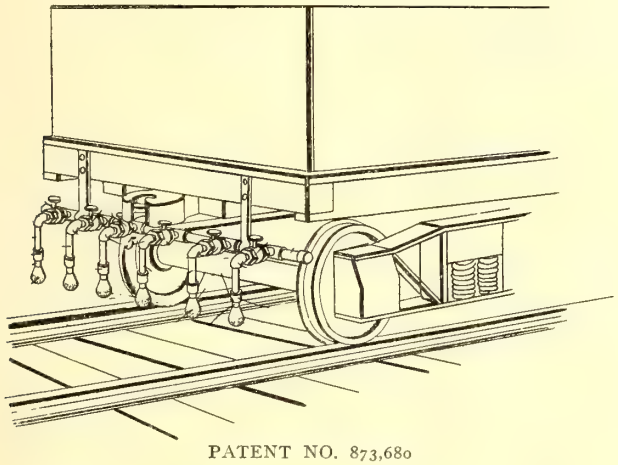
873,101. Regenerative System for Braking; Walter I. Slichter, Schenectady, N. Y. App. filed June 11, 1906. The method of braking electrically in systems embodying a plurality of motors adapted to drive a common load, which consists in operating a portion of the motors as separately excited generators driven by the load and operating other of said motors as generators driven by the load and excited by current generated in the first-named portion of the motors.

873,134. Switch; Milton B. McConnell, Tampa, Fla. App. filed Aug. 9, 1907. Consists of an oscillating member secured to and extending laterally from the pivoted end of the switch point, and means operable by a passing car for actuating said member to effect the movement of the switch point.

873,177. System of Motor Control; William F. Schneider, Norwood, Ohio. App. filed March 25, 1907. Means whereby the same operations of the main controlling switch produce different results at different times. Adapted for use in train service where different speeds must be observed.

873,197. Fender for Street Cars; Morris Wilenski, Chicago, Ill. App. filed Feb. 14, 1907. Consists of jointed side pieces pivotally secured at their rear ends to the car body and provided at their forward ends with a scoop, and means through the platform of the car for lowering the scoop.

873,284. Control System for Electric Motors; Louis M. Adpinwall, Wilkinsburg, Pa. App. filed April 4, 1906. Means dependent upon a predetermined value of electric current flowing



PATENT NO. 873,680

in the motor circuit for retarding the accelerating action. Comprises a single limit switch and may be adjusted at the will of the operator.

873,200. Electric Apparatus; Howard L. Beach, Wilkinsburg, Pa. App. filed March 3, 1906. Produces a step by step movement of an operating device, and automatically returns the aforesaid device to its initial position upon the interruption of a predetermined circuit.

873,298. Electric Motor Control; William Cooper, Wilkinsburg, Pa. App. filed March 3, 1906. Relates to modifications of patent 873,284.

873,377. Blocking and Derailing Device; William J. C. Kenyon and Winfred S. King, Omaha, Neb. App. filed Dec. 7, 1906. A derailing device comprising an inclined part in line with the track, a flange inclined transversely to the track, said flange sloping downward to the track at the end opposite said inclined part, and an inclined ear at the side of said flange.

873,368. Automatic Switch; Francis M. Hall, Potomac, Ill. App. filed Aug. 31, 1907. The switch is closed through the medium of a spring under tension. Means for releasing the spring from an approaching car or train.

873,419. Trolley and Harp Therefor; Samuel F. Estell, Los Angeles, Cal., and Frederick W. G. Phillips, Wilmitte, Ill. App. filed Aug. 8, 1907. The trolley wheel is mounted on its axle by a ball and socket joint so as to be capable of deviating from the normal plane of its rotation.

873,468. Automatic Block Signaling System for Electric Railways; Fitzhugh Townsend, New York, N. Y. App. filed June 29, 1906. A block signal system for electric railways in which a track current is impressed upon each block section and utilized to control translating devices covering the action of the signals.

873,492. Insulating Rail Joint; James H. Brothers, Newark, N. J. App. filed March 22, 1907. Provides a construction serving to increase the bearing area for the insulating material, and decrease the fiber strain, thus enabling the material to better withstand the load imposed.

873,522. Third Rail; Ralph K. Eddowes, Philadelphia, Pa. App. filed Dec. 7, 1906. Consists of an outer body portion supporting the conducting member or members, face downward, and insulated therefrom.

873,570. Amusement Apparatus; William F. Mangels and Charles N. Brewster, New York, N. Y. App. filed July 27, 1907. Comprises an inclined surface having a circuitous route laid out thereon from the upper end of the said inclined surface to the bottom thereof; and a car adapted to travel down the said surface and confined in its travel along the route.

873,587. Rail Magnetic Brake; Victor L. Ochoa, New York, N. Y. App. filed Feb. 23, 1907. A rectangular casing depends from the truck frame and is magnetically wound so as to produce a magnetic pole face adjacent to the track rail.

873,622. Derailer; Martin C. Sloderbeck, Marion, Ind. App. filed Aug. 23, 1907. Comprises a pivoted block having a curved bearing face at its end beyond the pivot thereof, and a bearing block having an oppositely curved face disposed to contact with the bearing face.

873,662. Trolley Head; Gardner P. Copp, Los Angeles, Cal. App. filed March 12, 1906. The harp is pivotally connected to the pole so that it may turn angularly when the car is on a curve.

873,668. Electric Trolley; Albert S. Janin, New York, N. Y. App. filed Aug. 14, 1905. Consists of a toggle lever frame carrying a long roller in place of the usual grooved trolley wheel.

873,680. Spraying Apparatus; John V. Pearse, Owensboro, Ky. App. filed March 13, 1907. Apparatus for spraying plants upon railroad roadbeds with a liquid adapted to destroy the plants.

PERSONAL MENTION

MR. H. S. HOLT, the only Candian director of the Detroit United Railways, has resigned owing to his inability to attend board meetings in Detroit and New York.

MR. C. N. WILSON has resigned as president, general manager and director of the American Engineering Company, of Indianapolis, Ind., his resignation to take effect Jan. 1.

MR. THOMAS J. HURLEY, of Brooklyn, N. Y., is dead, aged sixty years. Mr. Hurley was identified with the development of the Southwest and installed electric street railways in Texas and Arizona.

MR JOHN BLAIR MACAFEE, of Philadelphia, Pa., has been elected vice-president of the Lexington & Interurban Railways Company, of Lexington, Ky., succeeding Mr. Louis des Cognets, who has resigned to devote himself to private business matters. Mr. des Cognets will continue as a director, however.

MR. GEORGE BULLOCK, retired last week as vice-president of the Worcester Consolidated Street Railway, and Mr. L. S. Storrs, of the New England Investment Company, which holds the street railways in Massachusetts controlled by the New York, New Haven & Hartford, succeeds.

MR. WILLIAM SELFRIDGE has been elected president of William Wharton, Jr., & Company, Inc., to succeed the late Mr. William Wharton, Jr. Mr. Selfridge has been connected with the company for many years as director and assistant treasurer, and in the past has given the greater part of his attention to the finances of the company.

MR. FRANK T. SLOANE, who has been connected with the Brooklyn Rapid Transit Company for two years as insurance engineer, has resigned from the company to become connected with the R. M. Bowser Company, of Ft. Wayne, Ind., as special representative. Before becoming connected with the Brooklyn Rapid Transit Company, Mr. Sloane was insurance inspector for the United States Steel Corporation.

MR. GEORGE F. FABER, of Ringold, Ill., has been chosen superintendent of the lines of the Western Ohio Railway Company, to succeed Mr. James K. Gray, who accepted a similar position on the Mansfield-Bucyrus lines of the Cleveland, Southwestern & Columbus some time ago. Mr. Faber has for some time been with the Aurora, Elgin & Chicago and has had an extended and favorable experience in electric railway affairs.

MR. C. N. RYAN has been appointed assistant secretary and assistant treasurer of the Eastern Pennsylvania Railways Company, and its subsidiary railway and lighting companies, with offices at Pottsville, Pa., to succeed Mr. F. B. Lasher, resigned. Mr. Ryan was for three years auditor of the Michigan United Railways Company, and during the past year, has been traveling operating auditor with J. G. White & Company, of New York.

MR. ARTHUR WILLIAMS, general inspector of the New York Edison Company, recently received from the French Government the decoration of "Officier de l'Instruction Publique," for his work in the field of electric lighting and industrial hygiene. In recognition of this honor his colleagues on the board of the American Museum of Safety Devices and other friends entertained him as a guest at a luncheon at the Engineers' Club, of New York, Dec. 18, at which time the insignia was presented by Dr. W. H. Tolman, director of the Museum. Mr. T. Commerford Martin, president of the club, presided, and among the speakers were Dr. Josiah Strong, Dr. W. Tolman, of the Museum of Safety Devices and Industrial Hygiene, and Mr. John W. Lieb, Jr., assistant general manager of the New York Edison Company.

MR. WALTER PERLEY HALL, of Fitchburg, Mass., assistant attorney-general of Massachusetts, has been appointed chairman of the Board of railroad commissioners by Governor Guild, to succeed Hon. James F. Jackson, resigned. The selection of a railroad commissioner has been perhaps the most difficult appointment problem which the Governor has had to solve during his career as chief executive, alike because of the record of Mr. Jackson and the importance of the office. Mr. Hall is about forty years of age, and is a native of Manchester, N. H. He was educated at Brown University and the Harvard Law School. Since January, 1906, he has been assistant attorney-general, and has represented the state in all grade crossing matters, besides being generally familiar with the general railroad situation in the commonwealth. Mr. Hall is not expected to assume his new duties much before Jan. 1. Under the law, the appointment went over until this week for confirmation. Moreover, Mr. Hall's position as assistant attorney-general involved matters from which he could not hastily withdraw without considerable embarrassment to Attorney-General Malone, it is understood. As the matters heretofore pending before the railroad commission will practically all be disposed of by Commissioners White and Bishop, before the issuance of the annual report, at the opening of the year, the intervening time will afford the new chairman an oportunity of attending to matters claiming his personal attention, and he will be able to enter the new work with his older coadjutors at the beginning of the new year.

MR. H. W. CLAPP, of the General Electric Company, has recently resigned from that company to accept a position with the electrical engineering department of the Southern Pacific Railroad Company, and will shortly remove to San Francisco. On Saturday, Dec. 14, a number of his friends in New York tendered him an informal luncheon at the Engineers' Club to express their regret at his departure from this city and to wish him success in his new field. Among those present were Messrs. W. J. Clark, manager of the traction department, General Electric Company; T. Beran, manager New York office, General Electric Company; J. G. Barry, manager railway department, General Electric Company; W. B. Potter, engineer, railway department, General Electric Company; A. R. Whaley, general superintendent, electric zone, New York Central & Hudson River Railroad Company; C. L. Bardo, superintendent, electric zone, New York Central & Hudson River Railroad Company; J. S. Doyle, superintendent car equipment, Interborough Rapid Transit Company; H. N. Latey and F. R. Slater, of Latey & Slater Company; W. H. Sawyer, engineer, Ford, Bacon & Davis; J. R. C. Armstrong, electrical engineer, New York City Railway; Alexander McIver, superintendent equipment, New York City Railway; W. C. Campbell, assistant superintendent equipment, New York City Railway; F. V. Greene, Westinghouse Air Brake Company; A. H. Sisson, St. Louis Car Company; J. G. Buehler, president and treasurer, Columbia Machine Works, New York City; C. S. Hawley, Consolidated Car Heating Company. During the five and a half years he has spent in and about New York, Mr. Clapp has been engaged in some of the most important electric railway propositions as sepcial representative of the railway engineering and construction departments of the General Electric Company. He has given particular attention to the installation and operation of the rolling equipment used in tl electrification of the New York Central Railroad and to tl cars for the Interborough Rapid Transit Company's systen He also equipped the cars for the West Jersey & Seashor Railroad, which it will be remembered was an installation ot peculiar interest, because of the short time in which the contract was executed. Mr. Clapp is a son of Mr. F. Boardman Clapp, managing director of the Melbourne (Australia) Tramway & Omnibus Company, and before coming to America he was for four years superintendent of motive power of the Brisbane Tramways Company, Brisbane, Australia.

WILLIAM THOMSON, Lord Kelvin, died at his home in Glasgow, Scotland, Tuesday evening, Dec. 17. For some months his health had been slowly failing and his friends realized that the end was approaching. He was born in June, 1824, at Belfast, Ireland, and was the son of Dr. James Thomson, a man of remarkable ability and a great mathematician of his day. Lord Kelvin will in the history of science take place with Newton, Liebnitz, Laplace and Helmholtz. In an age of specialists, he was the greatest specialist in innumerable branches of science, but nevertheless his towering intellect escaped the fetters which science in its modern development and exacting specialization imposes upon its devotees. The activities of Lord Kelvin were so great that a mere enumeration of his more important work is only practicable. As a mathematical physicist, he was one of the founders of the science of thermodynamics and the mathematical theory of electricity, and to him more than any other is due the modern development of the ether theory. For the past half century, no great question has arisen in science to which Lord Kelvin did not give heed, and often the world waited upon his opinion as that of a final arbiter. While his fame ages hence will rest upon his purely intellectual achievements, he was perhaps best known to the world at large for his work on the transatlantic cable and the long line of apparatus he devised for scientific and industrial purposes. It was William Thomson's studies showing the scientific practicability of submarine telegraphy that brought the project of laying a transatlantic cable to a commercial stage; and it was his invention of the mirror galvanometer and the syphon recorder that placed the operation of submarine lines on a parity with land lines with respect to practical operation. Lord Kelvin also was chairman of the international committee of engineers appointed to consider the subject of electrical development at Niagara Falls in connection with the Cataract Power Company's plans. Merely to catalogue in part other inventions, we have from him besides laboratory instruments for the absolute measurement of electrical quantities, the line of instruments of laboratory accuracy for industrial use; the ship's binnacle, which in a short time replaced all other forms of the mariner's compass on the ships of the world; the types of sounding apparatus for the assistance of navigation near shore and for sounding the greater depths of the ocean, and the seismograph.



LORD KELVIN.

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Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1907 *to date,* 427,250 *copies, an average of* 8,216 *copies per week.*

The New Standard Classification of Accounts

The conference held at the rooms of the Interstate Commerce Commission last week to discuss the standard classification of accounts for electric railway companies was one of the most important events of the year in the street railway industry. This fact was evinced by the attendance at the meeting of the chief executive and accounting officers, and in many cases of both of these officers, of electric railway companies representing a capitalization of about $2,000,000,000. In fact, it is to be doubted whether there has ever been a meeting at which the executive and financial officers of the most important street railway interests of the country have been so generally represented, the annual conventions of the American Street and Interurban Railway Association not excepted. It is not surprising, however, that there should have been such an attendance, because any important alteration in the standard classification of operating accounts for electric railway companies carries with it far-reaching consequences. The present system has been in general use for some eight years, so that practically all existing financial records, statistics and blanks of the street railway companies of the country are based upon it. A change in the classification, therefore, if radical, involves not only considerable expense and confusion in the accounting offices of the companies themselves while the new plan is being put into force, but also precludes satisfactory comparisons with previous years until sufficient time has elapsed so that new records and criteria can be established. Concurrently, it involves the destruction in large part of the value of the data compiled during the last eight years by the companies and by the Census Bureau and other statistical departments of the National and State Governments.

To some it may seem surprising that so much importance should be attached to the adoption of a standard classification of accounts by the Interstate Commerce Commission, because comparatively few electric railway companies conduct an interstate business, and no others are under its jurisdiction. The explanation is found, however, in the close relation of the Interstate Commerce Commission with the State commissions, and the expressed intention of at least some of the latter to adopt the classification promulgated by the Interstate Commerce Commission. Members of several of these State commissions were in attendance at the Washington meetings and took part in the discussions, so that the conference was recognized as possessing an importance greater than if confined to a national department only.

Meetings were held in Washington, Tuesday and Wednesday of last week, and, as readers of this paper know, a decision was reached, due to the wishes of the Interstate Commerce Commission, to adopt an entirely new classification of street railway accounts, patterned largely upon the existing steam railroad classification. The extent to which this correspondence will be followed in the tentative form of report, to be submitted for criticism to the street railway companies by the national authorities, will not be wholly known until the official circular is made public. It is understood, however, that schedule "B," of the sub-committee, published last week and which is to serve as a model, will not be followed verbatim, but that many of the suggestions in regard to changes in the accounts, made at the meeting, will be acted upon by the Commission. It

should also be clearly understood that even this classification is tentative and is subject to change in detail after a canvass by the Commission of the opinions of the electric railway companies on the subject. We assume, however, that these changes will not materially alter the proposed plan of the Commission to retain, so far as possible, a general conformance of the new classification to the standard steam classification and a practical abandonment of the existing classification.

It is somewhat difficult to understand the paramount advantages of providing for electric railway companies an accounting system whose principal merit is that it is patterned after that used on steam railroads. The operating methods in the two systems of transportation are so different it would seem that similarity in accounts could be secured only by a sacrifice of convenience and the logical arrangement of many of the accounts. One has only to compare the operating methods of the electrical zone of the New York Central Railroad and of the New York City Railway to realize how widely the methods necessary in one class of road differ from those requisite with the other. Hardly any features of the organization of the transportation departments of the two companies are the same, yet both operate with the same motive power in the same territory, and the New York City Railway Company is one of the largest of the electrical roads, while the electrical division of the New York Central Railroad is devoted largely to a passenger business. We assume, however, that all of these points were given very careful consideration and that the advantages of a change are firmly believed, by those who had the matter in charge, to outweigh all of the manifest and very serious disadvantages. Heretofore the only thought in preparing a classification of accounts for electric railways has been to adopt a system which was best suited for the requirements. In the Washington schedule a new element or factor was made paramount, viz.: similarity to the steam classification—the suitability to the actual requirements of the case coming second. There is no intenhere to criticise the decision. The facts are mentioned simply to indicate the tremendous responsibility which now rests upon those who insisted upon the change, to be sure that the future gain will be large enough to recompense both the public and the companies for the loss which each will sustain by the abandonment of the present system.

This course having been decided upon, the next step will be the publication by the Commission of its proposed tentative schedule and the submission of this schedule to the railway companies for their suggestions and criticisms. It is the duty of every company which receives a copy to scrutinize the classification very carefully and to make any suggestions in regard to it which may be of value to the joint committee in charge of the revision. The proper course to pursue is for each company to apply the classification frankly and honestly to its own business, and to endeavor to determine how the schedule can be used in the practical operation of its own road. In fact, it is for this purpose that the classification will be sent to the companies. They should welcome the opportunity of passing upon it, before its final adoption. A careful and complete examination of its application to the conditions of each company and a fair and unbiased statement of the results are also due the Interstate Commerce Commission, as well as the American Street and Interurban Railway Association, which is represented on the revision committee. No matter how conscientious, able and representative the latter may be, its members cannot be expected to keep in touch with all of the conditions as they exist in every part of the United States, so that this co-operation on the part of every company is necessary to secure the best results.

One important decision made at the meeting last week was that two classifications would be adopted, one for the smaller roads, the other for the larger companies. The line of demarcation was not announced at the meeting, but during the discussion it developed that it would be fixed by the gross receipts per annum, and that the line would probably be drawn somewhere between $50,000 per annum and $300,000 per annum. The companies earning more than this amount are to use the amplified schedule, or that containing about 116 accounts, while those whose receipts are below the limit would use the abbreviated classification containing about twenty-one accounts. The present classification, it will be remembered, contains thirty-nine standard accounts, slightly more than the shorter schedule, but vastly less than the amplified schedule.

Whatever limit is adopted, we trust that it will be made reasonably high, certainly not less than the higher figure mentioned above. It is difficult to imagine what good will be accomplished by compelling a company with receipts of less than $300,000 per annum to keep 116 main accounts. The organization upon a road of this character is necessarily small. Many officers fill several offices and a considerable portion of the charges in the practical operation of the road apply to a number of departments. If, then, an attempt was made by such a company to maintain a classification of 116 accounts the figures would have to contain so many estimations as to make the statistics almost valueless. At the same time the cost of keeping these additional accounts, in extra clerk hire, would amount to at least, say, $1,000 or $2,000 per annum per road. As we assume that any statistics compiled from these reports by the Interstate Commerce Commission or any of the State commissions are for the benefit of the public, it seems doubtful whether they would be close enough to the exact facts to warrant this additional expense, the aggregate of which, if multiplied by the large number of small companies, would be very great.

The selection of the limit should not be made to depend upon the number of railway companies under the limit considered. The actual needs of the companies themselves should govern, and the limit should not be set as low as to include any considerable number of the companies which have no practical use for 116 accounts. Indeed, it is a question whether three classifications would not be more desirable than two. At present there is such a wide difference between twenty-one and 116 accounts that it is easy to understand how a company might profitably employ more than twenty-one accounts, but to whom the maintenance of more than a hundred would be an unnecessary hardship.

So long as the final form before publication of tentative classification "B" was not announced at the meeting, we trust that the committee of the Interstate Commerce Commission, which has the matter in charge, will consider the

final draft very carefully so far as radical variations from existing practice are concerned, and will endeavor to avoid such changes where they are not absolutely necessary to carry out the policy announced at Washington. The circular accompanying this tentative classification should then be so worded as to explain very fully, for the benefit of those companies which were not represented at the meeting, the object in making the electric railway classification like the steam, and the advantages to be derived therefrom, so that all of the companies will understand the situation. Finally, when the replies are received and the time for definite action arrives, we trust that the Commission will allow nothing to interfere with the adoption of a classification, which, independent of its general form, will be logical in arrangement, and which can be used by the companies and understood by others.

Caring for Fire Apparatus and Fire Drills in the Shop

Too many master mechanics regard fires as possibilities so very remote that they give no attention whatever to preparation for them. Insurance regulations have resulted in the installation of fire-fighting apparatus in most shops and car houses, but this apparatus is almost useless unless the men are trained how to handle it and unless some attention is given to keeping it in order.

Some master mechanics, however, have about all they can do to maintain the car equipment in good shape, and when there is considerable pressure from above to keep down expenses, they frequently do not feel justified in taking the men away from their regular work in order to fight an imaginary fire or to have a man devote a few hours every month to the care of the fire-fighting apparatus. Such a master mechanic, however, does not fully appreciate the responsibility of his position. The insurance rate on car houses and shops has been placed high because of this lack of appreciation. On no other portion of the system is there so much danger from fires or so much property exposed to danger. He should regard it just as much his duty to protect the car equipment as to maintain it. Not to take proper precautions is gambling with the odds against him.

That the fire-fighting apparatus in shops is not always kept in order may readily be determined by an inspection. One may find the hose detached from the risers or possibly the hose will be found in a tangled-up mass on the floor. Again, because of its age or because of improper care, it is rotten and ready to burst at the least pressure. Extinguishers, too, may be empty as the result of falling from their supports or hooks, or because of not being filled after being used for putting out fires under the cars, due to overheated rheostats. Occasionally water for washing cars or for general purposes is obtained from fire hydrants outside the buildings. In such cases there is possibility of the hydrants being frozen up. The room in which the hose cart is kept is sometimes regarded as a general catch-all, with the result that the cart cannot be pulled out until a quantity of miscellaneous materials is removed.

About the only way to keep the apparatus in condition is to delegate the task to one man and hold him responsible, and this man should be allowed a proper amount of time to do his work. It would be well, probably, for the same man to see that the hose is properly drained and dried after it has been used. The life of a hose is shortened materially by its return to the racks or reels with water in it.

Even with the apparatus in good shape, untrained men will be very slow in handling it in an emergency. Proper organization of the men into fire-fighting squads and frequent drills are almost as necessary as the apparatus itself. One of the first things to provide is a gong or whistle and definite signals to indicate fire and its location. After the men have been organized, periodic fire drills, possibly once in two weeks or once a month, should be given. It is, to be sure, a great deal of trouble to dry the hose, but occasionally water should actually be thrown on a building, notwithstanding this trouble.

A shop may, of course, continue in operation for years without experiencing a fire, but it should be remembered that at any time the occasion may come, when the master mechanic who is prepared for fires will feel truly grateful for past precautions; and, moreover, it should be a relief at all times to those responsible to feel that they were prepared.

Ventilation of Sub-Stations.

To reduce the transmission of noise to surrounding buildings, sub-stations in cities are sometimes designed with a minimum of openings in their side walls and openings in the roof are provided for ventilation. Where this has to be done the designer of the sub-station should see that the roof ventilators are of liberal area and inlets of some kind for fresh air should be arranged in the lower portion of the building. The designer should also remember that a great deal of heat is generated in the transformers, rotary converters and other apparatus, and that the system of ventilation should provide for the dissipation of this heat. If this precaution is neglected the temperature in the sub-station may easily rise 20 or 25 degrees above that of the outside air. In summer this means a tired and wornout operator, who is likely to give half his attention to worrying about the heat and the lack of interest shown by the company for the comfort of its men. In addition, the excessive heat decreases the efficiency of the apparatus to some extent and also increases the danger of burn-outs.

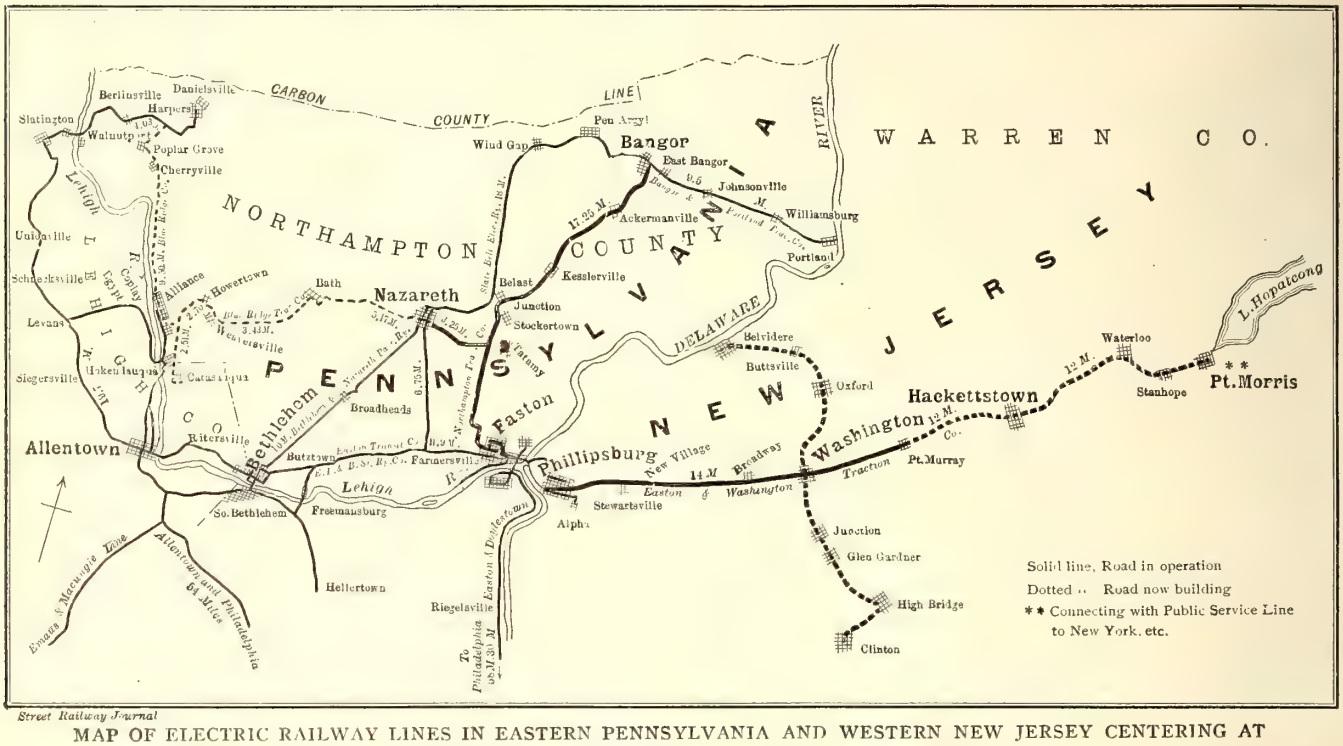
There has been considerable discussion regarding whether air blast transformers should be supplied with air from inside or outside the building. Where the building is not properly ventilated certainly the temperature should not be increased by keeping all the heat given off by the transformers in the building, and if there is no particular reason for doing otherwise the air should certainly be brought from outside the building. Where this is done warm air is, of course, pushed out.

In one city sub-station orginally built without proper ventilation, the opening of two windows afterwards provided in the side wall, caused a drop in the temperature of the building of 10 degrees in as many minutes, and these new windows, together with provisions for drawing the air for the transformers from the outside of the building, resulted in a comfortable temperature where there had previously been one which was almost suffocating during warm days in summer.

THE EASTON & WASHINGTON TRACTION COMPANY

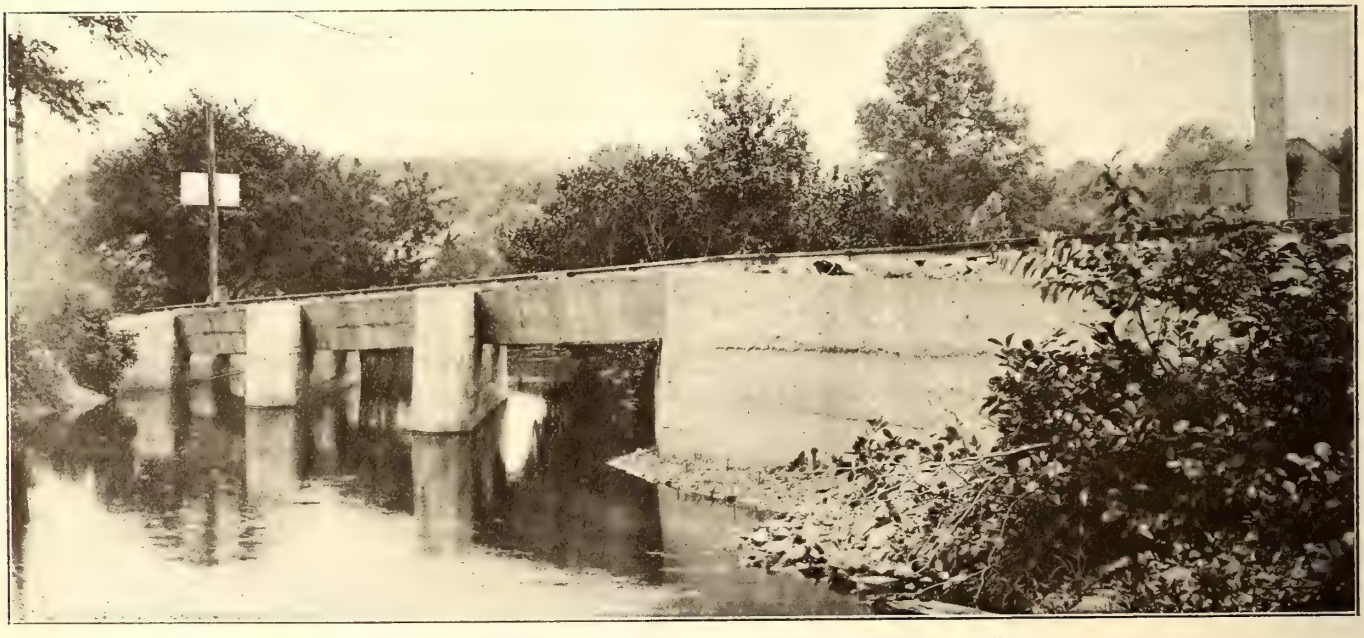
On account of its great mineral and agricultural wealth the portion of the valley of the Delaware River formed by eastern Pennsylvania and western New Jersey has long been thickly settled, and consequently has proved a fruitful field for both steam and electric railways. The electric railways already built or under construction in this territory are well shown in the accompanying map, from which it will be seen that while the section on the Pennsylvania side of the Delaware River, near Easton, is well supplied with electric railways, only one line runs due east from the city mentioned. This is the Easton & Washington Traction Company's railway now in operation from Phillipsburg, directly opposite Easton, to Port Murray. Eventually it will be extended to Lake Hopatcong and thus will secure a heavy through pleasure traffic to this celebrated resort in addition to the regular local patronage. At Lake Hopatcong connection will be made with the lines of the Morris County Traction Company, and as the latter in turn meet those of the Public Service Corporation at four points in Western New Jersey, several new trolley routes will be formed through the most attractive sections of New Jersey.

Although called the Easton & Washington Traction Company, the actual western terminus of the system is in Phillipsburg, N. J., which is separated from Easton by the Delaware River. The latter, at this place, is only a few hundred feet wide, and since it is spanned by several bridges, the two towns form practically a single community with a population of practically 100,000. Hitherto the only way to reach these cities from the east-lying towns nearby was by way of the Delaware, Lackawanna &



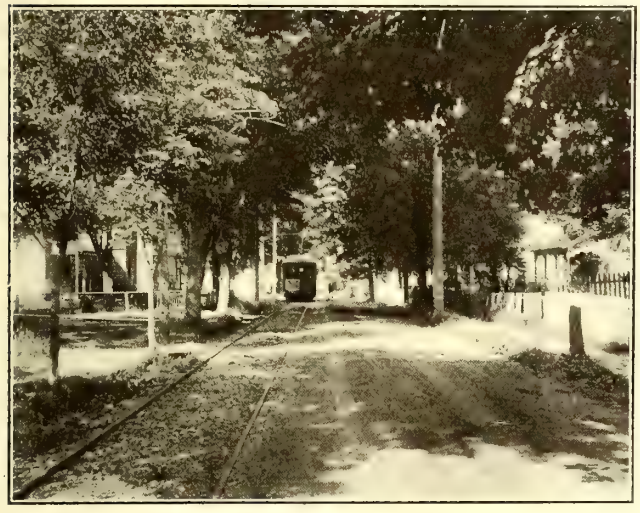
Street Railway Journal

MAP OF ELECTRIC RAILWAY LINES IN EASTERN PENNSYLVANIA AND WESTERN NEW JERSEY CENTERING AT EASTON, PA.



CONCRETE CROSSING OVER TAIL RACE FROM CANAL PLANE

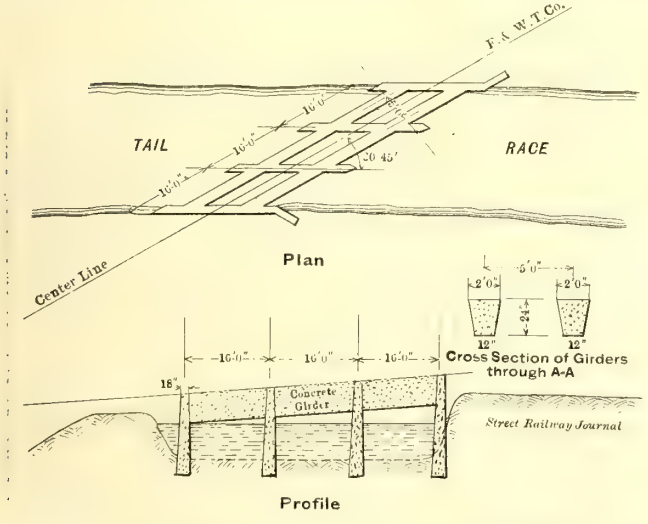
Western Railroad, but the latter, on account of its heavy freight business, could give the local passenger traffic little attention, and, in fact, encouraged the building of the electric railway. Between Washington and Phillipsburg there were only four trains a day, making the run in thirty-eight minutes, for which a charge of 60 cents per round trip was made; the same district now has an hourly electric service for 50 cents per round trip, and the running time, while four minutes more, actually works out less for most



RUNNING ON THE PUBLIC HIGHWAY ON BROADWAY, N. J.

of the riders, as the car brings them nearer their homes. The hourly service was maintained during the first year of operation (October, 1906, to October, 1907) with only two cars, which earned over $50,000; October, 1907, showed an increase of 20 per cent over the same month of 1906.

The greater part of the line is on right-of-way 40 ft. to 60 ft. wide, to permit a second track eventually. While



CONCRETE CROSSING OVER TAIL RACE OF MORRIS CANAL

there are not more than three or four villages between Phillipsburg and Washington, their population has increased quickly since the opening of the electric railway. For instance, at Stewartsville, which is only sixteen minutes from Easton, a large suburban population has been built up along the electric railway at quite a distance from the old village, which is near the steam railroad station. Washington is a community of some 10,000 people in a radius of two to three miles, many of whom are skilled employees of the local piano and organ factories and iron works, and prosperous enough to have their own dwellings. The district beyond this town is less thickly settled, but should be profitable on account of the Lake Hopatcong connection. Another source of traffic will be the ex-

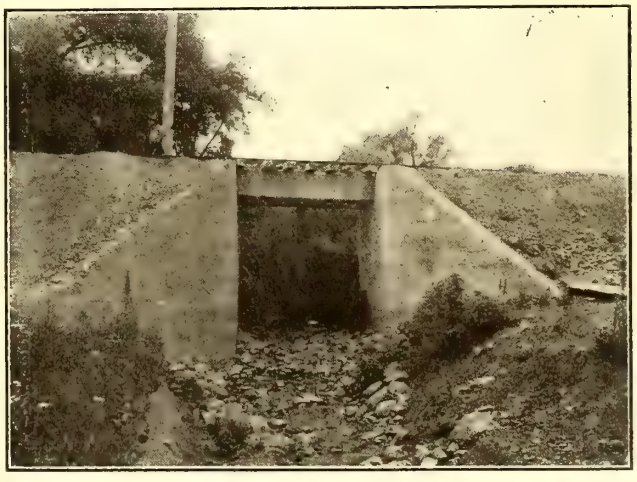


PHILLIPSBURG, N. J., TERMINUS OF THE EASTON & WASHINGTON TRACTION COMPANY

ploitation of a park near Washington, termed Silver Springs Forest.

ROADWAY AND TRACK

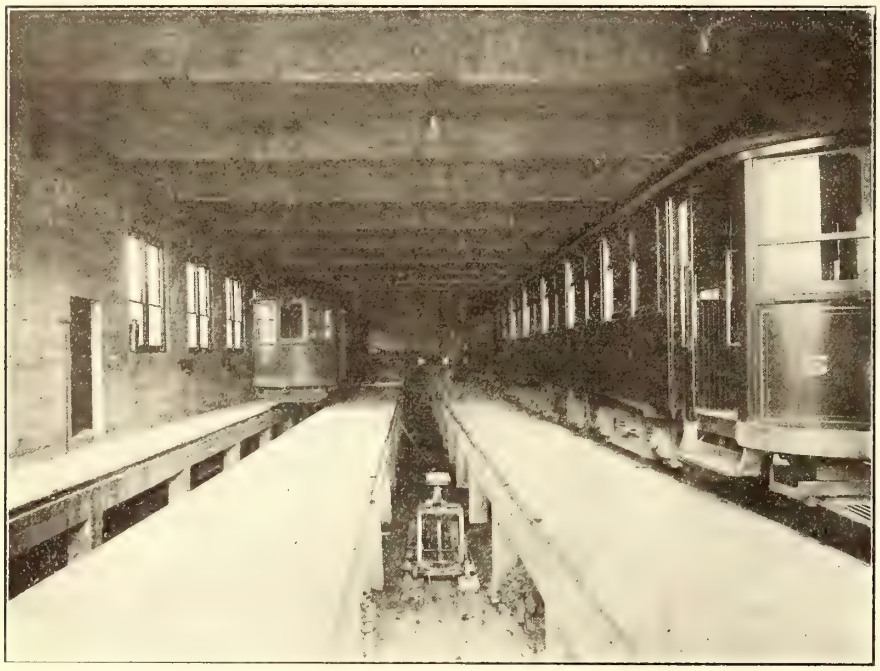
A very striking feature of the line is the extensive use of concrete for bridges, culverts, crossings, etc., so that the maintenance of roadway structures will be practically nil. The older part of the line has some steel work, but con-



BRIDGE WITH CONCRETE ABUTMENTS OVER STREAM TAKING CARE OF OVERFLOW FROM COOLING POND AT PORT COLDEN

crete is being used exclusively for all the later construction. The company is favorably situated in this respect, as it operates in the heart of a cement district and rock is also plentiful. Several specimens of concrete work are shown in accompanying illustrations, notably the crossing over the tail race from the Morris Canal plane, abutment work and a standard arch. From the drawing of the crossing over the tail race, it will be seen that the structure is 48 ft. long and consists of three 16-ft. spans. The track girders are of

rhomb section 2 ft. wide at the top, 2 ft. thick and 1 ft. wide at the bottom. The piers are 18 ins. wide at the top and 36 ins. at the bottom. The company also has built a concrete retaining wall at one place where it runs close to the bank of the Morris Canal. The cement for all of this concrete work, as well as for other portions of the line, was furnished by the Edison Portland Cement Company, of Easton, Pa., whose extensive plant, the third largest in the United States, is alongside the line of this company.



CONCRETE CAR HOUSE INTERIOR, SHOWING GENERAL LAYOUT AND THE OPEN PITS BEFORE COMPLETION

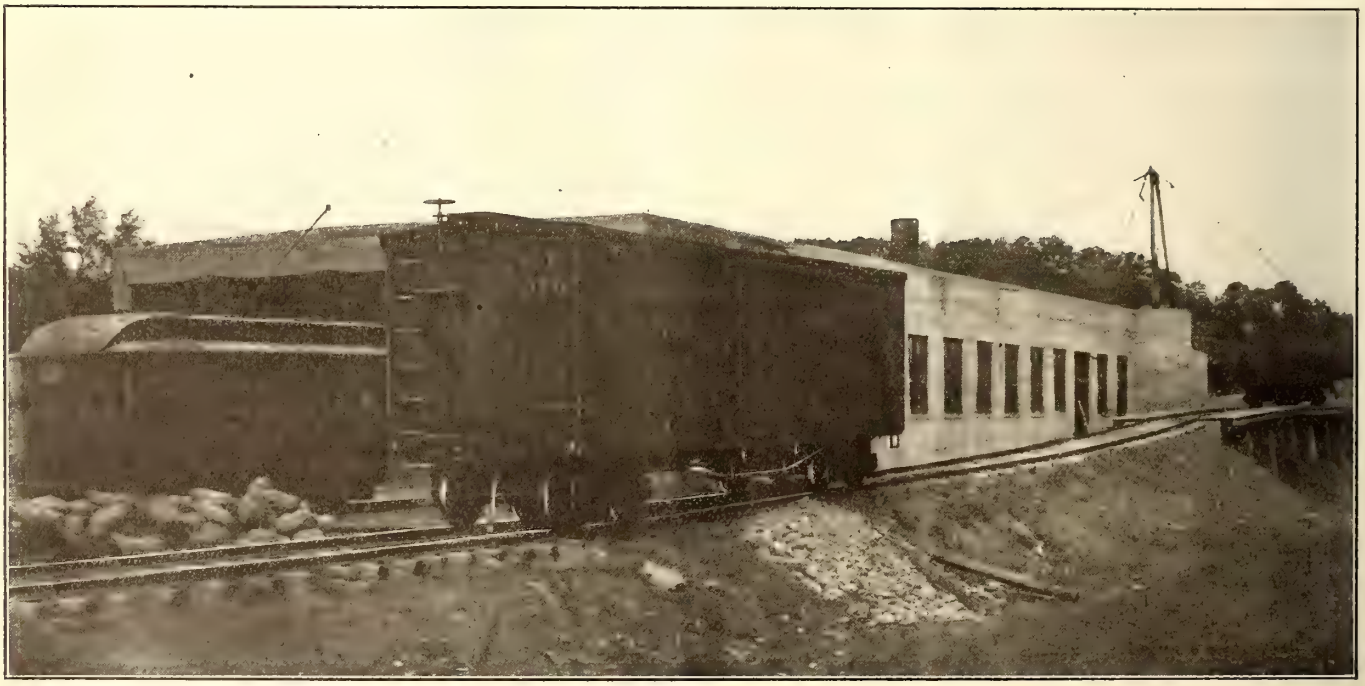
The track used throughout is a 74-lb. T, laid on 8 ft. x 6 in. x 6 in. ties, spaced 2 ft. centers. Both crushed native sandstone and cinders, laid 6 ins. under the ties, are used for ballast. The cinder ballast has been found quite satisfactory, as it gives springiness to the track and is self-tamping. Weber joints and Roebling soldered bonds are used throughout.

OVERHEAD CONSTRUCTION

Most of the overhead construction is of the bracket type, on poles spaced 120 ft. No. 00 is the standard size for the trolley wire. The two feeders are of 331,000 circ. mil aluminum; one of these is carried all the way between the power station at Port Colden and Phillipsburg, while the second is carried to within a mile of Phillipsburg. Woolley lightning arresters, placed four to the mile, protect the feeder circuits.

UTILITIES BUILDING AND POWER SUPPLY

At Port Colden, which is about a mile east of Washington, the company has erected a reinforced concrete fireproof structure which contains a power station, car storage, repair shop and offices. The general appearance of this building will be noted from the accompanying illustrations. Its total length is 193 ft. 10½ ins. The longest roof girders, which are reinforced with steel rods, have a clear span of 49 ft. 4 ins., and are spaced about 10 ft. centers. The roof of the car house section is solid, but a monitor is provided for the section containing the boiler plant.



VIEW OF THE CONCRETE UTILITIES BUILDING FROM THE FRONT WITH CONCRETE TRESTLE ON THE RIGHT

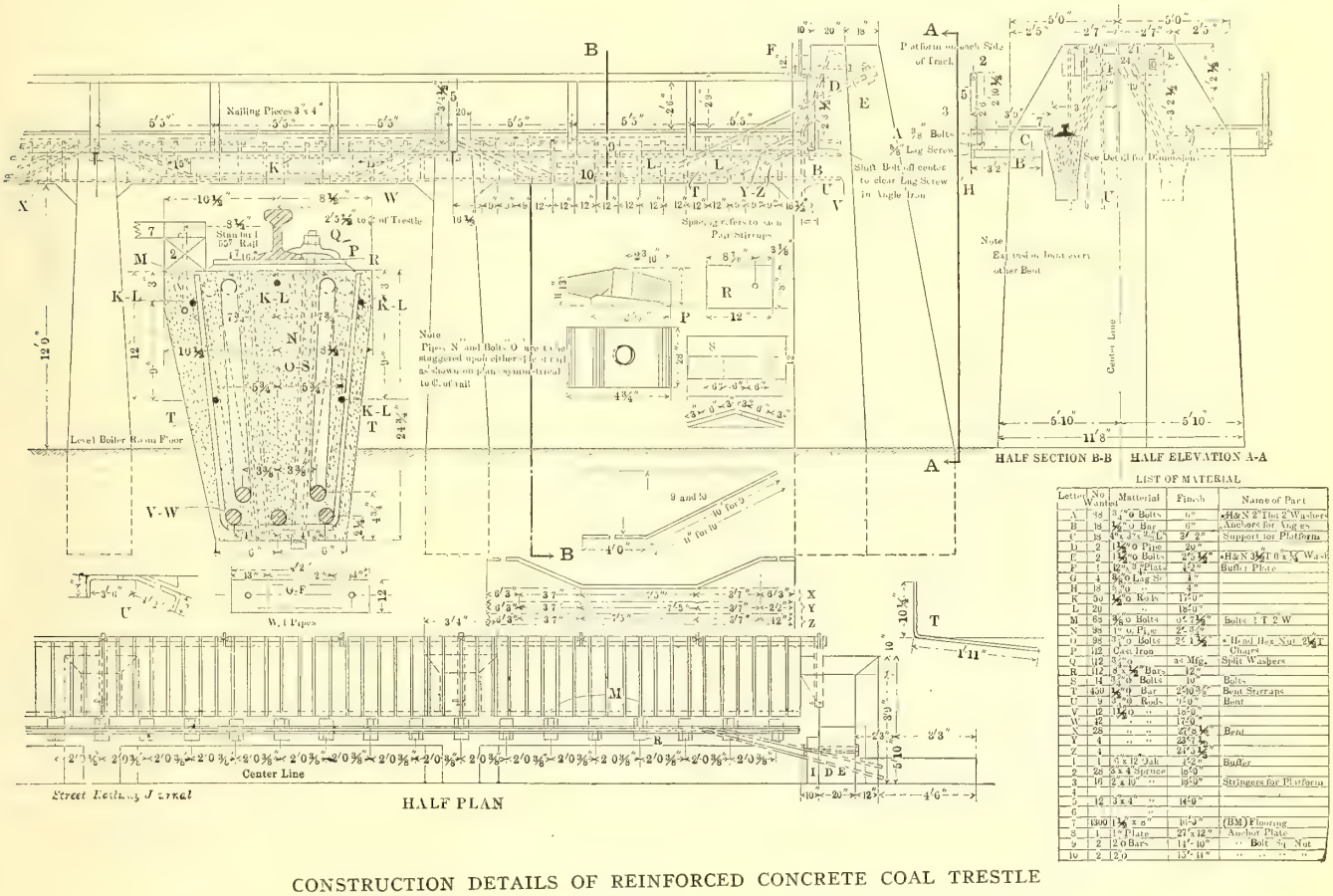
The boiler room, which is at the rear, is 41 ft. 3 ins. long, 51 ft. 10 ins. wide, and 7 ft. below the engine room. The latter measures 40 ft. x 47 ft. Separate entrances are provided for both boiler and engine rooms, and also to the extension, which serves as a pump and heater room.

The boiler room contains two B. & W. boilers, totaling 533 horse-power, and two 200-hp boilers supplied by the Atlas Engine Works, of Indianapolis. The coal is a low-grade rice

burned with the aid of mechanical draft supplied by an American Blower Company outfit. Each set of boilers is connected to a separate stack; the later one (shown under construction) is carried in concrete to the roof level. The generating equipment consists of two McIntosh & Seymour horizontal engines fitted with Richardson sight-feed oil pumps, and direct-connected to two G. E. 325-kw, 550-volt d. c. machines. Other features of the plant are the use of Bulkley injector condensers and Berriman closed feed-water heaters.

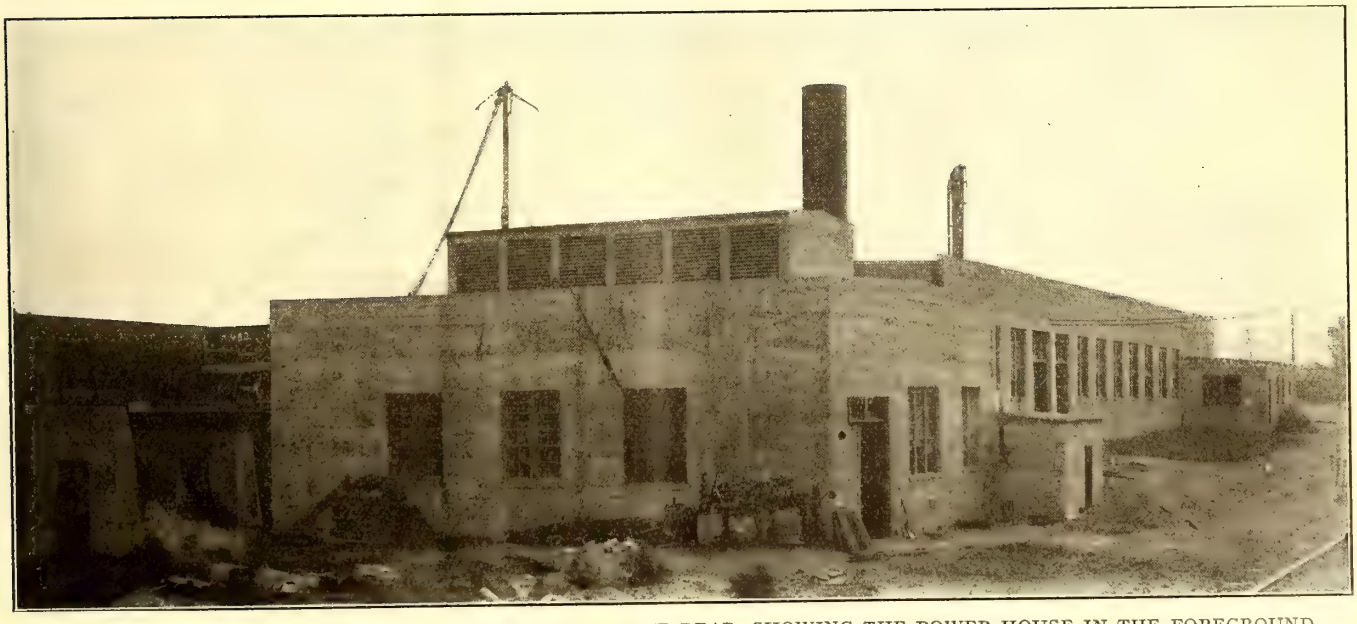
The water supply is secured from an adjacent pond made by damming a spring. The water flows through four sets of filters, the last one of which is placed in a concrete well outside the power house and is so arranged that the water from the pond must rise 3 ft. above the water level of the other compartment before it can reach the feed-water piping. This arrangement greatly reduces the likelihood of heavy detritus being carried over after a freshet.

The water returned from the hot well is passed to an outside concrete tank fitted with staggered compartments. As the water passes through the hollowed terra-cotta bricks at the bottom the oil which rises is skimmed off. By the



Letter	No. Wanted	Material	Finish	Name of Part
A	98	1" ⌀ Bolts	6"	*H&N 2" Tog 2 Washers
B	18	⅝" ⌀ Bar	11"	Anchors for Angles
C	18	4" x 3" x ⅜" L	3' 2"	Support for Platform
D	2	1½" ⌀ Pipe	20"	
E	2	1½" ⌀ Bolts	2'6"	*H&N 3½" ⌀ 0" x ¾" Wash
F	1	½" x 8" Plate	4'2"	Buffer Plate
G	4	⅝" ⌀ Lag Sc	4"	
H	18	⅝" ⌀ "	4"	
K	50	⅝" ⌀ Rods	12'0"	
L	20	" "	18'0"	
M	68	⅜" ⌀ Bolts	0'7½"	Bolts T T2 W
N	98	1" ⌀ Pipe	2'3"	
O	98	⅞" ⌀ Bolts	2'1½"	*Head Box Nut 3½" Cluevs
P	12	Cast Iron		
Q	12	⅝" ⌀	as Mfg.	Split Washers
R	12	⅜" x ½" Bars	12"	
S	18	⅜" ⌀ Bolts	10"	Bolts
T	100	⅜" ⌀ Bar	2'0⅜"	Bent Stirrups
U	9	⅝" ⌀ Rods	11'0"	Bent
V	12	1½" ⌀ "	18'0"	
W	12	" "	12'0"	
X	28	" "	27'8½"	Bent
Y	4	" "	23'1½"	
Z	4	" "	24'2⅝"	
1	1	½" x 12" Oak	12'2"	Buffer
2	28	3" x 4" Spruce	16'0"	
3	16	2" x 10" "	18'0"	Stringers for Platform
4		"		
5	12	3" x 4" "	14'0"	
6		"		
7	1300	1" x 6" "	16'2"	(BM) Flooring
8	1	1" Plate	2'5" x 12"	Anchor Plate
9	2	2 0 Bars	14'-10"	" Bolt " Not
10	2	2 0	13'-11"	" " " "

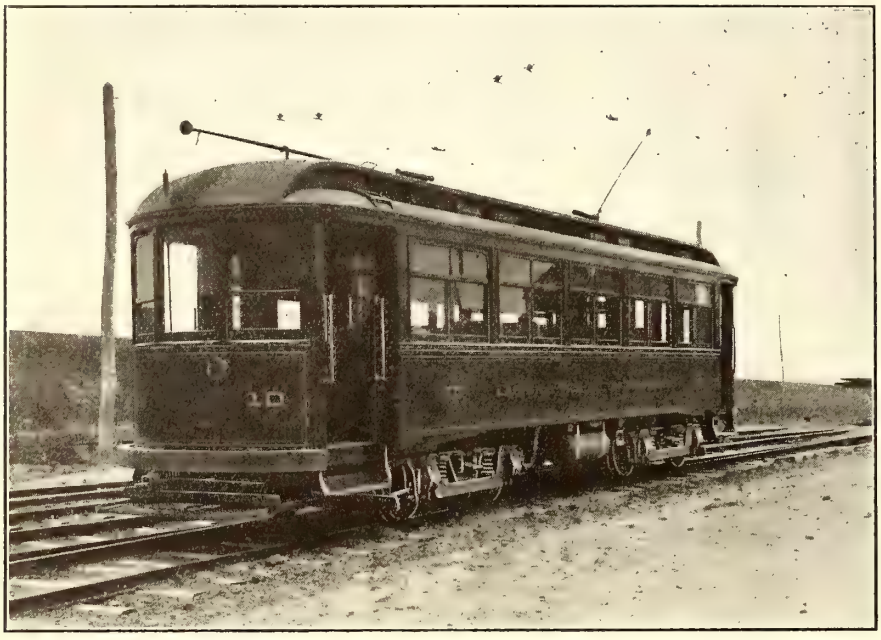
CONSTRUCTION DETAILS OF REINFORCED CONCRETE COAL TRESTLE



VIEW OF THE GENERAL UTILITIES BUILDING FROM THE REAR, SHOWING THE POWER HOUSE IN THE FOREGROUND AND END OF THE CONCRETE COAL TRESTLE

time the last compartment is reached the water is clean enough to be returned to the pond if needed. The oil thus secured is used for track grease.

Reference to the views of the utilities building will reveal the unique reinforced concrete coal trestle built alongside the power plant. This trestle is strong enough to carry four loaded hopper-bottom coal cars of standard size at one time, and covers enough ground to permit the storage of a year's supply of coal. In view of the novel character of the trestle and the care given to its design, the working drawing and list of material are reproduced in full. The



STANDARD CLOSED CAR OF THE EASTON & WASHINGTON TRACTION COMPANY

trestle was designed by Beadle & Maxwell, engineers, of Easton and New York.

CAR STORAGE

The front section of the utilities building, occupying a space of 49 ft. 4 ins. wide and a length of 110 ft, is taken



CONCRETE ARCH UNDER PARTIALLY COMPLETED ROADBED

up by four tracks, each furnished with an open-type pit for its entire length. The walks, which are of concrete reinforced with old rails, are 6 ft. 6 ins. wide and are carried on concrete piers. In the rear of the pits a space of 9 ft. 6 ins. is reserved for repair work.

The pits are heated by steam pipes carried under the walks. The pit drainage required particular attention as the soil in this territory is full of springs. Hence, in addition to the ordinary drains, the bottom of each pit is laid with terra-cotta drain tile under the concrete, so that water will not well through.

ROLLING STOCK AND SCHEDULE

The total rolling stock comprises five 18-ton double-truck closed cars, 42 ft. over all, of the type shown in an accompanying illustration; one single-truck car and one plow. All of these were furnished by the Wason Manufacturing Company, of Springfield, Mass. The double-truck cars are equipped with G. E. 80 motors, K 28 B controllers, National air brakes, Wilson trolley catchers and G. E. lightning arresters, Imperial headlights and Wheeler rattan seats. The single-truck car and plow are operated with two G. E. 57 motors each.

At present, only two of the double-truck cars are required to maintain the hourly schedule over the 18 miles operated in fifty-five minutes. There are four turn-outs between Phillipsburg and Port Murray, which make it possible to give a half-hour service with four cars. The carrying capacity can be further increased by running two-car trains or adopting the "following car" system when business is exceptionally heavy. The latter method would be quite practicable on this system, as there is little woodland along the line to conceal the car ahead, and but few grades or curves. The company is to install a telephone despatching system and probably will use one of the methods permitting telephoning from the car.

CAR ADVERTISING

Instead of looking for the patronage of the great national advertisers, the Easton & Washington Traction Company has made it a point to secure its car advertising at home, especially in Easton, which is the shopping center of this district. Owing to personal familiarity with the local trade, the management was able to prepare a list of the best merchants in the town, who were then successfully solicited. The charge for the insertion of a card 11 ins. x 21 ins. is

Easton, Pa._____ 190__

Easton and Washington Traction Co.:

We hereby authorize you to insert our advertising card, size 11x21 inches, in each of the cars of the EASTON AND WASHINGTON TRACTION CO. for the term of twelve months, commencing_____ Cards to be furnished by_____

In consideration of the above service, we agree to pay you the sum of_____ Dollars, ($_____) per month payable at the end of each month during said term.

If any cash installment provided for herein, is due and unpaid for in ten days, this contract may be terminated at your option.

REMARKS:_____

Name_____

Accepted_____ Address_____

CAR ADVERTISING CONTRACT FORM, 8½ INS. X 6½ INS.

$3 per month for five cars, covering two cars in winter and four or five cars in summer. The cards are furnished by the company and are changed four times a year without charge. Accounts are payable monthly. The gross earnings from this source for the first year were $1,200, of which $1,100 was net profit. The cost of getting the business was practically nothing.

GENERAL

In addition to the extension to Lake Hopatcong, the company is also planning to build a line from Belvidere to Clinton, as indicated on the map. The operation of the Easton & Washington Traction Company is managed by W. O. Hay, with headquarters at Easton, who is also secretary of the company. The other officers are: President, R. M. Petty, Washington, N. J.; treasurer, R. M. Eilenberger, Washington, N. J.; chief engineer, Chas. M. Brady. The entire building of track, roadway, concrete and steel structures was done by M. P. McGrath, of Worcester, Mass., and Easton, Pa., the well-known contractor, who gave it his personal attention very closely for more than a year.

PRACTICAL ASPECTS OF STEAM RAILROAD ELECTRIFICATION

As noted in the last issue of the STREET RAILWAY JOURNAL, W. N. Smith presented on Dec. 6 a paper on "Practical Aspects of Steam Railroad Electrification" before the Cornell University branch of the American Institute of Electrical Engineers. The following is a summary of the important points brought out by Mr. Smith:

The many novel problems arising in steam railroad electrification call for the services of a consulting engineer to act as interpreter between the railroad and the manufacturer. Not only must he specify what apparatus appears best adapted for the particular operating conditions, but also secure the proper co-operation of the different departments of a transportation system to make certain that the new equipment will be properly used.

One important aspect brought out was the question of standardization. The speaker referred to the manufacture of many parts by the electric railway companies themselves, following the example of steam railroads. He said that the standardization committee of the American Street & Interurban Railway Association had made an excellent beginning in pursuing the standardization question along the same general lines as the steam railroad associations. The time would undoubtedly come when standards would be fixed more commonly by the engineers of the companies rather than by the manufacturers. With regard to the changes that electrical equipment would bring about by the addition of a considerable quantity of extra parts, he did not believe it would be desirable to change steam railroad standards unless absolutely necessary. Occasionally, however, there are fundamental reasons for changing existing steam standards to accommodate certain electrical features. An instance of this was the adoption of a new shape of splice bar to accommodate a heavy rail bond underneath it upon a section where some new track was to be laid.

As to clearances, the stationary features pertaining to the right of way and the dimensions of moving equipment must not be allowed to interfere with each other. The third-rail sometimes conflicts with bridge gussets on the one hand and hopper bottom coal cars on the other, besides increasing the necessity for the elimination of highway crossings. On the other hand low overhead bridges conflict seriously with trolley construction, particularly when high voltage is desired. The speaker then mentioned the different types of electric locomotives that have been developed to date and particularly the point brought out by steam railroad engineers that the electric locomotive should have its weight distribution approximate more nearly that of the steam locomotive.

In discussing the increased capacity made possible by electrification, the speaker said that there were many lines where the installation of a block signal system would accomplish the same object. The total mileage of single track lines in the United States is about 200,000, and yet only 17½ per cent of the total is controlled by block signals. It would seem, therefore, that increasing the capacity of such unprotected lines by the installation of electric power need not be considered. It must also be borne in mind that there is a considerable difference in the dispatching systems of steam railroads and interurban electric railways. The former dispatch by telegraph mostly, while the latter prefer the telephone. In the case of the steam railroads, however, there are usually several classes of passenger and freight trains, while on the interurban electric railway complications of this character are not so great, or in many cases do not exist at all. On a steam railroad the necessity for giving the right of way to some fast train may hold up inferior trains for many hours, and this condition, of course, would apply just as well if the railroad were operated electrically.

The fact that it is impossible to generalize upon the capacity of single-track roads for train movement renders it equally impossible to generalize upon the applicability of electric motive power thereto in comparison with steam.

On the whole, the question of electrification can be discussed practically only with reference to a concrete case.

THE THREE-PHASE LOCOMOTIVES FOR THE GREAT NORTHERN RAILWAY

An announcement was made several months ago of the contract closed by the Great Northern Railway Company with the General Electric Company for several three-phase locomotives, to take care of all passenger and freight trains on the Great Northern Railway traversing the Cascade tunnel. This tunnel is approximately 2¾ miles in length, with no ventilating shaft, and a uniform grade east of 1.6 per cent in the tunnel section, making the difficulties of ventilation with steam locomotive operation a very serious factor both from the standpoint of safety and operating efficiency. Aside from danger of poisonous gases of combustion, the interior of the tunnel has become so fouled with soot as to reduce the tractive effort of the steam locomotives now used, by reason of the slippery condition of the rails. The introduction of electric locomotives will do away with many of the evils now encountered in steam operation.

Further particulars of the electric locomotives are now available. They will weigh 100 tons each, all weight being on the drivers. Each locomotive will be equipped with four three-phase induction motors of 325 hp capacity, mounted on two articulated bogie trucks and each machine will have a capacity of hauling a 500-ton train load up a 2 per cent grade at 15 miles per hour, and, as the motors are reversible, the speed of the train can be controlled down grade by regeneration. It is hoped by this means to introduce an additional feature of safety and eliminate the possibility of breakdown due to overheated wheel tires and brake shoes.

The locomotives will receive their supply from two 6600-volt conductors fed from a step-down transformer station located at the entrance of the tunnel. The generating station will be located on the Wenatchee River, 30 miles from the tunnel, and power will be transmitted over duplicate transmission lines at thirty-three thousand volts. The generating station will contain two 2000-kw three-phase water-wheel-driven generators operating at 25 cycles, and arrangements are being made to take care of excess power of regeneration due to an unbalanced load up and down grade. The entire installation is under the supervision of Dr. Cary T. Hutchinson, who acts as consulting engineer to the Great Northern Railway, and the entire apparatus is being supplied by the General Electric Company. It is expected to have the road in operation in about one year, and work is already well under way on the water-power development, as well as the electrical apparatus.

FIRST ELECTRIC TALK TO NEW YORK CENTRAL SHOP APPRENTICES

For some time the New York Central & Hudson River Railroad Company has been conducting schools for its shop apprentices at several of the important construction and maintenance places of the system. The instruction is along simple lines, consisting mainly in drawing and estimating material required for different parts, as the leading idea is to improve the efficiency of the men as mechanics rather than to make them members of the transportation or engineering departments. At the same time, the system does bring forth some of exceptional ability who are encouraged to study further.

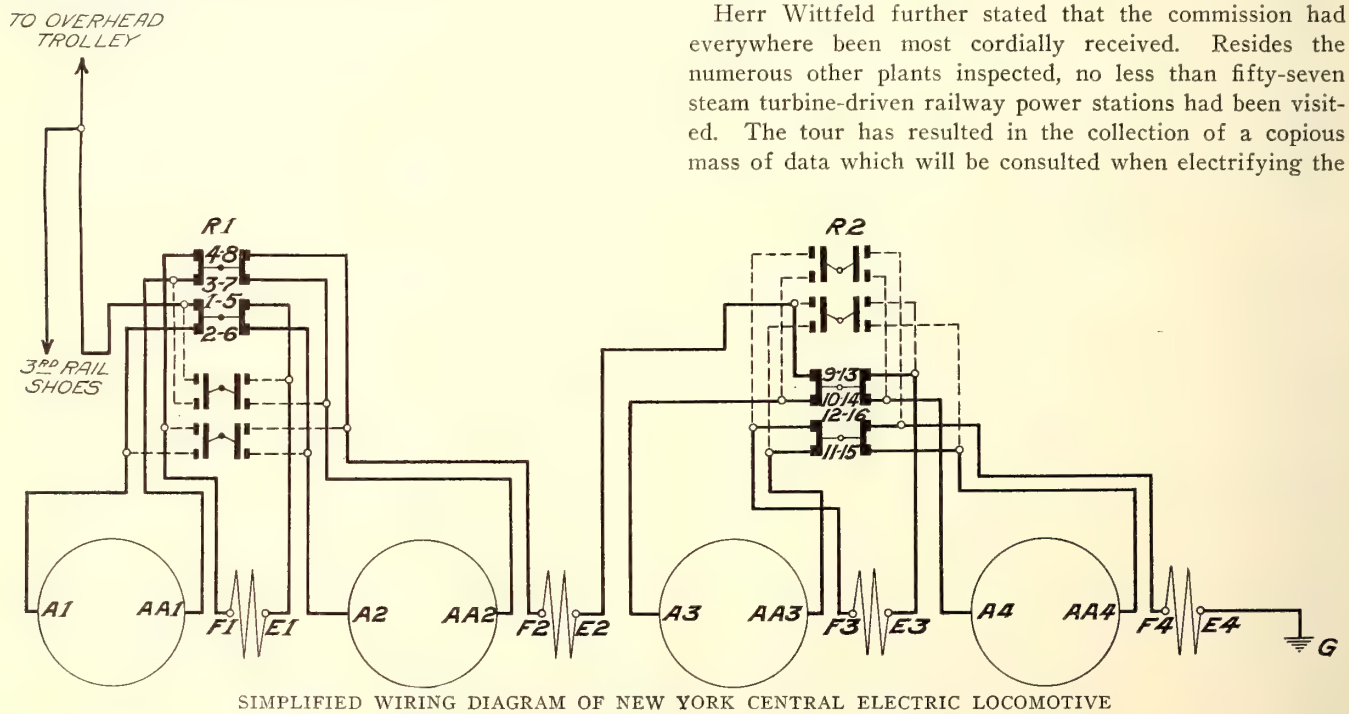
Hitherto nothing has been done to give definite instruction to these apprentices about electric railway equipment, but, realizing the important part electricity is playing and will play in the development of the New York Central, steps are being taken to spread information about the latter motive power. The first work along these lines was a lecture given Dec. 10 at the West Albany shops by J. G. Baukat, assistant superintendent of electrical equipment in the New York Electric Zone. Mr. Baukat spoke at the invitation of C. W. Cross and W. B. Russell, respectively superintendent and assistant superintendent of apprentices.

The lecturer did not attempt to go into the subject of electricity in a detailed way, but gave his audience an idea of the present electric locomotive and car equipment of the New York Central and how they are used. The definitions of electrical terms were given verbally and also presented on lantern slides. Following this, the speaker compared the functions of the different parts of steam and electric locomotives. One of the features was the accompanying simplified wiring diagram of a four-motor locomotive, which the lecturer explained for both third-rail and overhead contact. The lecture was concluded with numerous slides of locomotive, motor cars, trailers and the principal parts of their equipment.

GERMAN OPINION OF AMERICAN ELECTRIC RAILWAY ENGINEERING

The London "Engineer" contains an interview with the members of the delegation of German engineers who were recently in this country to investigate American electric traction developments. The party consisted of Messrs. Wittfeld, Frischmuth, Pforr, Jordon and Reichel. Mr. Wittfeld stated that since he had last studied the question in America the progress there in developing high-speed electric railways had been astonishing. The high standard of the work being done merited warm admiration, and it was surprising to see how, even with scanty means, excellent results were accomplished.

Herr Wittfeld further stated that the commission had everywhere been most cordially received. Resides the numerous other plants inspected, no less than fifty-seven steam turbine-driven railway power stations had been visited. The tour has resulted in the collection of a copious mass of data which will be consulted when electrifying the Prussian railways. The American experience which has been placed at the disposal of the commission will make it possible to adopt from the beginning the most suitable engines and plant. Privy Councillor Wittfeld will prepare an official report on the labors of the commission, embodying the information obtained in America, which will be laid before the Minister of Railways, and he will subsequently elaborate a memorial on the electrification of the Berlin city and suburban lines for the Ministry of Finance. An engineering department is now being organized, by which the final plans for the latter lines are to be fixed.



SIMPLIFIED WIRING DIAGRAM OF NEW YORK CENTRAL ELECTRIC LOCOMOTIVE

REPORT OF TESTS ON CONCRETE FOR HEAT RESISTANCE

Some tests made in the power house of the West Penn Railways at Connersville to determine the adaptability of concrete for use in the construction of smoke flues, may be of general interest. The tests were conducted by F. W. Scheidenhelm, construction engineer for the company, and the following report was submitted by him to the company officials. A flue constructed of the materials which the tests indicated best adapted to the purpose has since been submitted to the regular working temperature and has stood the service even better than was anticipated.

I.—REPORT OF TEST ON CONCRETE FOR HEAT RESISTANCE.

On September 25, 1907, five specimens were made, each 6 in. x 6 in. x 3 in. with a 6 in. x 6 in. piece of 3-in. mesh, No. 10 gage expanded metal placed ¼ in. from the bottom. The composition of the specimens is given in the table below. On Oct. 10 the specimens were put in the back of boiler No. 12 at the main power house, directly above the flue, where they received the heat from the flue gases just before the gases pass into the smoke-flue. They were exposed to heat for approximately 84 hours. The temperature was above 800 deg. F. for the thermometer, which reads only to 800 deg., went to its upper limit, and indications were that it would have gone still higher had its range been sufficient. The following table shows the composition of specimens and the effect of heat on them:

Specimen No.	Proportions Sand	Cement	Lime	Notes
1	3	1	0	Small crack apparently little affected as regards hardness
2	3	⅞	⅛	Distinct crack. Softened
3	3	¾	¼	Not cracked. Softened appreciably
4	3	⅓	⅔	Not cracked. Softened
5	3	¼	¾	Not cracked. Absolutely worthless

It will be noted that all the specimens containing lime were appreciably softened, so much so that the concrete blocks could be spalled and broken off by sharp blows with a stick of wood. The specimen containing only cement and sand was apparently little effected and still caused a hammer to ring when striking the block.

It will also be noted that all the specimens containing lime, except one, remained uncracked, whereas the specimen containing cement only had a small crack, which extended about half-way across one side of it, which might indicate either that the lime-concrete formed a better heat protection for the metal reinforcement or that the concrete containing lime lost its cohesive strength to such a degree that the expansion and contraction found no resistance at any point in the block. I am inclined toward the latter view, especially since the lime blocks were softened to so great an extent. The cement block acted more like a concrete wall, in which contraction or expansion has singled out the weakest point and there caused a crack.

II.—REPORT OF TEST ON CINDER CONCRETE BLOCKS FOR HEAT RESISTANCE.

Two specimens made on Sept. 26, were exposed to heat under same conditions as the specimens described in the previous report, that is to 800 deg. F. or more for approximately 84 hours. The specimens were 12 in. x 12 in. x 3 in. with a similar piece of expanded metal placed about three-quarter inch from the bottom. No. 1 block contained sand, cement and cinders in the proportion of 1, 2, 4; No. 2 block contained same proportion of sand and cinders, but one-quarter of the cement was replaced by lime, so that the proportion of lime, sand, cement and cinders were ¼, ¾, 2, 4.

The cinders were as clean as could be obtained from the river-washed ashes at the power house, and ranged in size from ¼ in. to ¾ in. Under the flue temperature some of the cinders, which still contained carbon, showed signs of having burned, but the burning did not seem to have effected the block, as a whole, to any appreciable extent, because, in breaking, the fractures did not extend across the burned portions.

EFFECT OF HEAT

Block No. 1 was slightly cracked; otherwise it was sound and hard. The cracks seemed to extend nearly through the whole block. Block No. 2 had surface cracks only, but was very much softened, as was discovered by tapping with a sledge.

These results are in accord with those given in report No. 1; that is, the specimens containing lime always show appreciable softening under heat, while specimens containing cement only show slight expansion and contraction cracks, but their hardness seems to be little impaired. It must, in this connection, be noted that, on cooling, all cracks in all specimens grow more prominent and perhaps slightly deeper.

III.—CONCRETE USED IN SMOKE-FLUE

The tendency of the cinders to burn, even though no direct proof could be obtained from this test indicating that this burning weakened the blocks, seemed to me sufficient to condemn the use of cinder concrete for our smoke-flue, for it was practically impossible to obtain more than a handful at a time of clean, entirely burned cinders. Accordingly, most of the concrete in the smoke-flue was put in in the proportion of 1, 2, 3, using Allegheny River sand, Vulcanite Portland cement and 1 in. crushed bluestone. In some portions of the floor and roof, however, a grout, in the proportion of 1 2, was spread in a ½-in. layer over forms to insure a good and even surface under the expanded metal.

TOOL ADJUSTMENTS BY COMPRESSED AIR

It is coming to be more and more recognized among up-to-date shop superintendents that when a man is working on a high-priced machine, the time lost in adjusting tool holders and other parts by hand should be minimized by using some mechanical method. This principle is recognized in the Harmon shops of the New York Central Railroad, where it has been found that the efficiency of a wheel lathe is increased 15 to 20 per cent by using compressed air to adjust tools on the lathe instead of doing the work by hand.

ONE WAY OF PREVENTING HOT BOXES

The Harmon shops, which were built to take care of the heavy repair work in the New York Central electric zone, are now in service. One of the interesting kinks which has been adopted there is the method of preventing hot boxes, or, what amounts to the same thing, avoiding rough journals. Before a wheel set is placed in service it is placed on a stand so as to be easily run by belting from a convenient motor or engine, while the journals are placed to revolve in leather bearings. A boy lubricates the journals from time to time, pressing down on them a piece of emery cloth until the combined action of the oil and emery has given the journals a high, smooth polish. This process usually requires one to one and a half hours. It has been found that the reduction in journal friction thus attained has practically eliminated hot boxes.

NEW TERMINAL STATION AT EVANSVILLE, IND.

The new terminal station of the Evansville, Suburban & Newburg Railroad at Evansville is noteworthy because of the unusual amount of attention given to, and expense incurred in, producing pleasing and harmonious effects in the waiting rooms. Other portions of the building have not been neglected, however, as is evidenced by the accompanying reproduction of the façade.



EXTERIOR OF EVANSVILLE TERMINAL

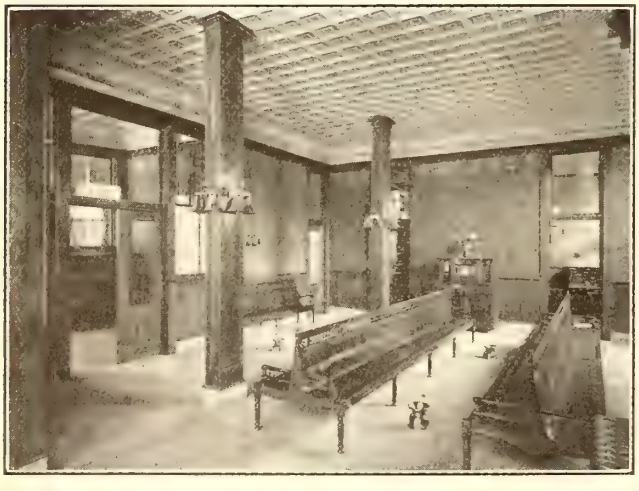
The station is located on Fifth Street, near Main, in the heart of the business district of the city and on the site of the former depot, and serves as a terminal for the Boonville and Newburg branches of the Evansville, Suburban & Newburg Railroad, the Evansville & Eastern Company and the Evansville and Mt. Vernon Traction Company. It has a front of 69 ft. on Fifth Street, while the passenger station proper has a depth of 50 ft. Behind the passenger station will be erected a freight station 69 x 100 ft.

The front of the passenger station is of Bedford limestone, and its appearance is enhanced considerably by an ornamental steel and glass awning. The track opening for the freight room is closed by a rolling steel door. The lower floor is taken up by waiting rooms, ticket and local freight offices and the office of the general manager and by freight tracks and a loading platform. The floors of all the rooms are of marble mosaic and the ceilings are of steel. The interior wood finish is oak. Above the marble baseboard and oak wainscoting the walls are plastered and painted. Both waiting rooms are amply provided with oak seats. For convenience of occupants of the ladies' waiting room, the one column in this room is surrounded by mirrors. The general effect of all the waiting rooms and offices is heightened considerably by the ornamental electric light fixtures on the columns and walls. These fixtures also provide for the use of gas in emergencies. Additional lighting is afforded by lamps located at intervals of about 2 ft. around the walls of the waiting rooms near the ceiling.

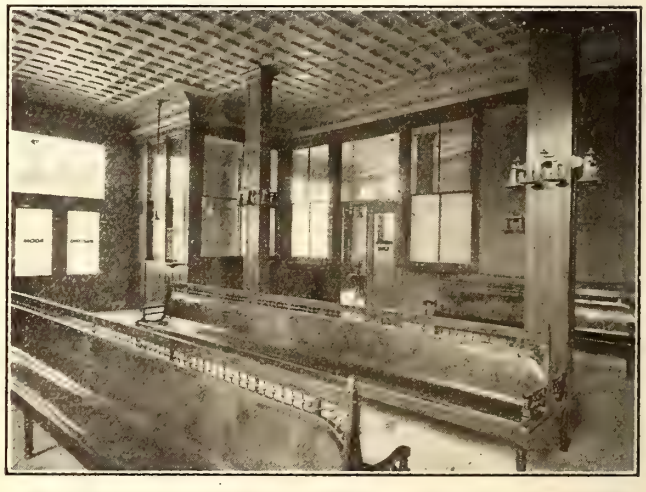
The arrangement of the rooms is such as to facilitate considerably the transaction of business. The ticket office is at the front of the building, where the agent may observe the loading and unloading of cars in the street. Ticket windows open into each waiting room. The general manager's office has a doorway leading into the freight office, and the latter office has doorway and window connections with the freight room.

The upper floor contains seven offices used by the operating department. Entrance to it is gained either by a stairway at the front of the building in the general waiting room, or by one at the rear from the freight room. A vault measuring 8 ft. 6 ins. x 11 ft., which is carried up both floors, opens into the general manager's office on the main floor and into the auditor's office on the second floor. Speaking-tubes are provided for communication between offices. The building is heated by steam from a heater in the basement.

The walls and roof structure have been built to permit the addition of a third story whenever expansion of busi-

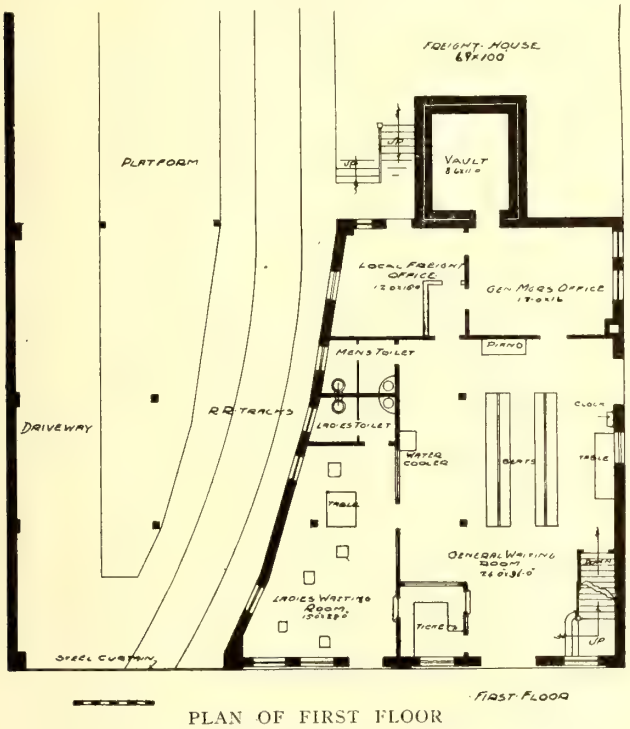


GENERAL WAITING ROOM WITH MANAGER'S OFFICE IN THE REAR

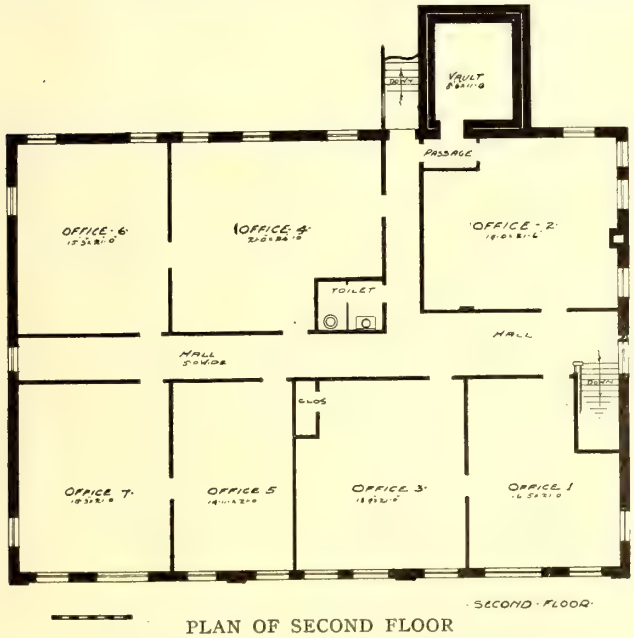


GENERAL WAITING ROOM, SHOWING TICKET OFFICE AND LADIES' WAITING ROOM IN REAR

ness necessitates. This third floor, moreover, may be built on without exposing the second floor to the weather. With a view to increasing the size of the waiting room at some future time, the wall adjacent to the freight room is built in a steel frame which supports the building in such a manner that the wall may be removed and the waiting rooms extended over the present track space. Credit for the completeness of the plans of the station and the manner in which all details were carried out is due in a great measure to Gus Muhlhausen, manager of the operating company, who took a personal interest in the design and erection of the building.



PLAN OF FIRST FLOOR

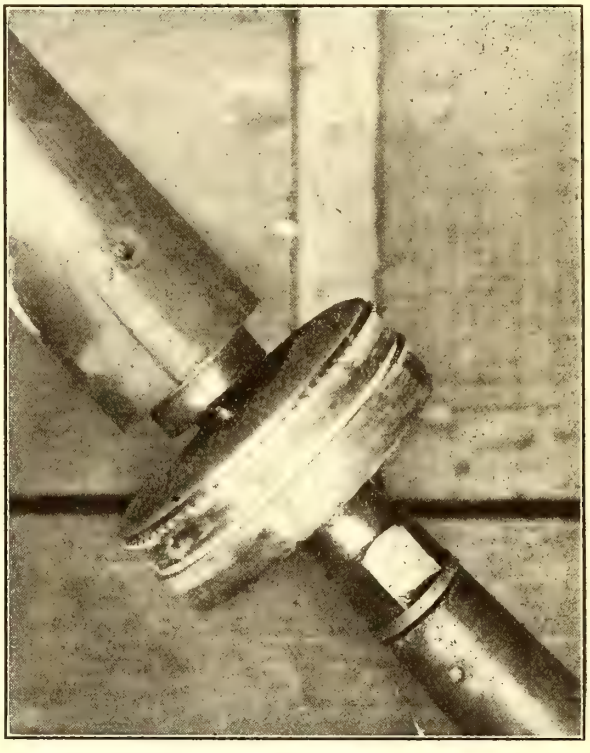


PLAN OF SECOND FLOOR

The Lake Shore Electric Railway Company is testing a trolley finder, which consists of a small trolley wheel placed on the pole midway between the car and the trolley wire. When the trolley wheel slips off the wire, it is intended that this small wheel shall strike the wire and furnish current until the trolley pole can be replaced.

GROOVING COMMUTATORS IN THE SHOPS OF THE INDIANAPOLIS & NORTHWESTERN TRACTION COMPANY

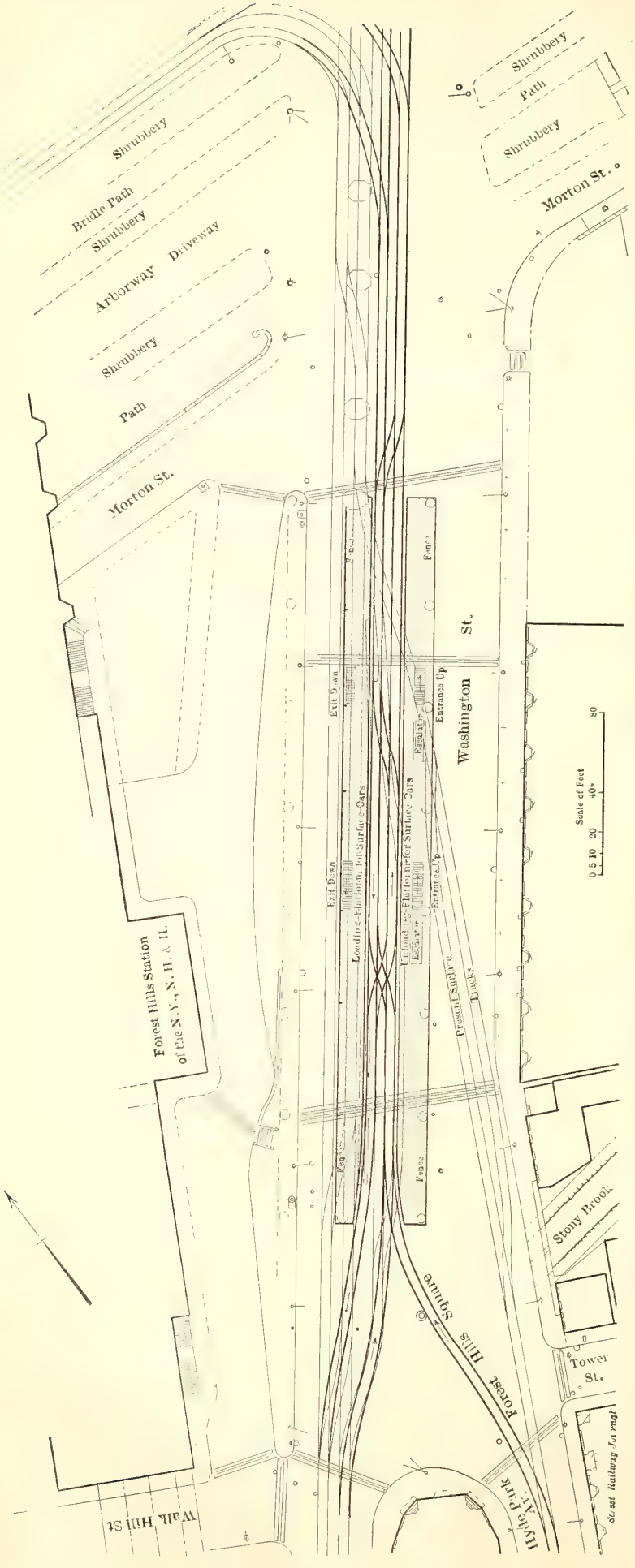
Practice in the shops of the Indianapolis & Northwestern Traction Company has demonstrated the fact that the G. E. No. 73 motors in use by the company operate better when the mica between the segments of the commutator is grooved out. Grooving the commutators by hand or in the lathe proved to be such a difficult task that Leverett M. Clark, former master mechanic of the system, now master mechanic of the Indianapolis Traction & Terminal Company, and L. W. Hayes, the present master mechanic, devised a special apparatus to expedite the work. A small wheel carrying a circular metal saw is operated at a high speed through a flexible shaft from an emery wheel shaft or other convenient machine. Suitable handles are placed on both sides of the wheel so that it can be held firmly by the operator. A metal disc at a distance from the saw equal to the width of a commutator segment, and which fits into one of the grooves between the segments, serves as a guide for the saw.



SAW FOR GROOVING COMMUTATORS IN THE INDIANAPOLIS & NORTHWESTERN TRACTION COMPANY'S SHOPS

With this device about one and one-half hours are required for one man to groove a commutator containing 117 segments and remove the burrs from the edges of the segments. The slots are grooved slightly deeper than it is intended that the commutator shall wear in order that the portion remaining may serve as a guide when the commutator is grooved again. It has been found that comparatively dry brushes work best on the grooved commutators. When the brushes contain too much oil and grease there is a tendency for the resulting mixture of carbon, dust and oil to fill up the grooves and cause short circuits.

The Sao Paulo Tramway, Light, Heat & Power Company will ask shareholders for permission to increase the capital from $8,500,000 to $10,000,000. It is intended to issue only $500,000 at the present time.



CONSTRUCTION AT SURFACE LEVEL FOR THE FOREST HILLS EXTENSION OF THE BOSTON ELEVATED RAILWAY COMPANY

BOSTON ELEVATED TEMPORARY TERMINAL AT FOREST HILLS

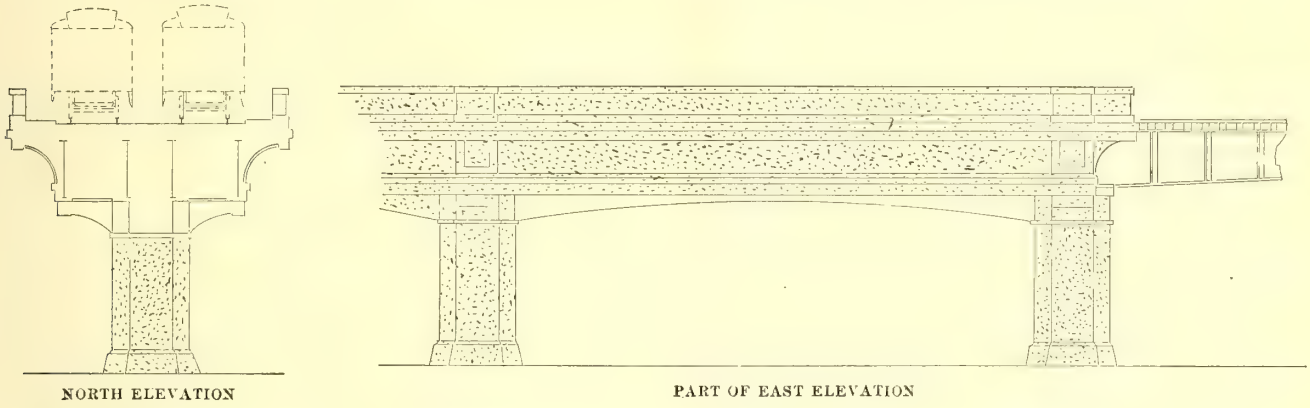
In connection with the extension of the Boston Elevated's overhead structure to Forest Hills, approval of the company's plans for a temporary terminal at the latter point has been granted by the Railroad Commission. The accompanying drawings illustrate the terminal at the elevated and surface levels, and also show the general design of the single column, concrete, arched structure to be erected on Washington Street at the crossing of the Arborway, which is a part of the park system of Boston.

The temporary terminal is to be located at the edge of Forest Hills Square, directly opposite the Forest Hills station of the New York, New Haven & Hartford Railroad. Southbound elevated trains arriving from in-town stations will stop at an unloading platform, 357 ft. long by 20 ft. wide, located on the west side of the station, the tracks being between the inbound and outbound platforms and 12 ft. apart on centers. These platforms, the inbound being on the east side of the station, will accommodate 8-car trains with ease. A double cross-over, to be installed south of the station, will provide for the reversal of trains for the return trip. The loading platform is to be of the same length as the unloading platform, but it will be 30 ft. wide in order to accommodate the waiting traffic. On the unloading platform there will be no occasion for passengers to wait, and for this reason the area allowed is smaller. South of the double cross-over the tracks will extend far enough beyond Walk Hill Street to accommodate an 8-car train on each side, with a little extra space at the ends. Four exit stairways will be provided from the unloading platform. These will lead to a lateral mezzanine passage-way, about 60 ft. long and 8½ ft. wide, connecting the north and southbound platforms. Exit stairways will be provided between the passage-way and the street. Two entrance stairways will be built between the street level and the mezzanine passage, and the latter will be connected by two flights with the loading platform for elevated trains. Two escalators will be provided between the street level and the train platform, inbound side.

At the street level two surface car platforms 360 ft. long will be provided, and between them will be located the surface tracks, at present shown in light lines in the engraving on this page. Crossovers will be provided to enable the surface cars to deliver passengers to the connections with the loading platform of the elevated trains and to receive passengers coming down from the elevated delivery platform. The loading platform for surface cars will be about 13 ft. wide and the unloading platform about 15 ft.

in width. Fences on the outside of each platform will probably be installed to prevent the entrance of passengers to the system without the payment of fare.

The detail design of the single column structure opposite the Arborway have not yet been completed, but the posts and arches will probably be of reinforced concrete. The parapets, copings and body of the structures will also employ concrete to a large extent. The terminal approaches were designed under the direction of Mr. George A. Kimball, chief engineer of elevated and subway construction.

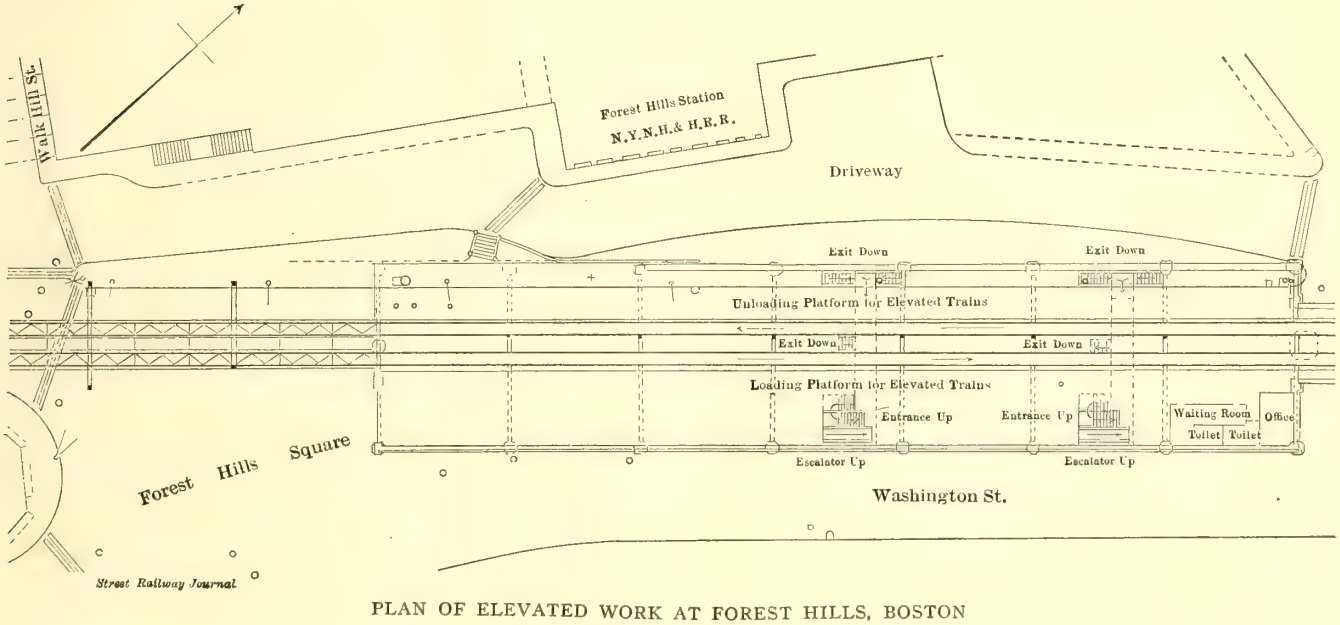


ELEVATIONS OF SPECIAL ELEVATED CONSTRUCTION AT FOREST HILLS ARBORWAY

FURTHER PROGRESS BY THE UNITED RAILROADS OF SAN FRANCISCO IN THEIR RECONSTRUCTION WORK

There is noticeable a steady improvement in conditions in San Francisco so far as the United Railroads are concerned. The strike on the company's lines, which had been in progress since last May, having been practically called off the latter part of September, the operation of the various lines is now on a larger and more satisfactory scale than it has been at any time since the earthquake. A large amount of new construction work, however, remains to be done, but this is now being pushed as rapidly as possible. According to General Manager Black there are now 450 cars in operation on the lines. They are mostly of the new type and have an aggregate carrying capacity equal to 600 of the old cars used before the disaster. More cars will be put into service later. Although conditions have improved materially within the last two months, there is no reason to believe that the United Railroads of San Francisco will be in a position to resume dividends on the stock, most of which is owned by the United Railways Investment Company, for some time.

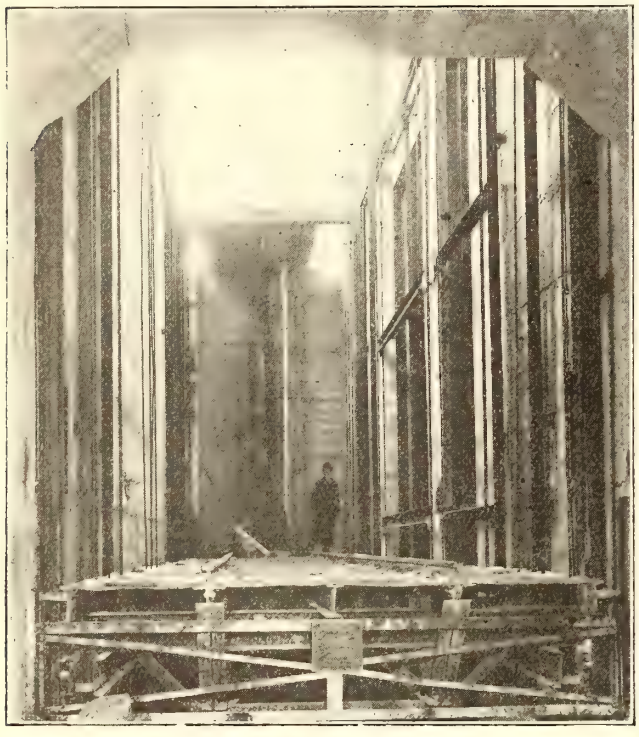
With the movement of a large frequency changer from the Martin to the North Beach power station the United Railroads will have reached a solution to the power question, which will enable them to increase the number of cars in service to 560, more by a hundred than have been running at any time since the fire. With the coming increase in the number of cars, and to decrease the liability of accidents, the company has adopted a new set of rules regulating the movement and spacing of cars and right of way at street intersections. The motormen received the new orders a few days ago and inspectors have been given instructions for their strict enforcement. The United Railroads have begun the work of restoring their portion of Harrison Street, between Fourth and Sixth Streets, so that the companies having contracts with the Board of Supervisors for repairing this thoroughfare can begin operations shortly.



PLAN OF ELEVATED WORK AT FOREST HILLS, BOSTON

CAR ELEVATOR FOR THE HUDSON RIVER TUNNELS

An interesting elevator installation has recently been completed at the Hoboken, N. J., terminal of the Hudson & Manhattan Railway Company tunnels under the Hudson River. This elevator is to take in and remove from the tunnels the electrically equipped passenger cars which will operate in these tunnels. It is located in the yard of the Hudson Companies, which adjoins the Hoboken terminal of the Lackawanna Railroad.



AT THE BOTTOM OF THE WELL

The passenger cars which will operate in the tunnels are 48 ft. long, over all, and 9 ft. wide. They weigh when empty 64,000 lbs., and when loaded with passengers 85,000 lbs. To raise and lower these cars into and out of the tunnel there has been installed an elevator of 100,000 lbs. lifting capacity, with a platform 50 ft. long and 12 ft. wide.

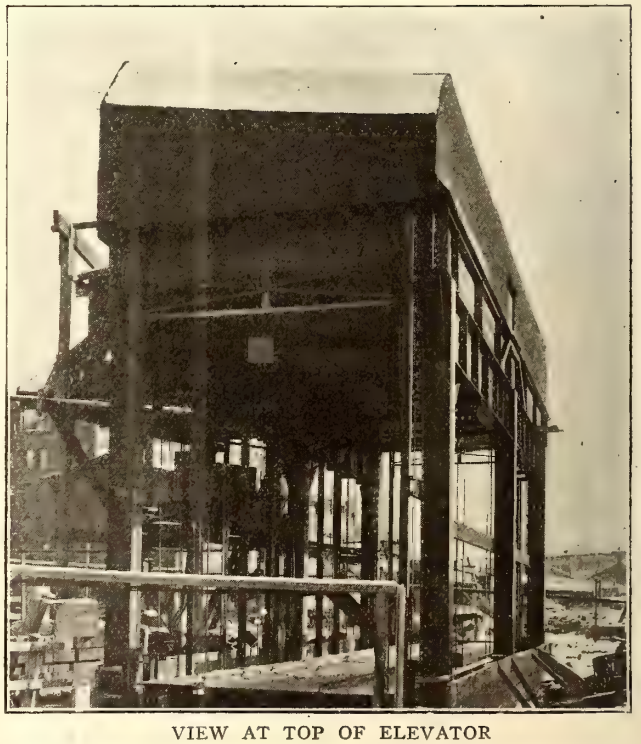
Provision for this elevator was made first by constructing a wellway, having reinforced concrete walls from the ground level to the tunnel. Upon the side walls of this structure are placed six steel columns supporting a steel girder framing directly over the hoistway, and upon these girders the machine operating the elevator platform is placed.

This machine consists of two drum shafts each 50 ft. long, one placed near each side of the wellway. These drum shafts are at the center of their length, driven by a system of four balanced worm gears, arranged so that the load on all four worm gears is equal under all conditions of platform load. All thrust loads are balanced by the worm shafts, which have right and left hand worms operating the worm gears. These worms and gears run in oil baths in tight casings. The entire system of drum shafts, worm gears and worm shafts is driven by one 100-hp motor placed at the center of one side of the elevator machine.

The elevator platform is constructed with two longitudinal steel girders, one under each rail, with suitable steel framing to support the suspension sheaves whereby the platform is suspended from and operated by the elevator machine. The floor of the platform, which is 600 sq. ft. in area, is covered with diamond pattern steel floor plates. At the sides of the elevator platform thirty-two ¾-in. dia. steel cables are dropped from the machine above. These cables pass under suspension sheaves below the steel-plate floor of the elevator and return to anchorage in the steel overhead structure. By this arrangement one-half the load is suspended directly by the overhead structure and one-half is suspended from the drums of the elevator machine. In addition to the thirty-two machine cables, the platform is suspended by eight counterweight cables, making a total suspension of the elevator platform and load by forty ¾-in. dia. steel cables, having a total combined strength of 1,552,000 lbs. The machine and cables are so arranged that the elevator platform cannot incline from a horizontal position wherever the load may be placed upon the elevator platform. Iron frame gates are provided which close when the elevator platform is not at the landings.

The elevator is controlled electrically by a pilot switch operated by a hand shipping cable, and the elevator may at the will of the operator be run at speeds of 10 to 20 ft. travel per minute, the platform stopping automatically at the track levels. The rise of the elevator from the tunnel track to the surface track is about 30 ft. The elevator platform will be equipped with the third rail, which will be alive only when the platform is at the track levels, and the tunnel cars may be run by their own motors on, off or across the elevator platform. Provision has been made to hold the elevator platform securely in position while the cars are run upon it.

In addition to the usual service of this elevator handling cars into and out of the tunnels, it is arranged to be utilized for quickly changing one or both of the motor trucks under a car body. For this purpose the elevator platform travels three feet above the surface tracks, and when in this position blocks are thrown in place under the car body, the truck connections are released, and as the elevator platform descends the car body remains suspended upon the blocks while the trucks descend on the elevator platform. New trucks are placed under the car body in similar manner. This operation permits the quick interchange of car bodies and trucks when either may require repairs.



VIEW AT TOP OF ELEVATOR

The following figures of this elevator are of interest when compared with the usual freight elevator: Size of elevator platform, 50 ft. x 12 ft.; lifting capacity, 100,000 lbs., additional to the weight of the elevator platform; weight of elevator platform, 32,000 lbs.; suspended by forty ¾-in. steel cables of combined strength of 1,552,000 lbs., and weight of counterweights, 63,800 lbs.

This elevator is now handling rails, ballast and other tunnel equipment material. It provides the only means of access of the cars into and out of the tunnel. The construction of the elevator is fireproof throughout. The lifting capacity of this elevator is fifty tons, but it has handled loads of sixty-five tons with safety. It is believed to be the largest elevator in size and lifting capacity that has been constructed.

The elevator was built and installed by the Geo. T. McLauthlin Company, of Boston, Mass., under designs and patents of Martin B. McLauthlin. The same company has installed a considerable number of railroad car elevators in New York and elsewhere.

THE FRANCO-BRITISH EXPOSITION OF 1908

This exposition, of which a short notice was published recentiy in this paper, is to be opened at Shepherd's Bush. London, in May, 1908. The site consists of 140 acres within four miles of Charing Cross, and the principal entrance will be immediately adjoining the terminal station of the Central London Railway. It is also close to stations of the London & Northwestern and the Great Western Railways and the Metropolitan, Hamersmith & City Railway, as well as through tube and main line railways and tramways. The various methods of transportation are capable of conveying to the spot 75,000 persons per hour. The exposition will be housed in twenty buildings, one of the largest of which will be Machinery Hall, which will contain with its annexes about 200,000 square feet of floor space. Other buildings will be devoted to education, fine arts, liberal arts, electricity, science, applied arts and music. One-half of the space will be devoted to exhibits from France and the French colonies; the other half will be devoted to exhibits from Great Britain and the British colonies and dependencies. Canada has secured an area of 120,000 square feet.

The honorary president of the exposition is the Duke of Argyll, who is also president of the Tramway & Light Railway Association of Great Britain. The other officers include gentlemen prominent in national affairs in Great Britain. Thus, the chairman of the department of surface transportation is Sir J. Clifton Robinson, chairman of the London United Tramways; the chairman of the department of transportation is H. Cosmo Bonsor, chairman of the Southeastern & Chatham Railway: the chairman of the department of electrical engineering is Dr. R. T. Glazebrook, president of the Institute of Electrical Engineers.

MORE CARS FOR WICHITA

The town of Wichita, Kan., has had a remarkable growth, as is evidenced by figures lately compiled by the Wichita Railroad & Light Company showing the number of passengers carried in the past few years. In 1899 the records show that 425,000 passengers paid fares and the year following the figures jumped to one million; in 1906 over four and a half millions of passengers were carried, and when the records for the present year are complete it is expected they will show that five and a quarter millions were carried. Of course, the railway company has been active in meeting the demands, and it has been necessary on three occasions this year to provide more cars for the various lines. In all, sixteen cars were added, twelve of which were of the type illustrated, and the remainder of the standard open type. All were supplied by the American Car Company. Six of the closed cars were shipped this month, and are identical to those shipped in the spring and described in these columns. The J. G. Brill Company furnished the seats and numerous specialties, such as gongs, signal bells, angle-iron bumpers, etc., as well as the trucks, which are of the No. 21-E type with 8 ft. wheel base. Some of the dimensions are: Length over end panels, 20 ft. 8 ins.; over crown pieces, 31 ft. ½ in.; width over sills, including panels, 7 ft. 9½ ins.; over posts at belt, 8 ft. 2 ins.; side sills, 5 ins. x 3⅜ ins., with 3½ in. x ⅜-in. x 6-in. angle-iron; end sills, 3½ ins. x 8⅝ ins.; length of front platform, 4 ft. 8½ ins.; rear platform, 5 ft. 8 ins.



NEW CARS PREPARED FOR SERVICE IN WICHITA

LEGAL DEPARTMENT*

CARRYING BAGGAGE

In Pitcher v. Old Colony Street Railway Company, in the Supreme Judicial Court of Massachusetts (June, 1907, 81 N. E. 876), it appeared that plaintiff was a passenger on an ordinary street car, having seats running lengthwise on each side. As she was leaving the car, she stumbled over a bag which another passenger had placed on the floor, and fell, receiving injuries for which she sued. The bag did not obstruct free passage from the car, and did not render the passageway dangerous to a person exercising due care. It was held that the conductor was not negligent as a matter of law in suffering the bag to be placed and to remain on the floor. It was further held that evidence that it was not customary to have racks for baggage or parcels in street cars, and that it was the custom to allow passengers to put hand baggage and dress-suit cases on the floor, was admissible as bearing on the question whether defendant exercised due care in the premises.

The result of this case is certainly just. It would be impracticable to make an absolute rule that nothing in the nature of hand baggage may be taken into a street car. It probably would also be impracticable to prescribe that baggage shall not be permitted under any circumstances, unless it be held in the lap or at least off the floor of the car or platform. In the case under discussion, the questions both of defendant's negligence and plaintiff's contributory negligence were submitted to the jury, and a general verdict for defendant was rendered. Cases are readily imaginable, even if this Massachusetts case was not one of them, in which, on conceded facts as to the small size of the piece of baggage, the position in which it was placed, and its not being hidden in any way from anybody who chose to look, the court ought to hold, as a matter of law, that the railway company was not negligent. On the other hand, the servants of a street railway company might admit baggage of such bulky or dangerous character that its presence and position would be sufficient to establish the defendant's negligence.

Usually the question is one of reasonable care under the facts of each case. This principle is recognized by the Massachusetts court when it holds that it would have been error to instruct the jury as requested "that under all conditions the aisles, entrances and exits should be kept free from all obstructions by the use of the highest possible degree of care and caution on the part of street railway companies" engaged in transportation of passengers.

There are times when a street car connecting with a railroad ferry takes on board a sufficient number of passengers with dress-suit cases to turn it for the time being to a large extent into a baggage car. It may be that some rule ought to be adopted to cover such cases, although it is difficult to say just what the substance and form of the regulation should be. But, between absolutely prohibiting baggage and admitting such quantity as does not interfere with the safety or reasonable convenience of passengers, there is a wide range. The matter of liability must depend largely upon the exercise of discretion by the conductor.

LIABILITY FOR NEGLIGENCE.

ALABAMA.—Carriers—Passengers—Duty to Protect from Violence of Other Passengers—Question for Jury—Liability of Carrier.

A carrier owes to its passengers the duty of protecting them from violence and insults of other passengers, so far as it can be done in the exercise of a high degree of care, and is liable for its own or its servant's neglect in this particular, when by exercising proper care the violence might have been foreseen and prevented.

If an intoxicated street car passenger weighing about 225 lbs. was unable to stand, and his condition was known to the conductor, the conductor was negligent toward other passengers in permitting him to walk up and down the aisle while the car was in motion.

In an action against a carrier for personal injury to a passenger caused by an intoxicated passenger falling, whether the conductor in the exercise of the care required by law could have foreseen that the intoxicated passenger might do injury to some other passenger, held, under the evidence, a question for the jury.

A carrier's servant may eject a drunken and disorderly passenger, when necessary to protect other passengers against his insults or violence; but, if injury to another passenger could have been avoided by requiring the drunken passenger to be and remain seated, the carrier cannot avoid liability for the injury by the servant's failure to perform that duty.—(Montgomery Traction Co., vs. Whatley, 44 S. Rep., 538.)

ALABAMA.—Damages—Excessive—Personal Injury.

A verdict of $3,400 for personal injury was not excessive, where plaintiff was considerably bruised and injured, and there was evidence that a part of his injury was of a permanent character, tending to shorten his life; organic heart trouble, liable to produce death at any time having been developed or aggravated.—(Montgomery Traction Co. vs. Bozeman., 44 S. Rep., 559.)

ALABAMA.—Street Railroads—Collision with Vehicle—Injuries to Driver—Action—Complaint—Torts—Willfulness—Defenses—Contributory Negligence—Injuries to Traveler—Action—Variance—Operation of Cars—Duty to Look Out—Wantonness.

In an action against a street railroad company for injuries to the driver of a vehicle in a collision with a car, a count alleging that the injury resulted from the wanton and willful negligence of defendant's servants in control of the car sufficiently charged that plaintiff's injuries were wantonly or intentionally inflicted.

In an action for injuries alleged to have been willfully inflicted, contributory negligence is no defense.

Where a count in an action for injuries in a collision between defendant's street car and a vehicle charged simple negligence, and alleged that the collision occurred at a point where defendant's track was on a public highway, but the proof showed that the wagon was struck while on defendant's track, not on a highway, there was a fatal variance as to such count.

A street railroad company, operating its cars over a public highway, is required to keep a lookout for travelers on the highway; but no such duty is required at points along its track outside the highway.

Where a count in a complaint against a street railroad company for injuries to a traveler outside a highway alleged that the injuries were inflicted intentionally, it could not be supported by proof of a failure to discover plaintiff's peril, but was dependent on the failure of defendant's employees to use proper means to stop the car after actually discovering such peril.—(Birmingham Ry., Light & Power Co. vs. Brown, 44 S. Rep., 572.)

ALABAMA.—Carriers — Injury to Passenger — Action — Evidence—Trial—Questions to Witness—Objection—Instructions—Theory of Trial.

Where, in an action for injuries to a passenger, she alleged that her car stopped at a place where is was customary to stop to let off passengers, and that as she was attempting to alight the car suddenly started, whereby she was injured, it was proper to permit a witness to testify that cars usually stopped there to let off passengers.

A party cannot object to a question to a witness for the first time after the question is answered.

Where, in an action for injuries to a passenger owing to the sudden starting of a car, defendant proceeded throughout the trial on the assumption that it operated the car, it was not entitled to an instruction based on the ground that there was no evidence that it operated the car.—Birmingham Ry., Light & Power Co. vs. Taylor, 44 S. Rep., 580.)

*Conducted by Wilbur Larremore, of the New York Bar, 22 Nassau Street, New York, to whom all correspondence concerning this department should be addressed.

CALIFORNIA.—Damages — Personal Injury — Future Consequences—Evidence—Admissibility—Causes—Injury to Passenger—Joint Liability—Defenses—Last Clear Chance.

To justify a recovery for future consequences resulting from a personal injury, the evidence must show with reasonable certainty that such consequences will follow from the injury.

Where, in an action for personal injury, the evidence showed that plaintiff sustained a fracture at the base of the brain, the testimony of physicians that in a majority of cases, where the injury consisted of a fracture at the base of the brain, epilepsy, paralysis, or mental deterioration would result in the future, was admissible to prove future suffering on which the jury could award damages for futre injury.

Where a passenger in a street car injured in a collision between the car and a car operated by another company sued both companies, and showed that the collision was due to the joint or concurrent acts of negligence of the two companies, an instruction confining a recovery against the company having the last clear chance to avoid the collision and neglecting to act on it was properly refused; the rule of last clear chance being only applicable to cases where the defense is contributory negligence.

One having a right to recover against either of two joint wrongdoers or both cannot, in an action against both, be involved in litigation to determine the question of the respective rights of the wrongdoers as against each other.—(Cordiner vs. Los Angeles Traction Co., et al., 91 Pac. Rep., 436.)

CALIFORNIA.—Street Railroads—Injury to Person on Track—Contributory Negligence—Trial—Introduction of Evidence—Rebuttal.

Decedent was guilty of contributory negligence barring recovery for his death, where at night he attempted to cross a street railway track in front of a moving car, when it was from 8 to 15 feet distant, the headlight plainly visible and the gong ringing.

In an action for a pedestrian's death caused in collision with a street car, any error in excluding evidence for plaintiff as to the car's speed was harmless, where the death resulted from contributory negligence.

Where, in an action for the death of a pedestrian attempting to cross a street car track at night, plaintiff offered testimony as to the absence of signal lights at the place, at the close of defendant's case, it was not error to exclude similar testimony; the evidence being not in rebuttal, and no reason being given tending to appeal to the discretion of the court, nor excuse given for not offering the testimony when the other was given.—(Higgins, et al., vs. Los Angeles Railway Co., 91 Pac. Rep., 344.)

GEORGIA.—Corporations—Liability for Torts of Agent—Master and Servant—Injuries to Third Persons—Liability of Master.

A street railway company is liable for a tort committed by its conductor in the prosecution and within the scope of its business, whether by negligence or wilfully.

Where a petition alleged that a conductor on the car of a street railway company, while engaged in the prosecution and within the scope of his business in collecting fares, failed and refused to give a passenger correct change, and, upon request therefore, drew a pistol and fired at the passenger, but that the ball missed the passenger and struck a woman passing on the public street through which the car was running, causing her death, and that the plaintiffs were the husband and children of the decedent, the allegations set out a cause of action against the company, and the petition was not demurrable.

Allegations that the company knowingly placed in charge of one of its passenger cars a conductor of bad character, who was drunk and armed with a pistol, and that a homicide occurred in the manner indicated in the preceding note, were not demurrable.—(Savannah Electric Co. vs. Wheeler, et al., 58 S. E. Rep., 38.)

MISSOURI.—Carriers—Injury to Passengers—Instructions—Negligence—Contributory Negligence—Burden of Proof.

In an action against a carrier for personal injuries, where there was a defense of contributory negligence, an instruction which authorizes a recovery for plaintiff on facts hypothesized in it, without limiting it by reference to contributory negligence, is not reversible error, where other instructions submit the question of plaintiff's contributory negligence.

In an action for negligence, the burden of proving contributory negligence is on defendant.—(Underwood vs. Metropolitan St. Ry. Co., 102 S. W. Rep., 1045.)

MISSOURI—Master and Servant—Action for Injuries—Evidence—Sufficiency—Burden of Proof—Presumptions—Res Ipsa Loquitur.

In an action by a motorman for injuries sustained by the explosion of the controller on a street car, expert proof held not to show the cause of the explosion to be the defective condition of the controller or the want of necessary inspection.

Where, in an action by a motorman for injuries sustained by the explosion of the controller on a street car, it was alleged that the railroad company was negligent in that the defective condition of the controller could have been discovered by ordinary care in inspecting the same, the burden was on the motorman to show that the controller was defective to the knowledge of the railroad company, had it exercised ordinary care; no presumption of negligence arising from the happening of the accident.

The doctrine of res ipsa loquitur is inapplicable where an injury has resulted to a motorman by the explosion of the controller on a car; that doctrine being inapplicable where injuries result from complicated machinery.—(Beebe vs. St. Louis Transit Co., 103 S. W. Rep., 1019.)

MISSOURI.—New Trial—Grounds—Disqualification of Juror—"Striking" Employe — Damages — Grounds—Expenses—Nursing by Family—Carriers—Personal Injuries—Damages—Excessive Damages.

In an action against a street railway company for personal injuries, a juror on his voir dire testified that he had no business relations with or interest in the defendant company, and that he had no bias or prejudice against the parties, or either of them. It afterwards appeared that the juror had been an employe of defendant company, who had gone on a strike, which had continued for several months, during which feeling ran high and defendant's tracks were demolished by dynamite. A motion for a new trial was made on that ground, and on the hearing the juror was offered as a witness for plaintiff. He did not admit that he was one of the strikers, nor did he deny the charge made against him, but repeated that he had no prejudice either way. It was shown by affidavits that he was one of the leaders in the strike. An unusually large verdict was returned by the jury. Held, that a new trial should have been granted.

In an action by a passenger for personal injuries, the testimony of plaintiff showed that she was 52 years of age, and had been in perfect health prior to the accident, and was earning from $30 to $40 per week, and that she had suffered a great deal of pain in her back, dizziness in her head, numbness in her limbs, and severe pains in her hips and legs; that she could get around the room with great difficulty; that she was unable to work or take care of herself, and was as helpless as a child; that she had paid $10 to a physician for consultation and $35 to a masseuse, but two larger doctor bills had not been paid. A physician testified that she showed evidence of traumatic neurasthenia and appeared to be losing strength. He diagnosed the case as traumatic or railroad spine. Another physician, a specialist, treated plaintiff for about 10 months. He found her condition a nervous one, with symptoms of concussion of the spine. He considered plaintiff an invalid who would never permanently recover. Another physician testified that she was suffering from neurasthenia or nervous exhaustion; that she had suffered a great deal of pain, but presented no evidence of any organic disease. He could not state whether the condition was permanent or temporary. Defendant's surgeon, who treated plaintiff for about two weeks immediately after the accident, testified that a week or 10 days later, he went to see her, saw her sitting by the window, but, after being admitted to the house, found that she had gone upstairs and had gotten into bed with her clothes and shoes on. A physician appointed by the court to examine plaintiff did so in the presence of her physician. In his opinion she had no permanent injuries. He was a specialist in neurosis. Held, that a verdict of $30,000 was excessive.—(Gibney vs. St. Louis Transit Co., 103 S. W. Rep., 44.)

MISSOURI.—Street Railroads—Injuries to Person on Track—Actions—Instructions—Trial—Instructions—Conformity to Evidence—Conformity to Issues—Appeal—Review—Harmless Error—Exclusion of Evidence—Evidence—Opinion Evidence—Conclusion of Witness—Witnesses—Impeachment—Inconsistent Statements—Plea of Privilege.

An instruction, in an action for the death of one who was

struck by a street car, that, as to the alleged negligence of defendant in operating its car at an excessive speed, under the ordinances of the city defendant had a right to operate its car at a speed not exceeding 10 miles an hour, and that before the jury could find against the defendant for excessive speed they must find either that defendant operated its car in excess of 10 miles an hour, or at such a speed which under the evidence amounted to negligence, and unless the jury so found, and that such excessive speed was the cause of the death, then plaintiff could not recover on account of such speed, was not objectionable as stating that the railway company had the absolute right to run its cars 10 miles an hour, regardless of the circumstances.

Where, in an action for the death of one who was struck and dragged by a street car, plaintiffs did not ask an instruction submitting the question whether there was a failure to sound the gong, but the only issues in reference to defendant's negligence submitted to the jury under plaintiffs' instructions related to the alleged failure to stop the car in time to avoid the accident and running in excess of the speed ordinance, an instruction, for defendant, following the charge in the petition and in form the same as instructions given for plaintiffs, that plaintiffs could not recover on account of failure to sound the gong, unless the failure caused the death, was not ground of complaint by plaintiffs.

An instruction, in an action for the death of one struck by a street car, that as to the charge of negligence, in that the motorman failed to stop the car after plaintiffs' son was in a position of peril, this principle of law did not apply unless plaintiffs' son was in such position a sufficient length of time to enable those in charge of the car to stop, or to check the same, so as to avoid striking him in the exercise of ordinary care and with the means at hand for stopping the car, was not erroneous as leaving out of consideration the duty of the motorman to be on the lookout to discover the peril.

Where, in an action for the death of one who was struck by a street car, there was no evidence that would warrant submitting the proposition that the boy struck lost his life, not in being struck, but in being dragged, instructions that if the boy was of sufficient age, judging him by boys of his age, to appreciate the danger, and he went upon the track without looking or listening, so close to the car that the motorman with ordinary care could not avoid hitting him, the defendant was not liable, and that if he undertook to cross the track in front of the car while the same was so close as to prevent the motorman in the exercise of ordinary care from stopping, whereby he was struck and killed, then plaintiffs could not recover, were not erroneous, in that they did not deal with the question of dragging after the boy was struck.

Where, in an action for the death of one who was struck and dragged by a street car, plaintiffs sought a verdict on the theory that the motorman failed to use ordinary care to stop the car after he discovered their son was in danger at a sufficient distance to have permitted the car to have been stopped before striking him, an instruction for defendant that if plaintiffs' son undertook to cross the street in front of the car, and while the same was so close as to prevent the motorman in the exercise of ordinary care from stopping so as to avoid striking him, whereby plaintiffs' son was struck, plaintiffs could not recover, was not erroneous, in that it failed to state that, though the boy may have come on the track so close to the car that it was impossible for the motorman to stop, yet, if that impossibility was caused by the excessive speed, the defendant was liable; that not being the theory on which the case was tried.

In an action for the death of one who was struck and dragged by a street car, after a witness for plaintiff had testified that "he stumbled there," it was objected by defendant that witness was stating a conclusion, which objection the court sustained, but the record showed that the objection was aimed at what witness had said in the sentence preceding, that "evidently, as I found later, there was a hole where the bricks had been sunken, was what caused the child's fall," and the witness had before stated that the child stumbled. Held, that there was no error in the ruling.

In an action for the death of one who was struck and dragged by a street car, evidence "that there were persons on the platform, and that the conductor evidently was talking to some one on the platform," was properly excluded as a conclusion of the witness.

In an action for the death of one struck and dragged by a street car, evidence to impeach the motorman, who testified for defendant, that at the coroner's inquest, when asked to state the circumstances of the accident, he replied, "I don't care to testify —I might incriminate myself," was properly excluded.—(Masterson et al. vs. St. Louis Transit Co., 103 S. W. Rep., 48.)

MISSOURI. — Carriers — Street Railroad — Passengers—Care Required—Injury to Passenger—Res Ipsa Loquitur—Malicious Acts of Third Person—Negligence of Defendant's Servants—Trial—Instructions—Conformity to Issues—Carriers—Injury to Passenger—Question for Jury—Damages—Personal Injuries—Evidence.

A street car company as a carrier of passengers is bound to exercise the highest care and skill for the safety of passengers that a prudent man would exercise in a like business and under like circumstances.

Where a street car passenger was injured by the derailment of a car caused by a brick on the track, plaintiff established a prima facie case by proof of her relation as a passenger, and that she was injured by the derailment of the car.

Where plaintiff, a street car passenger, was injured by the derailment of a car caused by a brick maliciously placed on the track by a boy, and, though the motorman could have seen the brick in time to have stopped the car before striking it or at least reduced the speed so as to have prevented the derailment, he did neither, the malicious act of the boy was no answer to the street car company's liability for plaintiff's injuries.

In an action for injuries to a street car passenger, an instruction that if, before plaintiff reached her destination, the car left the track and struck a post, causing plaintiff to be thrown from her seat and sustain the injuries complained of, she was entitled to recover, unless defendant showed by a greater weight of evidence that it could not have prevented such derailment by the exercise of the highest degree of care employed by a very careful railroad under the same or similar circumstances in maintaining its tracks in the same condition, and in the management and control of cars, etc., was proper.

Where, in an action for injuries to a street car passenger by derailment, the charge given fully covered all the issues in the case and a vigilant watch ordinance in no manner affected it, the court did not err in refusing to charge that, while it was the duty of defendant's motorman to exercise that degree of care that a very careful motorman would be expected to use to avoid injury to plaintiff, it was also his duty to keep a vigilant watch for persons on or approaching the tracks, especially children, and that if children immediately before the accident were running or playing about the track so as to be in danger, and defendant's motorman, seeing the children, was putting his car under control and sounding his gong in order to warn them, and while so engaged he failed to see the brick on the track which caused the derailment, etc., it was not a part of his duty to anticipate that a boy would run suddenly from the sidewalk and place a brick on the track.

Where a street car passenger was injured by the derailment of the car caused by a brick placed on the track by a boy some 40 or 50 feet in front of the car, whether the motorman by the exercise of reasonable diligence could have seen the brick placed on the track, or could have seen it after it had been placed there for a sufficient length of time to have permitted him, with the means and appliances at his command, to stop the car, was for the jury.

Plaintiff, a married woman, 35 years of age and enceinte, was thrown from her seat in a street car by the derailment thereof against the seats and timbers of the car, striking on her abdomen and right chest. She was rendered unconscious for a few minutes, when she immediately went home and sent for a doctor. She suffered a miscarriage of a three months' fœtus on the succeeding evening, and was confined to her bed for six weeks. Her health was poor after she was able to get up, and her physician testified that she could never be entirely well without an operation, which would be necessarily dangerous, that he had continued to treat her up to the time of the trial, and that her trouble would require continued treatment. Two other experts, who had examined plaintiff under order of court, testified that she did not have a retroverted womb. Held, that a verdict allowing her $7,500 allowed to stand by the trial court was not so excessive as to indicate passion and prejudice.—(O'Gara vs. St. Louis Transit Co., 103 S. W. Rep., 54.)

MISSOURI.—Street Railroads—Collisions—Injuries to Pedestrians—Negligence—Municipal Corporations—Torts—Gov-

ernmental Powers—Negligence of Agents—Liability—Damages—Personal Injury—Petition—Evidence—Admissibility—Appeal—Harmless Error—Witnesses—Examination—Damages—Instructions.

In a suit against a street railway company and a city for injuries to a pedestrian in consequence of a collision between a car and a vehicle of the city under the control of an employee thereof, evidence held insufficient to show negligence on the part of the company.

A city is liable for the negligence of its servants engaged in removing piles of dirt from its streets, though the removal may in a remote degree be referable to governmental regulation to promote the general health of the city.

Where the petition in an action for personal injuries alleges an injury to the head, eyes, spinal cord, and muscles and ligaments surrounding the same, the extent of which could not be known, evidence of plaintiff's loss of memory and injury to his eyes was admissible.

The error, if any, in overruling an objection to a hypothetical question, asked a physician in a personal injury action, as to whether he would attribute plaintiff's nervous condition to the accident, was harmless, where the answer was that that was possible.

Where, in an action for personal injuries, the petition alleged that plaintiff incurred expenses for medicine, medical care and attention, and there was proof of application of medicine and of medical care and attention, with the charge therefor, an instruction submitting the question of expenditure for medicine was proper.—(Young vs. Metropolitan St. Ry. Co., 103 S. W. Rep., 135.)

MISSOURI.—Carriers—Injuries to Passenger—Instructions—Evidence—Admissions—Conclusiveness.

Where, in an action for injuries to a passenger, plaintiff claimed that the car started suddenly while she was boarding it, an instruction submitting the question whether the car was suddenly started, and that defendant's servants knew, or by the exercise of "proper care" should have known, that plaintiff was on the step, was not erroneous because of the phrase "proper care"; the requisite care having been previously properly stated.

A requested instruction that plaintiff's statements against her interest must be regarded as absolutely true was properly modified so as to read that they were presumably true.—(Randolph vs. Metropolitan St. Ry. Co., 102 S. W. Rep., 1085.)

MISSOURI.—Street Railways—Negligence—Excessive Speed—Duty of Railway—Contributory Negligence—Pleadings.

The running of a street car at a speed of from 15 to 40 miles an hour along a street in the populous part of a city, without reducing the speed at street intersections, is not only negligence, but is a wanton and reckless act.

It is the duty of the operators of an electric street car to keep it under reasonable control while passing through well-populated districts, and especially while approaching street crossings.

The fact that one approaching a street railway crossing is justified in assuming that an approaching car will be operated with reasonable care, and will not be negligently run at an excessive rate of speed, does not absolve him from the duty of attending to his own safety.

Where plaintiff, on nearing a street railway crossing, saw a car, about 315 feet away, approaching at a speed of from 15 to 40 miles an hour, and nevertheless attempted to cross the track, he was guilty of contributory negligence.

In an action against a street railway for injuries received by plaintiff while attempting to cross a track in front of defendant's car, a petition, alleging that the motorman of the car could have prevented the injury by stopping the car or checking the speed, had it been operated at a reasonably careful rate of speed, was insufficient to state a cause of action predicated on a violation of the duty of defendant to stop the car after seeing plaintiff in a place of danger, although plaintiff was guilty of contributory negligence in placing himself in a dangerous position.—(Grout vs. Central Electric Ry. Co., 102 S. W. Rep., 1026.)

MISSOURI.—Carriers—Injuries to Passenger—Sufficiency of Evidence—Burden of Proof—Damages—Married Women—Pleading—Sufficiency—Carriers—Injuries to Passenger—Action—Pleading.

In an action against a street railway for injuries received by plaintiff as a result of stepping on an electrified plate in defendant's car, evidence examined, and held to show that plaintiff was injured as a direct result of the shock.

Where a passenger on a street car was injured by stepping on an electrified metal plate in defendant's car, and receiving an electric shock, the burden was on defendant to show that the presence of the electricity could not have been detected and prevented by the exercise of the highest degree of care.

In an action by a married woman for personal injuries, plaintiff may recover damages for physical or personal inconvenience resulting from the injury.

In an action against a street railway for injuries received by plaintiff through stepping on an electrified metal plate on defendant's car, allegations in the petition that as a result of the injuries plaintiff's lower limbs were partially paralyzed, her nervous system injured and diseased, and she suffered severe pains, etc., and that, as a result of the injury, she was for a considerable period of time confined to her bed, and was unable to perform her household duties, etc., were broad enough to include damages on account of physical inconvenience.

In an action against a street railway for injuries, a petition alleging that plaintiff, in passing over the floor of the defendant's car, received a severe electric shock through stepping on an electrified plate on the floor of the car, and that the shock was caused by the negligence of the defendant in negligently constructing, maintaining, and operating the car, sufficiently alleged negligence on defendant's part.—(McRae vs. Metropolitan St. Ry. Co., 102 S. W. Rep. 1032.)

MISSOURI.—Street Railroads—Injuries to Pedestrians—Collisions—Contributory Negligence.

A pedestrian, before crossing a street on which double tracks for cars were maintained, looked in one direction, and saw a car approaching on one track, and waited until it passed, when she started and was struck, on stepping onto the other track, by a car coming from the other direction. There was a space of a few feet between the tracks. Held, that she was guilty of contributory negligence precluding a recovery.—(Ross vs. Metropolitan St. Ry. Co., 102 S. W. Rep., 1036.)

MISSOURI.—Street Railroads—Operation—Duty of Railway—Negligence—Crossing Accident—Injuries to Driver of Vehicle—Rights of Pedestrians—Pleading—Scope—Duty of Traveler on Public Street—Contributory Negligence—Question for Jury—Instructions.

It is the duty of a street railway to so construct its road and equip and operate its cars that the latter may be readily controlled by the operators, under all conditions and in all situations reasonably to be anticipated.

Before descending a steep hill, down which its line ran, defendant was accustomed to stop its cars, and it was the conductor's duty not to give the signal to start until he was at the hand brakes on the trailer of the train prepared to use them if necessary. At the time of the accident the train was so crowded that, when brought to a stop at the top of the hill, the conductor had difficulty in reaching his position, and the gripman started the car without the signal from the conductor, the car acquiring some speed before the latter reached the hand brake. The gripman had detached his hold on the cable, and set the brakes under his control in such a manner that they locked the wheels, causing them to slide on the rails. Had the brakes been set with less force, such sliding would have been avoided, and the train could have been brought to a standstill. The gripman was a raw hand, inexperienced, and incompetent, and the train sliding down the hill struck the vehicle plaintiff was driving. Held, that defendant was negligent.

Travelers on public thoroughfares traversed by street cars have the right to presume that the street car company will not negligently overload its cars, thereby imperiling the safety of travelers by losing control of the cars.

In an action against a street railway for injuries received by plaintiff by being struck by one of defendant's cars, a petition alleging that by reason of defendant's negligence in the operation of its road, its equipment, its trains, and cars running thereon, its negligent failure to stop one of its cars before crossing a street, etc., plaintiff was injured, included defendant's negligent act in making a premature start at the top of a hill on the descent whereof plaintiff was injured, permitting the train to attain a too rapid rate of speed in the descent, the negligent handling of the brakes, the failure to apply sand to the rails to prevent the wheels from sliding on them, and the negligent overloading of defendant's cars, whereby they could not be controlled.

It is the duty of a traveler on a public street, when approaching a railway crossing, to make a reasonable use of his senses of sight and hearing before entering the sphere of danger to ascertain whether the safety of his passage on the crossing is threatened by approaching cars, and to act with reasonable care to avoid an encounter with present danger.

A traveler on a public street has a right to presume that the operators of approaching street cars are exercising and will continue to exercise reasonable care in approaching a crossing.

In an action against a street railway for injuries sustained by plaintiff being struck by defendant's car at a street crossing, the question of plaintiff's contributory negligence held one for the jury.

Where, in an action against a street railway for injuries received by a plaintiff by being struck by defendant's car at a street crossing, plaintiff alleged and proved that he attempted to cross defendant's track in reliance on a custom of the latter to stop its cars before crossing the street at the intersection, an instruction permitting a recovery for plaintiff if he was injured by reason of defendant's failure to stop the cars according to the custom, without requiring a further finding that plaintiff had knowledge of the custom, or that he relied on it, was prejudicial error.

An instruction which on an assumed hypothesis directs a verdict for the plaintiff, to be free from criticism, should contain all of the ingredients essential to the right of recovery under the pleadings and evidence.—(Percell vs. Metroplitan St. Ry. Co., 103 S. W. Rep., 115.)

MISSOURI.—Carriers—Street Railroads—Duty to Stop—Injury to Passengers—Res Ipsa Loquitur—Damages—Personal Injuries—Future Consequences—Pleading.

A street railroad company as a common carrier is bound to employ the highest degree of care to avoid injury to passengers, and, when signaled to stop at a regular stopping place, is required to bring the car to a complete stop, and hold it stationary until the departing passengers, in the exercise of reasonable care, may accomplish their departure in safety.

When a street car is stopped for passengers to alight, it is the duty of the carrier's servants, not only to hold the car stationary a reasonable length of time for the passengers to alight, but to look to the places of exit to ascertain that no passenger is in the act of alighting before giving the signal to proceed.

In an action for injuries to a street car passenger as she was endeavoring to alight, proof that the car was brought to a full stop to discharge and receive passengers that it suddenly started while plaintiff was stepping to the street, and that she was injured in consequence of a fall caused by the starting of the car, was sufficient to raise a presumption that the starting of the car was due to negligence.

When a street car passenger was injured by the alleged premature starting of the car as she was endeavoring to alight, and the facts raised a presumption of negligence on the part of the carrier's servants, its liability for the injuries sustained was fixed, unless it could show affirmatively that, notwithstanding the existence of such facts, the starting of the car was the result of unavoidable accident or some cause beyond its control.

In an action for injuries, an allegation that plaintiff was reasonably certain to suffer in the future great physical pain and mental anguish was not insufficient to raise such issue, because it did not charge in terms that she "would" suffer future pain.—(Bell vs. Central Electric Ry. Co., 103 S. W. Rep., 144.)

MASSACHUSETTS.—Street Railroads—Lien Under Massachusetts Law—Agreement to Issue Bonds.

Rev. Laws Mass. 1902, c. 112, § 23, requiring a street railroad company before issuing mortgage bonds to obtain authority therefor from the State Board of Railroad Commissioners, which may be granted only after a hearing and examination into the assets and liabilities of the company, and upon being satisfied that its property, exclusive of its franchise, equals or exceeds its indebtedness, embodies a rule of public policy which cannot be ignored nor overridden by the courts.

A provision in notes, given by a Massachusetts street railroad company, by which it agreed to issue to the holder as security certain of its bonds secured by a mortgage previously executed, as soon as a further issue of bonds thereunder should be authorized by the State Railroad Commissioners, whose authority was necessary before they could be legally issued under Rev. Laws, Mass. 1902, c. 112, § 23, does not place the notes on an equality with bonds previously issued, nor entitle the holders to any preference over general creditors where no further issue of bonds was authorized, and the company has become insolvent and is in the course of administration, although the circumstances were such as to create an equitable lien as between the parties which the courts would enforce in the absence of the statute.—(Augusta Trust Co. vs. Federal Trust Co. et al., 153 Fed. Rep., 157.)

NEBRASKA.—Carriers—Injury to Passengers—Contributory Negligence—Question for Jury—Evidence—Opinion Evidence.

It is a question of fact for the jury whether or not a passenger, who is riding on the lower step of a platform of a crowded street car, and who is thrown therefrom and injured by reason of the negligent operation of the car, is, by voluntarily riding in such place, guilty of such contributory negligence as will defeat a recovery.

Evidence as to the negligence of the defendant in the operation of the car examined, and held sufficient to require its submission to the jury.

A witness who sees a moving car, and possesses a knowledge of time and distance, is competent to express an opinion as to the rate of speed at which the car was moving. Omaha St. Ry. Co. vs. Larson, 97 N. W. 824, 70 Neb. 591, followed and approved.—(Coffey vs. Omaha & C. B. St. Ry. Co., 112 N. W. Rep., 589.)

NEBRASKA.—Carriers—Injury to Passenger—Contributory Negligence—Trial—Instruction.

A party cannot be charged with contributory negligence on account of taking a place on a crowded street car designated by the conductor of the car.

An instruction not based upon the evidence, although correct as a legal proposition, is ground for the reversal of a judgment if it has a tendency to mislead the jury.—(Boesen vs. Omaha St. Ry. Co., 112 N. W. Rep., 614.)

NEW JERSEY.—Street Railroads—Operation—Statutes—Local and Special Laws—Constitutional Law.

The traction companies act of March 14, 1893, authorizes companies incorporated thereunder to acquire and operate actually existing street railways, whether or not they are at the time being operated with legal authority.

Section 1 of the traction companies act of March 14, 1893, is a constitutional enactment.—(Mayor, etc., of Jersey City vs. North Jersey St. Ry. Co., 67 Atl. Rep., 113.)

NEW JERSEY.—Taxation—Property Subject—Franchises.

Under the supplement of April 11, 1866, to the general tax law of 1846 the franchises of a corporation are not taxable as property.

Under the general law of 1903, which exempts from taxation under this act, inter alia, "all offices and franchises, and all property used for railroad and canal purposes, the taxation of which is provided for by any other law of this state," all offices and franchises are excluded from taxation under this act, whether taxed under other laws or not. The qualifying clause relates only to the last antecedent, to wit, property used for railroad and canal purposes.—(North Jersey St. Ry. Co. vs. Mayor, etc., of Jersey City et al., 67 Atl. Rep., 33.)

NEW JERSEY.—Carriers—Injury to Passenger—Contributory Negligence.

When one who has alighted from a trolley car in which he had been a passenger passes behind the car and proceeds to cross the track on which cars run in the other direction, making no observation for his own safety except to "look up" when the car from which he had alighted prevented his view of the other track, and, without waiting until that car had passed sufficiently far to permit observation, enters on that track and is struck by a car thereon before he had seen it, which is not shown to have been running at excessive speed, his negligence contributing to the injury he received is so disclosed as to leave no question to be submitted to the jury.

Whether the duty which the trolley company owed to him as a passenger just discharged from one of its cars exceeded that which it owed to any foot passenger attempting to cross its tracks is not involved. The fact that he had been a passenger does not relieve him from the duty on his part to take reasonable care for his own safety.—(Eagen vs. Jersey City, H. & P. St. Ry. Co., 67 Atl. Rep., 24.)

NEW JERSEY.—Carriers—Injuries to Passengers—Evidence.

In an action for injuries sustained while alighting from a street car, evidence examined, and held to warrant the direction of a verdict for defendant on the ground that plaintiff alighted

before the car came to a stop.—(Dockham vs. North Jersey St. Ry. Co., 66 Atl. Rep., 961.)

NEW YORK.—Carriers—Passengers—Personal Injuries—Taking up Passengers.

The duty of a street car company to give a person a fair and reasonable chance to get aboard its car does not arise until the car has been brought to a stop or the person has been invited to board it.—(Schwartz vs. New York City Ry. Co., 105 N. Y. Sup., 1.

NEW YORK.—New Trial—Inadequate Damages.

The evidence warranting a finding that plaintiff was intentionally thrown from defendant's car, on which he was a passenger, by the conductor, and fairly establishing that he was confined to his bed for six weeks and to the house two weeks longer by the resulting injury, that two ribs were broken, and both legs and his back and spine injured, as a result of which he had frequent fainting spells to the time of the trial, two years later, and that one knee joint was permanently injured by laceration of the ligaments, a new trial will be granted for inadequacy of damages; the verdict being for only $200.—(Tourtelotte vs. Westchester Electric Ry. Co., 105 N. Y. Sup., 50.)

NEW YORK.—Appeal—Evidence—Reversal.

Where, in an action for injuries due to the alleged faulty construction of a subway, plaintiff's testimony and admissions with reference to the side of the train from which he alighted, were in irreconcilable conflict, he was not entitled to a reversal of a judgment for defendant, because the court limited the testimony with reference to defects to the west side of the platform in question, where a verdict for plaintiff could not stand.—(Zeigler vs. Interborough Rapid Transit Co., 104 N. Y. Sup., 822.)

NEW YORK.—New Trial—Verdict Contrary to Evidence—Credibility of Witness.

Plaintiff's case depending on the fact that the car came to a full stop before he attempted to alight, and that while he was doing so it suddenly jerked forward, and it not appearing that any one saw him when he alighted, and there being discrepancies in the testimony and contradictions on circumstantial points warranting the jury in doubting his testimony, the court could not set aside the verdict for defendant and grant a new trial on the ground that the verdict was contrary to the evidence; the credibility of plaintiff being for the jury.—(Foreman vs. New York City Ry. Co., 104 N. Y. Sup., 932.)

NEW YORK.—Master and Servant—Death of Servant—Negligence—Evidence—Contributory Negligence.

Evidence, in an action for death of an employee of a railway company, who, in attempting to cross its tracks in a subway, was killed by a car, held insufficient to show negligence.

Evidence, in an action for death of an employee of a railway company, who was killed by attempting to cross its tracks in a subway, jumping from the platform almost in front of a car, held to show contributory negligence.—(Kupec vs. Interborough Rapid Transit Co., 104 N. Y. Sup., 924.)

NEW YORK.—Railroads—Injuries to Person on Track—Licenses—Negligence—Duty to Give Signals—Question for Jury.

An employee of a switch and signal company, which had a contract with defendant railway company to install switches and signals, was a mere licensee on defendant's tracks while engaged in work under that contract.

In an action against a railway company for the negligent killing of a person on its track, whether it was defendant's duty to give a signal, at a curve, of the approach of its train, held, in the absence of statute relating thereto, a question for the jury.—(Froelich vs. Interborough R. T. Co., 104 N. Y. Sup., 910.)

NEW YORK.—Carriers—Assault on Passenger—Provocation of Employee.

A carrier is liable for damages from insult to and assault on a passenger by a guard of the carrier on the car, notwithstanding the use of provoking language by the passenger.—(Danziger vs. Interborough Rapid Transit Co., 104 N. Y. Sup., 845.)

NEW YORK.—Street Railroads—Injuries to Persons on Tracks—Contributory Negligence.

Where, in an action against a street railroad for injuries to one struck by a car while crossing the track, it appeared from his evidence that he looked each way for a car before leaving the curb, and then proceeded diagonally across the street without again looking until he was upon the track, he failed to show affirmatively freedom from contributory negligence.—(Ayres vs. Forty-Second St., M. & St. N. Ave. Ry. Co., 104 N. Y. Sup., 841.)

NEW YORK.—Carriers—Injuries to Passengers—Taking up Passengers — Trial — Instructions — Invading Province of Jury.

Where plaintiff was injured in attempting to board a street car, the company is liable, in the absence of contributory negligence, if its servants in charge of the car knew, or should have known, that the plaintiff intended to take passage and did not afford him a reasonable opportunity to do so safely.

Where plaintiff was injured in attempting to board a street car, it was error to instruct that he was entitled to a verdict if the jury believed his testimony.—(Johnston vs. New York City Ry. Co., 104 N. Y. Sup., 1039.)

NEW YORK.—Street Railroads—Injuries to Travelers—Contributory Negligence.

In an action for injuries to the driver of a truck by collision with a street car approaching the truck from the rear, a clear preponderance of the evidence held to establish that plaintiff was negligent.—(Shatzman vs. New York City Ry. Co., 105 N. Y. Sup., 115.)

NEW YORK.—Evidence—Admissions—Offer of Settlement—Trial—Motions to Strike Out Evidence—Evidence Admissible in Part—Sufficiency of Motion.

In an action for personal injuries, testimony of the plaintiff that he went to defendant's office to see if he were not going to make a settlement, and that defendant offered him $200, to settle, simply to show that defendant acknowledged plaintiff's claim by offering to settle and pay plaintiff $200, was inadmissible.

Where the whole answer of a witness was objectionable, and the motion was promptly made to strike it out, and was overruled, and the answer could not in any way or for any purpose be competent testimony, the rule that where an answer, a part of which is objectionable, is given by a witness to a question which did not call for the objectionable part, and no objection is made to the question until it has been answered in part, nor any motion made after the entire answer was received to strike out any part of it, nor request for instruction to disregard it, the objectionable portion of the testimony is not ground for appeal, has no application.—(O'Brien vs. New York City Ry. Co., 105 N. Y. Sup., 238.)

NEW YORK.—Street Railroads—Injury to Travelers—Question for Jury—Rights in Street—Duty to Stop—Negligence—Concurrent Negligence—Imputed Negligence.

In an action for injuries to plaintiff while riding on a truck by a rear-end collision between the truck and one of defendant's street cars, evidence held to require submission of the question of defendant's negligence to the jury.

A street railroad company, though entitled to a paramount right of way over the portion of the street on which its rails are laid, has not such exclusive right to its tracks as to permit it to negligently run into a truck, without giving the driver thereof a reasonable opportunity, in the exercise of reasonable care, to get off the track.

The motorman of a street car was under no obligation to stop the car in order to prevent a collision with a truck, unless he saw, or should have seen in the performance of his duty to take notice of existing conditions, that there was danger of collision.

Where plaintiff, while riding on a truck with his employer, was injured in a collision between the truck and defendant's street car, defendant, having been negligent, could not escape liability for plaintiff's injuries, though plaintiff's employer, who was driving the truck, was concurrently negligent.

Where the servant was riding on a truck driven by his master at the time of the servant's injury in a collision between the truck and one of defendant's street cars, the negligence of the master, if any, was not imputable to the servant.—(Doctoroff vs. Metropolitan St. Ry. Co., 105 N. Y. Sup., 229.)

NEW YORK.—Carriers—Injuries to Passengers—Negligence.

Where a street car slowed down as it approached plaintiff in response to a signal, and plaintiff attempted to step on the platform, and was thrown down and injured by a sudden acceleration of speed, plaintiff was not entitled to recover, in the absence of proof that the motorman or conductor had actual notice that plaintiff was in the act of boarding the car, or that the place where he attempted to board it was a usual stopping place.—(Gomez vs. New York City Ry. Co., 105 N. Y. Sup., 108.)

NEW YORK.—Carriers—Injury to Passenger—Sufficiency of Evidence.

Where, in an action for injuries received while attempting to board a street car, the defendant offered no evidence, and plaintiff's testimony, which was corroborated by one apparently disinterested witness, clearly supported the allegations of the complaint that while plaintiff was attempting to board the car after it had come to a standstill, and before he had a reasonable time to do so, the car was started, and he was thrown to the ground and injured, a verdict for the defendant was unwarranted.—(Klein vs. Interurban St. Ry. Co., 105 N. Y. Sup., 96.)

NEW YORK.—Street Railroads—Injuries to Persons on Track—Evidence—Sufficiency—Negligence—Contributory Negligence—Care Required of Children.

In an action against a street railroad for the death of a child, evidence held insufficient to show that the driver of the car was negligent in failing to keep a proper lookout.

A child of tender years is not required to exercise the same degree of care and prudence in the presence of danger required of an adult under like circumstances, but is required to exercise such care and prudence as is commensurate with one of his age and intelligence.—(Kostenbaum vs. New York City Ry. Co., 105 N. Y. Sup., 66.)

NEW YORK.—Trial—Taking Case from Jury—Conflicting Evidence — Street Railroads — Operation — Collision with Vehicles—Actions for Injuries—Instructions.

Where the evidence is conflicting on the material issues of fact, the case is for the jury.

In an action for injuries to the driver of a truck, caused by his truck being struck by defendant's street car, a charge that defendant company was required to do everything and anything to stop and avoid hurting anybody was erroneous, since it placed upon the defendant the duty to exercise extraordinary precaution.—(Heckmuller vs. New York City Ry. Co., 104 N. Y. Sup., 679.)

NEW YORK.—Damages—Personal Injuries—Loss of Wife's Society.

Where, in an action against a railway for loss of the society of plaintiff's wife, resulting from injuries occasioned by defendant's negligence, it appeared that after the accident the wife remained in bed for three weeks and abstained from going out of the house for three or four weeks, and no evidence was given as to any loss of services, as to any expense having been incurred, or as to the condition in life of the couple or the occupation of plaintiff, a judgment for plaintiff for $229 was excessive.—(Schulz vs. Union Ry. Co., 104 N. Y. Sup., 722.)

NEW YORK.—Carriers—Street Railways—Refusal to Give Transfer.

A street railway is not liable for refusal to give a transfer to one who becomes a passenger solely to lay a foundation to sue for such refusal.—(Johnston vs. New York City Ry. Co., 104 N. Y. Sup., 812.)

NEW YORK.—Carriers—Street Railroads—Passengers—Transfers—Action for Refusal.

In an action under Railroad Law, Laws 1892, p. 2107, c. 565, § 104, against a street railroad company for refusing a transfer, it is no defense that the company provided the conductor with transfers to give to passengers, the conductor's refusal being the company's, and section 39, providing exempting railroad companies from liability for asking or receiving more than lawful fare, where it is done through inadvertence or mistake not amounting to gross negligence, being inapplicable.—(Snee vs. Brooklyn Heights R. Co., 104 N. Y. Sup., 907.)

NEW YORK.—Carriers—Street Railroads—Transfers—Penalties—Variance—Penalties—Action—Previous Defaults.

Where, in an action against a street railway company for penalty for refusal to give a transfer, the complaint alleged that the refusal was by defendant's conductor and occurred December 7, 1905, while the proof showed that plaintiff applied to defendant's transfer agent on the street for a transfer, which was refused, on July 7, 1905, the variance was fatal.

The institution of an action to recover a statutory penalty against a street car company for refusal to give a transfer operates as a waiver of plaintiff's right to penalties for prior defaults.—(Stevenson vs. New York City Ry. Co., 104 N. Y. Sup., 866.)

PENNSYLVANIA.—Pleading—Amendment.

In an action by a passenger against a street railway company for personal injuries sustained while alighting from a car, plaintiff may at the trial two years after the accident amend his statement by changing averment that there was no stop of the car at all to an averment that there was an insufficient stop.—(Schmelzer vs. Chester Traction Co., 66 Atl. Rep., 1005.)

PENNSYLVANIA.—Carriers—Assault on Passenger—Negligence.

In an action by a woman, a passenger on a street car, to recover against the railroad company for injuries received from an intoxicated passenger, where the only negligence alleged was allowing the man to enter the car when he appeared intoxicated, it was error to submit the case to the jury where the evidence showed that there was no appearance of intoxication until he was asked to pay his fare.—(Brehony et al. vs. Pottsville Union Traction Co., 66 Atl. Rep., 1006.)

PENNSYLVANIA.—Street Railroads—Collision with Traveler—Contributory Negligence.

In an action against a street railway company to recover for personal injuries by collision with a street car, evidence held to establish such contributory negligence on the part of the driver of the wagon in which plaintiff was riding as to require direction of verdict for defendant.—(Leister vs. Philadelphia Rapid Transit Co., 66 Atl. Rep., 866.)

TEXAS.—Damages—Personal Injury—Instruction.

In a personal injury action, an instruction to assess plaintiff's damages at such sum "as, if paid now, will fairly compensate him for the injury," and then enumerating the elements of damages to be considered in estimating them, was proper, and not objectionable as authorizing double damages.—(Beaumont Traction Co. vs. Edge, 102 S. W. Rep., 746.)

VERMONT.—Carriers—Street Railways—Collision—Injury—Liability of Company—Duty of Motorman—Question for Jury.

Though a street car's collision with a wagon resulted from the driver's negligence in crossing the track, the company was liable to a passenger for her injury, if the motorman's negligence in running the car at a very rapid and unusual rate of speed, or too close to a car in front, after the passing of which the driver drove his wagon across the track, prevented him from avoiding the collision.

Where a street car's collision with a wagon caused a passenger's injury, the motorman was not negligent as a matter of law merely because the ringing of the gong, which was not done, would have prevented the obstruction; the inference of negligence not being necessarily contained in that finding.

A motorman had no right, as to passengers, to assume that one driving a wagon along the street in the same direction the car was going would not attempt to cross the track "mid block," but owed her the duty to exercise the most watchful care and the most active diligence for her safety against collision with the wagon.

In an action against a street railway company for injury to a passenger, caused by a collision with a wagon crossing the track, whether the motorman was negligent held, under the evidence, a question for the jury.—(Strong vs. Burlington Traction Co., 66 Atl. Rep., 786.)

VIRGINIA.—Street Railroads—Injuries to Travelers—Negligence—Pleading—Public Highway—Establishment—Dedication—Acceptance—Country Highways.

A complaint against a street railroad company for injuries to a traveler, alleging that defendant so carelessly, etc., managed its cars that by reason of its negligence one of them ran against plaintiff, who was then on the highway, whereupon, etc., was fatally defective for failure to allege the facts from which the negligence arose.

Where plaintiff was injured in a collision with a street car in a highway outside the limits of a city, whether the place where the injury occurred was in fact a public highway must be determined by the law with reference to the establishment of public roads in the country, and not with respect to the dedication and opening of streets in a city.

The acceptance of the dedication of a city street may be shown by the acts of the municipality's officers.

The acceptance of a highway in the country, so as to impose on the public the burden of keeping it in order, must appear by matter of record, either by a formal acceptance or a showing that the county court has laid off a road before used into precincts, or appointed an overseer or surveyor for it, thereby claiming the road for the benefit of the public.—(Lynchburg Traction & Light Co. vs. Guill, 57 S. E. Rep., 644.)

FINANCIAL INTELLIGENCE

WALL STREET, Dec. 24, 1907.

The Money Market

Although the general monetary conditions improved materially during the past week rates for money in the local market have ruled somewhat higher than those heretofore quoted. Money on call after loaning in quantity at from 6 to 12 per cent early in the week, rose sharply to 25 per cent at the close, while small amounts of thirty-day money were placed at 15 per cent, and of sixty-day and ninety-day funds at 12 per cent. The advance in the local money rates was due almost entirely to the calling and shifting of loans incidental to the Jan. 1 interest and dividend disbursements, which are estimated at about $190,000,000 or considerably in excess of the total disbursements on Jan. 1 of this year, despite the fact that dividends on many industrial corporations have been reduced and in some instances entirely passed. The increased disbursements on Jan. 1 next are the result of extra payments by some of the large railway systems, notably the Lake Shore and Michigan Central lines and the Pennsylvania Company, a subsidiary of the Pennsylvania Railroad. Otherwise the week's developments have been more favorable than for several weeks past. The demand for money at the interior for crop moving purposes has practically ceased, and were it not for the disposition on the part of the interior banks to keep large supplies of cash on hand, money would now be flowing in this direction. However, the demand from the West and South was considerably smaller during the past week and this was largely responsible for the heavy gains in cash by the New York City banks and a further large decrease in the deficit of the Clearing House institutions. Business in currency has fallen off to small proportions and the only demand now appears to be for pay roll purposes which has served to maintain the premium around ¾ of 1 per cent. Foreign exchange ruled decidedly firm throughout the week, owing to the heavy purchases of bills in connection with the Jan. 1 settlements abroad, but notwithstanding the high rates of exchange, the premium on currency has enabled our bankers to secure additional amounts of gold in Europe and it is expected that further engagements will be announced from time to time. It is not believed that local conditions will become decidedly easier until after the turn of the year. It is pointed out that numerous time loans will mature between now and Jan. 1, and at the same time it is said that large amounts of mercantile paper will fall due, which will have to be provided for. After the middle of January, however, the belief prevails in banking circles that the money market will become normal. The moneys disbursed on Jan. 1 for interest and dividends should by the end of the first week in the new year find their way back to the banks and the influx of currency from the interior should be well under way by that time, particularly as the contraction in general trade will call for considerably less money than was required in previous years.

The bank statement published last Saturady was well received. Loans decreased $9,581,100 and deposits decreased $7,371,900 cash increased $6,507,200, and as the reserve repuired was $1,842,975 less than in the preceding week, the deficit was reduced $8,350,175. The total deficit now stands at $31,751,000, as compared with a surplus of $3,280,900 in the corresponding week of last year and a surplus of $4,159,400 in the corresponding week of 1905. Circulation increased $1,661,700.

The Stock Market

With the close approach of the end of the year, the general stock market has been, during the past week, even duller and more professional than in the immediately preceding week, and were it not for the operations of a few speculative cliques, interest in the course of values would have been at an exceedingly low ebb. As it was the fluctuations in prices were mostly of the same description as the dealings, but the general tone of the market was quite firm considering the surrounding circumstances. The preparations making for the January interest and dividend payments, which are estimated at close to $190,000,000, thereby establishing a new high record in this regard, naturally created more or less uneasiness in the local money market and for both call and time loans the rates continued to rule fully up to, if not above, those lately current. The issuance of a call for a statement of the condition of our state banks, following a similar call to the National banks, led to a good deal of "window dressing," and while some encouragement was felt on account of the fact that the Clearing House banks are slowly but surely bettering their position, it was likewise felt that the present is hardly the time to inaugurate a bullish campaign in the stock market. As a matter of fact, if any such movement were begun just now the banks would be the very first to discourage in every way possible such an attempt. In the meantime, the financial situation is steadily improving, though further contraction in general business is noted, as reflected in a big drop in bank clearings, and even a further curtailment is to be feared. Our banks continue to lose money to the interior and banks out of town are still pursuing their hoarding tactics. It is this that is mainly responsible for the further contraction in business, and it is earnestly hoped that the financial institutions may soon be brought to see the error of their ways. The demand for funds for crop moving purposes has practically ceased and under ordinary circumstances money should be flowing toward New York. However, the reverse of this is the case, and until conditions mend in this respect it is hardly reasonable to look for any sustained upward movement in security values, particularly with the reserves of our banks still many millions under the amount required by law.

The declaration of regular dividends by the Reading and New York Central, whereas rumors of reductions in both cases had been freely circulated, had a slightly reassuring influence, as did also increased dividends by some of the Vanderbilt and other railroads, but the continued stoppage and cutting of distri butions to stockholders in other instances served to nullify the good effect of these announcements. In reality, the Street was in no humor to take advantage of this or any similar condition of affairs, and for the time being such matters as the favorable state of our foreign trade as indicated by the Government's November figures, and the fact that the anthracite coal roads among others are now earning more than at any time in their history, were to all intents and purposes lost sight of. The demand for bonds kept up and the market for that class of securities was relatively firmer than that for stocks. However, even in this direction there was a disposition to slow down some pending developments in the money market.

Aided no doubt by present and prospective large earnings incident upon the holidays, the local traction shares continued to rule firm, and though speculation in them was not active, the investment buying that has been noticed in them ever since the panic was maintained. The fact that the investigation into the affairs of the Brooklyn Rapid Transit has failed utterly to bring out anything detrimental to that property is proving a very strong factor in creating a better inquiry for that stock.

Philadelphia

There was a material falling off in the dealings in the local traction issues during the past week, but the general tone of the market was decidedly firmer, prices for all of the leading issues showing substantial advances over those prevailing at the close of last week. Philadelphia Rapid Transit, which was under pressure last week, recovered sharply and advanced to 17⅞. Union Traction advanced a point to 47¾ and Philadelphia Traction sold at 84, unchanged. Consolidated Traction of New Jersey advanced a point to 61, on light trading. Philadelphia Company common sold at 36 and odd lots of the preferred sold at 36. American Railways was unchanged, with transactions at 43¾.

Baltimore

There was a broader market for traction issues at Baltimore and while prices displayed more or less irregularity, the net changes were for the most part unimportant. United Railway common sold at 10 for small amounts. United Railway 4's sold at 81¼, the incomes at 45¼ @ 45 and the funding 5's at

70½ @ 70¾. Transactions in Metropolitan Railway of Washington 5's are reported at 104¾ and in Richmond Traction 5's at 100. Other transactions included Virginia Electric Railway and Development 5's at 95, Baltimore Traction 5's at 106, City & Suburban 5's at 105, and Baltimore City Passenger 5's at 100.

Other Traction Securities

The market for traction issues at Chicago was practically at a standstill, trading including only a few issues, none of which showed any noteworthy price changes. Metropolitan Elevated common sold at 17½, Chicago City Railway 5's at 95 and Northwestern Elevated 4's at 87. The Boston market also was quiet. Boston & Worcester preferred, dropped from 57 to 55, on the exchange of small lots. Boston Elevated was firm at 126. Massachusetts Electric common sold at 9, the preferred at 39, West End common at 81 and West End preferred at 98 @ 98½.

Security Quotations

The following table shows the present bid quotations for the leading traction stocks, and the active bonds, as compared with last week:

	Dec. 18.	Dec. 25.
American Railways	43⅞	43½
Boston Elevated	123½	126
Brooklyn Rapid Transit	37½	38
Chicago City	a150	140
Cleveland Electric	37	—
Consolidated Traction of New Jersey	59½	60½
Detroit United	34	32
Interborough-Metropolitan	6½	6¼
Interborough-Metropolitan (preferred)	17	17½
International Traction (common)	35	35
International Traction (preferred) 4s	59¼	59
Manhattan Railway	114	116
Massachusetts Elec. Cos. (common)	9	9
Massachusetts Elec. Cos. (preferred)	37	38
Metropolitan Elevated, Chicago (common)	a17	a17
Metropolitan Elevated, Chicago (preferred)	44	46
Metropolitan Street	21	20
North American	41¾	42¼
North Jersey Street Railway	25	25
Philadelphia Company (common)	35½	35¾
Philadelphia Rapid Transit	17¾	17
Philadelphia Traction	83	82½
Public Service Corporation certificates	54	54
Public Service Corporation 5 per cent notes	85	85
South Side Elevated (Chicago)	62	64
Third Avenue	22	23
Twin City, Minneapolis (common)	83	83
Union Traction (Philadelphia)	46⅝	47⅜

a Asked.

Metals

According to the *Iron Age,* new business in finished iron and steel has been light, and bookings are at the rate of about 30 per cent. of their capacity. Shipments, however, are fully double that amount, taking the industry as a whole. It is estimated that the shipments of fabricated material by the American Bridge Company during 1907 will total 650,000 tons, as compared with 577,000 tons in 1906. There is a little more inquiry for plates.

Copper has moved upward a little, apparently due to speculative operations. Consumers have bought little, but are sounding the market for January metal. Lake is quoted at 13⅜ to 13½ cents, and electrolytic at 13¼ and 13⅜ cents.

PAY FARE AS YOU ENTER IN PITTSBURG

The Pittsburg Railways Company started, on Dec. 24, to enforce the new rule of collecting fares from each passenger as he enters the car. The company will try the experiment on the ordinary cars. Each passenger will enter the car by the rear platform, and is expected to have his fare ready when he boards the car. As he passes in he will hand the money to the conductor. The object of enforcing this new rule is to enable the conductor to remain on the rear platform at all times. Because of the many hills there, accidents happen frequently, and usually the conductor is in the car collecting fares at the time.

ANNUAL MEETING OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

The next meeting of the Central Electric Railway Association will be held in Dayton, Ohio, on Thursday, Jan. 23. This will be the annual meeting of the association and the customary banquet will be held.

EARNINGS IN ST. LOUIS

The United Railways of St. Louis reports for November and eleven months ended Nov. 30. Compared as follows:

November.	1907.	1906.
Gross receipts	$871,075	$846191 Inc.
Operating expenses	579,509	511,088 Inc.
Net earnings	$291,566	$335,103 Dec.
Fixed charges	231,314	231,918 Dec.
Surplus	$60,252	$103,185 Dec.
Eleven months—		
Gross receipts	9,958,733	$9,412,762 Inc.
Operating expenses	6,485,975	5,855,676 Inc.
Net earnings	$3,472,758	$3,557,086 Dec.
Fixed charges	2,546,527	2,550,049 Dec.
Surplus	$926,231	$1,007,037 Dec.

PENNSYLVANIA COMPANIES ORGANIZE AN ASSOCIATION

The Pennsylvania Street Railway Association was organized Dec. 21, at the Bellevue-Stratford, Philadelphia, with nearly one hundred members. The charter was taken out several years ago, when a similar organization existed. Notice has been given, however, of many changes in the by-laws to cover the objects of the new association. Headquarters will be established in Philadelphia. The officers are: President, F. B. Muster, Central Pennsylvania Traction Company, Harrisburg; first vice-president, R. P. Stevens, president Lehigh Valley Transit Company; second vice-president, Francis J. Torrance, Washington & Cannonsburg Railway Company; secretary, Charles H. Smith, Lebanon Valley Street Railway Company; treasurer, W. H. Lanius, York County Traction Company. The executive committee consists of Mr. Musser, M. Smith, Charles O. Kruger, of this city; E. H. Davis, Williamsport, and John A. Rigg, Reading.

AN IMPORTANT DECISION IN OHIO

The Ohio State Railroad Commission has decided that, where the State grants a charter to one electric railway company to parallel another, the latter has a right to abandon that portion of its tracks which may be damaged through competition. The commission also justified the sale of such portion of the track to the competing company, the same ground being taken, that the State has through chartering the other company made damage by competition possible. The case is that of Edward J. Bickerstaff against the Steubenville, Mingo & Ohio Valley Traction Company and the Steubenville & Mingo Traction Company. The complaint was that the companies abandoned a portion of their line over a high summit known as Altamount, between Steubenville and Mingo, and Mr. Bickerstaff asked that the companies be forced to perform their duties as common carriers and afford service to the residents of that place. It was shown that certain persons had purchased lots in Altamount through the inducement that electric railway service would be furnished them. The commission says that, if a private contract was made to that effect, the remedy lies in the courts of law and not in the commission.

After the line had been built the County Commissioners relocated the public highway along the river and a new electric railway track was built between Steubenville and Mingo at a heavy outlay of money. Under these conditions, the commission holds that the change was warranted. The work was done by the Steubenville & Wheeling Traction Company, which had purchased the line from the original company, the transaction having been made in good faith. The chief reason for upholding the company, as pointed out by the commission, is the fact that the Altamount line was too dangerous to operate on account of the character of the territory over which it was built, and that the change was justified, since the public is provided with service by the low-grade division. The significant points mentioned above were brought out in the course of the decision, however, although not meant to be the principal reasons.

TRANSIT MATTERS IN NEW YORK

Details of the defects in cars in use by the New York City Railway Company were brought out Saturday, when the report of A. W. McLimont, electrical engineer for the Public Service Commission, on his recent examination of the rolling stock was made public. This report constituted the sole argument of the commission for its order made ten days ago that the cars be put into better repair. In explanation of the case to the commission the receivers said: The most frequent causes of breakdown are those peculiarly incident to the operation of cars by the conduit electric system and differ from the troubles incident to the operation of surface cars by the overhead trolley system. A large percentage of breakdowns on the road is due to failure of the contact plow, notwithstanding the fact that the expert engineers employed by the company have been constantly working on the problem of finding some corrective ever since the conduit system was first introduced. The severe winter of 1906-'07, therefore, greatly increased the demand for thorough overhauling and extensive repairs. In April, 1907, the 146th Street car barn was destroyed by fire. This not only left the company without adequate storage facilities but also destroyed the main overhauling and repair shops, as well as the electrical shops which were there located. Two subsequent fires, destroying two other car barns, still further crippled the resources of the system. Meanwhile the work of repair and maintenance has been vigorously pushed, although under great disadvantages. The good results of such policy are shown by the records: The number of cars that were disabled on the road for the week ended Dec. 9, 1907, was less than half the number disabled under similar conditions during the weeks just prior to the receivership.

The hearing before Judge Lacombe on the petition of the receivers of the New York City Railway Company and the Metropolitan Street Railway Company for instructions regarding the Third Avenue Railroad was held Dec. 19. Judge Lacombe heard representatives for the receivers for the Metropolitan Street Railway bondholders' committee, for the Metropolitan Street Railway stockholders, for the unsecured holders of the Metropolitan Street Railway Company and the New York City Railway Company, and for the bondholders' committee and the stockholders' committee of the Third Avenue Railroad. The Public Service Commission was invited to send a representative to the hearing, but none appeared. It was the opinion of most of those who appeared before Judge Lacombe that further time should be given in which to consider the matter, and accordingly Judge Lacombe stated that further opportunity would be given to those interested to state their views. He will accept briefs and papers regarding the matter until next Monday. During the course of the hearing the suggestion was made that the court appoint referees to consider the entire matter and to arrive at some conclusion. John M. Bowers, representing the holders of the second mortgage bonds of the Third Avenue, suggested that no action be taken until another trustee for the bonds had been named to take the place of the Morton Trust Company. Mr. Bowers announced that nearly all of the bonds had been deposited under a form of agreement, and that a new trustee will be named within a few days. Henry Wollman, representing some of the minority holders of Metropolitan stock, stated his belief that separate receivers for the Metropolitan Street Railway should be appointed in order that they might look into the Third Avenue situation carefully and act to protect the Metropolitan's interest. Edward M. Shepard, counsel for the Third Avenue stockholders, will submit in writing his opinion of the receivers' petition.

The Public Service Commission has issued an order directing the Interborough Rapid Transit Company to show cause why all of its cars, on both the elevated and subway lines, should not be equipped with emergency tools such as are carried on steam railroads. Mr. Willcox said that in case of an accident, where cars might be jammed together and the doors of necessity closed, such tools might be valuable in enabling passengers to escape, particularly if fire should break out.

So successful has been the introduction of special policemen in the subway that their number has been increased from twenty-five to forty-two, and the service over the underground lines has been increased nearly 10 per cent, with a prospect of a further increase within a short time. The policemen were engaged by President Theodore P. Shonts on the recommendation of the Public Service Commission's expert, Bion J. Arnold. At the Grand Central station there is a dispatcher for uptown trains and another for downtown trains. These dispatchers, during rush hours, are stationed on small inclosed platforms, which are elevated above the passenger platforms so as to give an unobstructed view of the entire station, and which have been specially built since the policemen went into service. Each of the dispatchers is provided with a stop watch on which he takes the length of time that each train remains in the station. The dispatcher has instructions to limit the time a train is in the station to forty-five seconds if possible. When he sounds the gong the special officers close the doors and the train proceeds immediately.

It will be nearly three months before the first of the McAdoo tunnels from Manhattan to New Jersey will be in operation. The upper tunnels running from Hudson and Christopher Streets to Hoboken were to be opened to the public early in January, but W. G. McAdoo, president of the Hudson & Manhattan Railroad Company, which owns the tunnels, wrote to the Public Service Commission last week asking for an extension of time. On Monday, of this week, the commission extended the time to March 7. By the terms of its first franchise, which covered the tunnel under the North River and up to Christopher and Greenwich Streets, the company was to begin operation of that section on or before Jan. 7. For the portion north of that, up Sixth Avenue to Thirty-Third Street, and across Ninth Street to Fourth Avenue, another franchise was granted, and for these sections the company has until Jan. 15, 1910, to begin operations. When the line is opened in March the most northerly stopping place will be Sixteenth Street, and it will be a considerable time before the line is in operation all the way up to Thirty-Third Street, where a large terminal is to be built. The delay of the uptown tunnels has nothing to do with the lower Manhattan tunnels, which extend from the neighborhood of Cortlandt Street to Jersey City, and which are being built on a franchise granted much later than that affecting the uptown tubes.

Attorney General Jackson obtained an order Dec. 24 from the Supreme Court which appoints John Frankenheimer referee to decide whether the federal receivers shall continue in charge of the New York City Railway or the state receivers assume control.

ORGANIZATION OF THE N. E. L. A. EXHIBITION

At the Washington convention of the National Electric Light Association, last June, the Class "D" members (manufacturers) of the association made a most attractive exhibition of electrical apparatus and appliances. During the convention these exhibitors got together and offered to relieve the association of the troubles and responsibilities connected with the organization and maintenance of such exhibits at the annual conventions. The executive committee of the association approved a plan whereby the Class "D" members were to recommend annually an "exhibition committee" of Class "D" or "E" members. This committee, upon recognition by the president, would elect its own chairman, and organize to conduct the work pertaining to manufacturers' exhibits at the convention.

A nominating committee was formally appointed, consisting of Geo. F. Porter (chairman), of the Atlantic Insulated Wire Company, 120 Liberty Street, New York; T. G. Whaling, of the Westinghouse Lamp Company, and Alex. Henderson, of the American Circular Loom Company.

The ticket presented by this committee to the Class "D" members has been approved by a mail ballot of Class "D" members and accepted by Dudley Farrand, president of the N. E. L. A. This committee, known as the "exhibition committee," is as follows: F. H. Gale, General Electric Company; J. C. McQuiston, Westinghouse Companies; H. P. Heger, Allis-Chalmers Company; Rodman Gilder, Crocker-Wheeler Company; H. M. Post, Western Electric Company; C. P. Frey, Weston Electrical Instrument Company; Benj. Wall, Metropolitan Engineering Company; James I. Ayer, The Simplex Electric Company, and S. E. Doane, National Electric Lamp Association. On Dec. 6, the committee met in the association rooms in New York, and elected F. H. Gale, chairman.

A committee on by-laws and rules for governing the committee was appointed, and preliminary plans regarding the convention next June were discussed. The committee is, of course, subject to the executive committee of the association and will co-operate fully with the president and other officers in making arrangements for the convention.

THE CLEVELAND SITUATION

Negotiations between F. H. Goff, representing the Cleveland Electric Railway Company, and Mayor Johnson, for the city, have progressed to some extent during the past week, public meetings being held regularly every day. Under the influence of Mr. Goff's offer to treat every point from the standpoint of actual value, the Mayor has yielded on several points to which he had formerly seemed rooted. On Saturday Mr. Goff went to him with a proposition that the consent fight on Quincy Street and Central Avenue be abandoned for a time. In other words, he proposed a truce for a limited time, with privilege to the Forest City Railway Company to operate cars over certain West Side lines from which the company has been barred for a time through legal proceedings, although the City Council had provided for this contingency. Further, Mr. Goff said he would arrange with the courts to continue the injunction suits now pending until the expiration of the time provided by the truce. Although Mayor Johnson has scouted the idea of a truce at the first meeting, he gave up to Mr. Goff's proposition, and nothing further will be done until negotiations progress far enough to have some idea whether an agreement can be reached or not.

Messrs. Andrews and DuPont have agreed upon valuation of $1,007,000 for the overhead construction, while the old estimate was $1,251,425. The return current was placed at $95,409, the former valuation being $114,892. Power house valuations were placed at $2,216,990. Mr. DuPont's valuation a year or more ago was $2,399,273. Real estate was placed at $1,134,473, an increase over the former valuation, which was $1,084,204. Buildings were valued at $842,987, which shows quite a substantial reduction from the old figures, $650,500. Storage batteries were returned at $289,862, Mr. DuPont's figures a year ago being $348,392. The total of these valuations is $5,586,721, in comparison with the former valuation of $6,048,687. The decreased value in the overhead system and the storage batteries is the result of the fall in the prices of copper and lead. Mr. Andrews was willing to yield on these points at the present time, but a delay might change the valuations the other way, if the markets should advance in the meantime. The power house valuations were reduced because of the lower price of apparatus and the depreciation of a year's operation.

Engineer C. H. Clark and City Engineer Hoffman failed to agree or come anywhere near an agreement on the valuation of the tracks. Mr. Goff said he was satisfied that Mr. Clark was going on experience, while Mr. Hoffman was fixing a value from a theoretical standpoint, not having had the experience necessary for such work, but that he was willing that these two gentlemen be freed from further consideration of the subject and two other men appointed. Owing to objections from the Mayor, two or three men suggested by Mr. Goff were rejected, and finally Engineer Ross, of the Toledo Railways & Light Company, and Harry Bunning, of the Forest City Railway Company, were chosen to take up the work. Mr. Clark had his own ideas as to what strack valuations should be, and he would not be swayed by Mayor Johnson or any one else.

CHANGE IN THE CHICAGO OFFICE

Cale Gough, who has been associate editor of the Street Railway Journal in Chicago for the past three years, and who has been connected with the Chicago office of this paper for a somewhat longer time, has resigned to engage in other business not connected with newspaper work. He is being succeeded by Rodney Hitt, formerly associate editor of the *Railroad Gazette,* of New York. Mr. Hitt was born in 1882, in Indianapolis, Ind., and was graduated from Purdue University in the class of 1901, as a mechanical engineer. He was connected with the National Malleable Castings Company, of Cleveland, for about a year subsequent to leaving college, but then accepted the position with the *Railroad Gazette,* which he has just resigned to become connected with this paper. Mr. Hitt has also been editor of the 1903 and 1906 editions of "The Car Builders' Dictionary," issued by the *Railroad Gazette.* He also edited the 1904 edition of the "Roadmaster's Assistant," and is the editor of the "Signal Dictionary," now in press, by the same publishers. Mr. Hitt is an associate member of the Master Car Builders' Association, a junior member of the American Society of Civil Engineers and a member of the New York Railroad Club. His headquarters will be in the Western office of this paper, Room 509, Old Colony Building, Chicago.

NOTICE OF THE JANUARY MEETING A. S. M. E.

The next monthly meeting of the American Society of Mechanical Engineers will be held Tuesday evening, Jan. 14, in assembly room No. 1, of the Engineering Societies Building, at 29 West Thirty-ninth Street, New York. The subject will be "Car Lighting," the presentation being made by R. N. Dixon, president of the Safety Car Heating & Lighting Company, and will treat of the general subject of light of trains, showing relative economies in the several systems, electric and gas. There will be in operation exhibits of different methods, such as the Pintsch mantel, the vapor mantel system, a new acetylene system, and several varieties of axle lighting by electricity, with their regulating and governing mechanism.

IMPORTANT HYDRO-ELECTRIC AND RAILWAY PLANS IN VIRGINIA

On Dec. 13, an interesting engineering program for the development of Eastern Virginia was explained when Judge Alvin T. Embrey appeared before the Corporation Commission of the State and applied for a charter for the Fredericksburg & Southern Railway Company to build a railroad (to use any motive power) from a point at or near Fredericksburg, Spotsylvania County, to Doswell, Hanover County, with the privilege of extending the line 50 miles in any direction. This line will practically parallel the Richmond, Fredericksburg & Potomac Railroad from Fredericksburg to Doswell. When the latter was built, the state legislature in order to encourage subscriptions, enacted a prohibition against paralleling this line for 35 years, and at the expiration of this time the act was renewed. The State took about one-third of the capital stock of this road, and owns it at present. On Dec. 16, the Corporation Commission listened to arguments concerning the granting of the charter, and of course the Richmond, Fredericksburg & Potomac Railroad, as well as the State, opposed it. The commission reserved decision. Should it refuse to grant this charter, the case will immediately be taken to the State Supreme Court. Should the Supreme Court, in January, refuse the grant, the company will go before the next Legislature to have the law against paralleling repealed.

All the water power in the Rappahannock River and most of the power in the James and Appamattox Rivers, together with all lighting, power and street railways, both urban and interurban, in Richmond, Manchester and Petersburg, are controlled by Frank J. Gould and Miss Helen Gould, of New York City. Mr. Gould also owns the Richmond & Chesapeake Bay Company, which owns the Fredericksburg Power Company. The latter is to own the Fredericksburg & Southern.

The Fredericksburg Power Company has purchased more than 4000 acres of land on the Rappahannock River, and is preparing to develop more than 30,000 horse-power, which is more than the power furnished by both the James and the Appamattox Rivers. This power will be an inducement to new industries to locate at or near Fredericksburg and it will be used to operate the street railway in Fredericksburg and furnish power to the Fredericksburg & Southern road. Preparations are being made for complete hydraulic and electrical development on the Rappahannock River at and above Fredericksburg, and an application is soon to be made to the City Council of Fredericksburg for a franchise to sell light, heating and power. The Fredericksburg & Southern Railroad will be built along the same lines as the Richmond & Chesapeake Bay line. A line from Fredericksburg to Doswell, with the Richmond & Chesapeake Bay Railway extending its line from Ashland to Doswell, will give Mr. Gould control of an electric railway from Fredericksburg to Petersburg, a distance of 85 miles, and the street railways in Fredericksburg, Richmond, Manchester and Petersburg.

The officers and incorporators of the Fredericksburg & Southern are: Wm. C. Whitner, president; E. J. Smith, vice-president; Alvin T. Embrey, secretary and treasurer; and these gentlemen, together with A. P. Rowe, A. W. Embrey, C. W. Jones and J. T. Lowery, of Fredericksburg, Va., form the incorporators and directors. The officers of the Fredericksburg Power Company are: Wm. C. Whitner, president; Alvin T. Embrey, secretary and treasurer; and they, together with A. W. Embrey, A. P. Rowe, of Fredericksburg, Va., and W. L. Roddey, of Rock Hill, S. C., are the directors. Mr. Whitner is chief engineer of hydraulics for Mr. Gould in all of his enterprises in Virginia.

AFFAIRS IN CHICAGO

The South Chicago City Railway Company and the Calumet Electric Street Railway Company are to consolidate. New branches are to be built. The Calumet Electric has agreed to build extensions in 103d and 115th Streets and to Riverdale. Other additions may be made and general improvement of the service on both roads will take place when consolidation has been achieved. The Calumet Electric is still in the hands of a receiver. The Calumet Company now operates 75 miles of track, running from Sixty-Third Street—South Park and Stony Island Avenues—to the Indiana State line at Roby. The Calumet Electric has issued bonds in the amount of $3,000,000, which fall due Nov. 1, 1909. There is $500,000 in stock out and $675,000 of receivers' certificates. The line is mostly double track, and besides connecting with the City Railway and South Side "L" at Sixty-Third Street, also reaches the Illinois Central suburban station at that point. It traverses South Chicago, Auburn Park, Manhattan Beach, Burnside, Pullman and West Pullman. The South Chicago City Railway Company operates 37 miles of track within the Chicago city limits. Its northern terminus is Madison Avenue and Sixty-Third Street. It is one of D. Mark Cummings' properties, the same interest controlling the Hammond, Whiting & East Chicago Railway. The South Chicago City runs from Jackson Park to the Indiana State line, where it connects with its Hoosier extension. It has $1,844,800 in stock outstanding and a bonded debt of $1,804,000. The officers of the South Chicago City are: D. F. Cameron, president; D. M. Cummings, vice-president; O. S. Gaither, secretary-treasurer. The officers of the Calumet Electric are: Ira M. Cobe, president and receiver; J. W. McKinnon, vice-president; F. H. Murray, secretary-treasurer.

The terms of the compromise whereby the Guaranty Trust Company, of New York, has agreed to withdraw its opposition to the reorganization plans of the Union Traction Company were made public Dec. 18. Under the original plans, the claim of the Guaranty Company for $1,185,000 was to have been met with an equal amount of bonds of series C. This the trust company objected to, and the present arrangement is as follows: It is to receive $700,000 in securities of series A, or first mortgage bonds, and for the remaining $485,000 get a short term note secured by series C securities. Under the plan of reorganization the committee has the right to issue additional series A bonds up to $1,500,000, and this authority will be used to meet the compromise with the Guaranty Company. At the same time, the Union Traction stockholders have withdrawn the notice they recently served on the banks in which the stocks of all the roads making up the system were deposited, in accordance with the terms of the reorganization plan, demanding the right to withdraw from the agreement. This notice was regarded at the time it was served as intended to help out the Guaranty Company's demand for better securities, inasmuch as Hollins & Company, of New York, control the Union traction stock, and that firm and the Guaranty Trust Company are closely identified financially. At any rate, the notice of its withdrawal came at the same time the demands of the trust company were complied with.

The time for making deposits under the Chicago Railway Company's modified plan of Oct. 25 has expired and no further extension has been granted. Deposits can now be made only upon special leave from the committee on application showing good cause and upon such conditions as may be prescribed. The total of the bonds which have assented to the modified plan is stated to be $22,631,000, which is substantially 89 per cent of the outstanding issue. The pending foreclosure proceedings are ripe for decrees which are expected to be shortly executed.

PROGRAM OF THE INTERNATIONAL STREET & INTERURBAN RAILWAY ASSOCIATION

The next biennial meeting of the International Street & Interurban Railway Association is to be held in Munich during September, 1908. The list of papers to be presented at the meeting has just been published by the secretary from the headquarters of the association in Brussels, and is as follows:

1. Rail Corrugation.

This report is to be presented by an international commission consisting of Messrs. Boulvin, general manager of the Cie. Générale de Tramways et d'Electricité, of Brussels; Busse, chief engineer of the Grosse Berliner Strassenbahn; Culin, chief engineer of the Strassen-Eisenbahn Gesellschaft, of Hamburg; d'Hoop, manager of the technical department of Les Tramways Bruxellois; Dubs, manager of the Marseilles Tramways; Fischer, general manager of the Phœnix Steel Works at Ruhrort; Mariage, chief engineer and manager of the engineering department of the General Omnibus Company, at Paris; t'Serstevens, secretary of the association.

2. Generation of Electric Power; the comparative advantages of reciprocating steam engines, steam turbines, gas engines, Diesel engines, etc., in power stations, with comparative figures on the costs of installation.

This report is to be presented by M. Rizzo, engineer and assistant engineer of the Société Générale de Chemins de fer Economiques, of Brussels.

3. Advantages and Disadvantages of the Different Types of Cars in Tramway Operation (motor cars and trail cars, double-truck cars, cars with radial axles, convertible cars, semi-convertible cars, combination cars, cars with central entrance, etc.).

This report is to be presented by M. Spangler, engineer and manager of the Municipal Railways of Vienna.

4. Progress report on brakes, with special reference to the expense of maintenance.

This report is to be presented by Messrs. Petit, engineer and division superintendent of the Société Nationale des Chemins de fer Vicinaux, of Brussels; Scholtes, engineer and manager of the Nuremberg Tramways, and Schorling, chief engineer of the Hanover Tramways.

5. Car-wattmeters and their value in economy of current.

This report is to be presented by Messrs. Battes, manager of the Frankfort Municipal Tramways, and Otto, chief engineer of the Grosse Berliner Strassenbahn.

6. The use of electric traction on steam railways for suburban service.

This report is to be presented by M. Reichel, professor of electrical engineering at the Berlin Polytechnic School.

7. Life of the essential parts of rolling-stock equipment.

This report is to be presented by M. Stahl, manager of the Dusseldorf Municipal Tramways.

8. The auto-bus in operation.

This report is to be presented by Messrs. Mauclère, manager of the construction department of the General Omnibus Company, of Paris, and Otto, chief division engineer of the Berlin Tramways.

9. Lubrication of journals and gears.

This report is to be presented by M. Julius, manager of the Haarlem Electric Company, of Holland.

10. Track construction.

This report is to be presented by M. C. de Burlet, general manager of the Société Nationale des Chemins de fer Vicinaux of Brussels.

11. Steam locomotives for suburban railways, especially for narrow-gage lines; results obtained by compounding and superheating; locomotives using fuel other than coal.

This report is to be presented by Messrs. H. von Littrow, traction engineer of the Austrian State Railways, Triest, and H. Heimpel, chief engineer of the Bavarian Suburban Tramways, Munich.

12. Auto-cars on railway lines in general and especially on suburban lines.

This report is to be presented by E. A. Ziffer, president of the Bukowina Railways Company, of Vienna.

13. Economic value of large central stations from the standpoint of developing local railway systems.

This report is to be presented by M. O. Petrie, manager of the Siemens-Schuckert Company, of Nuremberg.

PERSONAL MENTION

MR. F. B. MATTHEWS, of Fremont, Ohio, formerly chief engineer of the Lake Shore Electric Railway, died very suddenly at Michigan City, Dec. 16.

MR. S. B. LUCAS, formerly division master mechanic of the Indiana Union Traction Company with headquarters at Muncie, Ind., has been appointed master mechanic of the South Chicago City Railway and Hammond, Whiting & East Chicago Electric Railway, of South Chicago, Ill.

MR. H. S. POTTER, who has been superintendent of the El Paso Electric Railway for the last three years, has been made general superintendent, having charge of both the railway and lighting departments, and Mr. George G. Morse, of

Jacksonville, Fla., has been appointed superintendent of transportation. The new position was created to relieve Mr. Potter of the detail work of his office.

MR. LLOYD LYONS has been appointed secretary and auditor of the Mobile Light & Railway Company. Mr. Lyons was formerly assistant manager and assistant treasurer of the San Juan Light & Power Company, of San Juan, Porto Rico. Mr. J. E. Z. Watson, who has held the position of secretary of the local company for more than a year past, has returned to St. Louis, where he will engage in business.

MR. F. C. CRANE, passenger and freight agent of the Rochester & Eastern Rapid Railway Company, has been appointed general passenger agent for the Eastern Pennsylvania Railways Company, under the operating management of J. G. White & Company. Mr. Crane's duties will be particularly the improvement of summer resorts on the Eastern Pennsylvania Railway system in Schuylkill County and the building up of excursion business.

PROF. JOHN PRICE JACKSON has just been appointed dean of the school of engineering at the Pennsylvania State College, from which he was graduated in the course of mechanical engineering in 1889. In his early career Professor Jackson was connected with the Edison Illuminating Company, of Philadelphia, and the Sprague and Edison companies, of New York City. He also obtained considerable experience while with the Western Engineering Company, of Lincoln, Neb. He was appointed professor of electrical engineering at the Pennsylvania State College in 1894. At the present date the department of electrical engineering has an enrollment of more than 700 students. Professor Jackson is a member of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Society for the Advancement of Engineering Education, the Harrisburg Engineers' Club, and other technical organizations. He is a joint author of "Alternating Currents and Alternating Current Machinery" and "Electricity and Magnetism," two standard text-books in electrical engineering, and has written numerous articles on educational and engineering topics which have appeared in Society *Transactions* and other technical publications. Professor Jackson has also acted as consulting engineer for various companies and towns.

THE BROOKLYN RAPID TRANSIT COMPANY announces a number of changes in its personnel, to become effective Jan. 1. Mr. W. S. Menden, chief engineer and general superintendent of the company, and Mr. Arthur N. Dutton, assistant to the general manager, are affected. Mr. Menden after Jan. 1 will assume the title of assistant general manager and chief engineer, and Mr. Dutton will assume the title of superintendent of transportation, the position of general superintendent having been abolished. Mr. Menden is a graduate of Purdue University, and before being connected with the Brooklyn Rapid Transit Company was chief engineer and general superintendent in turn of the Northwestern Elevated Railroad, of Chicago. About three years ago he became connected with the Brooklyn Rapid Transit Company as chief engineer, and about six months ago was appointed general superintendent and chief engineer, succeeding as general superintendent Mr. Dow S. Smith, resigned. Mr. Dutton, who will assume the title of superintendent of transportation, is a native of Milwaukee, and for a number of years was on the Santa Fe Railroad. He became connected with the Brooklyn Rapid Transit Company about four years ago. After considerable experience in the superintendent's office he was appointed to the position of assistant to the vice-president and general manager, Mr. J. F. Calderwood.

JUDGE JOHN W. McNAMARA, who for a number of years was general manager of the Albany Railway Company and later was president of the United Traction Company, of Albany, died at his home in that city on Dec. 20. Judge McNamara was born in 1839 in Watertown, N. Y., but in 1844 his parents moved to Albany, where he lived the rest of his life. He was graduated from the State Normal School in 1858. He then took up the study of law and in December, 1861, was admitted to the bar. He continued to practice law in Albany until 1885. In July, 1869, Mr. McNamara was elected police justice in Albany and served in this capacity until May, 1873. His street railway experience commenced in 1864, when he was elected secretary of the Albany Railway. He retained this office until 1880, when he was elected treasurer of the company. In August, 1885 he was also chosen superintendent of the company, and at this time he gave up the actual practice of the law and devoted his entire energies to his railway interests. Between 1880 and 1890, in addition to his other duties, he also served as president of the company and between 1890 and 1900 as general manager. Upon the organization of the United Traction Company, on Jan. 1, 1900, Judge McNamara was chosen president of the consolidated company. He was succeeded in this office a few years ago by Mr. David Wilcox, when the Delaware & Hudson Railroad Company acquired its interest in the corporation. Judge McNamara was one of the most prominent members of the "old guard" of electric railway managers in New York State, under whose regime most of the street railway companies in the State introduced electric traction, and his knowledge of the law was of the greatest value to the companies during their early litigation, especially in connection with overhead rights and the telephone interests. He served frequently on the Executive Committee of the Street Railway Association of the State of New York, and was president of that organization in 1888. He was also prominent in civic and philanthropic affairs in Albany, being a trustee of the Catholic University, St. Vincent's Orphan Asylum, the Hospital for Incurables, and St. Patrick's Church.

MR. J. R. ELLICOTT, who has just been elected president of the American Street and Interurban Railway Manufacturers' Association to succeed Mr. James H. McGraw, has long been a prominent figure in steam and electric railway circles and an active participant in association work. Mr. Ellicott was born in Batavia, N. Y., in 1858, and in 1873 made his start in railroad work as a fireman on the Michigan Central Railway. In 1877 he entered the claim department of the Chicago & Northwestern Railway, but resigned in 1882 to become traveling auditor of the St. Paul, Minneapolis & Omaha Railway. Later he accepted a similar position with the Chicago & Northwestern Railway and then was general manager of the Ajax Forge Company, of Chicago, for four to five years. This last position he gave up in 1891 to enter the railway supply business in New York, where he started the General Agency Company. In 1900, he sold out his railway supply business to take his present position as Eastern manager of the Westinghouse Air Brake Company. He is also Eastern manager of the Westinghouse Traction Brake Company. Mr. Ellicott has one daughter and two sons. One of the latter is attending college and the other, Mr. C. R. Ellicott, is associated with his father in the air brake business.



J. R. ELLICOTT.

The other officers elected at the meeting of the executive committee of the Manufacturers' Association, on Dec. 15, were: Vice-President, Howard F. Martin, general manager of sales, Pennsylvania Steel Company, Philadelphia; treasurer, A. H. Sisson, general manager, St. Louis Car Company, St. Louis; secretary, George Keegan, assistant to general manager, Interborough Rapid Transit Company, New York. The members of the executive committee present were: Messrs. J. H. McGraw, H. F. Martin, F. C. Randall, A. S. Partridge, J. R. Ellicott, Otis Cutler, A. H. Sisson, K. D. Hequembourg and C. C. Peirce. Messrs. Evans and McFarland were represented by proxy. The treasurer's report showed a surplus of $5,544.11 and 293 members in good standing. A vote of thanks was tendered to the finance committee and to the entertainment committee, whose report was presented by A. L. Whipple, chairman. Messrs. McGraw, Martin and Peiree were appointed as a committee to draft resolutions on account of the death of William Wharton, Jr., who was a member of the executive committee up to October of this year. A motion was passed to secure the consent of the members, by a mail vote, to a change in the by-laws providing for three vice-presidents instead of one as at present. Mr. A. F. Bell and Mr. C. D. White represented the Atlantic City Hotel Men's Association, and extended an invitation to the manufacturers to hold the next annual convention at Atlantic City. Their proposition was received but action deferred.


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